BIOECONOMIC ASSESSMENT OF THE MOZAMBICAN SHALLOW WATER SHRIMP FISHERY

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ABSTRACT

The Shallow Water Shrimp fishery is the most important fishing activity in the Mozambican fishing industry. The shrimp resources along the Mozambican coast are concentrated in the Maputo Bay, Limpopo River mouth and Sofala Bank. Sofala Bank is the most important fishing area with around 50.000 Km^2. Three main fleets exploit the shrimp resources, namely, artisanal, semi-industrial and industrial. The semi-industrial and industrial fleets are the most important in terms of volume of catches that count for around 83% of the total shrimp catch per year. In this fishery the resource rent is not maximised and some operators face difficulties in making profits due to the high effort. Due to the intensive exploitation of the resource, management measures are being put in place to secure present and future sustainability of the resource. Bioeconomic models have been used to help on the management of the fishery. In this study the Beverton-Holt model which focuses its analysis on the year class-cohort has been used to assess the resource and find management reference points to improve the management regime. Reducing the current effort by half and opening the fishery in May to close in December the catches will be optimised and the profits can increase significantly. In order to improve the results from the model further investigations must be taken for instance precise the shrimp biological parameters such as growth, environmental effects and stock biomass-recruitment relationship.

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DEDICATION

To my Fallen Hero! Dad, you initiated my education but never saw its fruits.

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1. Introduction

1.1. History of the fishery sector

The history of fishery sector development in Mozambique according to (Goncalves 2004) can be divided in two main periods. The first period run from the colonial time which dates as far back as the 15th century to 1975. This is the period before independence. The second period is from 1975 to date. This is the post independence period. Before the independence period the fisheries sector was not well developed. This is because of several reasons. One of which was that the country was considered as potential market for Portuguese and Angolan fishery products. This meant that the country was a big importer of fish and fishery products and at that same time the fishery industry was basically artisanal. The fish products were only used at a subsistence level and for domestic market. However, spread along the main coastal region of Maputo and Beira were semi-industrial and industrial fisheries limited in terms of number of vessels that was commercially oriented.

After independence the semi-industrial and industrial fleet were increased in terms of numbers and capacity. Two phases appear in the fishery. Note that Mozambique is one of the countries in Africa that was under colonial rule prior to 1975. Most of the investors in the country were the colonists. They owned all the fishing industry at that time. But after independence they left the country for several reasons and the Government at that time took over management of all such investment. This meant that the fishing industry of the country was totally centralised. The centralised management is what is referred to here as the first phase of the fisheries management. This will be looked at in subsequent sections. In 1987, there was a major economic reform in the country in which the Government privatised the fishery industry. A free market economic regime was ushered in and this meant more investors coming into the fishery. Effectively, the capacity and dynamic of the fishery industry was greatly improved in respond to the new market demand created.

2. Background

2.1. The shrimp fishery

The shrimp fishery is the principal fishing activity in terms of economic contribution to the country. This is due to the high shrimp export which is one of the main sources of foreign earnings. Mozambique has a total coast line of 2,700 Km. The shrimp fishery is developed in around two thirds of the total coast line length, namely in Sofala Bank region, Maputo Bay and Limpopo River mouth. Sofala Bank is the most important region in terms of extension and production volume. To support the fishing industry there are four essential fishing ports localized in Maputo, Beira, Quelimane and Angoche .

According to (Tembe 2004), the fishery sector participate with 4% on GDP and 28% in total exports of the country making the fisheries sector very important in the national economy. In terms of total fishery production based on statistics of 2003, the country earns a total value of US$ 160 millions from the fishery industry. Of this amount a US $ 102 millions comes from the shallow water shrimp fishery.

To identify priorities, strategies and to give the private sector an orientation document for investment a Master Plan was formulated in (1994). One of the main objectives of the sector states that and I quote directly '*one of the most important objectives is to increase the net exchange earnings through maximising the viability of stock exploitation, in particular the chief export product – the shrimp*' (Anon 1994). The same document identify the role of the state as '*as the owner and guardian of the fishery resources is to ensure that the resources are being exploited in the sustainable way and create a favourable climate for private investment and set up mechanisms to regulate the fishery activities. The state will continue to lend special attention to shrimp stock management on the Sofala Bank with a view to guarantee its long term exploitation*'. Again the Master Plan specifies the role of the private sector and says that '*The private sector is meant to be the principal contributor towards the improvement of the national economy participating in the formulation of priority activities to be undertaken by the state to achieve the goals for development* (Anon 1994).

The Ministry of Fisheries is responsible for the monitoring and control of the fishery activity in the territorial waters. For the industrial and semi-industrial fisheries there are two monitoring and control sub-systems. One composes of monitoring in the landing sites and the other is of monitoring at sea. The Provincial Directorates of Fisheries is in charge to control the monitoring sub-systems being the role of the National Directorate of Fisheries Administration more normative. For the monitoring in the sea, fishing observers go on board of the industrial and semi-industrial ships for a period of 30 days at maximum. The Sofala Bank extends from Angoche (16˚ S) until Mambone (21˚ S) in the strip of 40 Km from the coast with a total area of 50 000 Km^2. There are risk of infringement regarding the catching of more than the quota allocated, use of illegal mesh size, fishing during the closed season and fishing within the 3 nautical miles from the coast. The use of logbooks that is obligatory in all vessels, the inspections on board of vessels at sea and in the ports have been helping to detect and prevent these kinds of infractions.

2.2. Management

According to (Panayotou 1982) cited by (Hersoug et al. 1996), fisheries management can be defined as *'the pursuit of certain objectives through the direct or indirect control of effective fishing or some of its components'*. This definition must be seen in the view of an attempt to achieve the objectives**.**

2.2.1. Objectives

In the Mozambican reality the shallow water shrimp fishery management is seen in the context of sustainable use of natural resources (Tembe 2004). Thus, the management objectives that have been identified by many researchers take in account the need of biological, socio-economic and environmental sustainability. Therefore preservation of the resource for long-term exploitation, maximize catches, maximize the resource rent and reduction of by-catch were identified by (Saetersdal 1995) and other authors as the leaders objectives. In the light of the Master Plan (Anon 1994), other important objectives are *'socio-economic improvements such as increasing the value added to the fishing products for export through onshore processing, in particular for shrimp'*.

2.2.2. Measures

Realising that the management measures that were in use at that time (before 1985) were not sufficient other management measures were introduced in 1985 the first management measures in the post-independence period. This was because it was noticed then that there was a gradual increase in effort in the sector (Lichucha 2004). According to research information, the Total Allowable Catch (TAC), was established as the necessary condition for quota allocation and fishing mortality control (Cristina et al. 1992). Individual non transferable quotas were attributed to the industrial operators for one year time span and later on the semi-industrial operator with on board freezing conditions were also covered (Anon 2002). The minimum mesh size was altered in 1989 from 37 mm to 45 mm (Cristina et al. 1992) and in 1995 to 55 mm (Lichucha 2004). The mesh size control was introduced fundamentally to protect the juveniles in order to reach the sexual maturity.

In 1990 the Government introduced a closure season for two months running from December to January (Almeida 1992) and from 2003 one more month was added to increase the closure time for three months making it span from December to March (Sousa et al. 2003). Despite the new management measures put in place good results are not yet obvious in terms of exerted effort over the resource. This is seen from research information that shows that the total effort was almost doubled from 1980 to 1999 (Eide 2003). This is because in respond to the closure period the companies increased their total effort. This closure therefore seems to be ineffective in terms of effort control.

Nevertheless it was observed that in the first two months of the shrimp fishing season the catches are relatively high and in average the size is greater (Eide 2004). Therefore it seems that the three months closure is reflected on the catch and mean size shrimp only in two months and in the remaining almost eight months of fishing season the catches are very low. As good profits and revenues are the target for all producers or fishers, the managers must find alternatives to improve the gains and reduce the effort.

In light of the shrimp fishing strategic plan, approved in 1999, effort control was considered as a way to reverse the situation of the decreasing Catch per Unit of Effort

(CPUE). This is an additional management measure for the shrimp fishery aiming to alter the actual system based on the quota supported by the TAC.

The new management arrangement will focus on giving to the companies an annual fishing opportunity based on the limited number of standard effort taken from the "maximum annual admissible effort" that is previously established. This system will be complemented with all previous management measures, namely, mesh size, closing season, monitoring, control, etc. The quota will be used as a reference point for statistics and licensing.

2.2.3. Monitoring Control & Surveillance

Under the Ministry of Fisheries (MoF), there is the Institute of Fishery Research (IIP) with the responsibility to monitor the biological component of the fishery and the Institute for the Development of Small-Scale Fishing (IDPPE), in charge to monitor the socio-economic aspects of the fishery. The IIP through execution of cruises in annual basis and systematic sampling assesses the resource, determine the resource stock potential then give recommendations to the MoF about the TACs and closing times among other much research information. IDPPE through currying out fisheries census and socio-economic surveys and diagnosis, determine the impact of the fishing activities in the community. That information is taken into account in the fisheries development projects.

The control task is undertaken by the National Directorate of Fisheries Administration (DNAP) that has representatives in the coastal provinces. The DNAP has a board of fishing observers or inspectors in charge to control the fishing activities on shore that is at the landing places and offshore in the fishing vessels.

For the surveillance of fishing activities and the territorial waters efforts has been done to improve the collaboration between the Army, Maritime Police, Maritime Administration and Administration and Marine Surveillance Services (SAFMAR). In 2003 these agencies together with the Fisheries Administration carried out several operations during the closing season and some small scale vessels were arrested (Tomás 2004).

2.2.4. Effects of the management measures

The closing season regulation was introduced in 1991 and brought both good and worrying effects on the shrimp fishery; the catches tended to be stable in the short run, however the total effort was increased because the Companies increased the fishing hours per day from around 18 to 24 hours. This total effort is considered to be unsustainable in the long run.

2.3. Constrains

Notwithstanding the importance of the use of quota allocation it is considered to be an inefficient measure for better management of the shrimp fishery as the companies are trying to increase the total effort to be able to compensate the closing season even in the case of reduced abundance. The quota system must be complemented with the effort control measure.

2.4. Bioeconomic studies

Some bio-economic and economic studies have been carried out to assess the fishery. In these studies different models were used, for instance, short and long run models. '*Since 1991 the modelling has been improved in terms of biological part as well as in the fleet dynamics'* (Eide 1993). The assessment results show that the resource rent still produced despite the decreasing tendency of the CPUE.

This paper will focus on a tentative approach to increase the total revenue meanwhile reducing the total effort over the resource in the long run. This will be reflected in increasing catches and improving the size of shrimp over the fishing year. One of the most important objectives is 'increasing the gains from the shrimp fishery' according the Mozambican Fishery Policy (Anon 2003a). Therefore, this tentative approach ties well with the national development objectives.

3. Research problem

Despite the fact that the shrimp fishery currently is showing constant revenues for the most efficient companies as shown by (Eide 2004), there is however '*mention that some new operators face difficulties in making a profitable fishery and some already have left the fishery*'. The same report for a stock assessment studies taken in annual basis shows a systematic reduction of the stock size from around 7,000 tonnes in 1977 to around 2,000 tonnes in 1999 and in the same period there has also been increase in effort from around 108,000 hours to 300,000.The problems mentioned above shows clearly that the resource rent is not maximised and long-term exploitation of the fishery will eventually be compromised.

It should be noted though that the fishery currently is being managed on a closed season basis. Because of this management system it has been possible to keep running the fishery update. There is business in the first two months after opening the fishing season as indicated by good catches and the increase in the shrimp size. Nevertheless after that time (two months), the catches and the shrimp size starts decreasing continuously until the end of the fishing season. This study will try to propose means by which the current problems in the shrimp fishery in the country can be reduced. This will be done through the design of appropriate bioeconomic models to work hand in hand with the current management regime.

3.1. Objective of the study

This study basically has two major objectives namely;

I. Investigate the resource rent potential to increase the total revenue, optimizing catches and reducing the effort over the resource.
II. Find out reference points to be the basis for management regime.

3.2. Expectations

It is expected that the study will give valuable contribution and ideas on the modelling approach to improve the management and gains from the shallow water shrimp fishery in the Sofala Bank.

3.3. Relevance

The relevance of this study is to make different approach from the previous assessment studies of the shrimp as Beverton-Holt model consider factors affecting biomass through time, such as growth, recruitment and mortality to find fishing management alternatives to improve the resource rent.

3.4. Limitations of the study

The main limitations of this study are related with the scarcity of some important biological and economic information. There is no clear information about the relationship between the recruitment and the runoff of the rivers in the Sofala Bank area. In the economic side, data about costs and revenues are considered to be as “top secret information” by the Companies thus difficult to be revealed.

4. Materials and Methodology

4.1. Materials

4.1.1. Shrimp biology and ecology

The Indian White prawn, *Penaeus indicus* and Speckled shrimp, *Metapenaeus monoceros* (Fischer et al. 1990) are the most important species caught by the three main fleets, namely, artisanal, semi-industrial and industrial (Sousa et al. 1992). The resource is currently intensively exploited and thus a tremendous reduction of catches have been recorded as from 1986 to 1994 (Eide 2003). From 1995 the level of catches are oscillating and in 2003 the lowest figure was recorded. This situation is seen as a threat for the sustainability of the resource. Giant tiger prawn, *Penaeus monodon,* Green tiger prawn, *Penaeus semisulcatus*, Kuruma prawn, *Penaeus japonicus and* Western king prawn, *Penaeus latisulcatus* are the other species caught by the industrial fleet (Sousa et al. 1992).

4.1.2. Life cycle[1]

Post-larvae and juveniles of all species of white prawn and speckled shrimp occur in estuaries and lagoons, their adults migrate to the sea. All these species favour a bottom substratum of mud, or mud and sand, a few white prawn prefers soft sand, while green tiger prawn, in their breeding stage prefer soft green mud, pre-adults of green tiger prawn are found on a mixture of mud, sand and shell grit in the sea; most species are found at the depths of 8 to 30 m in the sea, some may be found at greater depths up to 90 m.

Shrimps generally breed in the sea (Macia 2004). Eggs are hatched in the sea and develop into post-larvae which migrate into lagoons and backwaters for growth and maturity. On maturing they return to the sea for reproduction. Most species are nocturnal in habit and hide in the mud or soft sand during the daytime, forming large schools, especially *Metapenaeus.* Some migrate into mid-water and surface, perhaps for copulation and

[1] Bliss, D. E. and A. Provenzano (1985). The Biology of Crustacea, Economic Aspects: Fisheries and Culture. New York and Norfolk, Academic Press, Inc.

breeding. Many feed on detritus, benthic amphipods, polychaetes, and some are cannibalistic. Others feed on a mixed diet of animal and plant like giant tiger prawn.

Species belonging to *Penaeus* and *Metapenaeus* except those of small size are of very great commercial value and are mainly exported to Japan and USA. They form the food of many fishes and play a major role in food relationships and ecology in both lagoons and the sea. Some are used as live bait for large carangids as they remain alive out of water for several hours.

4.1.3. Natural mortality

Natural mortality is the mortality created by all other causes except fishing. Examples of natural mortality include among others predation due to cannibalism and other biological factors like diseases, spawning stress, starvation and old age (Sparre et al. 1992). Natural mortality is normally related to the environment, it means that, the same species living in different locations can show different natural mortality rates, depending on the ecosystem (predators, competitors, food abundance, etc.). Similar shrimp species in Mexico have annual mortality rates ranging from 1 to 11 (Gulland et al. 1981). In the Sofala Bank the annual natural mortality of shrimp is estimated to be around 2.16 (Eide 1992).

4.1.4. Recruitment

Surveys to measure the recruitment for the Mozambican most important species white prawn and speckled shrimp are carried out to study the relationship between recruitment and the catch during the year. This gives facilities to predict annual catch (Sousa et al. 2003).

'Reef fish ecologists often equate recruitment with the time when larvae first settle on a reef and can be counted by underwater visual census techniques' (Jennings et al. 2001). In this shrimp case we define recruitment as the '*number of youngest year class shrimp that enter in the fishery*' (Sparre et al. 1992). The detailed data on number of Mozambican shrimp recruitment can be seen in the table 1.

Table 1: The shrimp recruitment in numbers

Year	Recruitment (millions)	Year	Recruitment (millions)
1977	1,437	1984	939
1978	1,384	1985	967
1979	1,145	1986	913
1980	1,042	1987	865
1981	1,189	1988	861
1982	980	1989	697
1983	911	1990	649

Source: (Eide 1992)

The relationship between the spawners and new recruits is important to know because it gives an indication about the possibility to maintain the stock abundance under the fishing activity. In some cases the recruitment tends to be poorer when the biomass is lower (Caputi et al. 1998). Evidence on the relationship between the biomass and recruitment can be observed in the table below. Note that the high biomass gives high recruitment.

Table 2: Relationship between average biomass and number of recruits

Year	Average biomass (in tonnes)	Recruitment (in millions)
1977	7,989	1,437
1978	7,388	1,384
1979	5,498	1,145
1980	4,983	1,042
1981	5,498	1,189
1982	4,381	980
1983	3,350	911
1984	3,608	939
1985	4,038	967
1986	3,772	913
1987	3,674	865
1988	3,550	861
1989	2,954	697
1990	2,496	649

Source: (Eide 1992)

If the amount of spawners is not sufficient to recover the stock abundance, in the long run the stock will be depleted or even extinct. There are several possibilities to describe the spawner-recruit relationship. Here the study will show the two examples from (Clark 1990), that is the normal compensation and the overcompensation. This is clearly represented in the graphs (a) and (b) below. '*In both graphs the assumptions are of discrete-time model with equilibrium points P = K represented by the equation: [F(K) = K]. On the 45˚ line will be found any of the equilibrium points*'.

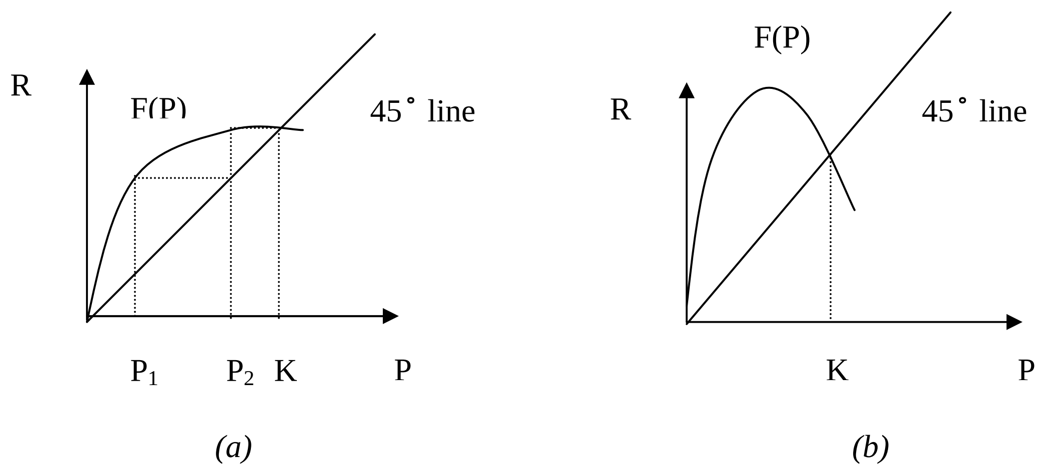


Figure 1: Spawner-recruit relationship curves

The graph (*a)* indicates the consecutive population levels (P_1, P_2, etc.) and the corresponding level of recruits tending to the equilibrium point K and in the example (*b)* there is the case of overcompensation because the sequence of parent stock P is having oscillations that converge to the equilibrium point K.

The environment also affects the recruitment, in particular the rivers run off. The Zambezi River runoff has effect on the recruitment of speckled prawn. For white prawn was not found to be closely related to Zambezi River runoff (Sousa et al. 2003). It is important to mention that the management of the Cahora Bassa Dam can influence the runoff of the Zambezi River down stream. It is not yet known the real effects of the Cahora Bassa Dam on the environment beside the most known appearance of Kapenta (*Limnothrissa miodon*) in the Cahora Bassa reservoir created in 1975 in the sequence of the construction of the Dam (Silva et al. 2004). The wettest years of the Zambezi basin was recorded in between the 1940s and 1970s. The period between 80s and 90s was characterized by prolonged draught in all the Southern Region of Africa with serious implications in the Zambezi basin. In the last 25 years were recorded two floods in the down Zambezi namely in 1977 and 2000, 1978 being exceptionally wet while 2001 was wet only in February and March (Silva et al. 2004).

4.1.5. The effort and fleet

The industrial and semi-industrial fleets are the most important in terms of effort exerted and the volume of catches. In 2003 there were 111 vessels operating in the shrimp fishery. Out of which 61 were industrials and 50 semi-industrials. The total effort was 7,447 fishing days and the industrial fleets accounted for 5,295 fishing days while 2,152 fishing days belonged to the semi-industrial fleet (Anon 2003b). The table below highlights the fishing effort and their corresponding years in the shrimp fishery from 1977 to 1990.

Table 3: Trend in total effort in shrimp fishery

Year	Effort (in 1000 Vega hours)	Year	Effort (in 1000 Vega hours)
1977	102	1984	195
1978	112	1985	173
1979	137	1986	175
1980	138	1987	168
1981	147	1988	170
1982	155	1989	166
1983	208	1990	195

Source: (Eide 1992)

The table below describe the fleet structure of the shrimp industry and it shows that from 1988 to 2002, the number of vessels increased from 126 to 143. Note that there are tendency to reduce the industrial vessels and increase the semi-industrial. This was recommended by the National Fisheries Policy to reduce gradually the industrial vessels and increase the semi-industrial as a measure to bring down the total effort (Anon 2003) .

Table 4: Shallow water shrimp licensed vessels (1998-2002)

Year	Industrial	Semi-industrial				Total
		Freezer (SB)	Ice (SB)	Ice (MB)	Ice (LR)	
1998	65	21	22	18	0	126
1999	67	28	25	21	0	141
2000	58	27	20	22	0	127
2001	60	20	33	23	0	136
2002	59	20	34	25	5	143

Source: (Anon 2002) - SB - Sofala Bank; MB - Maputo Bay; LR - Limpopo River

4.1.6. Catches

The shrimp production in 2003 was 7,690 tonnes. This has been considered the lowest since 1994 (Sousa et al. 2003). All the products are exported as raw material to the European Union (EU) and Japan. Some of the product goes to the regional markets of South Africa, Malawi and Zimbabwe (Wilson et al. 1999). Catch trend is shown in the table 5 below.

Table 5: Shrimp catches 1977-2003

Year	Catch (in tonnes)	Year	Catch (in tonnes)
1977	9,500	1991	6,967
1978	9,600	1992	6,332
1979	8,778	1993	6,696
1980	8,007	1994	6,321
1981	9,377	1995	7,344
1982	7,908	1996	7,221
1983	8,101	1997	8,419
1984	8,205	1998	7,861
1985	8,128	1999	8,114
1986	7,720	2000	9,140
1987	7,206	2001	9,162
1988	7,290	2002	9,000
1989	5,807	2003	7,690
1990	5,668		

Source: (Dengbol et al. 2002)

Changes in catch are reflected in the catch per unit of effort (CPUE). In the historical data, the CPUE is decreasing from 1977. Also during the fishing year there are changes in the CPUE with the peak occurring in March, which then start decreasing until December when the fishery is closed. The CPUE trend is shown in the table 6 below.

Table 6: CPUE trend 1977-1999

Year	CPUE (Kg/hour)	Year	CPUE (Kg/hour)
1977	93.1	1989	35.0
1978	85.7	1990	29.0
1979	64.1	1991	32.0
1980	58.0	1992	31.0
1981	64.0	1993	31.0
1982	51.0	1994	28.5
1983	39.0	1995	28.9
1984	42.0	1996	26.7
1985	47.0	1997	30.3
1986	44.0	1998	25.9
1987	43.0	1999	25.8
1988	43.0		

Souce: (Dengbol et al. 2002)

4.1.7. Fishing mortality

Fishing mortality is the mortality caused by fishing activity. The gear selectivity plays important role in this mortality. Therefore bigger shrimp suffer more fishing mortality than smaller. The total effort is a factor to consider in the long run for securing the resource sustainability. To determine fishing mortality is not easy and usually entails a very difficult task. This analysis will use mortality information from the data published by the Mozambican Fishery Institute of Research (IIP). According to this source, the annual fishing mortality is estimated to be about 2.1 (Cristina et al. 1992).

4.1.8. Biomass

In the total catch history, the biomass has been decreasing gradually from 1977 as result of intense exploitation. In monthly basis, expected changes in biomass can be observed as attaining the peak in March then decreasing gradually from April to December. The tables below show the trend in shrimp biomass from 1997 to 1999.

Table 7: Average annual shrimp biomass trend

Year	Average stock biomass (in tonnes)	Year	Average stock biomass (in tonnes)
1977	7,989	1989	2,954
1978	7,388	1990	2,496
1979	5,498	1991	2,746
1980	4,983	1992	2,660
1981	5,498	1993	2,660
1982	4,381	1994	2,446
1983	3,350	1995	2,480
1984	3,608	1996	2,114
1985	4,038	1997	2,509
1986	3,772	1998	2,241
1987	3,674	1999	2,310
1988	3,550		

Source: (Dengbol et al. 2002)

Similarly to the annual average biomass in the monthly biomass there are also decreasing tendencies from 1988 to 1990.

Table 8: Monthly variation of the stock biomass in tonnes

Year / Month	1988	1989	1990
January	2,969	2,943	2,191
February	3,807	3,291	2,935
March	4,775	4,168	3,744
April	4,723	4,061	3,590
May	4,437	3,757	3,269
June	4,049	3,378	2,898
July	3,638	2,998	2,542
August	3,279	2,673	2,245
September	2,965	2,400	2,005
October	2,704	2,181	1,820
November	2,494	2,012	1,681
December	2,331	1,885	1,585

Source: (Eide 1992)

4.2. Methodology

The shrimp fishery catches shrimps from different year classes and in different abundance at the time they become ready for the fishing activity. To optimize the value of these cohorts, bioeconomic models can help to predict the right time to harvest in order to maximize the value of the shrimp. Beverton-Holt and Schaefer-Gordon models will be used in this study. The data used in this paper is based on general information from reports and in most cases are used average figures from historical data. The economic calculations regarding costs, revenues and profits are related to estimations values for "19 m vessel with freezing capacity".

4.2.1. Beverton-Holt model

Beverton-Holt suggests that the fish population consists of a number of different year-classes or cohorts, one resulting from each annual spawning and subsequent recruitment' (Clark 1990). In this particular case consideration of the year-classes of shallow water shrimp of Sofala Bank in Mozambique will be made. Note that the year class is the number of individuals born in that specific year and from it is possible to deduce the number of individuals each day using the number of individual function. It is therefore necessary to have a deeper look at the function.

4.2.1.1. Number of individuals function

To know the number of shrimp individuals alive at any point in time t in the future it will be a function of the number of shrimp alive now minus total mortality. If the initial population size is called N_t, then the number alive one point in time unit later N_{t+1}, will be expressed by the equation (Jennings et al. 2001):

$$N_{t+1} = N_t e^{-(F+M)} \qquad (1)$$

Where, the symbol *F* is the rate of shrimp mortality; *M* is the rate of natural mortality and e is the base of the natural logarithm (e = 2.71828) (Jennings et al. 2001). If it is considered that the gear will catch only shrimp at knife-edge, and the small shrimp will not be caught, the number of fish in the cohort is equal to the recruitment N(0) = R therefore we will have (Clark 1990):

$$N(t) = \begin{cases} Re^{-Mt} & for\ 0 < t < t_\mu \\ Re^{-Mt_\mu} e^{-(M+F)(t-t_\mu)} & for\ t \geq t_\mu \end{cases} \qquad (2)$$

Where *N(t)* is number of shrimp in the cohort at time t; *R* is the recruitment; t_μ is the time at which the cohort becomes first available to the fishing gear (Clark 1990), assuming that the fishing mortality, recruitment and mesh size are constant.

From the equation (1) and (2) we can calculate the rate of change in number of shrimp alive in the cohort N_t over time which can be expressed as a function of natural mortality *M* and fishing mortality *F* (for F>0) respectively. If the fishing mortality equal zero (F=0) the number of recruits depends only on the natural mortality. Using the equation (2), the number of individuals will be determined for one year (365 days). Refer to appendices 1 and 2 for tables showing F=0 and for F≥0. The calculations for number of individuals each day when F=0 uses only the daily natural mortality coefficient along all the year. These calculations are necessary to determine the time at which the cohort achieves its maximum biomass. This time is expressed in days. It is necessary to make complementary calculations for F≥0 that give us the daily number of individuals present in the cohort in case of starting the fishing activity. Here both natural and fishing mortality coefficients will be used keeping in mind that in the beginning of the year there is no fishing mortality therefore (F=0). This is due to the fact that there is no fishing activity and also the shrimp size is very small, a clear combined factor which makes it unavailable to be caught by the net. For simulation purposes different opening times will be used. This time can be in the second, third or fourth month of the year. If the fishing mortality is a function of catchability *q* and fishing effort *f* the equation (1) can be written as below (Clark 1990):

$$\frac{dN}{dt} = -(F + M)N \quad (3)$$

4.2.1.2. Catch function

The number of individuals caught over time C_t is the proportion of losses due to the fishing mortality and can be given by the equation below (Jennings et al. 2001):

$$C_t = \frac{F}{Z} N_t (1 - e^{-Z}) \quad (4)$$

Where Z = F+M; and the daily catch C_t**,** will be equal to (Clark 1990):

$$C_t = F_t N_t \quad (5)$$

Derived from the yield equation (Clark 1990): $Y = Y_\mu(F) = \int_{t_\mu}^{\infty} FN(t)w(t)\,dt$

4.2.1.3. Growth in length and weight

Growth in length of aquatic organisms is very well described using the von Bertalanffy growth equation (Jennings et al. 2001):

$$L_t = L_\infty (1 - e^{-k(t - t_o)}) \quad (6)$$

'Where, L_t is the length at age t; L_∞ the length at which growth rate is in theory equal to zero; k is coefficient the body growth and t_o is the time at which the length is equal to zero. If the equation (6) is combined with the length-weight relationship ($w = aL^b$) it can be rearranged to give the von Bertalanffy growth curve for weight (Jennings et al. 2001):

$$w_t = w_\infty (1 - e^{-k(t - t_o)})^b \quad (7)$$

Where, w_t is the weight at age t, w_∞ is the weight at which the growth rate is in theory equal to zero and *b* is the parameter from length-weight relationship.

The total biomass of the cohort is therefore equal to: $B(t) = N(t)w(t)$ (8)

The size of stock biomass is an indication of the resource productivity and is reflected in the catch as the catch depends on the number and weight of individuals.

4.2.1.4. Optimization in the Beverton-Holt model

Describing the fishery in terms of mesh size μ and fishing mortality coefficient *F*, Beverton and Holt introduce the concept of *eumetric yield curve*, '*meaning that for each value of F there exists some mesh size μ that results in maximum possible sustainable yield:* $Y_{eum}(F) = max_\mu Y_\mu(F)$' (Flaaten 2004c) .

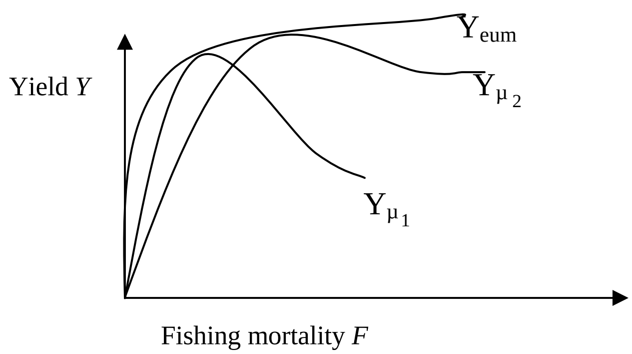


Figure 2: Eumetric yield curves

Considering a single cohort, the optimal fishing will not capture immature shrimp. It is not necessary to take into account the mesh size factor in such a case. The fishing mortality *F* that gives the maximum yield at a specific age of first capture is called F_{max} (Flaaten 2004c). The F_{max} is expected to give the maximum revenue from the fishery assuming that the price is constant and the costs are proportional to the effort (Clark 1990). The fishing mortality is the control variable for the present value (PV).

4.2.1.5. Present value (PV)

Present Value is the amount of funds that must be invested at present in order to reach a determined amount of assets at a specified future date. The fish stock can be considered as a capital therefore a subject to be managed in the best way depending on the interest rates. The choice will be related to management principles conducing the catch biomass to be either above, below or equal to the natural growth of the stock (Flaaten 2004b). Normally, lower interest rate imply higher present value (Henderson 2002). To postpone fishing for the future use, the present value of the future must be greater than the value of harvesting now (Flaaten 2004b). According to Clark et al., 1990 the present value (PV) of profits from fishing such a cohort will be given by the expression:

$$PV = \int_0^{\infty} e^{-\delta t}(pN(t)w(t) - c)F(t)dt \qquad (9)$$

Where δ is the discount rate; *F(t)* is the fishing mortality; *p* is price, N_t is number of shrimp at time t; *w(t)* is mean individual weight at time t and *c* is fishing costs
Therefore, the optimal number of fish will be given by the equation (Clark 1990):

$$N^*(t) = \frac{p^{-1}c\delta}{w(t)\left(\delta + M - \frac{\dot{w}(t)}{w(t)}\right)} \qquad (10)$$

and the biomass B*(t) = N*(t)w(t):

$$B^*(t) = \frac{p^{-1}c\delta}{\delta + M - \frac{\dot{w}(t)}{w(t)}} \qquad (11)$$

Where, *p* is the price per tonne; *c* is the cost as a function of the fishing mortality; δ is the discount rate which is assumed to be 8.5% (Almeida 2004), *M* natural mortality and $\dot{w}(t)/w(t)$ is the relative change in weight. For a single cohort, the optimal fishing, equation (10) can be represented graphically as in the (figure 3), where: $B^*(t)$ is the optimal fishing biomass in time t equation (11); $B_o(t)$ is the cohort biomass curve before fishing; t_δ is the age at the first capture; t_o is age at the maximum cohort biomass.

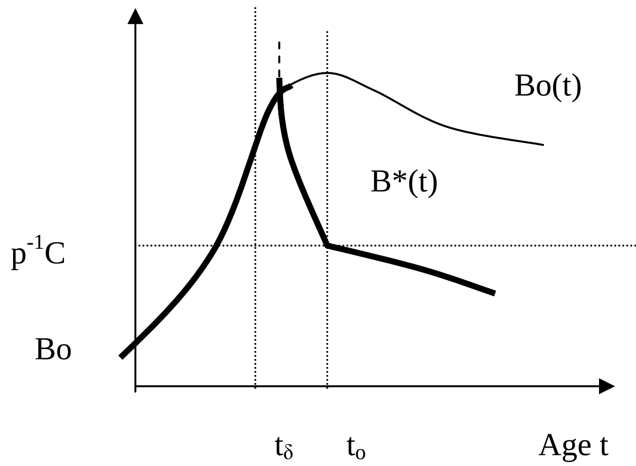


Figure 3: Optimal biomass curve B*(t)

The Figure 3 (Clark 1990), gives us important economic references (Flaaten 2005a) that are necessary to refer to for better understanding of the optimum biomass dynamic and its relationship with the benefit maximization. The curve B_o (t) represents the shrimp biomass growth over time t, which results from the equation (8). The shrimp biomass achieves its maximum at time t_o if fishing mortality is equal to zero (F = 0). At t_o the relative decrease in number of shrimp $(-\dot{N}/N)$ equals the relative weight growth in individuals $(\dot{W}/W)$. For $t > t_o$ the biomass curve decreases because the relative number of shrimp decreases faster than relative weight of individuals increases. Despite the high level of biomass, it is not worth and rational to start fishing at this time (t_o) because we will lose the potential abundance and will not optimize the fishery. In addition, it would be necessary to use an extremely high number of vessels at t_o to harvest total biomass B_o(t), such capital cost would not be sustainable. Therefore we should find another point that can give us a chance to optimize the gain in net economic terms (equation (9) and (11)) and not only the catch. That point is localized before t_o and is given by the asymptote of the optimum biomass (B*) represented by $t = t_\delta$. At this point, the relative change in weight $(\dot{W}/W)$ is equal to the sum of the natural mortality (M) and the interest rate (δ), relate to equation (11):

$$\frac{\dot{w}(t)}{w(t)} = M + \delta \qquad (12)$$

Increasing the interest rate (δ) the age at first capture t_δ will decrease and most of the individuals will be caught before they achieve big size.

It is considered that the price and costs are constant, but in real it can change according the market dynamics. For Mozambican shrimp, the main market is European Union (EU) and Japan. Actually, in both markets the prices are stable now as a result of stable production both from fishing and aquaculture. Nevertheless price can fall if the market supply increase as a result of aquaculture improvements. Considering the optimal biomass path B*(t) and the cohort biomass $B_o(t)$ we are now able to find the precise point to start the fishing, which is the point where B*(t) is equal to $B_o(t)$.

4.2.1.6. Fishing Costs

The fishing costs can be divided in variable and fixed costs. The variable costs are all those costs that can change when the output change and the fixed costs do not change with changes in the outputs and they exist even if there is no production. Total costs are the sum of variable and fixed costs. In some countries the fishing costs can be shared between vessel owner and crew (Flaaten 2004b). Among others, the main costs to be shared are, fuel and lubricants, bait, gear maintenance fees and provisions. In the table below we can see the main variable and fixed costs for Mozambican 19m trawler.

Table 9: Fixed and variable costs of 19m trawler

Fixed costs (1000 $ USD)		**Variable costs (1000 $ USD)**	
Salaries (national crew)	9.0	Salaries (national crew)	25.4
Salaries (expatriate crew)	32.8	Salaries (expatriate crew)	53.2
Trips	7.7	Fuel & Lubricants	173.7
Maintenance & repair	30.0	Packing materials	23.8
Food	10.0	Fishing gears	34.0
Depreciation	118.3	Ports expenses	4.0
Insurance	17.3	Off-shore assistance	25.0
Accountant	1.0	Trading costs	2.0
Technical assistance	12.9	Bank expenses	8.0
Other costs	12.0	Other costs	7.0
Fishing licence	10.3		
Sub-total	**261.3**	**Sub-total**	**356.1**

Source: (Almeida 2004)

From equation (14), our costs will be considered as a function of fishing mortality (F) (Flaaten 2005b), therefore it is related to the effort (f) and catchability coefficient (q). And the catchability *q* will be equal to:

$$q = \frac{Y}{fNw} \qquad (13)$$

Where, *Y* is the catch biomass; *f* fishing effort in days; *N* number of shrimp individuals and *w* the shrimp individual weight.

4.2.1.7. Resource rent (π)

According (Flaaten 2004a) the fishing benefits or earnings in excess after deducing the costs are called profit or resource rent, in fisheries it vary with fishing effort (a/q – from the equation (14)).

The resource rent π is assumed to be (Flaaten 2005b):

$$\pi = F\,(pNw - \frac{a}{q}) \tag{14}$$

Where $c = a/q$. The fishing costs c are a function of the fishing mortality, assuming that a is the cost per unit of effort (Flaaten 2005b).

4.2.2. Gordon-Schaefer model

According to the Gordon-Schaefer model, to maximise the resource rent π(E) = TR(E) – *TC(E)* the necessary condition is to have the marginal cost of effort *MC(E)* equalling to the marginal revenue of the effort *MR(E)*. This statement is based on the regression equation that describes the natural growth of the population (Flaaten 2004a).

4.2.2.1. Natural growth function

For better understanding it is necessary to start describing the logistic model based on the natural growth equation (Eide 1992):

$$F(X) = rX(1 - \frac{X}{K}) \tag{15}$$

Where, *F(X)* is the natural growth; *r* is the maximum relative growth rate; *X* is the stock level and *K* is the carrying capacity. From this equation the MSY of a biological stock can be derived.

4.2.2.2. Maximum sustainable yield

From the equation (15) above the stock level (X_{MSY}) that produces the maximum sustainable yield (MSY) can be deduce and equals (Flaaten 2004a):

$$X_{MSY} = \frac{K}{2} \tag{16}$$

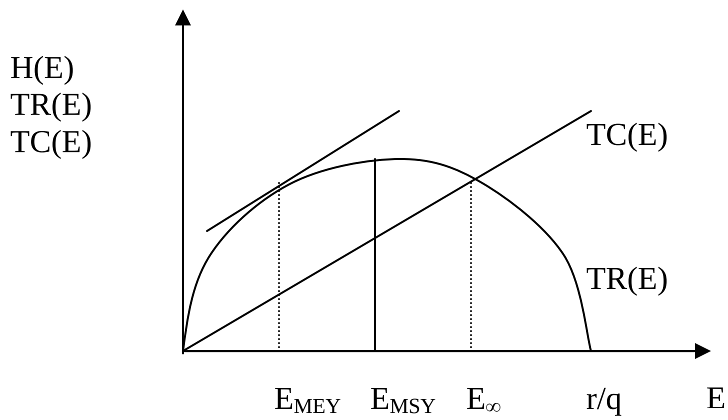
and the MSY that corresponds to the stock level will be (Flaaten 2004a):

$$MSY = F(X_{MSY}) = r\frac{K}{4} \tag{17}$$

In the long-run a natural equilibrium between catch and growth will be established (Flaaten 2004a), thus the natural growth function is equal to the harvest as follows:

$$F(X) = H\ ;\ H = H(E) = qKE\,(1 - \frac{qE}{r}) \qquad (18)$$

Where, q is catchability and E effort.



Harvest = H(E); Total revenue = TR(E); Total cost = TC(E)

Figure 4: Long-run Schaefer model

4.2.2.3. Gordon-Schaefer optimal harvesting

If p is considered as a constant price and multiplied with the harvest obtained in the equation (15), the total revenue *TR* is obtained (Flaaten 2004a):

$$TR(E) = pH = pqKE\,(1 - \frac{qE}{r}) \qquad (19)$$

and the marginal revenue *MR* will be derived from the equation (19) as a derivative of the TR as follows :

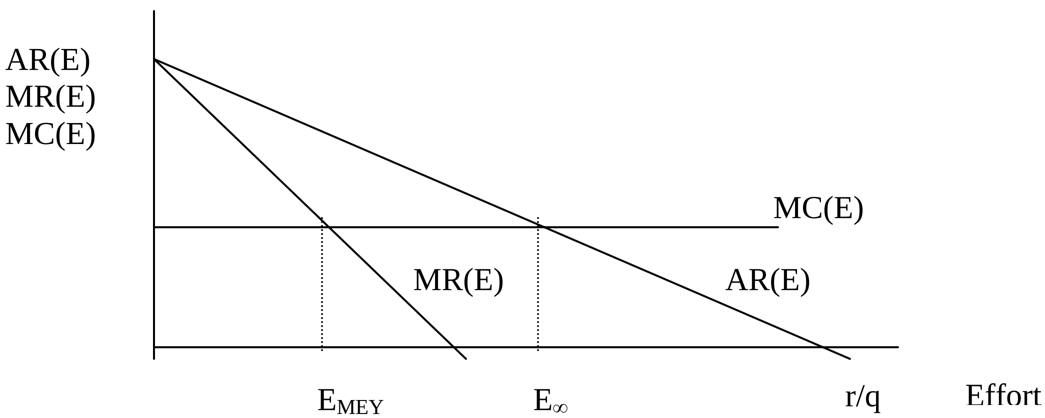
$$MR(E) = \frac{dTR(E)}{dE} = pqK(1 - \frac{2qE}{r}) \qquad (20)$$

The effort level that maximise the resource rent (E_{MEY}) can be calculated from the equation (20) that will be (Flaaten 2004a):

$$E_{MEY} = \frac{r}{2q}(1 - \frac{a}{pqK}) \qquad (21)$$

This equation (21) can be used to calculate the maximum economic yield effort in the management alternatives to find the effort that maximise the gains from the fishery. The parameters *r* and *K* will be estimated applying the regression method using information from tables 7 (average annual biomass) and table 5 (annual catch).

Summarily it can be said that Gordon-Schaefer suggests that when costs to enter into fishery are low the fishery will develop beyond the biological sustainability depleting the shrimp stock. Nevertheless, it is not clear about the costs involved in moving from high effort situation to maximum economic yield (MEY).



AR(E) – Average revenue; MR(E) – Marginal revenue; MC(E) – Marginal cost;

Figure 5: Marginal revenue and costs; Average revenue curves of the Gordon-Schaefer model

5. Results

This chapter presents the results from calculations, using both Beverton-Holt model. The results can be divided in biological and economic reference points.

5.1. Biological results

5.1.1. Recruitment

The number of recruits was estimated to be around 998.5 millions that is the average number from the historical data that is presented in table 1. This number was later on adjusted to the total biomass caught in the season and became 1,997 millions. Calculations undertaken (in appendix 1) using the equation (2) gives the following graphical results:

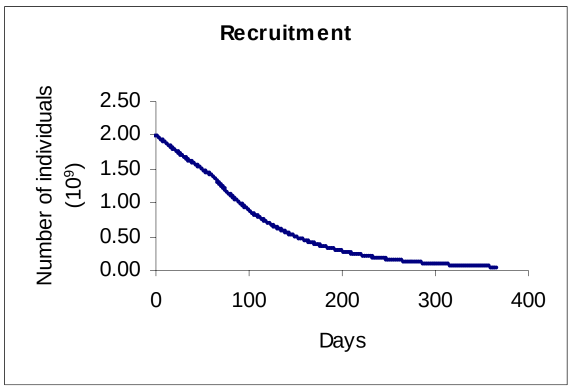
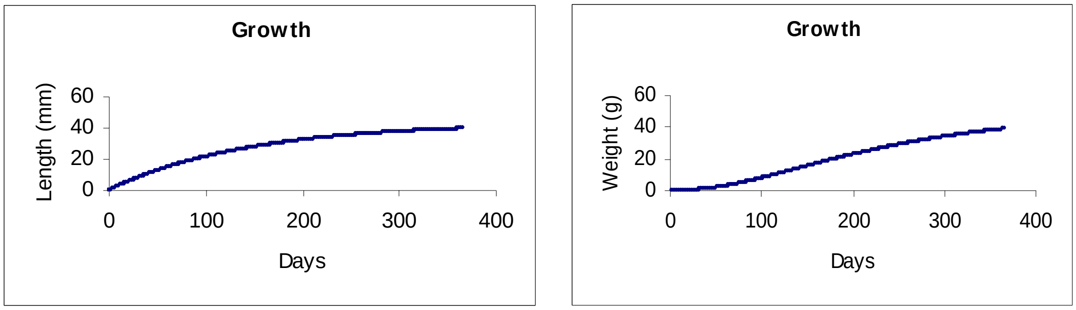


Figure 6: Number of shrimp individuals along the year

Note the curve changes its shape slightly from 60th day. It is assumed that in the first two months (January and February) there is a closure for fishing activity (F=0). The decreasing tendency of the curve is due to the natural mortality alone. In March the fishing activity starts (F>0). The beginning of the fishery is marked by the 'slope' then the curve continues decreasing smoothly as a result of both natural and fishing mortalities (Z) until the end of the season at 365 days (December). In the course of their life the recruits observe growth in length and weight, which is faster in the beginning and gets stable when the individuals gets the maturity age. The curves below (a) and (b) represents the daily growth in length and weight of the cohort during the year. The average length is 27.4 mm and weight is 19.3 g. The maximum length and weight achieved is respectively, 39.5 mm and 38.7 g. Details of calculations made using the von Bertalanffy equation (6) can be seen in the (appendix 1).



(a) *(b)*

Figure 7: Growth parameters curves, length (a) and weight (b)

5.1.2. Stock biomass

The stock biomass results from multiplying the number of shrimp recruits times the weight. It grows fast in the beginning until when it reaches its peak by day 202 which is in the middle of July. Then it starts decreasing because the mortality rate becomes greater than the growth. The size of the biomass is an indication of abundance and it is related to the CPUE. The curve below describes the biomass.

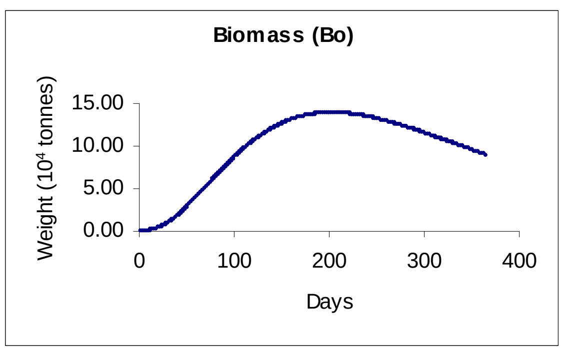
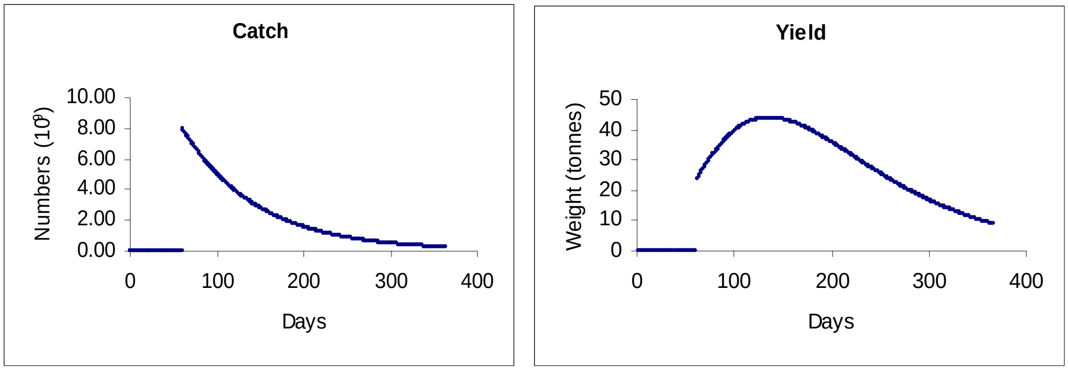


Figure 8: Biomass curve of the cohort

5.1.3. Catch and Yield

The catch in number of individuals was calculated using the equation (5) and the biomass was calculated from the equation (8). The graphical representation of the curves is shown in the figures (a) and (b) below.



(a) *(b)*

Figure 9: Catch and Yield curves

5.2. Economic reference points

Economic reference points are related to the biological parameters and time giving ideas about which strategy can be taken to make better economic use of the biological potential of the resource. Details on calculations of the economic reference points, for instance, the value of the catch (total revenue), variable costs, fixed costs and profits can be seen in the table 11. Three management alternatives are pointed out as well, to find the best option in terms of profits or resource rent.

5.2.1. Opening and closing fishery days

Running the Beverton-Holt model the opening day found is at 197th day. This is the day when the relative change in biomass ($\dot{B}/B$) is equal to the daily discount rate. In this specific case it happens 5 days before the biomass achieve its maximum growth on the 202nd day. In the (figure 10) below the natural biomass curve Bo(t) describes the biomass behaviour during the fishing year while the optimum biomass B*(t) is represented only from 198 to the end of the year. Note that in the left hand side of the optimum biomass curve we do not find the economic solution (refer to appendix 3a) until day 198 when it achieves the maximum growth, then decreases in very steep slop towards zero. This curve B*(t) was expected to look like the curve presented in the figure 3. The difference is due to the calculations. For this curve (figure 10), B*(t) was calculated in daily base and in figure 3 in annual base.

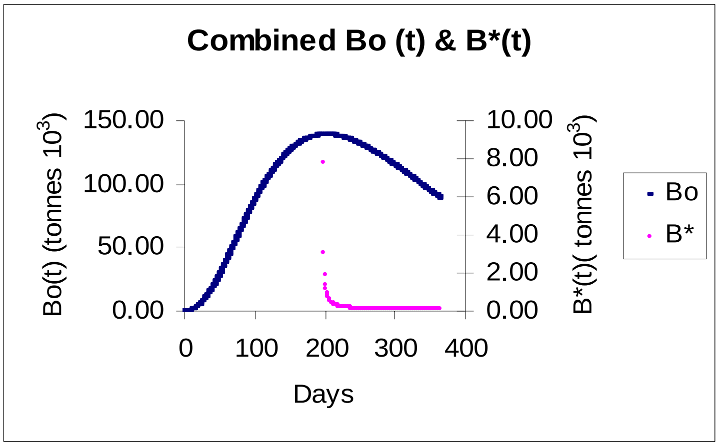


Figure 10: Natural and optimum biomass curves

For opening and closing days there will be only five days for fishing activities. In this way the profitability of the fishery will be difficult because the fishery will demand a huge effort to fish all the available biomass. This short interval for fishing activity is happening due to the relatively low discount rate δ. When δ tend to zero, the asymptote to the curve B*(t) t_δ tend to t_o time at which the natural biomass achieves its maximum growth (refer to figure 3). To find the ideal solution for this fishery, some management alternatives will be proposed.

5.3. Management alternatives and results

To suggest the best way to manage the fishery, three different possible alternatives were simulated taking into account the number of vessels, opening and closing days as follows:

- changing the number of vessels maintaining the opening and closing days;
- changing the opening days, maintaining constant the number of vessels and closing days;
- changing the closing days, maintaining constant the number of vessels and opening days;

Summarily, the three alternatives are presented in table below:

Table 10: Management alternatives

Variants	No. of vessels	Fishing Days	Opening date	Closing date
No. Vessels	120	27,000	01-March	31-December
	110	24,750	01-March	31-December
	100	22,500	01-March	31-December
Open fishery	50	10,000	01-April	31-December
	50	8,750	01-May	31-December
	50	7,500	01-June	31-December
Closing fishery	50	7,500	01-March	30-September
	50	8,750	01-March	31-October
	50	10,000	01-March	30-November

From the management alternatives some important economic reference points can be found and details on the calculations can be seen in the table below.

Table 11: Simulation scenarios of the results on management alternatives

Managem. alternatives	No vessel / Months	Fish. Days	Opening Date	Closing Date	Catch (tonnes)	Value of Catch 10^3	Variable Costs	Fixed Costs 10^3	Profits
Reference scenario for year (2002) (Anon 2003b)									
No. vessels	113	19,315	15-Mar	16-Dec	8,637	86,370	25,954,988	29,526,900	30,888,113.21
Simulation scenario									
No. Vessels	120	27,000	01-Mar	31-Dec	8,773	87,726	36,281,887	31,356,000	20,087,713.21
	110	24,750	01-Mar	31-Dec	8,773	87,726	33,258,396	28,743,000	25,724,203.77
	100	22,500	01-Mar	31-Dec	8.773	87,726	30,234,906	26,130,000	31,360,694.34
***Open fishery* (50 vessels)**	April	10,000	01-Apr	31-Dec	9,371	93,708	13,437,736	13,065,000	67,205,364.15
	May	8,750	01-May	31-Dec	9,417	94,173	11,758,019	13,065,000	69,349,481.13
	June	7,500	01-Jun	31-Dec	8,971	89,708	10,078,302	13,065.,000	66,564,398.11
***Closing* *times* (50 vessels)**	October	7,500	01-Mar	30-Sep	7,472	74,724	10,078,302	13,065,000	51,580,298.11
	November	8,750	01-Mar	31-Oct	8,039	80,389	11,758,019	13,065,000	55,565,781.13
	December	10,000	01-Mar	30-Nov	8,454	84,536	13,437,736	13,065,000	58,033,064.15

The reference scenario based on historical data shows a relative small profit that can be comparable to that shown by the scenario of changing the number of vessels. It was demonstrated that if the fishery use a relatively high effort (fishing days) the total profits reduces as a consequence of high operation costs. Reducing the fleet to the half, the gains are almost doubled. Using 50 vessels and opening the fishery in May to close in

December seems to be the "best" alternative and the "worst" was the operating with 120 vessels from March to December. In fact from the results, the opening date is crucial for the profitability of the fishery. The three alternatives used as opening dates gives reasonable results comparing with other alternatives which are changing the number of vessels and changing the closing dates. Looking at the historical data on relationship between the average biomass and number of recruits (table 2) there are evidence that show higher biomass corresponding to higher number of recruits. Therefore, it can be presumed that if the fishery is closed earlier by November or October, some profits will be lost but probably some benefits in terms of gains can be collected in the next season as the result of the increased escapement to spawn.

6. Discussion

General

In general the results show that the optimum period for shrimp fishing is very short, only five days from day 197 to 202 (in July third week). It will be economically unfeasible to operate in this way because it will need a huge effort and very high related costs to harvest the optimum available resource. It is advisable to start the fishing earlier by March and finish later by December. Actually three possible management alternatives are suggested.

Reducing the number of vessels to 25 or even less and starting the fishery earlier in March or April and closing by October or November, can be other valuable alternative. With 25 vessels the total effort will be considerable reduced and the profits almost tripled comparing with the actual situation. Therefore there is no a need to operate until late December. If the fisher uses a large number of vessels the total profits will be greatly reduced as the operating costs involved are high. Closing the fishery late is not actually a good management alternative because the resource rent will not be maximised since the catches will decrease as consequence of increased natural mortality that decreases the overall number of individuals. Opening the fishery from May to December makes the fishery profitable because it will take advantage of the resource potential when the growth rate is good and the natural mortality is less than the growth. Despite the fact that the price is considered as constant in this study, in the late months of the fishery that is October, November and December there are few number of individuals but the size is bigger and it can be associated with the price to make the catch more profitable. However, previous studies (Eide 1993) shows that the increased size is not enough to mitigate the negative profits observed in the end of the fishing season. The Beverton-Holt model shows that the maximum year class biomass is achieved by July each year and the number of individuals at that time is around a quarter of the initial, suggesting that resource availability will start decreasing and the fishing costs will be increasing gradually which makes sense because in practice this was observed to cause a negative economic results by November. The daily profits are negatives in the first two weeks of the year then they start increasing in proportion with the biomass. It decreases smoothly after July but do not get negative values because it assumes either a homogeneous or uniform situation in which all vessels have the same size and production capability. In practice there are remarkable differences among fleets and some are more efficient than others. That makes some vessels operating with negative profits in the end of the fishing season.

Fishing Costs

According to (Almeida 2004) the shrimp fishery vessels have crew members consisting of Mozambique nationals and foreigners. In terms of costs the foreigner workers are paid more money in salaries than their counter parts who are Mozambican thus they are more costly in that way. To explain this point further, the annual salary costs data for foreign crew workers is about 29.2% from the total costs compared to 12.2% for national crew workers. In this way, one can say that the companies can reduce considerably their total costs if it is possible for them to substitute the foreigner crews with the national one. Another way that can be used to reduce the total costs is optimising the fishing days. If the companies start fishing earlier and close later, it will contribute to increase the total costs and as it was previously mentioned in the end of the fishing seasons the profits are negatives due to the progressive decrease in stock biomass.

Fishing Profits

To optimise the profits, the fishery may start in May and close in December according the results. The model gives general profits from the available biomass during the season. Dividing this profit by the optimum number of vessels gives excellent annual resource rent per vessel compared with the amounts currently earned by the vessel. This statement must be seen in the sense that the natural resources in this particular case the shrimp are affected by several factors. The profit results presented here are indicative; they can suffer changes due to the biological factors and economic environment.

The current situation

In the current strategy, the fishery is opened by March 15th to December 16th and there are indications that the fishery is profitable but only for some Companies that operate in the vertical way. This means that in order to make the fishery more profitable the Companies should opt to harvest the product and then continue all the way with the procedure for processing and even selling the final product. Operating in such a way allows the fishing costs to become distributed in other components there by attenuating their effect on the total net earnings. Those Companies that are unable to make vertical operations probably are the ones making unprofitable fishing activities.

A lesson drawn from 1991 shows that after the introduction of the closing season, the Companies general increased the overall effort in the fishery. This behaviour led to shifting of the fishing hours from 16 hours a day to 24. This they did as a way to compensate the loss they incurred during the closure. This increase in fishing hours has implications on the costs. As it can be said that increasing one more day in fishing activities gives negative economic results because the resource do not increase in proportion with the effort. Conversely the pressure over the resource makes it even weaker in the long run and the resource potential will eventually be lost.

7. Conclusion

The Mozambican shallow water shrimp is a precious natural resource that can be used as capital to generate benefits for the country. The fishing Companies still make profits but there are potential to improve the benefits. As it was demonstrated there are losses in resource rent due to the high effort. Reducing the current effort by half is one way that will make the total profits increase considerably. The catches will probably be optimised if the fishery starts in early May and close in the end of December. To improve the management regime, it is very important that the opening dates and reduction of effort are crucially put in place now. Further investigations must also be taken to precisely determine the shrimp biological parameters such as growth, environmental effects and stock biomass-recruitment relationship.

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Appendix 1

Calculations on bioeconomic parameters

For F=0

Day	M_t	N_t	L_t	W_t	B_t	$\dot{W}/W$	$\dot{W}$	$\dot{N}$	$\dot{W}N$	$W\dot{N}$	$\dot{B}$ $\dot{W}N+W\dot{N}$	$\dot{N}/N$	$\dot{B}/B$ $\dot{W}/W+\dot{N}/N$	N*(t)	B*(t)
0		19967000000.00			0.00										
1	0.005918	19849188061.34	0.298	0.0001	1969737.90	0.8375	0.00051	-117116809.06	10153873.81	-11622.11	10142251.7	-0.005935	0.8316	-2429329006.80	
2	0.005918	19732071252.28	0.595	0.0006	12052078.37	0.6533	0.00115	-116425780.94	22707668.75	-71111.27	22636557.4	-0.005935	0.6473	-307221644.10	
3	0.005918	19615645471.34	0.889	0.0018	34554653.06	0.5271	0.00196	-115738830.13	38515321.46	-203883.94	38311437.5	-0.005935	0.5212	-85752459.28	
4	0.005918	19499906641.21	1.182	0.0037	72638837.37	0.4394	0.00292	-115055932.55	56944831.28	-428593.29	56516237.9	-0.005935	0.4335	-33728702.08	
5	0.005918	19384850708.66	1.472	0.0066	128819081.92	0.3758	0.00400	-114377064.29	77552997.27	-760075.41	76792921.8	-0.005935	0.3699	-16129332.15	
6	0.005918	19270473644.37	1.760	0.0106	205154415.31	0.3277	0.00519	-113702201.58	99999164.95	-1210479.26	98788685.6	-0.005935	0.3218	-8758184.96	
7	0.005918	19156771442.79	2.046	0.0158	303353072.68	0.2902	0.00647	-113031320.79	124007687.72	-1789883.99	122217803.	-0.005935	0.2842	-5200879.71	
8	0.005918	19043740122.00	2.331	0.0223	424839189.83	0.2601	0.00784	-112364398.42	149348116.56	-2506692.47	146841424.	-0.005935	0.2542	-3300914.01	
9	0.005918	18931375723.58	2.613	0.0302	570799410.37	0.2355	0.00929	-111701411.11	175823437.22	-3367906.30	172455530.	-0.005935	0.2296	-2205635.92	
10	0.005918	18819674312.48	2.893	0.0394	742217524.55	0.2150	0.01080	-111042335.64	203262494.76	-4379330.17	198883164.	-0.005935	0.2090	-1535440.43	
11	0.005918	18708631976.83	3.171	0.0502	939901372.85	0.1976	0.01237	-110387148.94	231514813.70	-5545730.60	225969083.	-0.005935	0.1917	-1105224.14	
12	0.005918	18598244827.89	3.448	0.0626	1164504441.57	0.1828	0.01400	-109735828.06	260446888.78	-6870963.38	253575925.	-0.005935	0.1768	-817969.92	
13	0.005918	18488508999.83	3.722	0.0766	1416543643.74	0.1699	0.01568	-109088350.19	289939429.46	-8358078.47	281581350.	-0.005935	0.1640	-619751.23	
14	0.005918	18379420649.64	3.995	0.0923	1696414255.69	0.1586	0.01740	-108444692.66	319885250.44	-10009408.1	309875842.	-0.005935	0.1527	-479093.73	
15	0.005918	18270975956.98	4.266	0.1097	2004402668.66	0.1487	0.01917	-107804832.91	350187616.14	-11826642.1	338360973.	-0.005935	0.1428	-376854.09	
16	0.005918	18163171124.07	4.534	0.1289	2340697419.26	0.1399	0.02096	-107168748.56	380758913.79	-13810893.0	366948020.	-0.005935	0.1340	-300970.58	
17	0.005918	18056002375.51	4.801	0.1498	2705398835.85	0.1320	0.02279	-106536417.31	411519570.64	-15962752.	395556818.	-0.005935	0.1261	-243607.37	
18	0.005918	17949465958.20	5.066	0.1726	3098527551.57	0.1249	0.02465	-105907817.02	442397156.64	-18282342.7	424114813.	-0.005935	0.1190	-199535.91	
19	0.005918	17843558141.18	5.330	0.1973	3520032075.13	0.1185	0.02653	-105282925.69	473325630.77	-20769359.5	452556271.	-0.005935	0.1126	-165184.04	
20	0.005918	17738275215.49	5.591	0.2238	3969795567.72	0.1127	0.02843	-104661721.43	504244700.48	-23423113.7	480821586.	-0.005935	0.1068	-138059.46	
21	0.005918	17633613494.06	5.851	0.2522	4447641943.08	0.1074	0.03035	-104044182.47	535099271.63	-26242566.2	508856705.	-0.005935	0.1015	-116390.29	
22	0.005918	17529569311.59	6.108	0.2826	4953341384.88	0.1025	0.03228	-103430287.20	565838971.81	-29226361.0	536612610.	-0.005935	0.0966	-98895.33	
23	0.005918	17426139024.39	6.364	0.3148	5486615357.55	0.0980	0.03423	-102820014.12	596417733.81	-32372854.8	564044879.	-0.005935	0.0921	-84633.89	
24	0.005918	17323319010.27	6.619	0.3491	6047141173.62	0.0939	0.03618	-102213341.85	626793429.09	-35680143.4	591113285.	-0.005935	0.0880	-72905.59	
25	0.005918	17221105668.42	6.871	0.3853	6634556169.60	0.0901	0.03815	-101610249.15	656927542.99	-39146087.2	617781455.	-0.005935	0.0842	-63182.26	
26	0.005918	17119495419.28	7.122	0.4234	7248461534.39	0.0865	0.04012	-101010714.89	686784885.39	-42768333.0	644016552.	-0.005935	0.0806	-55060.99	
27	0.005918	17018484704.38	7.371	0.4635	7888425827.59	0.0832	0.04209	-100414718.09	716333331.51	-46544335.1	669788996.	-0.005935	0.0773	-48231.02	
28	0.005918	16918069986.29	7.618	0.5056	8553988219.14	0.0802	0.04407	-99822237.87	745543588.56	-50471374.5	695072214.	-0.005935	0.0742	-42450.34	
29	0.005918	16818247748.42	7.863	0.5497	9244661478.10	0.0773	0.04604	-99233253.48	774388984.83	-54546576.4	719842408.	-0.005935	0.0714	-37528.69	
30	0.005918	16719014494.94	8.107	0.5957	9959934734.05	0.0746	0.04802	-98647744.29	802845278.33	-58766926.4	744078351.	-0.005935	0.0687	-33315.24	
31	0.005918	16620366750.65	8.349	0.6437	10699276031.8	0.0721	0.04999	-98065689.80	830890482.39	-63129285.9	767761196.	-0.005935	0.0661	-29689.45	

											$\dot{B}$		$\dot{B}/B$		
Day	**M_t**	**N_t**	**L_t**	**W_t**	**B_t**	$\dot{W}/W$	$\dot{W}$	$\dot{N}$	$\dot{W}N$	$W\dot{N}$	$\dot{W}N+W\dot{N}$	$\dot{N}/N$	$\dot{W}/W+\dot{N}/N$	**N*(t)**	**B*(t)**
32	0.005918	16522301060.86	8.589	0.6937	11462134698.2	0.0697	0.05196	-97487069.62	858504706.40	-67630405.6	790874300.	-0.005935	0.0637	-26554.28	
33	0.005918	16424813991.23	8.828	0.7457	12247943535.7	0.0674	0.05392	-96911863.50	885670009.84	-72266939.0	813403070.	-0.005935	0.0615	-23831.05	
34	0.005918	16327902127.73	9.065	0.7996	13056120859.0	0.0653	0.05588	-96340051.28	912370268.08	-77035453.9	835334814.	-0.005935	0.0594	-21455.55	
35	0.005918	16231562076.45	9.300	0.8555	13886072385.1	0.0633	0.05783	-95771612.95	938591048.81	-81932443.9	856658604.	-0.005935	0.0574	-19375.07	
36	0.005918	16135790463.50	9.534	0.9133	14737192990.7	0.0614	0.05976	-95206528.59	964319497.95	-86954338.4	877365159.	-0.005935	0.0555	-17546.07	
37	0.005918	16040583934.91	9.766	0.9731	15608868344.5	0.0596	0.06169	-94644778.42	989544234.06	-92097512.9	897446721.	-0.005935	0.0537	-15932.41	
38	0.005918	15945939156.49	9.997	1.0348	16500476425.7	0.0579	0.06361	-94086342.76	1014255250.45	-97358297.0	916896953.	-0.005935	0.0520	-14503.91	
39	0.005918	15851852813.73	10.226	1.0984	17411388936.0	0.0563	0.06551	-93531202.05	1038443824.30	-102732983.	935710840.	-0.005935	0.0503	-13235.29	
40	0.005918	15758321611.68	10.453	1.1639	18340972612.7	0.0547	0.06740	-92979336.86	1062102432.10	-108217836.	953884595.	-0.005935	0.0488	-12105.21	
41	0.005918	15665342274.81	10.679	1.2313	19288590450.9	0.0533	0.06928	-92430727.86	1085224670.95	-113809096.	971415574.	-0.005935	0.0473	-11095.64	
42	0.005918	15572911546.95	10.903	1.3006	202536028387	0.0519	0.07114	-91885355.84	1107805185.01	-119502990.	988302194.	-0.005935	0.0459	-10191.25	
43	0.005918	15481026191.12	11.125	1.3717	21235368614.1	0.0505	0.07298	-91343201.69	1129839596.97	-125295735.	1004543861	-0.005935	0.0446	-9378.96	
44	0.005918	15389682989.43	11.347	1.4447	22233246046.6	0.0492	0.07481	-90804246.43	1151324443.84	-1311835.82	1020140900	-0.005935	0.0433	-8647.56	
45	0.005918	15298878743.00	11.566	1.5195	23246593749.6	0.0480	0.07662	-90268471.18	1172257116.91	-137162632.	1035094484	-0.005935	0.0421	-7987.44	
46	0.005918	15208610271.82	11.784	1.5961	24274771527.6	0.0468	0.07842	-89735857.19	1192635805.51	-143229222.	1049406582	-0.005935	0.0409	-7390.28	
47	0.005918	15118874414.63	12.000	1.6745	25317141162.4	0.0457	0.08020	-89206385.80	1212459444.16	-149379550.	1063079893	-0.005935	0.0398	-6848.91	
48	0.005918	15029668028.83	12.215	1.7547	26373067142.3	0.0446	0.08195	-88680038.46	1231727663.14	-155609864.	1076117798	-0.005935	0.0387	-6357.09	
49	0.005918	14940987990.37	12.429	1.8367	27441917338.0	0.0436	0.08369	-88156796.75	1250440741.89	-161916436.	1088524305	-0.005935	0.0376	-5909.38	
50	0.005918	14852831193.62	12.641	1.9204	28523063627.6	0.0426	0.08541	-87636642.34	1268599565.32	-168295558.	1100304006	-0.005935	0.0366	-5501.06	
51	0.005918	14765194551.28	12.851	2.0058	29615882474.9	0.0416	0.08711	-87119557.01	1286205582.65	-174743553.	1111462029	-0.005935	0.0357	-5127.97	
52	0.005918	14678074994.27	13.060	2.0929	30719755463.6	0.0407	0.08879	-86605522.66	1303260768.75	-181256771.	1122003997	-0.005935	0.0348	-4786.47	
53	0.005918	14591469471.61	13.268	2.1817	31834069789.5	0.0398	0.09045	-86094521.28	1319767587.65	-187831596.	1131935991	-0.005935	0.0339	-4473.35	
54	0.005918	14505374950.33	13.474	2.2721	32958218713.6	0.0389	0.09209	-85586534.98	1335728958.22	-194464448.	1141264509	-0.005935	0.0330	-4185.78	
55	0.005918	14419788415.35	13.679	2.3642	34091601978.4	0.0381	0.09370	-85081545.97	1351148221.82	-201151786.	1149996435	-0.005935	0.0322	-3921.27	
56	0.005918	14334706869.38	13.882	2.4579	35233626190.0	0.0373	0.09530	-84579536.56	1366029111.81	-207890109.	1158139002	-0.005935	0.0314	-3677.58	
57	0.005918	14250127332.83	14.084	2.5532	36383705166.8	0.0366	0.09687	-84080489.17	1380375724.77	-214675957.	1165699767	-0.005935	0.0306	-3452.77	
58	0.005918	14166046843.65	14.284	2.6501	37541260258.4	0.0358	0.09842	-83584386.33	1394192493.35	-221505917.	1172686576	-0.005935	0.0299	-3245.06	
59	0.005918	14082462457.32	14.483	2.7485	38705720635.2	0.0351	0.09995	-83091210.66	1407484160.67	-228376620.	1179107539	-0.005935	0.0292	-3052.90	
60	0.005918	13999371246.66	14.681	2.8485	39876523550.7	0.0344	0.10145	-82600944.89	1420255756.18	-235284747.	1184971009	-0.005935	0.0285	-2874.90	
61	0.005918	13916770301.77	14.877	2.9499	41053114578.5	0.0337	0.10293	-82113571.85	1432512572.82	-242227025.	1190285547	-0.005935	0.0278	-2709.78	
62	0.005918	13834656729.92	15.072	3.0528	42234947825.4	0.0331	0.10439	-81629074.48	1444260145.46	-249200234.	1195059910	-0.005935	0.0271	-2556.45	
63	0.005918	13753027655.44	15.266	3.1572	43421486121.3	0.0324	0.10583	-81147435.80	1455504230.61	-256201204.	1199303025	-0.005935	0.0265	-2413.88	
64	0.005918	13671880219.64	15.458	3.2631	44612201188.1	0.0318	0.10725	-80668638.95	1466250787.20	-263226819.	1203023967	-0.005935	0.0259	-2281.16	
65	0.005918	13591211580.69	15.649	3.3703	45806573788.4	0.0312	0.10864	-80192667.16	1476505958.42	-270274015.	1206231943	-0.005935	0.0253	-2157.49	
66	0.005918	13511018913.54	15.838	3.4789	47004093855.5	0.0307	0.11000	-79719503.76	1486276054.63	-277339781.	1208936272	-0.005935	0.0247	-2042.10	
67	0.005918	13431299409.78	16.027	3.5889	48204260605.5	0.0301	0.11135	-79249132.18	1495567537.18	-284421164.	1211146372	-0.005935	0.0242	-1934.35	
68	0.005918	13352050277.60	16.214	3.7003	49406582632.4	0.0295	0.11267	-78781535.95	1504387003.12	-291515264.	1212871738	-0.005935	0.0236	-1833.62	
69	0.005918	13273268741.65	16.399	3.8130	50610577987.7	0.0290	0.11397	-78316698.70	1512741170.82	-298619237.	1214121933	-0.005935	0.0231	-1739.36	
70	0.005918	13194952042.95	16.583	3.9269	51815774245.4	0.0285	0.11524	-77854604.13	1520636866.34	-305730295.	1214906570	-0.005935	0.0226	-1651.07	
71	0.005918	13117097438.82	16.766	4.0422	53021708552.8	0.0280	0.11650	-77395236.09	1528081010.58	-312845709.	1215235301	-0.005935	0.0221	-1568.29	
72	0.005918	13039702202.73	16.948	4.1587	54227927668.2	0.0275	0.11772	-76938578.46	1535080607.19	-319962803.	1215117804	-0.005935	0.0216	-1490.62	

											$\dot{B}$		$\dot{B}/B$		
Day	**M_t**	**N_t**	**L_t**	**W_t**	**B_t**	**$\dot{W}/W$**	**$\dot{W}$**	**$\dot{N}$**	**$\dot{W}N$**	**$W\dot{N}$**	**$\dot{W}N+W\dot{N}$**	**$\dot{N}/N$**	**$\dot{W}/W+\dot{N}/N$**	**N*(t)**	**B*(t)**
73	0.005918	12962763624.27	17.129	4.2764	55433987986.3	0.0271	0.11893	-76484615.27	1541642731.10	-327078959.	1214563771	-0.005935	0.0211	-1417.66	
74	0.005918	12886279009.01	17.308	4.3953	56639455552.8	0.0266	0.12011	-76033330.61	1547774517.75	-334191619.	1213582898	-0.005935	0.0207	-1349.09	
75	0.005918	12810245678.40	17.486	4.5154	57843906067.0	0.0262	0.12127	-75584708.68	1553483152.93	-341298277.	1212184875	-0.005935	0.0202	-1284.57	
76	0.005918	12734660969.72	17.663	4.6367	59046924875.0	0.0257	0.12240	-75138733.76	1558775863.17	-348396488.	1210379374	-0.005935	0.0198	-1223.83	
77	0.005918	12659522235.96	17.838	4.7591	60248106953.5	0.0253	0.12352	-74695390.25	1563659906.72	-355483862.	1208176044	-0.005935	0.0194	-1166.59	
78	0.005918	12584826845.71	18.013	4.8826	61447056884.5	0.0249	0.12461	-74254662.62	1568142565.07	-362558065.	1205584499	-0.005935	0.0189	-1112.61	
79	0.005918	12510572183.09	18.186	5.0072	62643388821.4	0.0245	0.12567	-73816535.42	1572231134.87	-369616821.	1202614313	-0.005935	0.0185	-1061.67	
80	0.005918	12436755647.67	18.358	5.1329	63836726448.0	0.0241	0.12672	-73380993.32	1575932920.49	-376657910.	1199275009	-0.005935	0.0182	-1013.56	
81	0.005918	12363374654.36	18.528	5.2596	65026702929.7	0.0237	0.12774	-72948021.06	1579255226.85	-383679167	1195576059	-0.005935	0.0178	-968.10	
82	0.005918	12290426633.30	18.698	5.3874	66212960858.1	0.0233	0.12873	-72517603.48	1582205352.83	-390678483.	1191526869	-0.005935	0.0174	-925.10	
83	0.005918	12217909029.82	18.866	5.5161	67395152189.6	0.0230	0.12971	-72089725.51	1584790584.97	-397653805.	1187136779	-0.005935	0.0170	-884.41	
84	0.005918	12145819304.31	19.033	5.6458	68572938177.7	0.0226	0.13066	-71664372.16	1587018191.60	-404603134.	1182415057	-0.005935	0.0167	-845.87	
85	0.005918	12074154932.15	19.199	5.7765	69745989299.8	0.0223	0.13159	-71241528.54	1588895417.40	-411524526.	1177370891	-0.005935	0.0163	-809.36	
86	0.005918	12002913403.62	19.364	5.9081	70913985179.8	0.0219	0.13250	-70821179.83	1590429478.16	-418416090.	1172013387	-0.005935	0.0160	-774.73	
87	0.005918	11932092223.78	19.528	6.0406	72076614505.1	0.0216	0.13339	-70403311.32	1591627556.02	-425275989.	1166351566	-0.005935	0.0157	-741.89	
88	0.005918	11861688912.46	19.690	6.1740	73233574939.6	0.0213	0.13426	-69987908.38	1592496794.92	-432102440.	1160394353	-0.005935	0.0153	-710.70	
89	0.005918	11791701004.08	19.852	6.3082	74384573033.0	0.0210	0.13510	-69574956.45	1593044296.41	-438893712.	1154150584	-0.005935	0.0150	-681.08	
90	0.005918	11722126047.63	20.012	6.4433	75529324126.0	0.0207	0.13592	-69164441.07	1593277115.72	-445648124.	1147628991	-0.005935	0.0147	-652.93	
91	0.005918	11652961606.56	20.171	6.5792	76667552252.5	0.0204	0.13672	-68756347.88	1593202258.07	-452364048.	1140838209	-0.005935	0.0144	-626.15	
92	0.005918	11584205258.68	20.329	6.7160	77798990038.7	0.0201	0.13750	-68350662.56	1592826675.30	-459039907.	1133786767	-0.005935	0.0141	-600.68	
93	0.005918	11515854596.12	20.486	6.8535	78923378599.0	0.0198	0.13826	-67947370.93	1592157262.68	-465674174.	1126483088	-0.005935	0.0138	-576.43	
94	0.005918	11447907225.19	20.642	6.9917	80040467430.2	0.0195	0.13899	-67546458.85	1591200856.02	-472265369.	1118935486	-0.005935	0.0136	-553.33	
95	0.005918	11380360766.34	20.797	7.1307	81150014302.3	0.0192	0.13971	-67147912.28	1589964228.90	-478812065.	1111152163	-0.005935	0.0133	-531.32	
96	0.005918	11313212854.05	20.951	7.2704	82251785148.3	0.0189	0.14041	-66751717.28	1588454090.21	-485312879.	1103141210	-0.005935	0.0130	-510.33	
97	0.005918	11246461136.78	21.103	7.4108	83345553951.6	0.0187	0.14108	-66357859.95	1586677081.82	-491766479.	1094910602	-0.005935	0.0127	-490.32	
98	0.005918	11180103276.83	21.255	7.5519	84431102631.9	0.0184	0.14174	-65966326.51	1584639776.46	-498171577.	1086468199	-0.005935	0.0125	-471.21	
99	0.005918	11114136950.31	21.405	7.6936	85508220929.5	0.0182	0.14237	-65577103.26	1582348675.83	-504526933.	1077821742	-0.005935	0.0122	-452.97	
100	0.005918	11048559847.06	21.555	7.8360	86576706288.7	0.0179	0.14299	-65190176.54	1579810208.74	-510831352.	1068978856	-0.005935	0.0120	-435.54	
101	0.005918	10983369670.51	21.703	7.9790	87636363739.6	0.0177	0.14358	-64805532.83	1577030729.58	-517083683.	1059947046	-0.005935	0.0117	-418.89	
102	0.005918	10918564137.69	21.851	8.1226	88687005780.0	0.0174	0.14416	-64423158.64	1574016516.83	-523282820.	1050733695	-0.005935	0.0115	-402.97	
103	0.005918	10854140979.05	21.997	8.2667	89728452255.1	0.0172	0.14472	-64043040.58	1570773771.74	-529427701.	1041346070	-0.005935	0.0113	-387.74	
104	0.005918	10790097938.47	22.142	8.4115	90760530238.0	0.0170	0.14525	-63665165.35	1567308617.17	-535517304.	1031791312	-0.005935	0.0110	-373.17	
105	0.005918	10726432773.12	22.287	8.5567	91783073908.6	0.0168	0.14577	-63289519.71	1563627096.54	-541550652.	1022076444	-0.005935	0.0108	-359.22	
106	0.005918	10663143253.42	22.430	8.7025	92795924433.1	0.0165	0.14627	-62916090.50	1559735172.91	-547526807.	1012208365	-0.005935	0.0106	-345.86	
107	0.005918	10600227162.92	22.572	8.8488	93798929842.8	0.0163	0.14676	-62544864.64	1555638728.18	-553444872.	1002193855	-0.005935	0.0104	-333.06	
108	0.005918	10537682298.28	22.714	8.9955	94791944912.7	0.0161	0.14722	-62175829.15	1551343562.38	-559303991.	992039570.	-0.005935	0.0102	-320.79	
109	0.005918	10475506469.13	22.854	9.1427	95774831040.7	0.0159	0.14766	-61808971.08	1546855393.10	-565103346.	981752046.	-0.005935	0.0100	-309.03	
110	0.005918	10413697498.05	22.993	9.2904	96747456126.2	0.0157	0.14809	-61444277.60	1542179855.01	-570842157.	971337697.	-0.005935	0.0098	-297.75	
111	0.005918	10352253220.44	23.132	9.4385	97709694449.4	0.0155	0.14850	-61081735.94	1537322499.43	-576519683.	960802815.	-0.005935	0.0096	-286.92	
112	0.005918	10291171484.51	23.269	9.5870	98661426551.0	0.0153	0.14889	-60721333.39	1532288794.06	-582135219.	950153574.	-0.005935	0.0094	-276.53	
113	0.005918	10230450151.12	23.406	9.7359	99602539111.9	0.0151	0.14927	-60363057.33	1527084122.73	-587688096.	939396025.	-0.005935	0.0092	-266.55	

											$\dot{B}$		$\dot{B}/B$		
Day	**M_t**	**N_t**	**L_t**	**W_t**	**B_t**	**$\dot{W}/W$**	**$\dot{W}$**	**$\dot{N}$**	**$\dot{W}N$**	**$W\dot{N}$**	**$\dot{W}N+W\dot{N}$**	**$\dot{N}/N$**	**$\dot{W}/W+\dot{N}/N$**	**N*(t)**	**B*(t)**
114	0.005918	10170087093.79	23.541	9.8852	100532924833.	0.0149	0.14963	-60006895.22	1521713785.28	-593177681.	928536103.	-0.005935	0.0090	-256.97	
115	0.005918	10110080198.57	23.676	10.034	101452482319.	0.0147	0.14997	-59652834.59	1516182997.51	-598603376.	917579620.	-0.005935	0.0088	-247.76	
116	0.005918	10050427363.98	23.810	10.184	102361115956.	0.0145	0.15029	-59300863.03	1510496891.11	-603964617.	906532273.	-0.005935	0.0086	-238.91	
117	0.005918	9991126500.95	23.942	10.335	103258735796.	0.0144	0.15060	-58950968.22	1504660513.84	-609260872.	895399640.	-0.005935	0.0084	-230.40	
118	0.005918	9932175532.73	24.074	10.485	104145257440.	0.0142	0.15089	-58603137.91	1498678829.57	-614491645.	884187184.	-0.005935	0.0083	-222.21	
119	0.005918	9873572394.81	24.205	10.636	105020601921.	0.0140	0.15117	-58257359.91	1492556718.52	-619656468.	872900249.	-0.005935	0.0081	-214.34	
120	0.005918	9815315034.90	24.335	10.787	105884695590.	0.0138	0.15143	-57913622.12	1486298977.50	-624754908.	861544068.	-0.005935	0.0079	-206.76	
121	0.005918	9757401412.78	24.464	10.939	106737470000.	0.0137	0.15167	-57571912.49	1479910320.23	-629786561.	850123758.	-0.005935	0.0077	-199.46	
122	0.005918	9699829500.29	24.592	11.090	107578861796.	0.0135	0.15190	-57232219.07	1473395377.65	-634751052.	838644325.	-0.005935	0.0076	-192.44	
123	0.005918	9642597281.22	24.719	11.242	108408812599.	0.0133	0.15211	-56894529.95	1466758698.37	-639648038.	827110660.	-0.005935	0.0074	-185.67	
124	0.005918	9585702751.27	24.846	11.394	109227268895.	0.0132	0.15231	-56558833.30	1460004749.06	-644477202.	815527546.	-0.005935	0.0073	-179.14	
125	0.005918	9529143917.97	24.971	11.547	110034181928.	0.0130	0.15249	-56225117.38	1453137914.97	-649238257.	803899657.	-0.005935	0.0071	-172.86	
126	0.005918	9472918800.59	25.096	11.699	110829507588.	0.0129	0.15266	-55893370.50	1446162500.45	-653930943.	792231556.	-0.005935	0.0069	-166.80	
127	0.005918	9417025430.09	25.220	11.852	111613206306.	0.0127	0.15282	-55563581.03	1439082729.49	-658555026.	780527702.	-0.005935	0.0068	-160.95	
128	0.005918	9361461849.06	25.343	12.005	112385242942.	0.0126	0.15296	-55235737.43	1431902746.29	-663110299.	768792446.	-0.005935	0.0066	-155.31	
129	0.005918	9306226111.64	25.465	12.158	113145586687.	0.0124	0.15308	-54909828.21	1424626615.93	-667596580.	757030035.	-0.005935	0.0065	-149.87	
130	0.005918	9251316283.43	25.586	12.311	113894210952.	0.0123	0.15320	-54585841.97	1417258324.98	-672013712.	745244612.	-0.005935	0.0064	-144.62	
131	0.005918	9196730441.46	25.706	12.464	114631093269.	0.0121	0.15329	-54263767.35	1409801782.22	-676361563.	733440219.	-0.005935	0.0062	-139.55	
132	0.005918	9142466674.11	25.826	12.617	115356215189.	0.0120	0.15338	-53943593.08	1402260819.26	-680640023.	721620795.	-0.005935	0.0061	-134.66	
133	0.005918	9088523081.03	25.945	12.771	116069562179.	0.0119	0.15345	-53625307.95	1394639191.34	-684849007.	709790183.	-0.005935	0.0059	-129.93	
134	0.005918	9034897773.08	26.062	12.924	116771123528.	0.0117	0.15351	-53308900.80	1386940578.05	-688988453.	697952124.	-0.005935	0.0058	-125.36	
135	0.005918	8981588872.28	26.180	13.078	117460892242.	0.0116	0.15356	-52994360.56	1379168584.09	-693058317.	686110266.	-0.005935	0.0057	-120.94	
136	0.005918	8928594511.72	26.296	13.231	118138864956.	0.0115	0.15359	-52681676.21	1371326740.03	-697058582.	674268157.	-0.005935	0.0055	-116.67	
137	0.005918	8875912835.51	26.411	13.385	118805041830.	0.0113	0.15361	-52370836.81	1363418503.16	-700989247.	662429255.	-0.005935	0.0054	-112.55	
138	0.005918	8823541998.70	26.526	13.538	119459426463.	0.0112	0.15362	-52061831.46	1355447258.23	-704850334.	650596924.	-0.005935	0.0053	-108.56	
139	0.005918	8771480167.24	26.640	13.692	120102025797.	0.0111	0.15361	-51754649.34	1347416318.35	-708641883.	638774434.	-0.005935	0.0052	-104.70	
140	0.005918	8719725517.89	26.753	13.845	120732850028.	0.0110	0.15360	-51449279.71	1339328925.78	-712363956.	626964969.	-0.005935	0.0050	-100.96	
141	0.005918	8668276238.19	26.865	13.999	121351912511.	0.0109	0.15357	-51145711.85	1331188252.78	-716016631.	615171621.	-0.005935	0.0049	-97.35	
142	0.005918	8617130526.34	26.976	14.153	121959229679.	0.0107	0.15353	-50843935.14	1322997402.49	-719600004.	603397398.	-0.005935	0.0048	-93.85	
143	0.005918	8566286591.20	27.087	14.306	122554820953.	0.0106	0.15348	-50543939.02	1314759409.77	-723114190.	591645218.	-0.005935	0.0047	-90.47	
144	0.005918	8515742652.17	27.197	14.460	123138708654.	0.0105	0.15342	-50245712.98	1306477242.10	-726559322.	579917919.	-0.005935	0.0046	-87.19	
145	0.005918	8465496939.20	27.306	14.613	123710917924.	0.0104	0.15335	-49949246.56	1298153800.41	-729935547.	568218253.	-0.005935	0.0044	-84.01	
146	0.005918	8415547692.63	27.414	14.766	124271476638.	0.0103	0.15326	-49654529.40	1289791920.04	-733243030.	556548889.	-0.005935	0.0043	-80.93	
147	0.005918	8365893163.23	27.522	14.920	124820415326.	0.0102	0.15317	-49361551.17	1281394371.55	-736481950.	544912420.	-0.005935	0.0042	-77.95	
148	0.005918	8316531612.06	27.629	15.073	125357767094.	0.0101	0.15306	-49070301.61	1272963861.66	-739652505.	533311356.	-0.005935	0.0041	-75.06	
149	0.005918	8267461310.45	27.735	15.226	125883567541.	0.0099	0.15295	-48780770.51	1264503034.13	-742754902.	521748131.	-0.005935	0.0040	-72.26	
150	0.005918	8218680539.94	27.841	15.379	126397854684.	0.0098	0.15282	-48492947.75	1256014470.64	-745789367.	510225103.	-0.005935	0.0039	-69.55	
151	0.005918	8170187592.19	27.945	15.532	126900668884.	0.0097	0.15269	-48206823.23	1247500691.71	-748756138.	498744553.	-0.005935	0.0038	-66.91	
152	0.005918	8121980768.96	28.049	15.684	127392052768.	0.0096	0.15254	-47922386.95	1238964157.61	-751655466.	487308690.	-0.005935	0.0037	-64.36	
153	0.005918	8074058382.01	28.152	15.837	127872051159.	0.0095	0.15239	-47639628.93	1230407269.20	-754487616.	475919652.	-0.005935	0.0036	-61.88	
154	0.005918	8026418753.08	28.255	15.989	128340710999.	0.0094	0.15223	-47358539.28	1221832368.87	-757252865.	464579503.	-0.005935	0.0035	-59.48	

											$\dot{B}$		$\dot{B}/B$		
Day	**M_t**	**N_t**	**L_t**	**W_t**	**B_t**	**$\dot{W}/W$**	**$\dot{W}$**	**$\dot{N}$**	**$\dot{W}N$**	**$W\dot{N}$**	**$\dot{W}N+W\dot{N}$**	**$\dot{N}/N$**	**$\dot{W}/W+\dot{N}/N$**	**N*(t)**	**B*(t)**
155	0.005918	7979060213.80	28.357	16.142	128798081285.	0.0093	0.15205	-47079108.15	1213241741.44	-759951502.	453290238.	-0.005935	0.0034	-57.15	
156	0.005918	7931981105.64	28.458	16.294	129244212994.	0.0092	0.15187	-46801325.76	1204637615.02	-762583828.	442053787.	-0.005935	0.0033	-54.88	
157	0.005918	7885179779.88	28.558	16.445	129679159018.	0.0091	0.15168	-46525182.38	1196022161.92	-765150154.	430872007.	-0.005935	0.0032	-52.68	
158	0.005918	7838654597.50	28.658	16.597	130102974098.	0.0090	0.15148	-46250668.34	1187397499.51	-767650804.	419746695.	-0.005935	0.0031	-50.55	
159	0.005918	7792403929.17	28.757	16.749	130515714753.	0.0090	0.15127	-45977774.01	1178765691.16	-770086111.	408679580.	-0.005935	0.0030	-48.48	
160	0.005918	7746426155.15	28.855	16.900	130917439224.	0.0089	0.15105	-45706489.86	1170128747.03	-772456419.	397672327.	-0.005935	0.0029	-46.47	
161	0.005918	7700719665.29	28.953	17.051	131308207403.	0.0088	0.15083	-45436806.37	1161488625.03	-774762081.	386726543.	-0.005935	0.0028	-44.51	
162	0.005918	7655282858.92	29.050	17.202	131688080778.	0.0087	0.15059	-45168714.11	1152847231.64	-777003460.	375843771.	-0.005935	0.0027	-42.61	
163	0.005918	7610114144.81	29.146	17.352	132057122367.	0.0086	0.15035	-44902203.68	1144206422.76	-779180928.	365025494.	-0.005935	0.0027	-40.76	
164	0.005918	7565211941.13	29.241	17.503	132415396663.	0.0085	0.15010	-44637265.75	1135568004.62	-781294866.	354273138.	-0.005935	0.0026	-38.97	
165	0.005918	7520574675.38	29.336	17.653	132762969573.	0.0084	0.14985	-44373891.04	1126933734.57	-783345661.	343588072.	-0.005935	0.0025	-37.23	
166	0.005918	7476200784.34	29.431	17.803	133099908362.	0.0083	0.14958	-44112070.33	1118305321.99	-785333712.	332971609.	-0.005935	0.0024	-35.53	
167	0.005918	7432088714.01	29.524	17.952	133426281598.	0.0082	0.14931	-43851794.45	1109684429.05	-787259423.	322425005.	-0.005935	0.0023	-33.88	
168	0.005918	7388236919.57	29.617	18.102	133742159096.	0.0082	0.14903	-43593054.28	1101072671.61	-789123205.	311949466.	-0.005935	0.0022	-32.28	
169	0.005918	7344643865.29	29.709	18.251	134047611868.	0.0081	0.14874	-43335840.77	1092471620.01	-790925478.	301546141.	-0.005935	0.0021	-30.72	
170	0.005918	7301308024.52	29.801	18.399	134342712064.	0.0080	0.14845	-43080144.90	1083882799.89	-792666667	291216132.	-0.005935	0.0021	-29.20	
171	0.005918	7258227879.62	29.892	18.548	134627532927.	0.0079	0.14815	-42825957.72	1075307693.01	-794347205.	280960487.	-0.005935	0.0020	-27.72	-163.51
172	0.005918	7215401921.91	29.983	18.696	134902148741.	0.0078	0.14784	-42573270.33	1066747738.04	-795967530.	270780207.	-0.005935	0.0019	-26.29	-171.08
173	0.005918	7172828651.58	30.072	18.844	135166634783.	0.0078	0.14753	-42322073.88	1058204331.35	-797528085.	260676245.	-0.005935	0.0018	-24.89	-179.27
174	0.005918	7130506577.70	30.161	18.991	135421067271.	0.0077	0.14721	-42072359.57	1049678827.81	-799029321.	250649505.	-0.005935	0.0018	-23.53	-188.17
175	0.005918	7088434218.13	30.250	19.139	135665523323.	0.0076	0.14688	-41824118.66	1041172541.55	-800471693.	240700847.	-0.005935	0.0017	-22.20	-197.86
176	0.005918	7046610099.46	30.338	19.285	135900080907.	0.0075	0.14655	-41577342.46	1032686746.76	-801855661.	230831085.	-0.005935	0.0016	-20.91	-208.47
177	0.005918	7005032757.01	30.425	19.432	136124818797.	0.0075	0.14621	-41332022.31	1024222678.40	-803181689.	221040988.	-0.005935	0.0015	-19.66	-220.12
178	0.005918	6963700734.69	30.512	19.576	136339816531.	0.0074	0.14587	-41088149.64	1015781533.00	-804450248.	211331284.	-0.005935	0.0015	-18.43	-232.97
179	0.005918	6922612585.06	30.598	19.724	136545154367.	0.0073	0.14552	-40845715.89	1007364469.38	-805661809.	201702659.	-0.005935	0.0014	-17.24	-247.23
180	0.005918	6881766869.16	30.683	19.870	136740913241.	0.0073	0.14516	-40604712.59	998972609.37	-806816851.	192155757.	-0.005935	0.0013	-16.08	-263.13
181	0.005918	6841162156.57	30.768	20.015	136927174728.	0.0072	0.14480	-40365131.29	990607038.58	-807915856.	182691181.	-0.005935	0.0012	-14.95	-280.98
182	0.005918	6800797025.29	30.852	20.160	137104020999.	0.0071	0.14443	-40126963.59	982268807.06	-808959308.	173309498.	-0.005935	0.0012	-13.85	-301.16
183	0.005918	6760670061.69	30.936	20.304	137271534785.	0.0070	0.14406	-39890201.16	973958930.07	-809947695.	164011234.	-0.005935	0.0011	-12.77	-324.16
184	0.005918	6720779860.53	31.019	20.448	137429799338.	0.0070	0.14369	-39654835.71	965678388.71	-810881509.	154796879.	-0.005935	0.0010	-11.73	-350.60
185	0.005918	6681125024.82	31.102	20.592	137578898394.	0.0069	0.14330	-39420859.00	957428130.68	-811761243.	145666887.	-0.005935	0.0010	-10.71	-381.33
186	0.005918	6641704165.82	31.184	20.735	137718916138.	0.0068	0.14292	-39188262.82	949209070.88	-812587394.	136621676.	-0.005935	0.0009	-9.71	-417.48
187	0.005918	6602515902.99	31.265	20.878	137849937165.	0.0068	0.14252	-38957039.04	941022092.18	-813360461.	127661630.	-0.005935	0.0008	-8.74	-460.61
188	0.005918	6563558863.95	31.346	21.020	137972046452.	0.0067	0.14213	-38727179.56	932868045.99	-814080947.	118787098.	-0.005935	0.0008	-7.80	-512.98
189	0.005918	6524831684.39	31.426	21.163	138085329320.	0.0067	0.14173	-38498676.33	924747752.97	-814749353.	109998399.	-0.005935	0.0007	-6.88	-577.89
190	0.005918	6486333008.06	31.506	21.304	138189871399.	0.0066	0.14132	-38271521.34	916662003.64	-815366186.	101295816.	-0.005935	0.0007	-5.98	-660.48
191	0.005918	6448061486.73	31.585	21.446	138285758606.	0.0065	0.14091	-38045706.63	908611559.04	-815931953.	92679605.7	-0.005935	0.0006	-5.10	-769.07
192	0.005918	6410015780.09	31.664	21.587	138373077101.	0.0065	0.14050	-37821224.32	900597151.36	-816447161.	84149989.9	-0.005935	0.0005	-4.24	-918.28
193	0.005918	6372194555.78	31.742	21.727	138451913268.	0.0064	0.14008	-37598066.52	892619484.52	-816912321.	75707163.4	-0.005935	0.0005	-3.41	-1136.08
194	0.005918	6334596489.26	31.819	21.867	138522353680.	0.0063	0.13966	-37376225.42	884679234.82	-817327942.	67351291.9	-0.005935	0.0004	-2.59	-1483.93
195	0.005918	6297220263.83	31.896	22.007	138584485070.	0.0063	0.13923	-37155693.27	876777051.51	-817694538.	59082512.7	-0.005935	0.0004	-1.80	-2127.79

											$\dot{B}$		$\dot{B}/B$		
Day	**M_t**	**N_t**	**L_t**	**W_t**	**B_t**	**$\dot{W}/W$**	**$\dot{W}$**	**$\dot{N}$**	**$\dot{W}N$**	**$W\dot{N}$**	**$\dot{W}N+W\dot{N}$**	**$\dot{N}/N$**	**$\dot{W}/W+\dot{N}/N$**	**N*(t)**	**B*(t)**
196	0.005918	6260064570.57	31.973	22.146	138638394307.	0.0062	0.13880	-36936462.32	868913557.40	-818012621.	50900936.2	-0.005935	0.0003	-1.02	-3725.38
197	0.005918	6223128108.24	32.049	22.285	138684168365.	0.0062	0.13837	-36718524.92	861089349.40	-818282703.	42806646.0	-0.005935	0.0002	-0.26	-14445.53
198	0.005918	6186409583.33	32.124	22.423	138721894297.	0.0061	0.13793	-36501873.41	853304999.17	-818505298.	34799700.3	-0.005935	0.0002	0.48	7832.35
199	0.005918	6149907709.92	32.199	22.561	138751659214.	0.0061	0.13749	-36286500.22	845561053.60	-818680921.	26880131.8	-0.005935	0.0001	1.20	3102.61
200	0.005918	6113621209.70	32.273	22.699	138773550255.	0.0060	0.13705	-36072397.80	837858035.42	-818810086.	19047949.2	-0.005935	0.0001	1.91	1942.85
201	0.005918	6077548811.89	32.347	22.836	138787654563.	0.0059	0.13660	-35859558.66	830196443.70	-818893306.	11303137.4	-0.005935	0.0000	2.60	1418.62
202	0.005918	6041689253.23	32.420	22.972	138794059265.	0.0059	0.13615	-35647975.35	822576754.44	-818931096.	3645658.27	-0.005935	0.0000	3.27	1119.89
203	0.005918	6006041277.88	32.493	23.108	138792851447.	0.0058	0.13570	-35437640.44	814999421.05	-818923969.	-3924548.59	-0.005935	-0.0001	3.93	926.92
204	0.005918	5970603637.44	32.565	23.244	138784118131.	0.0058	0.13524	-35228546.58	807464874.90	-818872440.	-11407565.2	-0.005935	-0.0002	4.57	791.99
205	0.005918	5935375090.86	32.637	23.379	138767946255.	0.0057	0.13478	-35020686.44	799973525.83	-818777020.	-18803494.8	-0.005935	-0.0002	5.19	692.35
206	0.005918	5900354404.42	32.708	23.514	138744422650.	0.0057	0.13432	-34814052.75	792525762.62	-818638223.	-26112461.0	-0.005935	-0.0003	5.81	615.75
207	0.005918	5865540351.68	32.779	23.648	138713634023.	0.0056	0.13385	-34608638.26	785121953.52	-818456560.	-33334606.9	-0.005935	-0.0003	6.41	555.03
208	0.005918	5830931713.42	32.849	23.782	138675666936.	0.0056	0.13339	-34404435.79	777762446.72	-818232542.	-40470095.3	-0.005935	-0.0004	6.99	505.71
209	0.005918	5796527277.63	32.919	23.916	138630607784.	0.0055	0.13292	-34201438.18	770447570.84	-817966678.	-47519107.2	-0.005935	-0.0004	7.56	464.87
210	0.005918	5762325839.45	32.989	24.049	138578542779.	0.0055	0.13244	-33999638.32	763177635.38	-817659477.	-54481841.8	-0.005935	-0.0005	8.12	430.49
211	0.005918	5728326201.13	33.057	24.181	138519557936.	0.0054	0.13197	-33799029.15	755952931.20	-817311447.	-61358515.8	-0.005935	-0.0005	8.67	
212	0.005918	5694527171.98	33.126	24.313	138453739046.	0.0054	0.13149	-33599603.64	748773730.96	-816923093.	-68149362.7	-0.005935	-0.0006	9.20	
213	0.005918	5660927568.34	33.194	24.445	138381171670.	0.0053	0.13101	-33401354.81	741640289.57	-816494922.	-74854632.5	-0.005935	-0.0006	9.72	
214	0.005918	5627526213.53	33.261	24.576	138301941113.	0.0053	0.13053	-33204275.71	734552844.63	-816027435.	-81474590.8	-0.005935	-0.0007	10.23	
215	0.005918	5594321937.82	33.328	24.706	138216132416.	0.0052	0.13004	-33008359.44	727511616.86	-815521135.	-88009518.7	-0.005935	-0.0007	10.73	
216	0.005918	5561313578.38	33.394	24.836	138123830337.	0.0052	0.12956	-32813599.15	720516810.53	-814976522.	-94459712.1	-0.005935	-0.0007	11.22	
217	0.005918	5528499979.23	33.460	24.966	138025119336.	0.0051	0.12907	-32619988.00	713568613.84	-814394094.	-100825481.	-0.005935	-0.0008	11.70	
218	0.005918	5495879991.23	33.526	25.095	137920083563.	0.0051	0.12858	-32427519.23	706667199.38	-813774348.	-107107149.	-0.005935	-0.0008	12.17	
219	0.005918	5463452472.00	33.591	25.223	137808806842.	0.0051	0.12809	-32236186.08	699812724.48	-813117779.	-113305054.	-0.005935	-0.0009	12.62	
220	0.005918	5431216285.91	33.656	25.351	137691372659.	0.0050	0.12760	-32045981.87	693005331.65	-812424878.	-119419546.	-0.005935	-0.0009	13.07	
221	0.005918	5399170304.05	33.720	25.479	137567864150.	0.0050	0.12710	-31856899.92	686245148.91	-811696137.	-125450988.	-0.005935	-0.0010	13.51	
222	0.005918	5367313404.13	33.784	25.606	137438364087.	0.0049	0.12661	-31668933.62	679532290.22	-810932043.	-131399753.	-0.005935	-0.0010	13.94	
223	0.005918	5335644470.51	33.847	25.733	137302954867.	0.0049	0.12611	-31482076.38	672866855.83	-810133084.	-137266228.	-0.005935	-0.0011	14.35	
224	0.005918	5304162394.13	33.910	25.859	137161718501.	0.0048	0.12561	-31296321.66	666248932.63	-809299742.	-143050810.	-0.005935	-0.0011	14.76	
225	0.005918	5272866072.46	33.972	25.984	137014736600.	0.0048	0.12511	-31111662.96	659678594.53	-808432500.	-148753906.	-0.005935	-0.0011	15.17	
226	0.005918	5241754409.51	34.034	26.110	136862090371.	0.0047	0.12461	-30928093.80	653155902.78	-807531837.	-154375934.	-0.005935	-0.0012	15.56	
227	0.005918	5210826315.70	34.096	26.234	136703860599.	0.0047	0.12410	-30745607.77	646680906.37	-806598229.	-159917322.	-0.005935	-0.0012	15.94	
228	0.005918	5180080707.93	34.157	26.358	136540127644.	0.0047	0.12360	-30564198.46	640253642.30	-805632150.	-165378507.	-0.005935	-0.0013	16.32	
229	0.005918	5149516509.47	34.218	26.482	136370971427.	0.0046	0.12309	-30383859.53	633874135.96	-804634072.	-170759936.	-0.005935	-0.0013	16.69	
230	0.005918	5119132649.95	34.278	26.605	136196471422.	0.0046	0.12259	-30204584.65	627542401.43	-803604464.	-176062062.	-0.005935	-0.0013	17.05	
231	0.005918	5088928065.29	34.338	26.728	136016706651.	0.0045	0.12208	-30026367.56	621258441.80	-802543792.	-181285350.	-0.005935	-0.0014	17.40	
232	0.005918	5058901697.73	34.397	26.850	135831755669.	0.0045	0.12157	-29849202.01	615022249.48	-801452520.	-186430270.	-0.005935	-0.0014	17.75	
233	0.005918	5029052495.72	34.456	26.971	135641696563.	0.0045	0.12106	-29673081.79	608833806.53	-800331108.	-191497301.	-0.005935	-0.0015	18.08	
234	0.005918	4999379413.93	34.515	27.092	135446606939.	0.0044	0.12055	-29498000.74	602693084.91	-799180014.	-196486929.	-0.005935	-0.0015	18.42	
235	0.005918	4969881413.19	34.573	27.213	135246563920.	0.0044	0.12004	-29323952.73	596600046.83	-797999694.	-201399647.	-0.005935	-0.0015	18.74	
236	0.005918	4940557460.45	34.631	27.333	135041644134.	0.0044	0.11953	-29150931.66	590554645.00	-796790599.	-206235954.	-0.005935	-0.0016	19.06	

											$\dot{B}$		$\dot{B}/B$		
Day	**M_t**	**N_t**	**L_t**	**W_t**	**B_t**	**$\dot{W}/W$**	**$\dot{W}$**	**$\dot{N}$**	**$\dot{W}N$**	**$W\dot{N}$**	**$\dot{W}N+W\dot{N}$**	**$\dot{N}/N$**	**$\dot{W}/W+\dot{N}/N$**	**N*(t)**	**B*(t)**
237	0.005918	4911406528.79	34.688	27.452	134831923711.	0.0043	0.11902	-28978931.47	584556822.92	-795553179.	-210996356.	-0.005935	-0.0016	19.37	
238	0.005918	4882427597.32	34.745	27.571	134617478275.	0.0043	0.11851	-28807946.14	578606515.15	-794287879.	-215681364.	-0.005935	-0.0017	19.68	
239	0.005918	4853619651.18	34.802	27.690	134398382940.	0.0042	0.11800	-28637969.68	572703647.60	-792995144.	-220291496.	-0.005935	-0.0017	19.97	
240	0.005918	4824981681.49	34.858	27.808	134174712301.	0.0042	0.11748	-28468996.14	566848137.77	-791675413.	-224827275.	-0.005935	-0.0017	20.27	
241	0.005918	4796512685.35	34.914	27.925	133946540433.	0.0042	0.11697	-28301019.60	561039895.04	-790329123.	-229289228.	-0.005935	-0.0018	20.55	
242	0.005918	4768211665.76	34.969	28.042	133713940883.	0.0041	0.11645	-28134034.17	555278820.86	-788956708.	-233677887.	-0.005935	-0.0018	20.84	
243	0.005918	4740077631.59	35.024	28.159	133476986666.	0.0041	0.11594	-27968034.02	549564809.11	-787558600.	-237993790.	-0.005935	-0.0018	21.11	
244	0.005918	4712109597.57	35.079	28.275	133235750260.	0.0041	0.11543	-27803013.32	543897746.21	-786135225.	-242237478.	-0.005935	-0.0019	21.38	
245	0.005918	4684306584.25	35.133	28.390	1329903036.70	0.0040	0.11491	-27638966.29	538277511.46	-784687008.	-246409496.	-0.005935	-0.0019	21.65	
246	0.005918	4656667617.96	35.187	28.505	132740718090.	0.0040	0.11440	-27475887.20	532703977.23	-783214370.	-250510393.	-0.005935	-0.0019	21.91	
247	0.005918	4629191730.76	35.241	28.619	132487064566.	0.0040	0.11388	-27313770.33	527177009.20	-781717730.	-254540721.	-0.005935	-0.0020	22.16	
248	0.005918	4601877960.42	35.294	28.733	132229413325.	0.0039	0.11337	-27152610.01	521696466.56	-780197502.	-258501035.	-0.005935	-0.0020	22.41	
249	0.005918	4574725350.42	35.346	28.847	131967834107.	0.0039	0.11285	-26992400.58	516262202.26	-778654098.	-262391895.	-0.005935	-0.0020	22.66	
250	0.005918	4547732949.84	35.399	28.960	131702396092.	0.0039	0.11234	-26833136.44	510874063.22	-777087925.	-266213862.	-0.005935	-0.0021	22.90	
251	0.005918	4520899813.39	35.451	29.072	131433167903.	0.0038	0.11182	-26674812.02	505531890.49	-775499389.	-269967499.	-0.005935	-0.0021	23.13	
252	0.005918	4494225001.38	35.503	29.184	131160217598.	0.0038	0.11131	-26517421.76	500235519.53	-773888892.	-273653372.	-0.005935	-0.0021	23.36	
253	0.005918	4467707579.62	35.554	29.295	130883612669.	0.0038	0.11079	-26360960.15	494984780.36	-772256831.	-277272050.	-0.005935	-0.0022	23.59	
254	0.005918	4441346619.47	35.605	29.406	130603420043.	0.0037	0.11028	-26205421.72	489779497.77	-770603601.	-280824103.	-0.005935	-0.0022	23.81	
255	0.005918	4415141197.75	35.656	29.516	130319706078.	0.0037	0.10976	-26050801.02	484619491.50	-768929594.	-284310103.	-0.005935	-0.0022	24.03	
256	0.005918	4389090396.73	35.706	29.626	130032536558.	0.0037	0.10925	-25897092.63	479504576.44	-767235199.	-287730622.	-0.005935	-0.0023	24.24	
257	0.005918	4363193304.09	35.756	29.735	129741976699.	0.0036	0.10874	-25744291.18	474434562.81	-765520799.	-291086236.	-0.005935	-0.0023	24.45	
258	0.005918	4337449012.92	35.805	29.844	129448091141.	0.0036	0.10822	-25592391.30	469409256.33	-763786776.	-294377520.	-0.005935	-0.0023	24.65	
259	0.005918	4311856621.62	35.854	29.952	129150943950.	0.0036	0.10771	-25441387.68	464428458.41	-762033509.	-297605051.	-0.005935	-0.0024	24.86	
260	0.005918	4286415233.94	35.903	30.060	128850598616.	0.0036	0.10720	-25291275.04	459491966.31	-760261372.	-300769406.	-0.005935	-0.0024	25.05	
261	0.005918	4261123958.90	35.952	30.167	128547118055.	0.0035	0.10669	-25142048.10	454599573.29	-758470736.	-303871162.	-0.005935	-0.0024	25.25	
262	0.005918	4235981910.80	36.000	30.274	128240564603.	0.0035	0.10617	-24993701.66	449751068.82	-756661968.	-306910900.	-0.005935	-0.0024	25.44	
263	0.005918	4210988209.14	36.048	30.380	127931000023.	0.0035	0.10566	-24846230.51	444946238.68	-754835434.	-309889196.	-0.005935	-0.0025	25.62	
264	0.005918	4186141978.63	36.095	30.485	127618485496.	0.0034	0.10515	-24699629.49	440184865.15	-752991495.	-312806630.	-0.005935	-0.0025	25.81	
265	0.005918	4161442349.14	36.143	30.591	127303081629.	0.0034	0.10464	-24553893.46	435466727.17	-751130507.	-315663780.	-0.005935	-0.0025	25.99	
266	0.005918	4136888455.67	36.190	30.695	126984848450.	0.0034	0.10413	-24409017.33	430791600.46	-749252826.	-318461225.	-0.005935	-0.0026	26.16	
267	0.005918	4112479438.34	36.236	30.799	126663845410.	0.0034	0.10363	-24264996.01	426159257.68	-747358801.	-321199543.	-0.005935	-0.0026	26.34	
268	0.005918	4088214442.33	36.282	30.903	126340131385.	0.0033	0.10312	-24121824.47	421569468.57	-745448780.	-323879312.	-0.005935	-0.0026	26.51	
269	0.005918	4064092617.87	36.328	31.006	126013764673.	0.0033	0.10261	-23979497.68	417022000.07	-743523108.	-326501108.	-0.005935	-0.0026	26.67	
270	0.005918	4040113120.18	36.374	31.109	125684802996.	0.0033	0.10211	-23838010.67	412516616.50	-741582125.	-329065509.	-0.005935	-0.0027	26.84	
271	0.005918	4016275109.51	36.419	31.211	125353303501.	0.0032	0.10160	-23697358.48	408053079.63	-739626168.	-331573088.	-0.005935	-0.0027	27.00	
272	0.005918	3992577751.03	36.464	31.312	125019322764.	0.0032	0.10110	-23557536.19	403631148.87	-737655570.	-334024422.	-0.005935	-0.0027	27.16	
273	0.005918	3969020214.84	36.509	31.414	124682916784.	0.0032	0.10059	-23418538.89	399250581.33	-735670663.	-336420082.	-0.005935	-0.0027	27.31	
274	0.005918	3945601675.94	36.553	31.514	124344140990.	0.0032	0.10009	-23280361.73	394911131.99	-733671774.	-338760642.	-0.005935	-0.0028	27.46	
275	0.005918	3922321314.21	36.597	31.614	124003050241.	0.0031	0.09959	-23142999.85	390612553.81	-731659225.	-341046671.	-0.005935	-0.0028	27.61	
276	0.005918	3899178314.36	36.641	31.714	123659698826.	0.0031	0.09909	-23006448.46	386354597.82	-729633337.	-343278739.	-0.005935	-0.0028	27.76	
277	0.005918	3876171865.90	36.684	31.813	123314140465.	0.0031	0.09859	-22870702.77	382137013.28	-727594428.	-345457415.	-0.005935	-0.0028	27.90	

											Ḃ		Ḃ/B		
Day	M_t	N_t	L_t	W_t	B_t	Ẇ/W	Ẇ	Ṅ	ẆN	WṄ	ẆN+WṄ	Ṅ/N	Ẇ/W+Ṅ/N	N*(t)	B*(t)
278	0.005918	3853301163.13	36.727	31.912	122966428315.	0.0031	0.09809	-22735758.01	377959547.72	-725542811.	-347583263.	-0.005935	-0.0029	28.04	
279	0.005918	3830565405.12	36.770	32.010	122616614964.	0.0030	0.09759	-22601609.48	373821947.13	-723478796.	-349656848.	-0.005935	-0.0029	28.18	
280	0.005918	3807963795.63	36.812	32.107	122264752442.	0.0030	0.09709	-22468252.47	369723955.99	-721402690.	-351678734.	-0.005935	-0.0029	28.32	
281	0.005918	3785495543.16	36.855	32.204	121910892213.	0.0030	0.09660	-22335682.31	365665317.42	-719314797.	-353649479.	-0.005935	-0.0029	28.45	
282	0.005918	3763159860.85	36.897	32.301	121555085186.	0.0030	0.09610	-22203894.36	361645773.26	-717215417.	-355569644.	-0.005935	-0.0030	28.59	
283	0.005918	3740955966.49	36.938	32.397	121197381712.	0.0029	0.09561	-22072884.00	357665064.16	-715104848.	-357439783.	-0.005935	-0.0030	28.71	
284	0.005918	3718883082.48	36.980	32.493	120837831585.	0.0029	0.09512	-21942646.65	353722929.69	-712983382.	-359260453.	-0.005935	-0.0030	28.84	
285	0.005918	3696940435.84	37.021	32.588	120476484049.	0.0029	0.09462	-21813177.74	349819108.44	-710851312.	-361032203.	-0.005935	-0.0030	28.97	
286	0.005918	3675127258.10	37.061	32.682	120113387797.	0.0029	0.09413	-21684472.74	345953338.05	-708708923.	-362755585.	-0.005935	-0.0031	29.09	
287	0.005918	3653442785.36	37.102	32.776	119748590971.	0.0028	0.09364	-21556527.14	342125355.38	-706556500.	-364431145.	-0.005935	-0.0031	29.21	
288	0.005918	3631886258.23	37.142	32.870	119382141172.	0.0028	0.09316	-21429336.46	338334896.54	-704394325.	-366059428.	-0.005935	-0.0031	29.33	
289	0.005918	3610456921.77	37.182	32.963	119014085455.	0.0028	0.09267	-21302896.25	334581696.97	-702222674.	-367640977.	-0.005935	-0.0031	29.44	
290	0.005918	3589154025.52	37.222	33.056	118644470335.	0.0028	0.09218	-21177202.08	330865491.56	-700041822.	-369176330.	-0.005935	-0.0032	29.56	
291	0.005918	3567976823.44	37.261	33.148	118273341788.	0.0028	0.09170	-21052249.55	327186014.68	-697852040.	-370666025.	-0.005935	-0.0032	29.67	
292	0.005918	3546924573.89	37.300	33.240	117900745256.	0.0027	0.09122	-20928034.27	323543000.30	-695653596.	-372110596.	-0.005935	-0.0032	29.78	
293	0.005918	3525996539.62	37.339	33.331	117526725648.	0.0027	0.09074	-20804551.91	319936182.02	-693446756.	-373510574.	-0.005935	-0.0032	29.89	
294	0.005918	3505191987.71	37.377	33.422	117151327344.	0.0027	0.09026	-20681798.14	316365293.17	-691231782.	-374866488.	-0.005935	-0.0032	30.00	
295	0.005918	3484510189.57	37.416	33.512	116774594194.	0.0027	0.08978	-20559768.65	312830066.86	-689008931.	-376178864.	-0.005935	-0.0033	30.10	
296	0.005918	3463950420.91	37.454	33.602	116396569529.	0.0027	0.08930	-20438459.18	309330236.09	-686778459.	-377448223.	-0.005935	-0.0033	30.20	
297	0.005918	3443511961.73	37.491	33.691	116017296153.	0.0026	0.08882	-20317865.48	305865533.74	-684540620.	-378675087.	-0.005935	-0.0033	30.31	
298	0.005918	3423194096.25	37.529	33.780	115636816358.	0.0026	0.08835	-20197983.32	302435692.71	-682295663.	-379859970.	-0.005935	-0.0033	30.40	
299	0.005918	3402996112.93	37.566	33.868	115255171916.	0.0026	0.08788	-20078808.50	299040445.93	-680043834.	-381003388.	-0.005935	-0.0033	30.50	
300	0.005918	3382917304.43	37.603	33.956	114872404089.	0.0026	0.08740	-19960336.85	295679526.44	-677785377.	-382105850.	-0.005935	-0.0034	30.60	
301	0.005918	3362956967.58	37.640	34.044	114488553631.	0.0025	0.08693	-19842564.23	292352667.45	-675520531.	-383167864.	-0.005935	-0.0034	30.69	
302	0.005918	3343114403.35	37.676	34.130	114103660789.	0.0025	0.08646	-19725486.50	289059602.40	-673249536.	-384189933.	-0.005935	-0.0034	30.79	
303	0.005918	3323388916.84	37.712	34.217	113717765307.	0.0025	0.08600	-19609099.58	285800064.97	-670972624.	-385172559.	-0.005935	-0.0034	30.88	
304	0.005918	3303779817.27	37.748	34.303	113330906432.	0.0025	0.08553	-19493399.37	282573789.21	-668690028.	-386116239.	-0.005935	-0.0034	30.97	
305	0.005918	3284286417.90	37.784	34.388	112943122914.	0.0025	0.08507	-19378381.83	279380509.53	-666401976.	-387021467.	-0.005935	-0.0035	31.06	
306	0.005918	3264908036.07	37.819	34.474	112554453009.	0.0024	0.08460	-19264042.94	276219960.76	-664108695.	-387888734.	-0.005935	-0.0035	31.14	
307	0.005918	3245643993.13	37.855	34.558	112164934485.	0.0024	0.08414	-19150378.68	273091878.23	-661810406.	-388718528.	-0.005935	-0.0035	31.23	
308	0.005918	3226493614.45	37.890	34.642	111774604624.	0.0024	0.08368	-19037385.08	269995997.77	-659507330.	-389511332.	-0.005935	-0.0035	31.31	
309	0.005918	3207456229.38	37.924	34.726	111383500225.	0.0024	0.08322	-18925058.17	266932055.79	-657199684.	-390267628.	-0.005935	-0.0035	31.40	
310	0.005918	3188531171.20	37.959	34.809	110991657609.	0.0024	0.08277	-18813394.04	263899789.31	-654887682.	-390987893.	-0.005935	-0.0036	31.48	
311	0.005918	3169717777.17	37.993	34.892	110599112619.	0.0024	0.08231	-18702388.76	260898936.01	-652571536.	-391672600.	-0.005935	-0.0036	31.56	
312	0.005918	3151015388.41	38.027	34.974	110205900628.	0.0023	0.08186	-18592038.45	257929234.26	-650251455.	-392322220.	-0.005935	-0.0036	31.63	
313	0.005918	3132423349.96	38.061	35.056	109812056539.	0.0023	0.08140	-18482339.24	254990423.14	-647927644.	-392937220.	-0.005935	-0.0036	31.71	
314	0.005918	3113941010.72	38.094	35.138	109417614790.	0.0023	0.08095	-18373287.29	252082242.54	-645600306.	-393518064.	-0.005935	-0.0036	31.79	
315	0.005918	3095567723.43	38.128	35.218	109022609356.	0.0023	0.08050	-18264878.79	249204433.14	-643269643.	-394065210.	-0.005935	-0.0037	31.86	
316	0.005918	3077302844.64	38.161	35.299	108627073757.	0.0023	0.08006	-18157109.93	246356736.46	-640935851.	-394579115.	-0.005935	-0.0037	31.94	
317	0.005918	3059145734.71	38.193	35.379	108231041055.	0.0022	0.07961	-18049976.95	243538894.90	-638599127.	-395060232.	-0.005935	-0.0037	32.01	
318	0.005918	3041095757.77	38.226	35.459	107834543863.	0.0022	0.07917	-17943476.08	240750651.77	-636259661.	-395509010.	-0.005935	-0.0037	32.08	

											$\dot{B}$		$\dot{B}/B$		
Day	**M_t**	**N_t**	**L_t**	**W_t**	**B_t**	**$\dot{W}/W$**	**$\dot{W}$**	**$\dot{N}$**	**$\dot{W}N$**	**$W\dot{N}$**	**$\dot{W}N+W\dot{N}$**	**$\dot{N}/N$**	**$\dot{W}/W+\dot{N}/N$**	**N*(t)**	**B*(t)**
319	0.005918	3023152281.69	38.258	35.538	107437614344.	0.0022	0.07872	-17837603.61	237991751.33	-633917645.	-395925894.	-0.005935	-0.0037	32.15	
320	0.005918	3005314678.08	38.291	35.617	107040284219.	0.0022	0.07828	-17732355.81	235261938.79	-631573265.	-396311327.	-0.005935	-0.0037	32.22	
321	0.005918	2987582322.27	38.322	35.695	106642584768.	0.0022	0.07784	-17627729.02	232560960.40	-629226706.	-396665746.	-0.005935	-0.0038	32.29	
322	0.005918	2969954593.25	38.354	35.773	106244546835.	0.0022	0.07740	-17523719.56	229888563.41	-626878150.	-396989587.	-0.005935	-0.0038	32.35	
323	0.005918	2952430873.69	38.386	35.850	105846200829.	0.0021	0.07697	-17420323.78	227244496.13	-624527776.	-397283280.	-0.005935	-0.0038	32.42	
324	0.005918	2935010549.91	38.417	35.927	105447576730.	0.0021	0.07653	-17317538.08	224628507.97	-622175762.	-397547254.	-0.005935	-0.0038	32.48	
325	0.005918	2917693011.83	38.448	36.004	105048704093.	0.0021	0.07610	-17215358.85	222040349.43	-619822280.	-397781931.	-0.005935	-0.0038	32.55	
326	0.005918	2900477652.98	38.479	36.080	104649612049.	0.0021	0.07567	-17113782.51	219479772.15	-617467505.	-397987733.	-0.005935	-0.0038	32.61	
327	0.005918	2883363870.47	38.509	36.155	104250329313.	0.0021	0.07524	-17012805.50	216946528.94	-615111604.	-398165075.	-0.005935	-0.0039	32.67	
328	0.005918	2866351064.97	38.540	36.231	103850884181.	0.0021	0.07481	-16912424.29	214440373.77	-612754745.	-398314371.	-0.005935	-0.0039	32.73	
329	0.005918	2849438640.67	38.570	36.305	103451304540.	0.0020	0.07439	-16812635.37	211961061.82	-610397092.	-398436030.	-0.005935	-0.0039	32.79	
330	0.005918	2832626005.31	38.600	36.380	103051617868.	0.0020	0.07396	-16713435.23	209508349.48	-608038808.	-398530458.	-0.005935	-0.0039	32.85	
331	0.005918	2815912570.08	38.630	36.454	102651851241.	0.0020	0.07354	-16614820.40	207081994.39	-605680052.	-398598057.	-0.005935	-0.0039	32.91	
332	0.005918	2799297749.68	38.659	36.527	102252031330.	0.0020	0.07312	-16516787.44	204681755.44	-603320981.	-398639226.	-0.005935	-0.0039	32.97	
333	0.005918	2782780962.24	38.689	36.600	101852184414.	0.0020	0.07270	-16419332.90	202307392.81	-600961752.	-398654359.	-0.005935	-0.0040	33.02	
334	0.005918	2766361629.34	38.718	36.673	101452336374.	0.0020	0.07228	-16322453.38	199958667.95	-598602515.	-398643847.	-0.005935	-0.0040	33.08	
335	0.005918	2750039175.96	38.747	36.745	101052512703.	0.0020	0.07187	-16226145.48	197635343.64	-596243423.	-398608079.	-0.005935	-0.0040	33.13	
336	0.005918	2733813030.48	38.775	36.817	100652738510.	0.0019	0.07145	-16130405.82	195337183.98	-593884622.	-398547438.	-0.005935	-0.0040	33.19	
337	0.005918	2717682624.66	38.804	36.889	100253038517.	0.0019	0.07104	-16035231.07	193063954.40	-591526259.	-398462305.	-0.005935	-0.0040	33.24	
338	0.005918	2701647393.59	38.832	36.960	99853437070.5	0.0019	0.07063	-15940617.87	190815421.68	-589168478.	-398353056.	-0.005935	-0.0040	33.29	
339	0.005918	2685706775.72	38.860	37.030	99453958139.6	0.0019	0.07022	-15846562.93	188591353.98	-586811419.	-398220065.	-0.005935	-0.0040	33.34	
340	0.005918	2669860212.80	38.888	37.101	99054625322.3	0.0019	0.06981	-15753062.94	186391520.84	-584455223.	-398063702.	-0.005935	-0.0041	33.39	
341	0.005918	2654107149.86	38.916	37.170	98655461847.9	0.0019	0.06941	-15660114.63	184215693.17	-582100026.	-397884332.	-0.005935	-0.0041	33.44	
342	0.005918	2638447035.24	38.944	37.240	98256490581.2	0.0018	0.06900	-15567714.74	182063643.30	-579745962.	-397682319.	-0.005935	-0.0041	33.49	
343	0.005918	2622879320.49	38.971	37.309	97857734025.5	0.0018	0.06860	-15475860.05	179935144.95	-577393166.	-397458021.	-0.005935	-0.0041	33.54	
344	0.005918	2607403460.44	38.998	37.377	97459214326.6	0.0018	0.06820	-15384547.33	177829973.29	-575041767.	-397211794.	-0.005935	-0.0041	33.59	
345	0.005918	2592018913.11	39.025	37.446	97060953276.0	0.0018	0.06780	-15293773.39	175747904.90	-572691895.	-396943990.	-0.005935	-0.0041	33.63	
346	0.005918	2576725139.72	39.052	37.513	96662972314.5	0.0018	0.06741	-15203535.04	173688717.79	-570343675.	-396654957.	-0.005935	-0.0041	33.68	
347	0.005918	2561521604.69	39.079	37.581	96265292535.8	0.0018	0.06701	-15113829.13	171652191.45	-567997232.	-396345040.	-0.005935	-0.0042	33.72	
348	0.005918	2546407775.56	39.105	37.648	95867934689.8	0.0018	0.06662	-15024652.51	169638106.80	-565652689.	-396014582.	-0.005935	-0.0042	33.77	
349	0.005918	2531383123.05	39.131	37.714	95470919186.4	0.0018	0.06623	-14936002.06	167646246.21	-563310165.	-395663919.	-0.005935	-0.0042	33.81	
350	0.005918	2516447120.98	39.157	37.781	95074266098.4	0.0017	0.06584	-14847874.69	165676393.53	-560969780.	-395293386.	-0.005935	-0.0042	33.85	
351	0.005918	2501599246.30	39.183	37.847	94677995165.7	0.0017	0.06545	-14760267.29	163728334.11	-558631650.	-394903316.	-0.005935	-0.0042	33.90	
352	0.005918	2486838979.01	39.209	37.912	94282125798.0	0.0017	0.06506	-14673176.80	161801854.72	-556295889.	-394494034.	-0.005935	-0.0042	33.94	
353	0.005918	2472165802.20	39.234	37.977	93886677078.7	0.0017	0.06468	-14586600.18	159896743.66	-553962610.	-394065866.	-0.005935	-0.0042	33.98	
354	0.005918	2457579202.02	39.260	38.042	93491667768.0	0.0017	0.06430	-14500534.39	158012790.69	-551631924.	-393619133.	-0.005935	-0.0042	34.02	
355	0.005918	2443078667.63	39.285	38.106	93097116306.6	0.0017	0.06392	-14414976.42	156149787.09	-549303939.	-393154152.	-0.005935	-0.0043	34.06	
356	0.005918	2428663691.21	39.310	38.170	92703040818.7	0.0017	0.06354	-14329923.26	154307525.59	-546978762.	-392671237.	-0.005935	-0.0043	34.10	
357	0.005918	2414333767.95	39.335	38.233	92309459115.7	0.0016	0.06316	-14245371.95	152485800.45	-544656500.	-392170699.	-0.005935	-0.0043	34.14	
358	0.005918	2400088395.99	39.359	38.297	91916388699.2	0.0016	0.06278	-14161319.52	150684407.42	-542337253.	-391652846.	-0.005935	-0.0043	34.18	
359	0.005918	2385927076.47	39.384	38.359	91523846764.7	0.0016	0.06241	-14077763.03	148903143.76	-540021125.	-391117982.	-0.005935	-0.0043	34.22	

											$\dot{B}$		$\dot{B}/B$		
Day	**M_t**	**N_t**	**L_t**	**W_t**	**B_t**	**$\dot{W}/W$**	**$\dot{W}$**	**$\dot{N}$**	**$\dot{W}N$**	**$W\dot{N}$**	**$\dot{W}N+W\dot{N}$**	**$\dot{N}/N$**	**$\dot{W}/W+\dot{N}/N$**	**N*(t)**	**B*(t)**
360	0.005918	2371849313.44	39.408	38.422	91131850204.5	0.0016	0.06204	-13994699.55	147141808.20	-537708215.	-390566407.	-0.005935	-0.0043	34.25	
361	0.005918	2357854613.90	39.432	38.484	90740415611.2	0.0016	0.06167	-13912126.17	145400201.02	-535398621.	-389998420.	-0.005935	-0.0043	34.29	
362	0.005918	2343942487.73	39.456	38.546	90349559281.1	0.0016	0.06130	-13830040.00	143678123.96	-533092439.	-389414315.	-0.005935	-0.0043	34.33	
363	0.005918	2330112447.73	39.480	38.607	89959297217.0	0.0016	0.06093	-13748438.16	141975380.29	-530789763.	-388814383.	-0.005935	-0.0044	34.36	
364	0.005918	2316364009.57	39.504	38.668	89569645131.9	0.0016	0.06057	-13667317.81	140291774.80	-528490686.	-388198911.	-0.005935	-0.0044	34.40	
365	0.005918	2302696691.77	39.527	38.728	89180618452.0										-10546.13
	Total (tonn)														
	AVR		27.428	19.344											

Appendix 2

Calculations on bioeconomic parameters

For F>0

Day	Condiction	M_t	F_t	N_t	L_t	w_t	B_t	$\dot{w}/w$	C_t	Y_t (tonn)
0		0	0	1997000000.00	0	0	0	1	0	0
1	0	0.00591781	0	1985217036.03	0.2984938	0.0000992	197003.38	0.83752879	0.00	0.00000
2	0	0.00591781	0	1973503595.47	0.5949094	0.0006108	1205388.92	0.65327485	0.00	0.00000
3	0	0.00591781	0	1961859268.11	0.8892615	0.0017616	3455984.48	0.52710189	0.00	0.00000
4	0	0.00591781	0	1950283646.14	1.1815643	0.0037251	7264975.12	0.43944451	0.00	0.00000
5	0	0.00591781	0	1938776324.20	1.4718320	0.0066453	12883843.67	0.37579210	0.00	0.00000
6	0	0.00591781	0	1927336899.27	1.7600790	0.0106460	20518523.93	0.32770110	0.00	0.00000
7	0	0.00591781	0	1915964970.76	2.0463192	0.0158353	30339865.08	0.29017097	0.00	0.00000
8	0	0.00591781	0	1904660140.41	2.3305666	0.0223086	42490302.10	0.26010348	0.00	0.00000
9	0	0.00591781	0	1893422012.32	2.6128350	0.0301510	57088517.18	0.23549163	0.00	0.00000
10	0	0.00591781	0	1882250192.92	2.8931384	0.0394384	74232904.12	0.21498338	0.00	0.00000
11	0	0.00591781	0	1871144290.97	3.1714903	0.0502389	94004259.11	0.19763668	0.00	0.00000
12	0	0.00591781	0	1860103917.53	3.4479043	0.0626137	116467940.59	0.18277598	0.00	0.00000
13	0	0.00591781	0	1849128685.96	3.7223939	0.0766175	141675647.65	0.16990466	0.00	0.00000
14	0	0.00591781	0	1838218211.92	3.9949725	0.0922997	169666913.84	0.15864967	0.00	0.00000
15	0	0.00591781	0	1827372113.29	4.2656535	0.1097042	200470382.60	0.14872550	0.00	0.00000
16	0	0.00591781	0	1816590010.25	4.5344500	0.1288705	234104910.42	0.13990998	0.00	0.00000
17	0	0.00591781	0	1805871525.21	4.8013751	0.1498338	270580531.64	0.13202770	0.00	0.00000
18	0	0.00591781	0	1795216282.79	5.0664419	0.1726251	309899309.89	0.12493831	0.00	0.00000
19	0	0.00591781	0	1784623909.85	5.3296634	0.1972719	352056095.26	0.11852823	0.00	0.00000
20	0	0.00591781	0	1774094035.42	5.5910523	0.2237983	397039202.12	0.11270455	0.00	0.00000
21	0	0.00591781	0	1763626290.76	5.8506214	0.2522252	444831019.20	0.10739054	0.00	0.00000
22	0	0.00591781	0	1753220309.27	6.1083834	0.2825706	495408561.41	0.10252228	0.00	0.00000
23	0	0.00591781	0	1742875726.53	6.3643509	0.3148497	548743971.00	0.09804611	0.00	0.00000
24	0	0.00591781	0	1732592180.27	6.6185364	0.3490752	604804974.39	0.09391662	0.00	0.00000

Day	Condiction	M_t	F_t	N_t	L_t	w_t	B_t	$\dot{w}/w$	C_t	Y_t (tonn)
25	0	0.00591781	0	1722369310.35	6.8709522	0.3852573	663555299.78	0.09009518	0.00	0.00000
26	0	0.00591781	0	1712206758.77	7.1216107	0.4234039	724955060.06	0.08654865	0.00	0.00000
27	0	0.00591781	0	1702104169.61	7.3705242	0.4635210	788961104.71	0.08324850	0.00	0.00000
28	0	0.00591781	0	1692061189.09	7.6177047	0.5056125	855527343.80	0.08017001	0.00	0.00000
29	0	0.00591781	0	1682077465.50	7.8631643	0.5496804	924605046.92	0.07729165	0.00	0.00000
30	0	0.00591781	0	1672152649.19	8.1069151	0.5957250	996143119.34	0.07459460	0.00	0.00000
31	0	0.00591781	0	1662286392.60	8.3489689	0.6437449	1070088357.57	0.07206231	0.00	0.00000
32	0	0.00591781	0	1652478350.20	8.5893376	0.6937372	1146385686.00	0.06968021	0.00	0.00000
33	0	0.00591781	0	1642728178.52	8.8280328	0.7456975	1224978376.37	0.06743536	0.00	0.00000
34	0	0.00591781	0	1633035536.09	9.0650662	0.7996202	1305808251.39	0.06531631	0.00	0.00000
35	0	0.00591781	0	1623400083.47	9.3004494	0.8554982	1388815873.85	0.06331281	0.00	0.00000
36	0	0.00591781	0	1613821483.23	9.5341939	0.9133233	1473940722.32	0.06141571	0.00	0.00000
37	0	0.00591781	0	1604299399.91	9.7663110	0.9730860	1561121354.44	0.05961680	0.00	0.00000
38	0	0.00591781	0	1594833500.05	9.9968122	1.0347761	1650295558.78	0.05790869	0.00	0.00000
39	0	0.00591781	0	1585423452.15	10.2257086	1.0983819	1741400496.08	0.05628473	0.00	0.00000
40	0	0.00591781	0	1576068926.66	10.4530115	1.1638912	1834372830.56	0.05473887	0.00	0.00000
41	0	0.00591781	0	1566769595.97	10.6787319	1.2312907	1929148852.13	0.05326566	0.00	0.00000
42	0	0.00591781	0	1557525134.43	10.9028808	1.3005662	2025664590.02	0.05186012	0.00	0.00000
43	0	0.00591781	0	1548335218.29	11.1254692	1.3717029	2123855918.39	0.05051773	0.00	0.00000
44	0	0.00591781	0	1539199525.71	11.3465080	1.4446851	2223658654.54	0.04923436	0.00	0.00000
45	0	0.00591781	0	1530117736.75	11.5660079	1.5194966	2325008650.17	0.04800624	0.00	0.00000
46	0	0.00591781	0	1521089533.37	11.7839797	1.5961203	2427841876.13	0.04682989	0.00	0.00000
47	0	0.00591781	0	1512114599.39	12.0004339	1.6745388	2532094500.99	0.04570214	0.00	0.00000
48	0	0.00591781	0	1503192620.50	12.2153812	1.7547338	2637702964.06	0.04462006	0.00	0.00000
49	0	0.00591781	0	1494323284.26	12.4288321	1.8366869	2744604042.88	0.04358097	0.00	0.00000
50	0	0.00591781	0	1485506280.05	12.6407969	1.9203789	2852734915.83	0.04258237	0.00	0.00000
51	0	0.00591781	0	1476741299.09	12.8512860	2.0057902	2962033219.93	0.04162196	0.00	0.00000
52	0	0.00591781	0	1468028034.43	13.0603097	2.0929008	3072437104.27	0.04069763	0.00	0.00000
53	0	0.00591781	0	1459366180.94	13.2678782	2.1816905	3183885279.20	0.03980739	0.00	0.00000
54	0	0.00591781	0	1450755435.26	13.4740016	2.2721384	3296317061.71	0.03894941	0.00	0.00000
55	0	0.00591781	0	1442195495.84	13.6786900	2.3642235	3409672417.04	0.03812199	0.00	0.00000

Day	Condiction	M_t	F_t	N_t	L_t	w_t	B_t	$\dot{w}/w$	C_t	Y_t (tonn)
56	0	0.00591781	0	1433686062.91	13.8819534	2.4579244	3523891996.87	0.03732355	0.00	0.00000
57	0	0.00591781	0	1425226838.47	14.0838017	2.5532197	3638917174.25	0.03655261	0.00	0.00000
58	0	0.00591781	0	1416817526.26	14.2842447	2.6500873	3754690075.43	0.03580779	0.00	0.00000
59	0	0.00591781	0	1408457831.79	14.4832922	2.7485052	3871153608.89	0.03508780	0.00	0.00000
60	0	0.00591781	0	1400147462.29	14.6809539	2.8484510	3988251491.50	0.03439144	0.00	0.00000
61	0	0.00591781	0	1391886126.74	14.8772396	2.9499024	4105928272.32	0.03371758	0.00	0.00000
62	0	0.00591781	0	1383673535.82	15.0721587	3.0528367	4224129353.81	0.03306516	0.00	0.00000
63	0	0.00591781	0	1375509401.91	15.2657208	3.1572311	4342801010.89	0.03243320	0.00	0.00000
64	0	0.00591781	0	1367393439.11	15.4579353	3.2630626	4461890407.81	0.03182075	0.00	0.00000
65	0	0.00591781	0	1359325363.18	15.6488117	3.3703083	4581345613.04	0.03122694	0.00	0.00000
66	0	0.00591781	0	1351304891.59	15.8383591	3.4789452	4701115612.24	0.03065095	0.00	0.00000
67	0	0.00591781	0	1343331743.44	16.0265870	3.5889499	4821150319.49	0.03009201	0.00	0.00000
68	0	0.00591781	0	1335405639.52	16.2135044	3.7002993	4941400586.82	0.02954937	0.00	0.00000
69	0	0.00591781	0	1327526302.25	16.3991205	3.8129702	5061818212.13	0.02902235	0.00	0.00000
70	0	0.00591781	0	1319693455.69	16.5834444	3.9269392	5182355945.72	0.02851030	0.00	0.00000
71	0	0.00591781	0	1311906825.53	16.7664850	4.0421830	5302967495.37	0.02801259	0.00	0.00000
72	0	0.00591781	0	1304166139.07	16.9482512	4.1586784	5423607530.09	0.02752865	0.00	0.00000
73	0	0.00591781	0	1296471125.24	17.1287521	4.2764020	5544231682.72	0.02705793	0.00	0.00000
74	0	0.00591781	0	1288821514.55	17.3079962	4.3953305	5664796551.27	0.02659990	0.00	0.00000
75	0	0.00591781	0	1281217039.10	17.4859926	4.5154408	5785259699.30	0.02615406	0.00	0.00000
76	0	0.00591781	0	1273657432.59	17.6627497	4.6367096	5905579655.20	0.02571995	0.00	0.00000
77	0	0.00591781	0	1266142430.27	17.8382762	4.7591138	6025715910.56	0.02529712	0.00	0.00000
78	0	0.00591781	0	1258671768.96	18.0125807	4.8826303	6145628917.63	0.02488515	0.00	0.00000
79	0	0.00591781	0	1251245187.04	18.1856717	5.0072361	6265280085.96	0.02448362	0.00	0.00000
80	0	0.00591781	0	1243862424.42	18.3575577	5.1329083	6384631778.27	0.02409217	0.00	0.00000
81	0	0.00591781	0	1236523222.55	18.5282470	5.2596241	6503647305.58	0.02371042	0.00	0.00000
82	0	0.00591781	0	1229227324.42	18.6977479	5.3873607	6622290921.71	0.02333803	0.00	0.00000
83	0	0.00591781	0	1221974474.51	18.8660689	5.5160954	6740527817.04	0.02297466	0.00	0.00000
84	0	0.00591781	0	1214764418.83	19.0332179	5.6458059	6858324111.83	0.02262000	0.00	0.00000
85	0	0.00591781	0	1207596904.87	19.1992033	5.7764696	6975646848.89	0.02227375	0.00	0.00000
86	0	0.00591781	0	1200471681.63	19.3640331	5.9080644	7092463985.78	0.02193562	0.00	0.00000

Day	Condiction	M_t	F_t	N_t	L_t	w_t	B_t	$\dot{w}/w$	C_t	Y_t (tonn)
87	0	0.00591781	0	1193388499.57	19.5277154	6.0405680	7208744386.57	0.02160534	0.00	0.00000
88	0	0.00591781	0	1186347110.64	19.6902581	6.1739585	7324457813.11	0.02128265	0.00	0.00000
89	0	0.00591781	0	1179347268.25	19.8516692	6.3082140	7439574915.96	0.02096728	0.00	0.00000
90	0	0.00591781	0	1172388727.26	20.0119566	6.4433127	7554067224.90	0.02065902	0.00	0.00000
91	1	0.00591781	0.005753425	1158785045.69	20.1711280	6.5792332	7623917081.28	0.02035761	6666982.45	43.86363
92	1	0.00591781	0.005753425	1145339212.92	20.3291914	6.7159540	7692045507.39	0.02006286	6589622.87	44.25560
93	1	0.00591781	0.005753425	1132049397.37	20.4861542	6.8534539	7758448357.91	0.01977453	6513160.92	44.63765
94	1	0.00591781	0.005753425	1118913788.70	20.6420243	6.9917117	7823122680.87	0.01949245	6437586.18	45.00975
95	1	0.00591781	0.005753425	1105930597.61	20.7968093	7.1307067	7886066677.14	0.01921640	6362888.37	45.37189
96	1	0.00591781	0.005753425	1093098055.52	20.9505166	7.2704179	7947279660.38	0.01894620	6289057.31	45.72407
97	1	0.00591781	0.005753425	1080414414.40	21.1031539	7.4108249	8006762017.87	0.01868168	6216082.93	46.06630
98	1	0.00591781	0.005753425	1067877946.49	21.2547285	7.5519072	8064515171.82	0.01842267	6143955.31	46.39858
99	1	0.00591781	0.005753425	1055486944.09	21.4052478	7.6936447	8120541541.52	0.01816900	6072664.61	46.72092
100	1	0.00591781	0.005753425	1043239719.29	21.5547192	7.8360173	8174844506.09	0.01792052	6002201.12	47.03335
101	1	0.00591781	0.005753425	1031134603.80	21.7031500	7.9790052	8227428368.01	0.01767706	5932555.25	47.33589
102	1	0.00591781	0.005753425	1019169948.67	21.8505475	8.1225887	8278298317.32	0.01743850	5863717.51	47.62857
103	1	0.00591781	0.005753425	1007344124.07	21.9969188	8.2667484	8327460396.55	0.01720468	5795678.52	47.91142
104	1	0.00591781	0.005753425	995655519.11	22.1422710	8.4114649	8374921466.37	0.01697547	5728429.01	48.18448
105	1	0.00591781	0.005753425	984102541.57	22.2866113	8.5567193	8420689172.01	0.01675075	5661959.83	48.44780
106	1	0.00591781	0.005753425	972683617.72	22.4299467	8.7024925	8464771910.30	0.01653038	5596261.91	48.70143
107	1	0.00591781	0.005753425	961397192.07	22.5722842	8.8487660	8507178797.58	0.01631425	5531326.31	48.94541
108	1	0.00591781	0.005753425	950241727.20	22.7136308	8.9955212	8547919638.18	0.01610225	5467144.18	49.17981
109	1	0.00591781	0.005753425	939215703.52	22.8539933	9.1427399	8587004893.77	0.01589425	5403706.79	49.40469
110	1	0.00591781	0.005753425	928317619.07	22.9933786	9.2904039	8624445653.32	0.01569016	5341005.48	49.62010
111	1	0.00591781	0.005753425	917545989.33	23.1317936	9.4384954	8660253603.86	0.01548986	5279031.72	49.82612
112	1	0.00591781	0.005753425	906899346.99	23.2692449	9.5869967	8694441001.83	0.01529326	5217777.06	50.02281
113	1	0.00591781	0.005753425	896376241.77	23.4057392	9.7358902	8727020645.33	0.01510027	5157233.17	50.21026
114	1	0.00591781	0.005753425	885975240.23	23.5412833	9.8851587	8758005846.87	0.01491078	5097391.79	50.38853
115	1	0.00591781	0.005753425	875694925.55	23.6758838	10.0347851	8787410406.92	0.01472470	5038244.78	50.55770
116	1	0.00591781	0.005753425	865533897.35	23.8095471	10.1847526	8815248588.19	0.01454196	4979784.07	50.71787
117	1	0.00591781	0.005753425	855490771.50	23.9422799	10.3350444	8841535090.45	0.01436246	4922001.70	50.86911

Day	Condiction	M_t	F_t	N_t	L_t	w_t	B_t	$\dot{w}/w$	C_t	Y_t (tonn)
118	1	0.00591781	0.005753425	845564179.95	24.0740887	10.4856441	8866285026.16	0.01418613	4864889.80	51.01150
119	1	0.00591781	0.005753425	835752770.49	24.2049797	10.6365354	8889513896.72	0.01401289	4808440.60	51.14515
120	1	0.00591781	0.005753425	826055206.62	24.3349596	10.7877022	8911237569.31	0.01384265	4752646.39	51.27013
121	1	0.00591781	0.005753425	816470167.35	24.4640345	10.9391287	8931472254.49	0.01367535	4697499.59	51.38655
122	1	0.00591781	0.005753425	806996347.01	24.5922108	11.0907993	8950234484.37	0.01351091	4642992.68	51.49450
123	1	0.00591781	0.005753425	797632455.09	24.7194947	11.2426984	8967541091.41	0.01334927	4589118.23	51.59407
124	1	0.00591781	0.005753425	788377216.04	24.8458925	11.3948108	8983409187.87	0.01319036	4535868.91	51.68537
125	1	0.00591781	0.005753425	779229369.13	24.9714103	11.5471214	8997856145.82	0.01303411	4483237.47	51.76849
126	1	0.00591781	0.005753425	770187668.23	25.0960543	11.6996155	9010899577.85	0.01288046	4431216.72	51.84353
127	1	0.00591781	0.005753425	761250881.70	25.2198305	11.8522783	9022557318.21	0.01272936	4379799.59	51.91060
128	1	0.00591781	0.005753425	752417792.17	25.3427449	12.0050954	9032847404.73	0.01258073	4328979.08	51.96981
129	1	0.00591781	0.005753425	743687196.41	25.4648037	12.1580526	9041788061.08	0.01243453	4278748.25	52.02125
130	1	0.00591781	0.005753425	735057905.15	25.5860127	12.3111358	9049397679.84	0.01229070	4229100.28	52.06503
131	1	0.00591781	0.005753425	726528742.89	25.7063778	12.4643311	9055694805.86	0.01214918	4180028.38	52.10126
132	1	0.00591781	0.005753425	718098547.82	25.8259050	12.6176249	9060698120.40	0.01200993	4131525.89	52.13004
133	1	0.00591781	0.005753425	709766171.58	25.9446000	12.7710037	9064426425.62	0.01187289	4083586.19	52.15149
134	1	0.00591781	0.005753425	701530479.13	26.0624687	12.9244543	9066898629.67	0.01173801	4036202.76	52.16572
135	1	0.00591781	0.005753425	693390348.62	26.1795167	13.0779636	9068133732.25	0.01160525	3989369.13	52.17282
136	1	0.00591781	0.005753425	685344671.21	26.2957499	13.2315187	9068150810.73	0.01147456	3943078.93	52.17292
137	1	0.00591781	0.005753425	677392350.91	26.4111739	13.3851069	9066969006.65	0.01134589	3897325.85	52.16612
138	1	0.00591781	0.005753425	669532304.47	26.5257943	13.5387157	9064607512.82	0.01121921	3852103.67	52.15254
139	1	0.00591781	0.005753425	661763461.21	26.6396167	13.6923328	9061085560.77	0.01109446	3807406.22	52.13227
140	1	0.00591781	0.005753425	654084762.84	26.7526467	13.8459462	9056422408.72	0.01097161	3763227.40	52.10544
141	1	0.00591781	0.005753425	646495163.40	26.8648898	13.9995438	9050637329.97	0.01085062	3719561.21	52.07216
142	1	0.00591781	0.005753425	638993629.02	26.9763514	14.1531139	9043749601.78	0.01073145	3676401.70	52.03253
143	1	0.00591781	0.005753425	631579137.87	27.0870371	14.3066450	9035778494.56	0.01061406	3633742.98	51.98667
144	1	0.00591781	0.005753425	624250679.93	27.1969521	14.4601256	9026743261.57	0.01049842	3591579.25	51.93469
145	1	0.00591781	0.005753425	617007256.93	27.3061020	14.6135447	9016663129.01	0.01038448	3549904.77	51.87669
146	1	0.00591781	0.005753425	609847882.18	27.4144919	14.7668911	9005557286.49	0.01027221	3508713.84	51.81280
147	1	0.00591781	0.005753425	602771580.44	27.5221273	14.9201541	8993444877.83	0.01016159	3468000.87	51.74311
148	1	0.00591781	0.005753425	595777387.77	27.6290133	15.0733230	8980344992.38	0.01005257	3427760.31	51.66774

Day	Condiction	M_t	F_t	N_t	L_t	w_t	B_t	$\dot{w}/w$	C_t	Y_t (tonn)
149	1	0.00591781	0.005753425	588864351.44	27.7351551	15.2263873	8966276656.53	0.00994512	3387986.68	51.58680
150	1	0.00591781	0.005753425	582031529.75	27.8405580	15.3793366	8951258825.70	0.00983922	3348674.55	51.50039
151	1	0.00591781	0.005753425	575277991.94	27.9452271	15.5321610	8935310376.66	0.00973483	3309818.58	51.40864
152	1	0.00591781	0.005753425	568602818.05	28.0491675	15.6848503	8918450100.12	0.00963192	3271413.47	51.31163
153	1	0.00591781	0.005753425	562005098.80	28.1523843	15.8373949	8900696693.74	0.00953047	3233453.99	51.20949
154	1	0.00591781	0.005753425	555483935.45	28.2548825	15.9897851	8882068755.39	0.00943044	3195934.97	51.10231
155	1	0.00591781	0.005753425	549038439.69	28.3566670	16.1420114	8862584776.74	0.00933182	3158851.30	50.99021
156	1	0.00591781	0.005753425	542667733.51	28.4577430	16.2940647	8842263137.20	0.00923456	3122197.92	50.87329
157	1	0.00591781	0.005753425	536370949.12	28.5581153	16.4459356	8821122098.08	0.00913865	3085969.84	50.75166
158	1	0.00591781	0.005753425	530147228.75	28.6577888	16.5976154	8799179797.12	0.00904406	3050162.14	50.62542
159	1	0.00591781	0.005753425	523995724.64	28.7567683	16.7490951	8776454243.18	0.00895076	3014769.92	50.49467
160	1	0.00591781	0.005753425	517915598.81	28.8550588	16.9003663	8752963311.36	0.00885873	2979788.38	50.35951
161	1	0.00591781	0.005753425	511906023.04	28.9526650	17.0514203	8728724738.21	0.00876796	2945212.74	50.22006
162	1	0.00591781	0.005753425	505966178.71	29.0495917	17.2022489	8703756117.36	0.00867840	2911038.29	50.07641
163	1	0.00591781	0.005753425	500095256.71	29.1458435	17.3528438	8678074895.27	0.00859005	2877260.38	49.92865
164	1	0.00591781	0.005753425	494292457.29	29.2414253	17.5031972	8651698367.29	0.00850288	2843874.41	49.77689
165	1	0.00591781	0.005753425	488556990.00	29.3363416	17.6533012	8624643673.92	0.00841687	2810875.83	49.62124
166	1	0.00591781	0.005753425	482888073.57	29.4305971	17.8031479	8596927797.33	0.00833199	2778260.15	49.46178
167	1	0.00591781	0.005753425	477284935.78	29.5241964	17.9527299	8568567558.07	0.00824824	2746022.92	49.29861
168	1	0.00591781	0.005753425	471746813.37	29.6171441	18.1020398	8539579611.98	0.00816558	2714159.75	49.13183
169	1	0.00591781	0.005753425	466272951.94	29.7094447	18.2510703	8509980447.36	0.00808399	2682666.30	48.96153
170	1	0.00591781	0.005753425	460862605.85	29.8011027	18.3998143	8479786382.31	0.00800347	2651538.28	48.78781
171	1	0.00591781	0.005753425	455515038.11	29.8921225	18.5482648	8449013562.22	0.00792399	2620771.45	48.61076
172	1	0.00591781	0.005753425	450229520.28	29.9825087	18.6964150	8417677957.52	0.00784553	2590361.62	48.43048
173	1	0.00591781	0.005753425	445005332.36	30.0722657	18.8442582	8385795361.56	0.00776807	2560304.65	48.24704
174	1	0.00591781	0.005753425	439841762.72	30.1613977	18.9917877	8353381388.70	0.00769160	2530596.44	48.06055
175	1	0.00591781	0.005753425	434738107.98	30.2499092	19.1389973	8320451472.54	0.00761610	2501232.95	47.87109
176	1	0.00591781	0.005753425	429693672.93	30.3378045	19.2858806	8287020864.32	0.00754156	2472210.17	47.67875
177	1	0.00591781	0.005753425	424707770.42	30.4250879	19.4324314	8253104631.49	0.00746795	2443524.16	47.48362
178	1	0.00591781	0.005753425	419779721.28	30.5117636	19.5786438	8218717656.41	0.00739527	2415171.00	47.28577
179	1	0.00591781	0.005753425	414908854.19	30.5978359	19.7245119	8183874635.24	0.00732349	2387146.83	47.08531

Day	Condiction	M_t	F_t	N_t	L_t	w_t	B_t	$\dot{w}/w$	C_t	Y_t (tonn)
180	1	0.00591781	0.005753425	410094505.68	30.6833089	19.8700299	8148590076.91	0.00725260	2359447.84	46.88230
181	1	0.00591781	0.005753425	405336019.91	30.7681869	20.0151921	8112878302.28	0.00718259	2332070.25	46.67683
182	1	0.00591781	0.005753425	400632748.71	30.8524740	20.1599931	8076753443.40	0.00711344	2305010.34	46.46899
183	1	0.00591781	0.005753425	395984051.38	30.9361743	20.3044275	8040229442.92	0.00704514	2278264.41	46.25885
184	1	0.00591781	0.005753425	391389294.70	31.0192918	20.4484899	8003320053.61	0.00697767	2251828.82	46.04650
185	1	0.00591781	0.005753425	386847852.76	31.1018307	20.5921754	7966038837.97	0.00691103	2225699.97	45.83200
186	1	0.00591781	0.005753425	382359106.93	31.1837950	20.7354788	7928399168.03	0.00684519	2199874.31	45.61545
187	1	0.00591781	0.005753425	377922445.77	31.2651886	20.8783953	7890414225.18	0.00678014	2174348.32	45.39690
188	1	0.00591781	0.005753425	373537264.91	31.3460156	21.0209201	7852097000.12	0.00671588	2149118.51	45.17645
189	1	0.00591781	0.005753425	369202967.00	31.4262798	21.1630485	7813460292.98	0.00665238	2124181.45	44.95416
190	1	0.00591781	0.005753425	364918961.64	31.5059853	21.3047759	7774516713.42	0.00658964	2099533.75	44.73010
191	1	0.00591781	0.005753425	360684665.25	31.5851359	21.4460980	7735278680.93	0.00652765	2075172.05	44.50434
192	1	0.00591781	0.005753425	356499501.05	31.6637354	21.5870104	7695758425.16	0.00646638	2051093.02	44.27697
193	1	0.00591781	0.005753425	352362898.93	31.7417877	21.7275088	7655967986.34	0.00640585	2027293.39	44.04803
194	1	0.00591781	0.005753425	348274295.41	31.8192966	21.8675892	7615919215.82	0.00634602	2003769.92	43.81762
195	1	0.00591781	0.005753425	344233133.55	31.8962659	22.0072475	7575623776.62	0.00628689	1980519.40	43.58578
196	1	0.00591781	0.005753425	340238862.86	31.9726993	22.1464799	7535093144.12	0.00622844	1957538.66	43.35259
197	1	0.00591781	0.005753425	336290939.24	32.0486007	22.2852826	7494338606.81	0.00617068	1934824.58	43.11811
198	1	0.00591781	0.005753425	332388824.91	32.1239735	22.4236518	7453371267.05	0.00611359	1912374.06	42.88241
199	1	0.00591781	0.005753425	328531988.33	32.1988217	22.5615840	7412202041.97	0.00605715	1890184.04	42.64555
200	1	0.00591781	0.005753425	324719904.12	32.2731488	22.6990756	7370841664.41	0.00600136	1868251.50	42.40758
201	1	0.00591781	0.005753425	320952053.00	32.3469584	22.8361234	7329300683.88	0.00594621	1846573.46	42.16858
202	1	0.00591781	0.005753425	317227921.72	32.4202541	22.9727239	7287589467.63	0.00589168	1825146.95	41.92860
203	1	0.00591781	0.005753425	313547002.99	32.4930396	23.1088741	7245718201.75	0.00583778	1803969.06	41.68769
204	1	0.00591781	0.005753425	309908795.38	32.5653183	23.2445707	7203696892.31	0.00578448	1783036.90	41.44593
205	1	0.00591781	0.005753425	306312803.31	32.6370938	23.3798107	7161535366.56	0.00573179	1762347.64	41.20335
206	1	0.00591781	0.005753425	302758536.93	32.7083696	23.5145914	7119243274.18	0.00567968	1741898.43	40.96003
207	1	0.00591781	0.005753425	299245512.08	32.7791493	23.6489097	7076830088.59	0.00562816	1721686.51	40.71601
208	1	0.00591781	0.005753425	295773250.23	32.8494361	23.7827630	7034305108.24	0.00557722	1701709.11	40.47134
209	1	0.00591781	0.005753425	292341278.38	32.9192336	23.9161486	6991677458.00	0.00552684	1681963.52	40.22609
210	1	0.00591781	0.005753425	288949129.03	32.9885452	24.0490640	6948956090.56	0.00547702	1662447.04	39.98030

Day	Condiction	M_t	F_t	N_t	L_t	w_t	B_t	$\dot{w}/w$	C_t	Y_t (tonn)
211	1	0.00591781	0.005753425	285596340.10	33.0573742	24.1815066	6906149787.89	0.00542775	1643157.03	39.73401
212	1	0.00591781	0.005753425	282282454.89	33.1257241	24.3134741	6863267162.66	0.00537902	1624090.84	39.48729
213	1	0.00591781	0.005753425	279007021.97	33.1935981	24.4449642	6820316659.81	0.00533083	1605245.88	39.24018
214	1	0.00591781	0.005753425	275769595.17	33.2609996	24.5759746	6777306558.02	0.00528317	1586619.59	38.99272
215	1	0.00591781	0.005753425	272569733.50	33.3279318	24.7065031	6734244971.28	0.00523602	1568209.43	38.74497
216	1	0.00591781	0.005753425	269407001.06	33.3943981	24.8365478	6691139850.51	0.00518939	1550012.88	38.49697
217	1	0.00591781	0.005753425	266280967.03	33.4604016	24.9661065	6647998985.11	0.00514326	1532027.48	38.24876
218	1	0.00591781	0.005753425	263191205.59	33.5259456	25.0951774	6604830004.60	0.00509763	1514250.77	38.00039
219	1	0.00591781	0.005753425	260137295.85	33.5910333	25.2237587	6561640380.28	0.00505249	1496680.33	37.75190
220	1	0.00591781	0.005753425	257118821.81	33.6556678	25.3518485	6518437426.87	0.00500783	1479313.77	37.50334
221	1	0.00591781	0.005753425	254135372.30	33.7198524	25.4794452	6475228304.20	0.00496365	1462148.72	37.25474
222	1	0.00591781	0.005753425	251186540.91	33.7835901	25.6065472	6432020018.90	0.00491994	1445182.84	37.00614
223	1	0.00591781	0.005753425	248271925.95	33.8468841	25.7331529	6388819426.10	0.00487670	1428413.82	36.75759
224	1	0.00591781	0.005753425	245391130.41	33.9097374	25.8592608	6345633231.13	0.00483392	1411839.38	36.50912
225	1	0.00591781	0.005753425	242543761.85	33.9721531	25.9848695	6302467991.28	0.00479158	1395457.26	36.26077
226	1	0.00591781	0.005753425	239729432.42	34.0341344	26.1099776	6259330117.52	0.00474970	1379265.23	36.01258
227	1	0.00591781	0.005753425	236947758.74	34.0956841	26.2345840	6216225876.23	0.00470825	1363261.08	35.76459
228	1	0.00591781	0.005753425	234198361.90	34.1568052	26.3586873	6173161390.99	0.00466724	1347442.63	35.51682
229	1	0.00591781	0.005753425	231480867.39	34.2175009	26.4822865	6130142644.28	0.00462665	1331807.73	35.26931
230	1	0.00591781	0.005753425	228794905.01	34.2777740	26.6053804	6087175479.30	0.00458649	1316354.25	35.02211
231	1	0.00591781	0.005753425	226140108.90	34.3376275	26.7279680	6044265601.69	0.00454675	1301080.08	34.77523
232	1	0.00591781	0.005753425	223516117.42	34.3970643	26.8500484	6001418581.30	0.00450741	1285983.14	34.52871
233	1	0.00591781	0.005753425	220922573.13	34.4560873	26.9716207	5958639854.01	0.00446849	1271061.38	34.28259
234	1	0.00591781	0.005753425	218359122.75	34.5146994	27.0926841	5915934723.41	0.00442996	1256312.76	34.03688
235	1	0.00591781	0.005753425	215825417.07	34.5729034	27.2132376	5873308362.65	0.00439183	1241735.28	33.79164
236	1	0.00591781	0.005753425	213321110.96	34.6307022	27.3332808	5830765816.17	0.00435409	1227326.94	33.54687
237	1	0.00591781	0.005753425	210845863.29	34.6880986	27.4528127	5788312001.45	0.00431673	1213085.79	33.30262
238	1	0.00591781	0.005753425	208399336.88	34.7450955	27.5718330	5745951710.80	0.00427976	1199009.88	33.05890
239	1	0.00591781	0.005753425	205981198.47	34.8016955	27.6903409	5703689613.12	0.00424316	1185097.31	32.81575
240	1	0.00591781	0.005753425	203591118.65	34.8579015	27.8083361	5661530255.62	0.00420693	1171346.16	32.57319
241	1	0.00591781	0.005753425	201228771.86	34.9137161	27.9258180	5619478065.60	0.00417107	1157754.58	32.33124

Day	Condiction	M_t	F_t	N_t	L_t	w_t	B_t	$\dot{w}/w$	C_t	Y_t (tonn)
242	1	0.00591781	0.005753425	198893836.30	34.9691422	28.0427863	5577537352.17	0.00413556	1144320.70	32.08994
243	1	0.00591781	0.005753425	196585993.90	35.0241825	28.1592406	5535712308.02	0.00410042	1131042.70	31.84930
244	1	0.00591781	0.005753425	194304930.29	35.0788395	28.2751807	5494007011.09	0.00406562	1117918.78	31.60936
245	1	0.00591781	0.005753425	192050334.74	35.1331160	28.3906062	5452425426.37	0.00403118	1104947.13	31.37012
246	1	0.00591781	0.005753425	189821900.15	35.1870146	28.5055170	5410971407.54	0.00399708	1092126.00	31.13162
247	1	0.00591781	0.005753425	187619322.95	35.2405380	28.6199130	5369648698.71	0.00396331	1079453.64	30.89387
248	1	0.00591781	0.005753425	185442303.10	35.2936888	28.7337940	5328460936.10	0.00392988	1066928.32	30.65690
249	1	0.00591781	0.005753425	183290544.06	35.3464695	28.8471600	5287411649.76	0.00389679	1054548.34	30.42072
250	1	0.00591781	0.005753425	181163752.72	35.3988828	28.9600110	5246504265.19	0.00386402	1042312.00	30.18537
251	1	0.00591781	0.005753425	179061639.36	35.4509312	29.0723470	5205742105.05	0.00383157	1030217.65	29.95084
252	1	0.00591781	0.005753425	176983917.64	35.5026172	29.1841680	5165128390.79	0.00379944	1018263.64	29.71718
253	1	0.00591781	0.005753425	174930304.53	35.5539434	29.2954743	5124666244.30	0.00376762	1006448.33	29.48438
254	1	0.00591781	0.005753425	172900520.29	35.6049123	29.4062660	5084358689.52	0.00373612	994770.12	29.25247
255	1	0.00591781	0.005753425	170894288.43	35.6555263	29.5165432	5044208654.12	0.00370492	983227.41	29.02147
256	1	0.00591781	0.005753425	168911335.65	35.7057879	29.6263063	5004218971.01	0.00367403	971818.64	28.79140
257	1	0.00591781	0.005753425	166951391.85	35.7556997	29.7355555	4964392380.00	0.00364343	960542.25	28.56226
258	1	0.00591781	0.005753425	165014190.03	35.8052639	29.8442911	4924731529.39	0.00361313	949396.71	28.33407
259	1	0.00591781	0.005753425	163099466.32	35.8544831	29.9525136	4885238977.46	0.00358313	938380.49	28.10685
260	1	0.00591781	0.005753425	161206959.89	35.9033596	30.0602232	4845917194.12	0.00355341	927492.10	27.88062
261	1	0.00591781	0.005753425	159336412.95	35.9518958	30.1674204	4806768562.36	0.00352398	916730.05	27.65538
262	1	0.00591781	0.005753425	157487570.69	36.0000942	30.2741058	4767795379.83	0.00349483	906092.87	27.43115
263	1	0.00591781	0.005753425	155660181.26	36.0479569	30.3802798	4728999860.34	0.00346596	895579.13	27.20794
264	1	0.00591781	0.005753425	153853995.75	36.0954865	30.4859429	4690384135.35	0.00343737	885187.37	26.98577
265	1	0.00591781	0.005753425	152068768.10	36.1426852	30.5910958	4651950255.44	0.00340905	874916.20	26.76465
266	1	0.00591781	0.005753425	150304255.15	36.1895552	30.6957390	4613700191.79	0.00338099	864764.21	26.54458
267	1	0.00591781	0.005753425	148560216.52	36.2360990	30.7998732	4575635837.65	0.00335321	854730.01	26.32558
268	1	0.00591781	0.005753425	146836414.65	36.2823187	30.9034991	4537759009.74	0.00332568	844812.25	26.10765
269	1	0.00591781	0.005753425	145132614.73	36.3282167	31.0066173	4500071449.67	0.00329842	835009.56	25.89082
270	1	0.00591781	0.005753425	143448584.65	36.3737951	31.1092287	4462574825.41	0.00327141	825320.62	25.67509
271	1	0.00591781	0.005753425	141784095.03	36.4190561	31.2113339	4425270732.60	0.00324466	815744.11	25.46046
272	1	0.00591781	0.005753425	140138919.13	36.4640021	31.3129338	4388160695.96	0.00321816	806278.71	25.24695

Day	Condiction	M_t	F_t	N_t	L_t	w_t	B_t	$\dot{w}/w$	C_t	Y_t (tonn)
273	1	0.00591781	0.005753425	138512832.84	36.5086352	31.4140292	4351246170.67	0.00319191	796923.15	25.03457
274	1	0.00591781	0.005753425	136905614.67	36.5529575	31.5146209	4314528543.67	0.00316590	787676.14	24.82331
275	1	0.00591781	0.005753425	135317045.67	36.5969713	31.6147098	4278009135.04	0.00314013	778536.43	24.61320
276	1	0.00591781	0.005753425	133746909.45	36.6406787	31.7142969	4241689199.26	0.00311461	769502.77	24.40424
277	1	0.00591781	0.005753425	132194992.14	36.6840817	31.8133831	4205569926.55	0.00308932	760573.93	24.19643
278	1	0.00591781	0.005753425	130661082.32	36.7271826	31.9119693	4169652444.12	0.00306426	751748.69	23.98978
279	1	0.00591781	0.005753425	129144971.05	36.7699834	32.0100565	4133937817.47	0.00303944	743025.86	23.78430
280	1	0.00591781	0.005753425	127646451.82	36.8124863	32.1076457	4098427051.59	0.00301485	734404.24	23.57999
281	1	0.00591781	0.005753425	126165320.48	36.8546932	32.2047380	4063121092.25	0.00299048	725882.67	23.37686
282	1	0.00591781	0.005753425	124701375.28	36.8966063	32.3013344	4028020827.18	0.00296633	717459.97	23.17491
283	1	0.00591781	0.005753425	123254416.81	36.9382276	32.3974361	3993127087.28	0.00294241	709135.00	22.97416
284	1	0.00591781	0.005753425	121824247.96	36.9795591	32.4930440	3958440647.84	0.00291871	700906.63	22.77459
285	1	0.00591781	0.005753425	120410673.92	37.0206029	32.5881594	3923962229.64	0.00289522	692773.74	22.57622
286	1	0.00591781	0.005753425	119013502.12	37.0613610	32.6827833	3889692500.18	0.00287195	684735.22	22.37905
287	1	0.00591781	0.005753425	117632542.25	37.1018353	32.7769170	3855632074.77	0.00284889	676789.97	22.18309
288	1	0.00591781	0.005753425	116267606.19	37.1420278	32.8705617	3821781517.70	0.00282604	668936.91	21.98833
289	1	0.00591781	0.005753425	114918508.02	37.1819405	32.9637185	3788141343.29	0.00280340	661174.98	21.79479
290	1	0.00591781	0.005753425	113585063.95	37.2215753	33.0563886	3754712017.03	0.00278096	653503.11	21.60245
291	1	0.00591781	0.005753425	112267092.36	37.2609342	33.1485734	3721493956.65	0.00275872	645920.26	21.41134
292	1	0.00591781	0.005753425	110964413.70	37.3000190	33.2402742	3688487533.18	0.00273669	638425.39	21.22144
293	1	0.00591781	0.005753425	109676850.53	37.3388318	33.3314921	3655693071.97	0.00271485	631017.50	21.03275
294	1	0.00591781	0.005753425	108404227.45	37.3773743	33.4222284	3623110853.77	0.00269321	623695.56	20.84530
295	1	0.00591781	0.005753425	107146371.11	37.4156485	33.5124846	3590741115.72	0.00267176	616458.57	20.65906
296	1	0.00591781	0.005753425	105903110.17	37.4536563	33.6022620	3558584052.34	0.00265051	609305.57	20.47405
297	1	0.00591781	0.005753425	104674275.26	37.4913994	33.6915618	3526639816.58	0.00262945	602235.56	20.29026
298	1	0.00591781	0.005753425	103459699.01	37.5288798	33.7803855	3494908520.69	0.00260857	595247.58	20.10769
299	1	0.00591781	0.005753425	102259215.96	37.5660993	33.8687345	3463390237.27	0.00258788	588340.69	19.92635
300	1	0.00591781	0.005753425	101072662.57	37.6030596	33.9566102	3432085000.18	0.00256737	581513.95	19.74624
301	1	0.00591781	0.005753425	99899877.23	37.6397626	34.0440139	3400992805.45	0.00254705	574766.42	19.56736
302	1	0.00591781	0.005753425	98740700.17	37.6762101	34.1309471	3370113612.24	0.00252691	568097.18	19.38969
303	1	0.00591781	0.005753425	97594973.49	37.7124038	34.2174112	3339447343.68	0.00250694	561505.33	19.21326

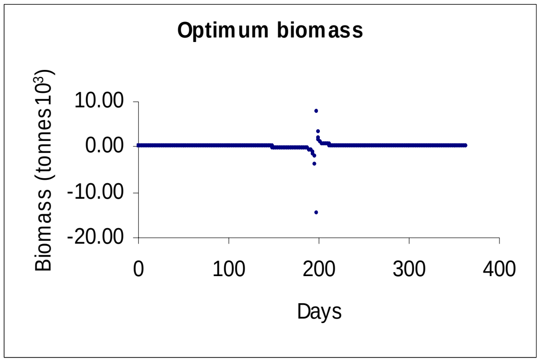
Day	Condiction	M_t	F_t	N_t	L_t	w_t	B_t	$\dot{w}/w$	C_t	Y_t (tonn)
304	1	0.00591781	0.005753425	96462541.12	37.7483456	34.3034078	3308993887.83	0.00248715	554989.96	19.03805
305	1	0.00591781	0.005753425	95343248.81	37.7840371	34.3889383	3278753098.47	0.00246754	548550.20	18.86406
306	1	0.00591781	0.005753425	94236944.07	37.8194801	34.4740041	3248724796.03	0.00244809	542185.16	18.69129
307	1	0.00591781	0.005753425	93143476.23	37.8546764	34.5586068	3218908768.40	0.00242882	535893.97	18.51975
308	1	0.00591781	0.005753425	92062696.31	37.8896277	34.6427478	3189304771.75	0.00240972	529675.79	18.34942
309	1	0.00591781	0.005753425	90994457.10	37.9243356	34.7264288	3159912531.40	0.00239078	523529.75	18.18032
310	1	0.00591781	0.005753425	89938613.09	37.9588019	34.8096511	3130731742.54	0.00237201	517455.03	18.01243
311	1	0.00591781	0.005753425	88895020.44	37.9930283	34.8924164	3101762071.10	0.00235341	511450.80	17.84575
312	1	0.00591781	0.005753425	87863537.01	38.0270163	34.9747263	3073003154.49	0.00233497	505516.24	17.68029
313	1	0.00591781	0.005753425	86844022.28	38.0607678	35.0565822	3044454602.36	0.00231668	499650.54	17.51604
314	1	0.00591781	0.005753425	85836337.37	38.0942842	35.1379857	3016115997.38	0.00229856	493852.90	17.35300
315	1	0.00591781	0.005753425	84840345.02	38.1275674	35.2189385	2987986895.93	0.00228059	488122.53	17.19116
316	1	0.00591781	0.005753425	83855909.56	38.1606188	35.2994422	2960066828.90	0.00226278	482458.66	17.03052
317	1	0.00591781	0.005753425	82882896.89	38.1934401	35.3794982	2932355302.31	0.00224512	476860.50	16.87109
318	1	0.00591781	0.005753425	81921174.46	38.2260329	35.4591083	2904851798.09	0.00222762	471327.31	16.71285
319	1	0.00591781	0.005753425	80970611.26	38.2583988	35.5382741	2877555774.75	0.00221027	465858.31	16.55580
320	1	0.00591781	0.005753425	80031077.82	38.2905393	35.6169971	2850466668.01	0.00219306	460452.78	16.39995
321	1	0.00591781	0.005753425	79102446.16	38.3224561	35.6952791	2823583891.53	0.00217601	455109.96	16.24528
322	1	0.00591781	0.005753425	78184589.76	38.3541507	35.7731216	2796906837.53	0.00215910	449829.15	16.09179
323	1	0.00591781	0.005753425	77277383.61	38.3856247	35.8505263	2770434877.42	0.00214233	444609.60	15.93949
324	1	0.00591781	0.005753425	76380704.13	38.4168795	35.9274950	2744167362.46	0.00212571	439450.63	15.78836
325	1	0.00591781	0.005753425	75494429.17	38.4479167	36.0040291	2718103624.37	0.00210923	434351.51	15.63840
326	1	0.00591781	0.005753425	74618438.00	38.4787379	36.0801304	2692242975.90	0.00209289	429311.56	15.48962
327	1	0.00591781	0.005753425	73752611.29	38.5093445	36.1558007	2666584711.49	0.00207669	424330.09	15.34199
328	1	0.00591781	0.005753425	72896831.11	38.5397380	36.2310414	2641128107.80	0.00206063	419406.43	15.19553
329	1	0.00591781	0.005753425	72050980.87	38.5699199	36.3058544	2615872424.30	0.00204471	414539.89	15.05022
330	1	0.00591781	0.005753425	71214945.37	38.5998916	36.3802414	2590816903.86	0.00202892	409729.82	14.90607
331	1	0.00591781	0.005753425	70388610.71	38.6296547	36.4542040	2565960773.27	0.00201326	404975.57	14.76306
332	1	0.00591781	0.005753425	69571864.33	38.6592106	36.5277439	2541303243.78	0.00199774	400276.48	14.62120
333	1	0.00591781	0.005753425	68764594.98	38.6885608	36.6008629	2516843511.66	0.00198235	395631.92	14.48047
334	1	0.00591781	0.005753425	67966692.69	38.7177066	36.6735626	2492580758.69	0.00196708	391041.25	14.34088

Day	Condiction	M_t	F_t	N_t	L_t	w_t	B_t	$\dot{w}/w$	C_t	Y_t (tonn)
335	1	0.00591781	0.005753425	67178048.77	38.7466494	36.7458448	2468514152.69	0.00195195	386503.84	14.20241
336	1	0.00591781	0.005753425	66398555.78	38.7753908	36.8177112	2444642848.05	0.00193695	382019.09	14.06507
337	1	0.00591781	0.005753425	65628107.56	38.8039321	36.8891634	2420965986.13	0.00192207	377586.37	13.92885
338	1	0.00591781	0.005753425	64866599.15	38.8322747	36.9602034	2397482695.85	0.00190731	373205.09	13.79374
339	1	0.00591781	0.005753425	64113926.82	38.8604200	37.0308326	2374192094.10	0.00189268	368874.65	13.65974
340	1	0.00591781	0.005753425	63369988.03	38.8883693	37.1010530	2351093286.20	0.00187817	364594.45	13.52684
341	1	0.00591781	0.005753425	62634681.46	38.9161240	37.1708662	2328185366.40	0.00186378	360363.92	13.39504
342	1	0.00591781	0.005753425	61907906.93	38.9436855	37.2402740	2305467418.28	0.00184952	356182.48	13.26433
343	1	0.00591781	0.005753425	61189565.46	38.9710552	37.3092781	2282938515.19	0.00183537	352049.55	13.13471
344	1	0.00591781	0.005753425	60479559.17	38.9982343	37.3778803	2260597720.70	0.00182134	347964.59	13.00618
345	1	0.00591781	0.005753425	59777791.37	39.0252241	37.4460822	2238444089.01	0.00180742	343927.02	12.87872
346	1	0.00591781	0.005753425	59084166.44	39.0520261	37.5138857	2216476665.35	0.00179363	339936.30	12.75233
347	1	0.00591781	0.005753425	58398589.92	39.0786415	37.5812924	2194694486.38	0.00177994	335991.89	12.62701
348	1	0.00591781	0.005753425	57720968.41	39.1050715	37.6483043	2173096580.58	0.00176637	332093.24	12.50275
349	1	0.00591781	0.005753425	57051209.60	39.1313176	37.7149228	2151681968.67	0.00175291	328239.84	12.37954
350	1	0.00591781	0.005753425	56389222.27	39.1573809	37.7811500	2130449663.93	0.00173957	324431.14	12.25738
351	1	0.00591781	0.005753425	55734916.23	39.1832628	37.8469874	2109398672.62	0.00172633	320666.64	12.13627
352	1	0.00591781	0.005753425	55088202.36	39.2089645	37.9124369	2088527994.28	0.00171321	316945.82	12.01619
353	1	0.00591781	0.005753425	54448992.56	39.2344873	37.9775001	2067836622.16	0.00170019	313268.18	11.89714
354	1	0.00591781	0.005753425	53817199.76	39.2598324	38.0421789	2047323543.49	0.00168728	309633.20	11.77912
355	1	0.00591781	0.005753425	53192737.90	39.2850010	38.1064751	2026987739.86	0.00167447	306040.41	11.66212
356	1	0.00591781	0.005753425	52575521.91	39.3099944	38.1703902	2006828187.55	0.00166177	302489.30	11.54613
357	1	0.00591781	0.005753425	51965467.72	39.3348138	38.2339262	1986843857.84	0.00164917	298979.40	11.43116
358	1	0.00591781	0.005753425	51362492.22	39.3594604	38.2970847	1967033717.30	0.00163668	295510.23	11.31718
359	1	0.00591781	0.005753425	50766513.28	39.3839355	38.3598676	1947396728.17	0.00162429	292081.31	11.20420
360	1	0.00591781	0.005753425	50177449.72	39.4082401	38.4222765	1927931848.57	0.00161200	288692.18	11.09221
361	1	0.00591781	0.005753425	49595221.29	39.4323755	38.4843133	1908638032.87	0.00159981	285342.37	10.98121
362	1	0.00591781	0.005753425	49019748.68	39.4563429	38.5459796	1889514231.94	0.00158772	282031.43	10.87118
363	1	0.00591781	0.005753425	48450953.51	39.4801434	38.6072772	1870559393.44	0.00157573	278758.91	10.76212
364	1	0.00591781	0.005753425	47888758.28	39.5037783	38.6682079	1851772462.10	0.00156384	275524.36	10.65403
365	1	0.00591781	0.005753425	47333086.43	39.5272486	38.7287734	1833152379.96		272327.35	10.54690

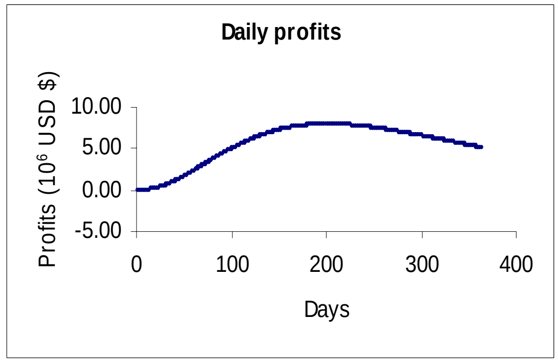
Day	Condiction	M_t	F_t	N_t	L_t	w_t	B_t	$\dot{w}/w$	C_t	Y_t (tonn)
Total							1,886,431.01			9,370.81
AVR					27.4282021	19.3440349				

Appendix 3

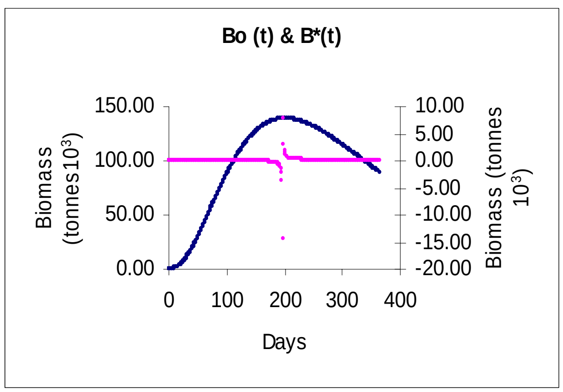
Economic reference points



(a)



(b)



(c)

Appendix 4

General information used for the calculations

L_∞	F	k	M	b	a
48.2	2.1	2.52	2.16	2.6	0.0029
39		3	2.16	2.84	0.0015
48.3		1.68	2.16	2.54	0.0029
36		3	2.16	2.56	0.0023

Recruitment
1,997,000,000.00

Costs ($ USD)	Year	Day
Fixed	261300	986.0377
Variable	356100	1343.774

Prices ($USD)	
Ton shrimp	850000.00
Kg shrimp	10
g shrimp	0.01

Production
Tons/Year
85

δ (interestrate)	q (catchability)	r	K
0.0002328	*0.000187*	2.3171	11585.5