WG Document No.

MANAGEMENT OF HAKE LONGLINE EFFORT IN SOUTH AFRICA

Submission For : *The Hake Longline Association*

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SUMMARY

TERMS OF REFERENCE

This work was commissioned by the Hake Longline Association of South Africa. The objective of the project was :

"To evaluate the hake longline fishery with a view to developing an appropriate mechanism for the management of hake longline effort in South Africa".

INTRODUCTION and BACKGROUND

Proposals have been submitted to the Demersal Working Group (MCM) for the management of hake-directed effort in the hake trawl fisheries (Deepsea and Inshore trawls sectors). The primary objective of this submission is to provide an mechanisim to manage hake longline effort that as far as possible is compatible with the trawl sector proposals (OLRAC, 2007 and MCM, 2007).

Hake longlining is an established sector of the South African hake fishery exploiting up to 10% of the hake Total Allowable Catch (hake handline catch also accommodated in this proportion). Although hake-directed longlining was first proposed in 1982 (the longline methods used were observed in North Atlantic Portuguese and Spanish fisheries). The fishery was first introduced to South Africa in 1983 as a hake longline fishery, but very quickly shifted to a kingklip-directed fishery between 1983 – 1989 (Japp, 1995). With the sharp decline in the kingklip catch rates effort shifted back to hake in 1989 and at the same time the boats in the kingklip fishery began targeting hake. The subsequent closure of the kingklip-directed longline fishery resulted in lobbying for a hake-directed longline fishery. This resulted in a period in which illegal hake-directed longlining occurred (between 1990-1993) followed by a structured experimental programme between 1994-1995 aimed at evaluating the scientific and socio-economic feasibility of hake longlining in South Africa.

A hake-directed fishery was subsequently introduced amidst much controversy and litigation oveR rights allocations. Stability in the sector was finally accomplished with the introduction of medium-term fishing rights from 2002 and long-term rights in 2006. The introduction of hake longlining increased the effective number of operators targeting hake significantly[1] with 65 rights issued in 2006 and between 50-70 boats operating each with allocations varying from 40 – 100 t per rights holder. From an effort management point of view this is the most challenging characteristic of the fishery as many boats operate with relatively small allocations, the boats carry multiple permits, fish for shorter periods than trawlers and also have unique market requirements. The objective of introducing effort (input control) management as well as quota (output control) is therefore :

[1] Noting that hake rights holders had also increased significantly in the trawl and handline sectors as well.

- try to achieve the desired control of fishing effort while
- maintain economic viability of the fishery
- introduce an effective effort management regime

Because of the characteristics of the fishery, hake longlining therefore requires a higher level of flexibility in the management of the fishery while simultaneously not compromising the objective of Effort Control.

METHODS APPLIED AND DATA UTILISED

To the best of the Authors knowledge, very little analysis of the hake longline fishery has been done since the completion of the experimental period in 1995. This assessment has been based on three primary data sets :

1. Historical (experimental) data (Japp, 1995)
2. Commercial logbook and landing returns from 2002-2007[2]
3. Observer reports from mid 2002 to March 2007

With respect to the historical data only the results were used (Japp, 1995). The commercial data set (provided by Phoebie Mullins, MCM) comprised 19 500 line sets. This data set required considerable review and correction or removal of sets where there were clear errors or inconsistencies. The subsequent refinement of the data set was however adequate for the purposes of this analysis and consistent with the authors historical experimental data. The Observer data was a smaller subset of the commercial data and comprised some 59 boats and 2422 line sets. These data have a higher level of reliability than the commercial data and were used where possible to verify or cross-reference outputs from the commercial data set.

The analytical procedure followed was as follows :

(a) The data were split into three groupings – Total sample (all areas), all data north of 33°S (i.e. longline grounds north of Cape Town towards the Namibian border), an "Intermediate" area extending from 33°S to 20°E and then the area East of 20°E[3];

(b) Establish average trip lengths – this required some descriptive analysis based on the areas and ports fished. It included estimating the average trip length assuming vessels leave from different bases. It also required the apportionment of effort between fishing days, time spent steaming to grounds, port turnaround times and lay-up periods expected. This apportionment is essential for the conversion of fishing days to calendar days;

[2] Note: Vessel-specific and rights-holder specific analysis was not done to preserve operator confidentiality
[3] The logic in separating these areas was to consider the effects of distance from the main ports as well as seasonality and variability in resource and operational characteristics such a trip length and catch rates.

(c) Identify appropriate effort units and determine if there is a relationship between these units and vessel size / capacity.

(d) Determine the historical, seasonal and current catch rates so that appropriate catch volumes could be allocated to effort units;

(e) Consolidate trip length estimates, fishing and calendar days, effort units and catch rates into a practical effort management regime.

RESULTS

A) Trip Lengths

Understanding the modus operandi of the hake longlijne fleet is essential to firstly derive fair estimates of operational requirements and secondly, any effort limitation must be practical and as far as possible not interfere with the normal operations and logistics of the fleet (Figure 1 refers)

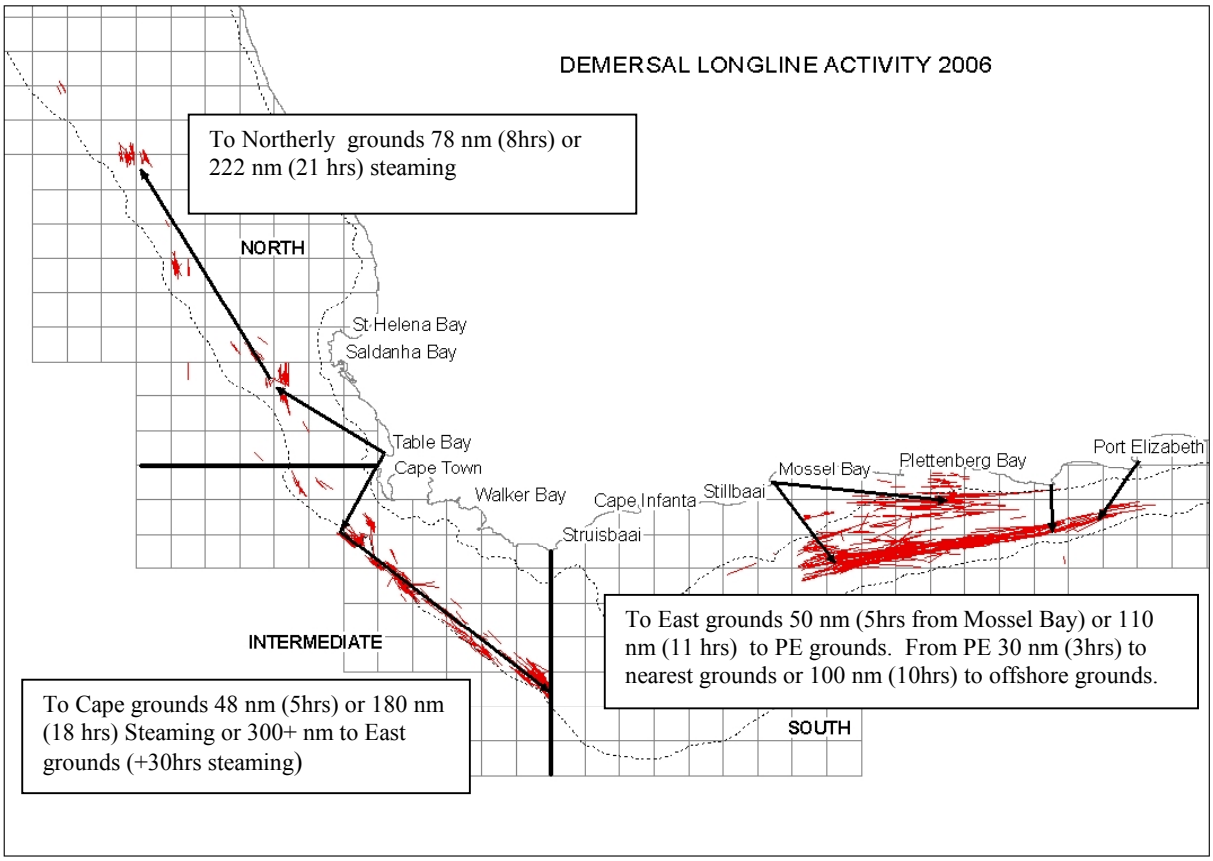


Figure 1. Main hake longline fishing grounds for 2006. Note the areas shown do not differ significantly between years.

Hake longline operations can be divided in to three main operational areas *viz:*

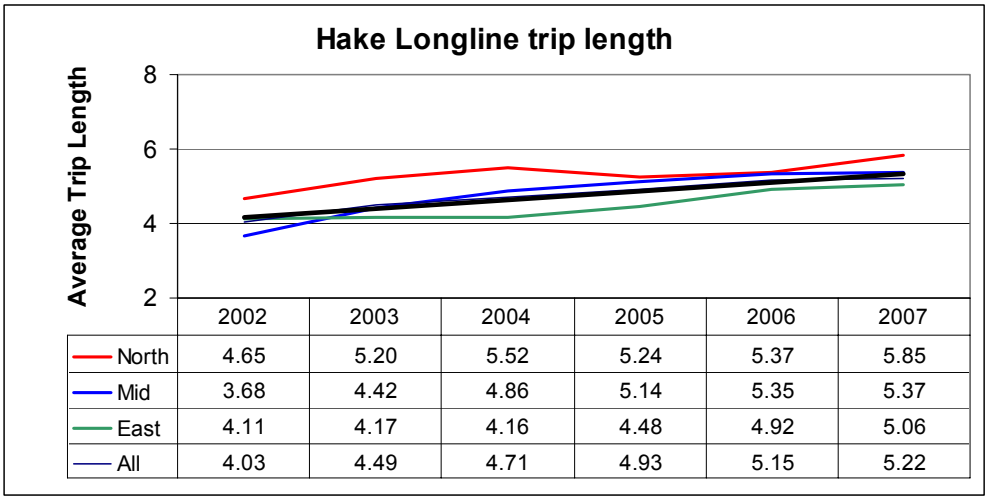
i. Vessels sailing from the west coast (Saldanha, Cape Town, Hout Bay) and targeting grounds off Cape Town and Cape Point. This is the most heavily targeted longline area and extends from west of Cape Town to due south of Cape Agulhas. Steaming time is relatively short for the 1st line set with boats mostly sailing from port in the afternoon and preparing and setting lines from late evening to early morning the next day. Lines are set between 2-3 am and hauling commences between 8 and 9 am and ends on average at 17h00 in the afternoon. Returning vessels from the same grounds haul during the day and return to port in the evening, so both fishing and steaming to or from grounds may occur on the same day or overlap into the following day. As mostly FOUR line sets are completed, four fishing days are accumulated with a combination of 3 days for steaming to and from grounds, discharge, re-provisioning and return to grounds (Note: this is an optimal situation assuming vessels fish optimally).

ii. Vessels sailing for the northern west coast grounds – these vessels sail from Cape Town, Hout Bay, Saldanha or St Helena Bay and fish west of Saldanha and north towards the Namibian border (never going that far north). Operational characteristics are similar to (i) but with slightly longer steaming times – logistically the trip lengths are similar to the Cape Point grounds.

iii. Vessels fishing the East Coast grounds sailing from either Mossel bay, Port St Francis or Port Elizabeth (Note: some smaller vessels fish from Plettenberg Bay). The steaming time to these grounds are shorter than for the West Coast but the operational characteristics are similar with four fishing days on average and three-day steaming / discharge and provisioning.

iv. In some cases boats may sail from the West to the East and vice versa – the occurrence of this strategy is however minimal as most rights holders are required by permit condition to fish East or West.

Log Book returns show that average trip lengths (reported sailing and landing dates) have increased since 2002[4]. End to end trips are shown in the Figure 2. Longest trips occur steaming to the Northerly grounds, shortest from the East. Most vessels leave port mid-day to get to grounds so that they can prepare lines and shoot in the early morning between 2-3 am. Hauling starts on average between 8-9 am and continues for on average 8-9 hours ending at about 17h00.



	2002	2003	2004	2005	2006	2007
North	4.65	5.20	5.52	5.24	5.37	5.85
Mid	3.68	4.42	4.86	5.14	5.35	5.37
East	4.11	4.17	4.16	4.48	4.92	5.06
All	4.03	4.49	4.71	4.93	5.15	5.22

Figure 2. Mean trip lengths per annum as declared on trip logs (Source MCM data)

[4] Note that these are reported sailing and landing dates and include fishing and steaming days

Using Observer data boat-specific trip lengths confirm that since 2002 the average number of days **FISHED** per trip per vessel is between 4-5 days. Figure 3 shows the relationship between these vessel and their gross registered tonnage (GRT) – the regression suggests bigger vessels have slightly shorter trips but not significantly so.

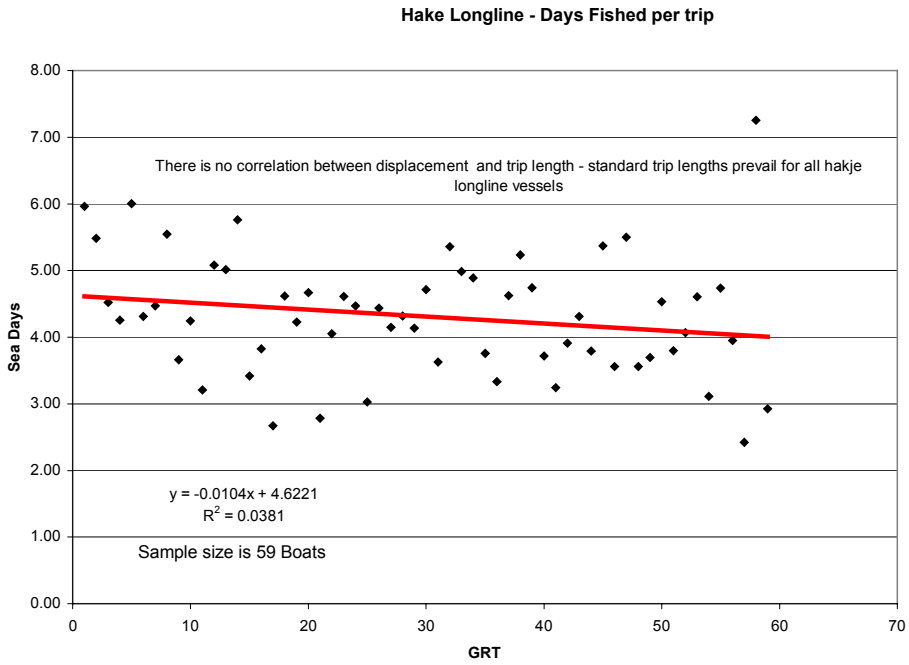


Figure 3. Relationship between boat size and trip lengths (source Observer data)

For the purposes of the effort calculations it is therefore suggested that the following parameters be used re trip lengths :

- Average trip hake fishing days per trip is 4 days
- Steaming time, discharge and provisioning approximates 3 days combined
- **A trip per week is therefore the norm in the hake longline industry**

B) INTERANNUAL AND MONTHLY EFFORT LEVELS

Hake longline effort fluctuates monthly – this effort fluctuation is determined by a host of factors including weather and sea conditions, fish availability market conditions and not least of all pressure to complete allocations towards the end of the quota years. In the consolidated Figure 4 the accumulated monthly effort levels is shown (top figure), the time series of monthly effort since 2002 (middle) and the mean effort levels by month between the three areas (bottom).

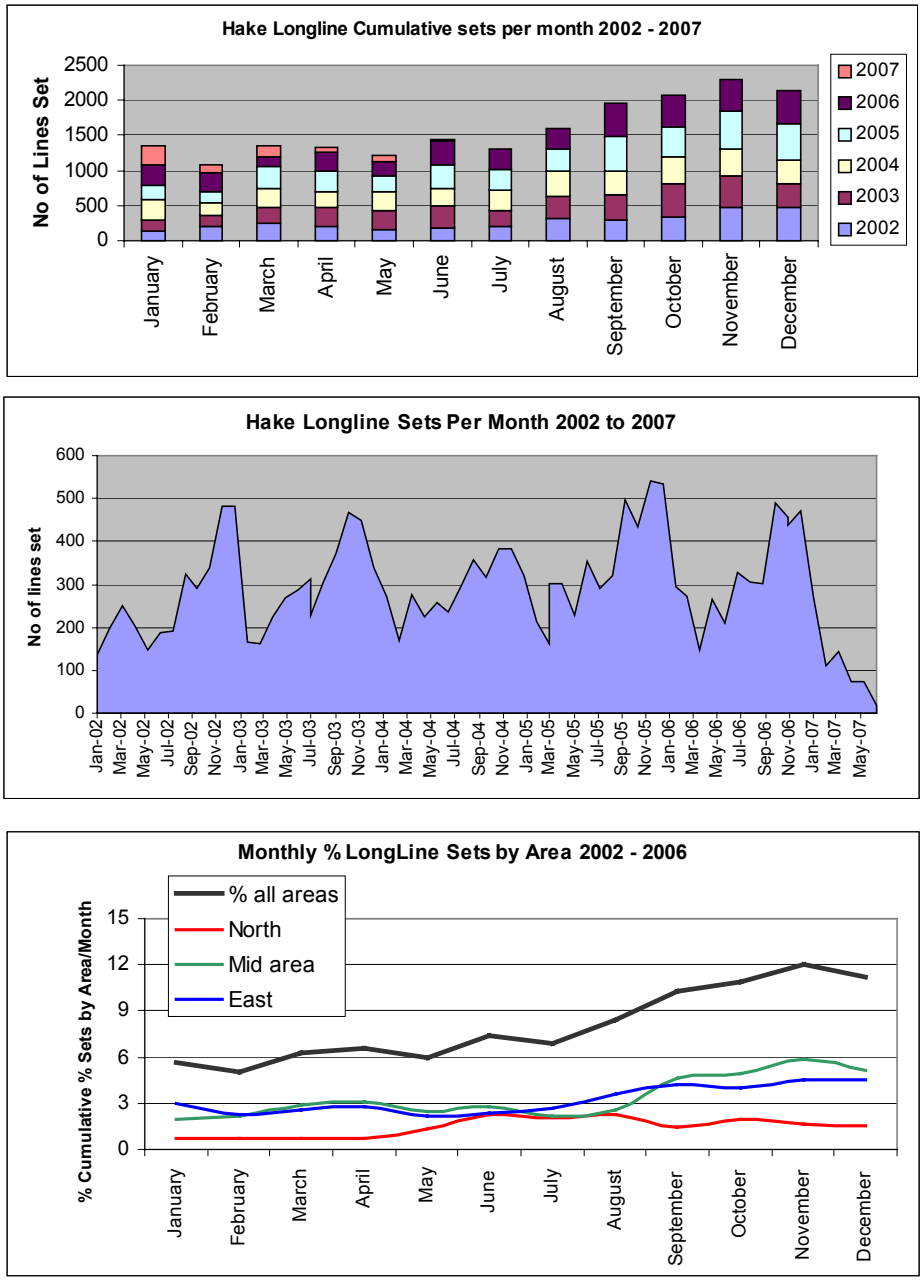


Figure 4. Hake longline effort levels monthly and inter-annualy from 2002-2007.

From these figures we can conclude that :

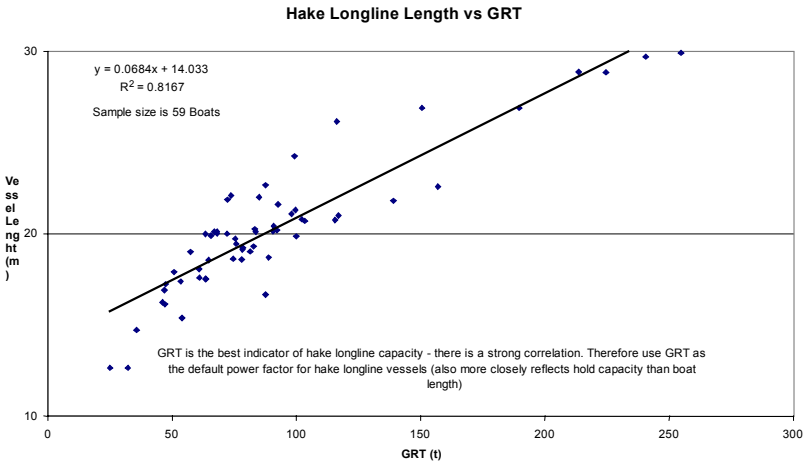
- Peaks in effort occurs consistently from September through to December
- The least effort is deployed in the Northern grounds on the West Coast – effort peaks there in mid winter
- The Intermediate and East Coast grounds deploy similar levels of effort but are also have seasonal signals – Peaks in effort on the West Coast occurs mostly in late spring to early summer while on the East Coast the peaks are about 1-2 months later – this is probably associated with both fish availability and preferred weather and sea conditions.

We would conclude from this that if effort were to be allocated on the basis of historical effort, that the proportions by month shown would be a fair indicator Table 1)

Table 1. The % sets on average per month (2002 – 2007).

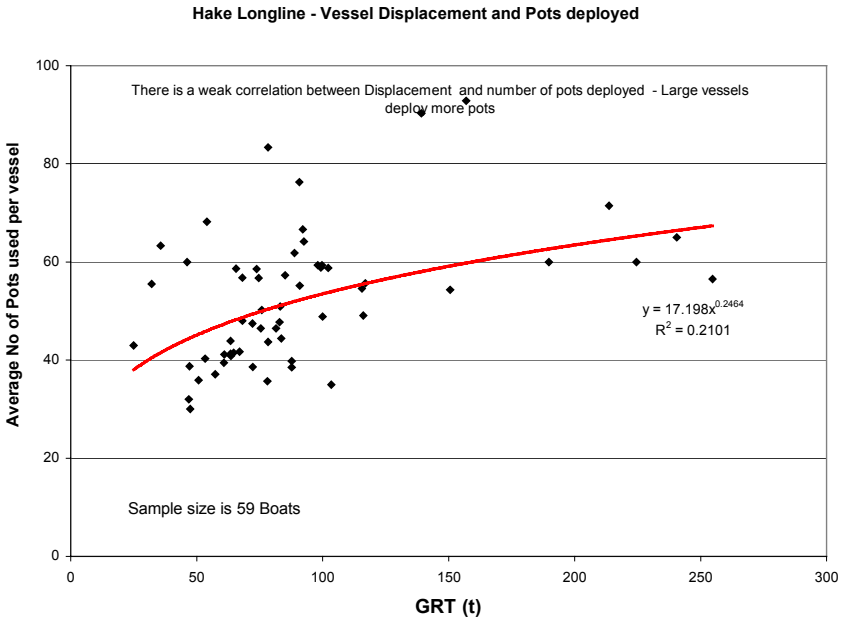
Average No of Longline sets	% all areas
January	5.7
February	5.0
March	6.3
April	6.6
May	5.9
June	7.4
July	6.8
August	8.4
September	10.3
October	10.9
November	12.0
December	11.2

C) THE RELATIONSHIP BETWEEN HOOKS, POTS AND BOATS



Gross tonnage of vessels and Vessel Total length (Figure 5) are closely correlated. If a vessel parameter is to be used to designate longline effort then Gross Tonnage is probably the best as it will be the best indicator of hold capacity.

Figure 5. Correlation between vessel displacement (hake longlines) and vessel length



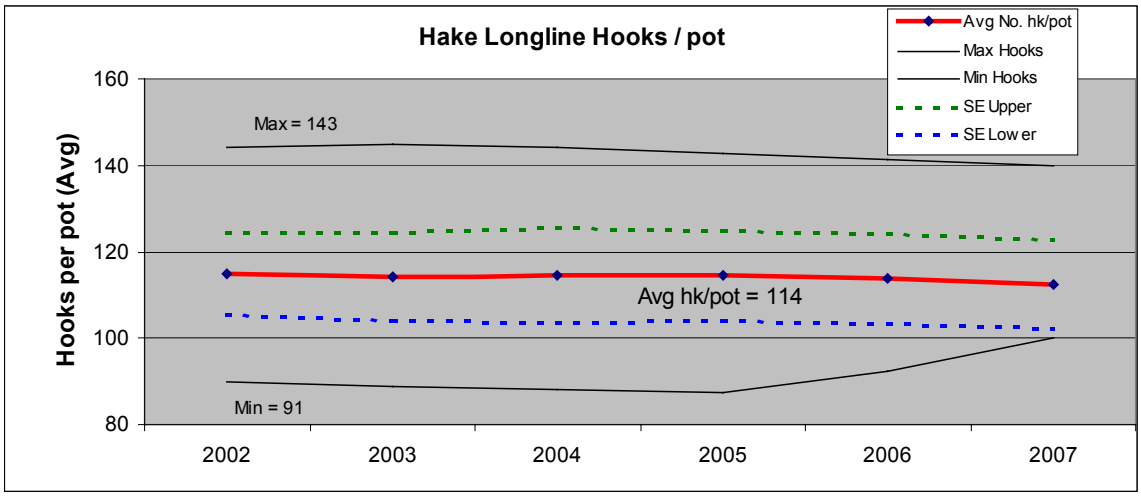
The relationship between boat size (GRT) and the number of pots is not strongly correlated (Figure 6). Most boats fall into the 50 – 100 pot category with only a few larger vessels deploying > 100 pots.

Figure 6. Correlation between vessel displacement (hake longlines) and pots deployed per vessel (source : Observer data)

Management of hake longline effort is therefore not recommended on the basis of pots and vessel displacement. Historically hake longliners in South Africa have deployed vessel-specific numbers of pots. Effort management for longline fleet is therefore probably best done on a "declaration per rights holder/vessel basis" and should not be associated with vessel size.

Figure 7. Standard hake longline pot as prepared prior to shooting of the line. Pots comprise normally of four lines of 25-30 hooks per line (source : CapFish)

If hake longline effort is managed on the basis of the number of pots then the number of hooks per pot and pot size would have to be standardised. Figure 7 shows a standard pot commonly deployed by the majority of hake longliners in South Africa. Logbook data indicate quite a high variation in hooks per pot (SE gives a max of 143 and min of about 91). The average however is 114 with most skippers declaring 120 hooks per pot on a standard longline. Observer data confirm the variability, but that it mostly relates to skipper error noting that repaired lines on a day to day basis will have a variable number of hooks (Figure 8)



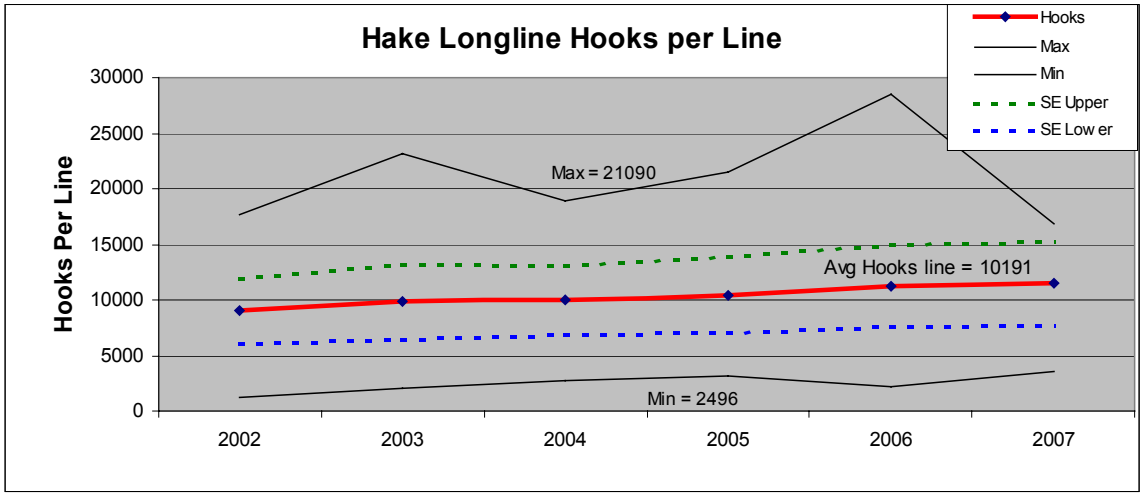


Figure 8. Declared number of hooks per pot and hooks per set (line) (Source : MCM longline data)

Although there has been a slight progressive increase since 2002 in the average number of hooks set per line (Figure 8) the average number of hooks per pot has remained steady at about 114.

For the purposes of Hake Longline effort management the recommended average number of hooks per pot should be set at a <u>maximum of 120.</u> Boats that shoot higher than that number will require adjustments to their allocated number of pots.

D) HAKE LONGLINE CATCH RATES

Determination of a longline-specific catch rate is essential if a practical limit is to be set for the management of fishing days. The hake longline CPUE trends are shown in two sets of consolidated figures showing annual and monthly CPUE trends (Figure 9) by area for the MCM commercial longline data.

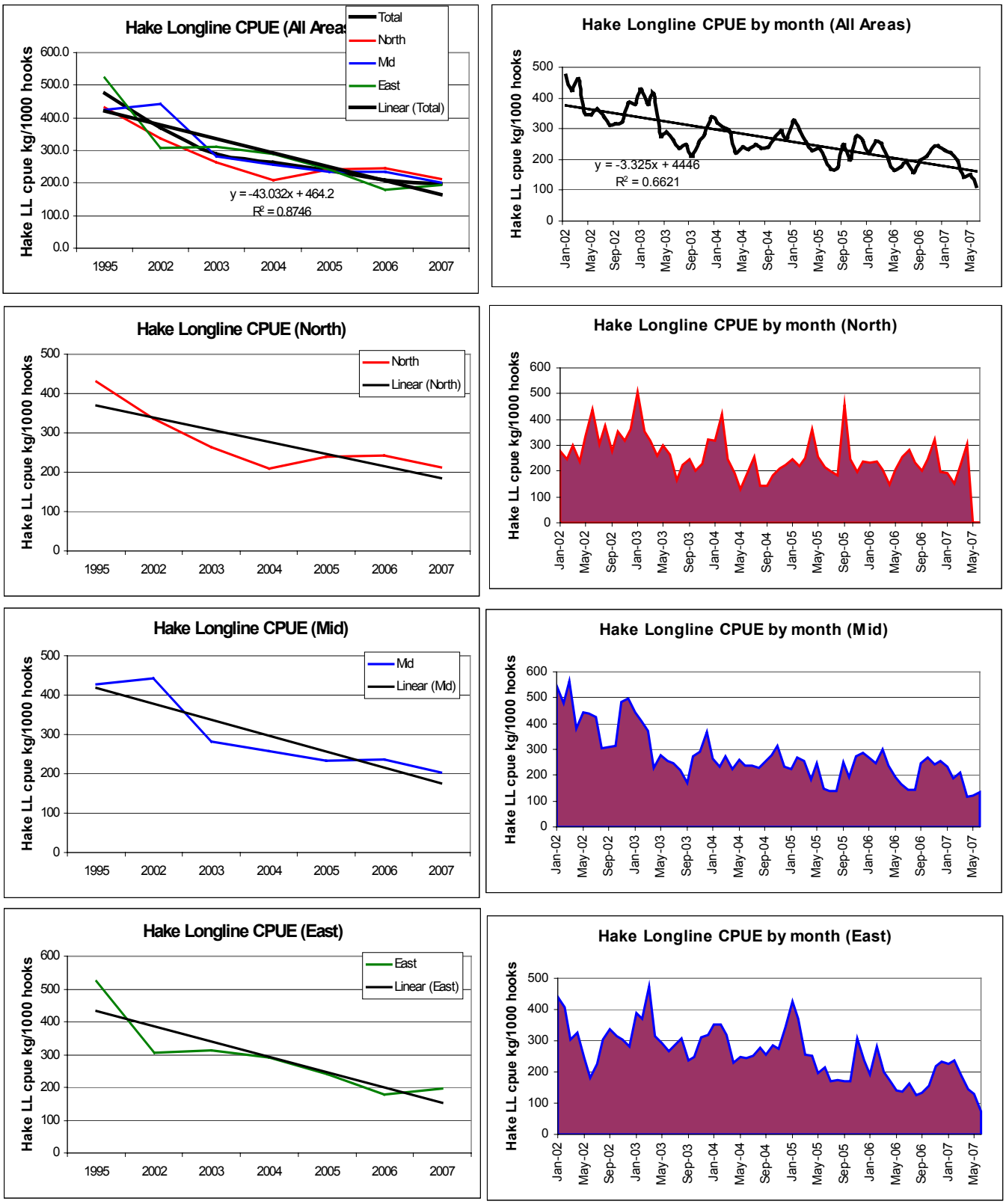


Figure 9. Catch rate trends for hake longline in South Africa by year, area and month(Source : MCM longline data)

Note that for the annual figures the 1995 CPUE has been added to the 2002-2007 data points. There is a strongly correlated decrease in hake longline catch rates (catch in kg per 1000 hooks)[5]. Further the monthly trend shows a distinct increase in catch rate in the late Spring to mid Summer period with some displacement of these peaks depending on the area targeted. The CPUE trend is a major concern and should be measured against other fisheries, particularly on the basis of the selective targeting of larger fish. We conclude from the hake longline CPUE data that :

- The hake longline CPUE has declined by more than 50% since 1995 from about 460 kg per 1000 hooks to less than 198.5 kg per 1000 hooks in 2007 (note 2007 data not complete)
- The monthly data show a similar downward trend – the monthly data are useful as they show clearly seasonal peaks in catch rates – the peaks occur mostly from spring to January. This increased availability probably relates to seasonal migrations and spawning.
- For the purpose of the hake longline effort management and estimation of expected catch, the following options are suggested :

  i) Apply the 2007 CPUE of 198 kg per 1000 hooks

  ii) Rather than kg per 1000 hooks convert and apply as kg per pot as this is the most convenient unit if effort is manage per pot. The CPUE per pot is also adjusted for the average number of hooks per pot determined by MCM data (114 hooks per pot) giving an expected catch per pot for 2007[6] of 22.63 kg per pot (nominal mass)

CONSOLIDATION OF RESULTS FOR EFFORT MANAGEMENT

Table 2 shows the consolidation of trips, estimated lay-up periods and steaming times for the conversion of Fishing days into Calendar days.

Table 2. Parameters used for the conversion of fishing to calendar days for hake longliners

	Days per Annum	Comments
Assume 21-Day lay up (3 weeks)	21	Note HLL vessels do generally not fish all year
Days available (Fishing)	344	No of days available for fishing
Max trips PA (7-day turnaround)	49.1	Assumes 7 day start of trip, to sailing again = 4 days fishing, 3 days steaming and turnaround
Max days setting lines (fishing)	196.6	
Max steaming and turnaround days	147.4	49.1 trips x 2 days steaming
Ratio Fishing : Calendar days	**0.5385**	Gives an index for converting sea days to calendar days = 196.6 / 365

[5] Note the CPUE calculation has converted landed products (mostly PQ fish and broken hake) to whole (nominal mass)

[6] Note that the 2007 data are incomplete and that this CPUE estimate must be revised on the basis of a complete calendar year. Industry indications are that this CPUE estimate is now even lower

The assumed conversion ration for fishing days to Calendar days that is applied to the effort matrix in Table 3 is therefore 0.5385. An illustration of the application of this matrix is shown in Table 3. By way of example a rights holder must declare pots deployed and then, based on hake allocation calculate Calendar days such as shown in the Figure 10. As an example we have applied conversion to a rights holder with 120 t of hake longline and a boat that fishes 70 pots on a line set at 22.63 kg per pot.

Boat nominates 70 pots based on 22.63 kg per pot will catch :

20 t	will need 884	pots /	12.6 sea days	and	23.4 Calendar days
60 t	will need 2651	pots/	37.9 sea days	and	70.3 Calendar days
120 t	will need 5303	pots/	75.8 sea days	and	140.7 Calendar days
240 t	will need 10605	pots/	151.5 sea days	and	281.3 Calendar days

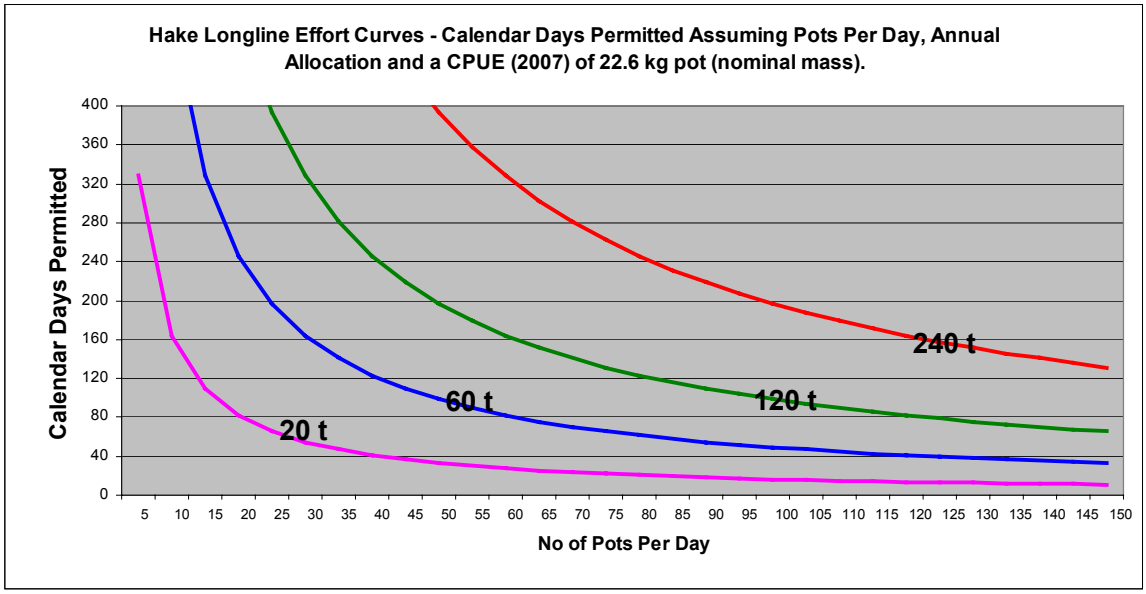


Figure 10. Conversion of hake longline sea days to calendar days based on hake allocation and number of pots deployed and a CPUE per pot of 22.63 kg nominal mass

MANAGEMENT OF THE EFFORT REGIME – APPLICATION OF A REAL-TIME DATA CAPTURE SYSTEM AND WEB-BASED OPTIONS

Management of the hake longline effort system will require real-time monitoring and trip by trip consolidation of effort. A possible Industry-Based solution to this problem that will support Marine and Coastal Management is appended (Appendix 1) for consideration.

REFERENCES

Japp, D.W. 1995 – The hake-directed longline pilot study conducted from 23 May 1994 to 31 may 1995 (WG/09/95/D:H:16)

MCM, 2007 – Rules for calculating the net horse power for effort limitation purposes on deep-sea trawlers

MCM, 2007 – Users guide to the development of fishing plans (Effort limitation for the deep-sea trawl fishery)

OLRAC, 2007 – Derivation of a base catch-rate for application to effort controls in the deep-sea hake trawl fishery. Demersal Working Group Document No. 4 – August 2007.

OLRAC, 2007 – Users guide for the capacity management software

Table 3 : Hake Longline Conversion Sea Day to Calendar Day Matrix

Sea Days Matrix	Pots --->																			
Allocation	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
20 t	176.8	88.4	58.9	44.2	35.4	29.5	25.3	22.1	19.6	17.7	16.1	14.7	13.6	12.6	11.8	11.0	10.4	9.8	9.3	8.8
40 t	353.5	176.8	117.8	88.4	70.7	58.9	50.5	44.2	39.3	35.4	32.1	29.5	27.2	25.3	23.6	22.1	20.8	19.6	18.6	17.7
60 t	530.3	265.1	176.8	132.6	106.1	88.4	75.8	66.3	58.9	53.0	48.2	44.2	40.8	37.9	35.4	33.1	31.2	29.5	27.9	26.5
80 t		353.5	235.7	176.8	141.4	117.8	101.0	88.4	78.6	70.7	64.3	58.9	54.4	50.5	47.1	44.2	41.6	39.3	37.2	35.4
100 t		441.9	294.6	220.9	176.8	147.3	126.3	110.5	98.2	88.4	80.3	73.6	68.0	63.1	58.9	55.2	52.0	49.1	46.5	44.2
120 t			353.5	265.1	212.1	176.8	151.5	132.6	117.8	106.1	96.4	88.4	81.6	**75.8**	70.7	66.3	62.4	58.9	55.8	53.0
140 t			412.4	309.3	247.5	206.2	176.8	154.7	137.5	123.7	112.5	103.1	95.2	88.4	82.5	77.3	72.8	68.7	65.1	61.9
160 t				353.5	282.8	235.7	202.0	176.8	157.1	141.4	128.6	117.8	108.8	101.0	94.3	88.4	83.2	78.6	74.4	70.7
180 t				397.7	318.2	265.1	227.3	198.9	176.8	159.1	144.6	132.6	122.4	113.6	106.1	99.4	93.6	88.4	83.7	79.5
200 t					353.5	294.6	252.5	220.9	196.4	176.8	160.7	147.3	136.0	126.3	117.8	110.5	104.0	98.2	93.0	88.4
220 t					388.9	324.1	277.8	243.0	216.0	194.4	176.8	162.0	149.6	138.9	129.6	121.5	114.4	108.0	102.3	97.2
240 t						353.5	303.0	265.1	235.7	212.1	192.8	176.8	163.2	151.5	141.4	132.6	124.8	117.8	111.6	106.1
Calendar Days	Ratio Fishing days to Calendar days = 0.5385																			
Allocation	Pots : 5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
20 t	328.2	164.1	109.4	82.1	65.6	54.7	46.9	41.0	36.5	32.8	29.8	27.4	25.2	23.4	21.9	20.5	19.3	18.2	17.3	16.4
40 t	656.4	328.2	218.8	164.1	131.3	109.4	93.8	82.1	72.9	65.6	59.7	54.7	50.5	46.9	43.8	41.0	38.6	36.5	34.5	32.8
60 t		492.3	328.2	246.2	196.9	164.1	140.7	123.1	109.4	98.5	89.5	82.1	75.7	70.3	65.6	61.5	57.9	54.7	51.8	49.2
80 t			437.6	328.2	262.6	218.8	187.5	164.1	145.9	131.3	119.3	109.4	101.0	93.8	87.5	82.1	77.2	72.9	69.1	65.6
100 t				410.3	328.2	273.5	234.4	205.1	182.3	164.1	149.2	136.8	126.2	117.2	109.4	102.6	96.5	91.2	86.4	82.1
120 t				492.3	393.8	328.2	281.3	246.2	218.8	196.9	179.0	164.1	151.5	**140.7**	131.3	123.1	115.8	109.4	103.6	98.5
140 t					459.5	382.9	328.2	287.2	255.3	229.7	208.9	191.5	176.7	164.1	153.2	143.6	135.1	127.6	120.9	114.9
160 t						437.6	375.1	328.2	291.7	262.6	238.7	218.8	202.0	187.5	175.0	164.1	154.5	145.9	138.2	131.3
180 t							422.0	369.2	328.2	295.4	268.5	246.2	227.2	211.0	196.9	184.6	173.8	164.1	155.5	147.7
200 t							468.9	410.3	364.7	328.2	298.4	273.5	252.5	234.4	218.8	205.1	193.1	182.3	172.7	164.1
220 t								451.3	401.1	361.0	328.2	300.9	277.7	257.9	240.7	225.6	212.4	200.6	190.0	180.5
240 t									437.6	393.8	358.0	328.2	303.0	281.3	262.6	246.2	231.7	218.8	207.3	196.9

APPENDIX 1

Hake Longline Effort Management System

TABLE OF CONTENTS

Version	Date	Author	Notes
0.1	22/09/2007	Kris Mortensen	Initial draft

Busii Business Intelligence Integrators – Customer Confidential

Purpose

The purpose of Hake Longline Data Management system (LDMS) is to manage the data provide by fishing vessels landing their catch and which are required for both permit condition compliance and effort management.

Overview

This document briefly describes concepts, principles and basic functionality of the LDMS. These are also applicable to areas of the fishing industry other than Landing Sheet that also require effective, pragmatic and secure data management. LDMS comprises of both an Information Technology (IT) component and the processes and resources required to ensure an effective operation. The IT component is developed and supported by an IT company specialized in data management systems and independent of the fishing industry and related government bodies.

Effort Sheet data

Capture

A record of a fishing trip needs to be recorded within 12 hours of a vessel landing. It is important that the recording of the data is easy and simple to do and yet is reliable and accurate. This caters for the realities of the conditions that exist in the fishing operations environment as well as a standard, auditable interface to the regulatory body.

Upon landing, a vessel needs to provide the pertinent information of its trip. This is done by sending the data to the Data Centre (DC) by SMS or fax. The information received by the data centre will be captured and checked for basic data compliance. An acknowledgement in the form of a reference number will then be sent from the DC to the originator of the landing data, also by SMS or fax. The captured data will then be viewable on the website for verification.

The basic data to be captured comprises of:

- Vessel name and code;
- Permit number;
- Sailing and landing dates;
- Number of sailing days
- Number of fishing days
- Number of pots

Storage

All effort sheet data will be stored on a central database. The database will reside in a secure facility with full backup and recovery facilities as well as disaster recovery.

Viewing and reporting

Access to a vessel's data is provided through a Web interface. All data captured, both recent and historical may be viewed.

System administration

Access control

Participating fishing companies must register to gain access to the system and will be issued with a user id and initial password. The password must then be changed by the company to prevent unauthorized access to the landing sheet data of the company's vessels. At the time of registration a service level agreement (SLA) will be signed between the fishing company and the IT company. The SLA will stipulate, amongst other things, the additional people / organisations that the fishing company will allow access to its data, e.g. industrial body, CMC, Data Centre administrator.

System up time

The system is housed in a secure facility that provides an un-interrupted power supply. The original landing sheet notification will remain available at the DC until the data is confirmed captured correctly and backed up. The capture of data is managed by a data capture clerk at the DC and therefore submission of landing sheet data will not be adversely affected by any temporary unavailability of the computer system, should that ever happen.

Backup and Disaster recovery

The central database will be backed up on a daily basis in case of system failure. An alternate site will be provisioned in order to continue operation of the system should the main facility befall a disaster. System overview