APPENDIX/ANNEXE I

LIST OF PARTICIPANTS/LISTE DES PARTICIPANTS

Name/Nom	Organization/ Organisme	Address/Adresse	Country/Pays	Phone/Tél.	Fax/Télécopie	E-mail/Adresse électronique
Balguerías, Eduardo *	IEO/Tenerife	Avenida San Andrés n°45 S/C Tenerife	Spain	+34 922 549400	+34 922 549554	eduardo.balguerias@ca.ieo.es
Barros, Pedro*	FAO-Consultant	Urb. Gambelinhas, 41 Gambelas 8005-327 FARO	Portugal	+351 (91) 941 87 23	-	pbarros@ualg.pt
Caramelo, Ana Maria*	FAO-Consultant	Rua Particular à Alameda das Linhas de Torres 2 1750-214 Lisboa	Portugal	+351217587189	-	ana.caramelo@fao.org/ ana.caramelo@sapo.pt
Chfiri, Hamid	INRH-C/R Laâyoune	Laâyoune port, B.P. 75	Morocco	+212 48 998811	+212 48 998812	inrh@wadern.net.ma chfiri_h@yahoo.fr
Corten, Ad *	RIVO-DLO	PO Box 68 1970 AB Ijmuiden	The Netherlands	+31 255 564646	+31 255 56 46 44	adcorten@yahoo.co.uk
El Moustapha, Ahmedou Ould Mohamed	IMROP	BP 22 Nouadhibou	Mauritania	+222 5745124 +222 57 43228	+222 5745081	ahmedou_mdm@yahoo.fr
Garcia Santamaria, Maria Teresa	IEO/Tenerife	Avenida San Andrés n°45 S/C Tenerife	Spain	+34 922 549400	+34 922 549554	teresa.garcia@ca.ieo.es
Gasyukov, Pavel*	AtlantNIRO/ Kaliningrad	DM Donskoy 5 Kaliningrad 236000 Russia	Russia	+7011225257	+70112 219997	pg@attlant.baltnet.ru

* Study group on reference points.

Name/Nom	Organization/ Organisme	Address/Adresse	Country/Pays	Phone/Tél.	Fax/Télécopie	E-mail/Adresse électronique
Mahmoud, Ebaye Ould Mohamed*	IMROP	BP 22 Nouadhibou	Mauritania	+222 5745124	+222 5745081	ebaye_mm@imrop.mr or ebaye_mhd@yahoo.fr
Mendy, Asberr N.*	Fisheries Department	6, Marina Parade Banjul	The Gambia	+220 202355 +220 228727	+220 224154	gamfish@gamtel.gm anmendy@yahoo.com
Ramzi, Azeddine*	INRH-Casablanca	2, Rue Tiznit, Casablanca	Morocco	+212 22 220249	+212 22 266967	az_ramzi@yahoo.fr
Samb, Birane*	CRODT	PO Box 2241 Dakar	Senegal	+221 834 8041	+221 834 2792	bsambe@yahoo.fr
Sarre, Abdoulaye	CRODT	PO Box 2241 Dakar	Senegal	+221 834 8041	+221 8342792	ablaysarrey@hotmail.com
Sylla, Mor	CRODT	PO Box 2241 Dakar	Senegal	+221 834 8041	+221 8342792	msylla@crodt.isra.sn
Tandstad, Merete*	FAO	Viale delle Terme di Caracalla, 0153 Rome (FIRM F 524)	Italy	+3906 57052019	+3906 57053020	merete.tandstad@fao.org
Timoshenko, Nikolai M.	AtlantNIRO	DM Donskoy 5 Kaliningrad 236000 Russia	Russia	+70112 225554	+70112219997	timoshenko@atlant.baltnet.ru
Pablo Tjoe-awie	RIVO	BP 15, Cansado, Nouadhibou	Mauritania	+2226219274	-	Pablo.tjoe-awie@wur.nl
Toresen, Reidar *	IMR	PO Box 1870-Nordnes N-5817 Bergen, Norway	Norway	+47 55 238420	+47 55 238555	Reidar@imr.no
Wagué, Abdoulaye	IMROP	BP 22 Nouadhibou	Mauritania	+222 5745124	+222 5745081	awague1@yahoo.fr

* Study group on reference points.

APPENDIX/ANNEXE II

BIOMASS DYNAMIC MODEL WITH ENVIRONMENTAL EFFECTS
USER INSTRUCTIONS
by Pedro de Barros

1) General instructions

a) Data entry

Data and initial parameter estimates should be entered only in the cells coloured green (Figure 1). All other cells are either not used, or used to calculate quantities used by the model. Data must be entered for all the data columns coloured green, and also for initial values of the parameters. Additionally, the model control settings may be entered (in the cells coloured orange – Figure 1). If these control settings are not changed, they may be left at their default values.

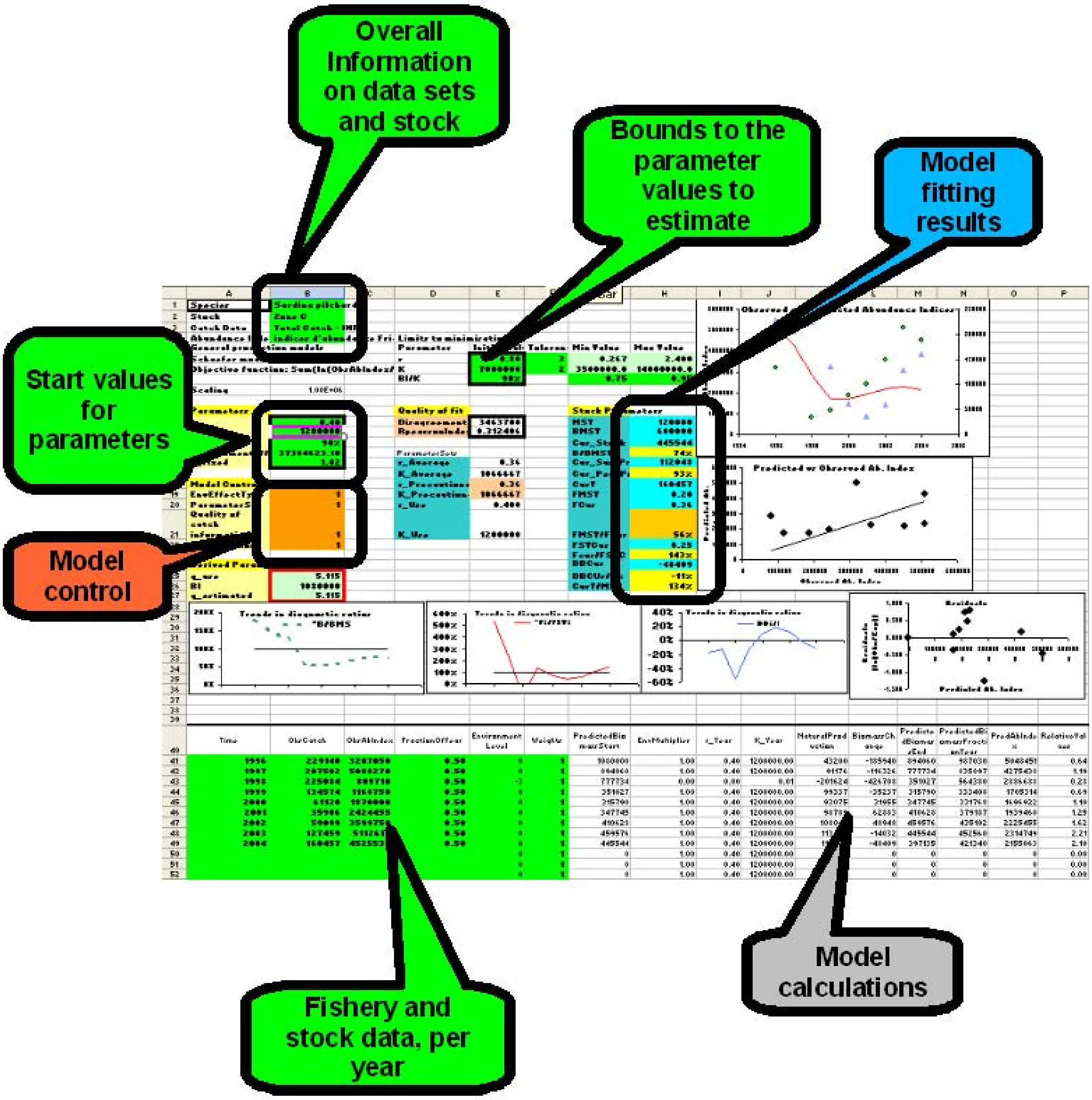


Figure 1. The main areas in the model worksheet

b) Defining the parameters to be estimated non-linearly (using Solver)

The non-linear estimation procedures suffer from a number of limitations, of which the most important is probably that the estimates obtained will depend on the start values defined. Therefore, one should try to keep the number of parameters to be estimated non-linearly to the minimum possible values.

As a minimum, one must estimate r and K by fitting the model to the data using the solver algorithm.

When defining the parameters to estimate, one should as much as possible set constraints (maximum and minimum values) so that the algorithm is limited to reasonable values, defined by the researchers. Use the spreadsheet area of Minimum and Maximum values to define these.

2) Detailed instructions

Entering data

The following data MUST be entered in the appropriate cells of the worksheet (Figure 2):

i) Years of the data (Year)

All years from the first to the last in the data set should be entered, consecutively. The first year should be entered in the cell immediately below the header “Year” and run consecutively until the last one. No empty cells should exist between the data, only after the last year;

ii) Total catch per year (ObsCatch)

Total catch is REQUIRED for ALL years in the data series. The model will fail if catch data is missing for any of the years (the reason is that catch is essential to calculating stock abundance the following year). This column should be filled like the one for year;

iii) Abundance index (ObsAbIndex)

This column should be filled like the previous ones. However, if there is no abundance index for a given year, this can be left blank. The model will still run correctly without a few years of data of Abundance indices (if there are many, however, the reliability of results will be doubtful);

iv) Timing of the abundance index (FractionOfYear)

When the abundance index corresponds to e.g. a scientific survey, or to a fishery concentrated in a short season, it will not represent the average abundance of the stock during the year, but rather this same abundance at the time of the survey or fishery. The values in this column represent the timing of the abundance index as a fraction of year (0.5 = July 1st). It should be set to a value corresponding roughly to the mid-point of the survey or of the fishing season. If the abundance index corresponds to a CPUE from a year-long fishery, this value should be set to 0.5 (mid-year).

v) Environment level

This column will include any index that can be considered to represent a deviation of the average growth conditions of the stock in each year. If a series of environmental indices exist (e.g. a series of upwelling indices) these can be used as the environmental level. If not, and there is external scientific evidence that there were particular years with exceptional conditions, then an arbitrary positive (for good growth) or negative (for poor growth) environmental level can be set for that year. If there is no information on environmental elements affecting the carrying capacity and/or the intrinsic growth rate of the stock, or it is considered that these parameters do not vary significantly, then the values in this column can be left at their default values of 0.

vi) Weights

Is some cases, there are doubts about the reliability or the representativeness (compared with the rest of the series) of one or a few of the abundance indices used (e.g. if there is a year with less complete coverage, or with uncommon distribution conditions). In these cases, the corresponding value of the abundance index will not be as reliable as the remaining of the series. These points can be given less weight in the fitting of the model, by setting a value less than **1** in the corresponding row of the column Weights.

Notes:

The number of consecutive non-empty cells in column Year is used to define the number of years in the data to fit. Therefore, only years for which catch data is available must be entered, and all cells below these must be empty (use "Delete");

In the calculated columns (to the right of the column "Weights") the rows below the last year of data should NOT be deleted. The worksheet will ignore those below the last year of data. Deleting these rows will force one to rebuild them when a new data point is entered.

Time	ObsCatch	ObsAbIndex	Environment Level	Weights
1996	229140	3207050	0	1
1997	207502	5088270	-3	1
1998	225084	809710	0	1
1999	134574	1168750	0	1
2000	61120	1870000	0	1
2001	35906	2424455	0	1
2002	59099	3599750	0	1
2003	127459	5112613	0	1
2004	160457	4525538	0	1
			0	1
			0	1
			0	1
			0	1
			0	1

Figure 2. Spreadsheet section for entering the data for model fitting

Initial parameter values

Enter the initial values (initial "guesstimates") of the parameters in the appropriate cells. As a minimum, initial values for the parameters **r** (intrinsic rate of growth), **K** (Carrying capacity, or Virgin Biomass) and **BI/K** (Stock Biomass at the start of the data series, as a proportion of the Virgin Biomass) are required.

Defining appropriate start values to these parameters may be difficult, and may require a bit of trial and error. However, setting adequate initial values is essential for the success of the estimation procedure.

One should start by defining an adequate value for BI/K.

To start the model running, it is necessary to give it a start point, the stock status at the start of the data series, BI (Initial Biomass). It is often very difficult to provide reasonable values for this parameter, but it may be easier to provide, from the knowledge of the scientists involved with the stock, a first estimate of the level of depletion of the stock at start of the data series available. This approach is similar to the idea of using the Exploitation Ratio (E) to start the calculation in a VPA, as suggested by Cadima (2004). The first estimate of this value will be named $\mathbf{BI/K_{Guess}}$.

A start value for r is usually found by setting r to a value similar to the natural mortality coefficient assumed for the stock.

A start value for K is usually more difficult, but a value consistent with the remaining parameters can also be found using a simple reasoning, as follows:

1- "Guess" the value of average stock Biomass during the period included in the assessment, (B_{Guess});
2- Calculate the average value of the Abundance Index used in the same period, ($AI_{Average}$). Make sure to include only real values of the abundance index, and to ignore any missing values;
3- Calculate a first estimate for the catchability coefficient **q**, as $q_{Guess} = AI_{Average} / B_{Guess}$;
4- Calculate a first estimate of the stock Biomass at the start of the series, (**B_{Start}**), using the value of the abundance Index at the start of the series, (**AI_{Start}**), and the first estimate of the catchability coefficient **q**, q_{Guess}, as **BStart = AIStart/qGuess**;
5- The first estimate of K (**K_{Guess}**) is then given by **$K_{Guess}=B_{Start}/(BI/K_{Guess})$**

This procedure is implemented in the worksheet "InitialValues", within the workbook supplied (Figure 3).

6			
7	AbIndexFirst	3207050	
8	BI/K	90%	This is arbitrated and depends on external information about wha
9			
10	AverageBiomass	3000000	"Guessed" from external information
11	AverageAbIndex	3089571	From real supplied data
12	CatchabilityGuess	1.029857	
13	BiomassFirst	3114073	
14	K_Guess	3460082	
15			

Figure 3. Estimation of the initial value for K implemented in the worksheet "Initial Values"

b) Setting limits to the estimation

When using non-linear estimation, it is advisable to set limits to the values the parameters may take. To do this, enter the appropriate values in the “tolerance” column for the estimation of **r** and **K**. If **BI/K** is to be estimated by the model, the upper and lower limits should be entered directly. Whenever the initial values for the parameters are modified, the values in cells InitialValues should be set to the same values entered in the cells used for the model parameters (Figure 4).

Initial Value	Tolerance	Min Value	Max Value
1.00	4	0.250	4.000
4993858	6	832309.6	29963145.4
90%		0.75	0.95

Figure 4. Process of defining the limits to the estimation in the model worksheet

c) Model control

In its current version, the model implementation allows the user to choose 3 main aspects of the calculation, (1) the type of environmental effect (simple multiplicative or exponential), (2) o estimate or not the catchability coefficient (q) and (3) the set of parameters to use for calculating the reference points and the current status of the stock relative to these reference points.

18	Model Control	
19	EnvEffectType	1
20	ParameterSet	1
21	Quality of catch information for last few years	1
22	q_Estimation	1

Figure 5. Cells of the spreadsheet used to control the options in the calculations of the model

i) Choice of environmental effect type:

The model includes two different formulations for the effect of the environment level on the r and K parameters of each year.
To select the type of environmental effect, set the value in cell EnvEffectType (Figure 5) to one of the following values:
0 – No effect
1 – Additive formulation: EM=1+(EE*|EL|^SIGN(EL))
2 - Exponential formulation: $EM=e^{(EE*EL)}$
EM: Environmental multiplier
EE: Environmental effect: Measures the overall intensity of the environmental effect. Usually estimated by Solver as a part of the fitting routines;
EL: Environmental level: Indicator of level of environment, for each year (normally, will be deviations from the average).

ii) Use of q

The user may choose to estimate the catchability coefficient **q**, or set it as fixed.
To select whether to estimate or to use the fixed value, set the value in cell **q_Estimation** (Figure 5) to one of the following values:
0 – Use the fixed value set for the start
1 – Estimate the catchability coefficient
The user should **never** include q as one more parameter to be estimated by Solver. If it is meant to be estimated, it should be estimated using the linear approximation given in the worksheet (just set q_estimation to 1).

iii) Estimation of current (in the last year of data) Biomass

Even if the absolute Biomass values are not used directly (and they may be misleading, given the degree of uncertainty involved in their estimation), they are necessary to estimate the F-values, since these are calculated as F=B/Y.
The stock Biomass in the last year of data, that is used as a main element in calculating the current status of the stock or the fishery, may be calculated in one of two ways: Either taken directly from the model, as the Biomass value predicted by the model, or using the observed abundance index for that year, and the estimated q, to calculate B=U/q.
The choice of the best option is not straightforward. However, if the quality of the total catch data in the last few years is low, this will affect strongly the reliability of the Biomass estimates from the model. In this case, it is better to calculate the Biomass using the Abundance Index for last year and the overall q. To achieve this, set **Quality of catch information for last few years** (Figure 5) to 0 (bad quality). Otherwise, set it to 1, to use the Biomass estimates from the model.
Notes: The quality referred to here is not of the LAST catch data point (it has no effect) but rather the few years before the last.

iv) Variable r and K (Depending on environment level of each year)

When using the option of introducing an environmental level indicator, different values of r and K are calculated for every year in the data set. In this situation, it becomes difficult to choose which is the best value of the parameters to use in the calculation of the overall

reference points. The best option will depend on the situation at hand. To define the option to use, set the value in cell "Parameter set" (Figure 5) to one of the following values:
1 – Overall r (estimated by the fitting procedure, independent of the environmental effects used in the fitting);
2 – Average value of the r-values estimated for each year in the data series (using the environmental levels for each year);
3 (or other value): Precautionary option – the smallest of the two previous values.

d) Running the model (estimating the parameters)

This is usually done using the "Solver" tool in Excel.

Call the tool (Figure 6).

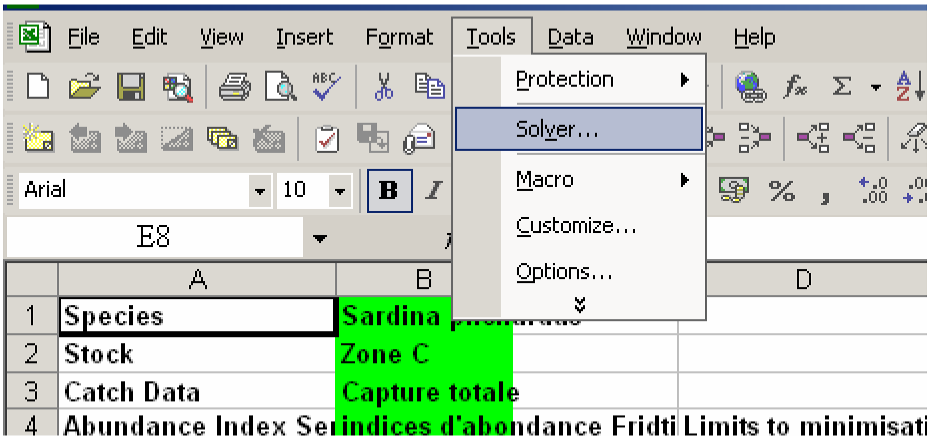


Figure 6. Starting the solver routine, for parameter estimation

Define the cell whose value is to be minimized Target cell (Objective Function) – Figure 7, and the cells that are to be manipulated for achieving this (By changing cells). You may choose all 4 parameters r, K, BI/K and EnvironmentEffect (if an environment effect is being estimated), or only a subset of these. You should not set the model to estimate q, as this is usually not defined enough by the data. Set also, as much as possible, the constraints – use the constraints area in the spreadsheet. Do not set constraints for the Environment effect.

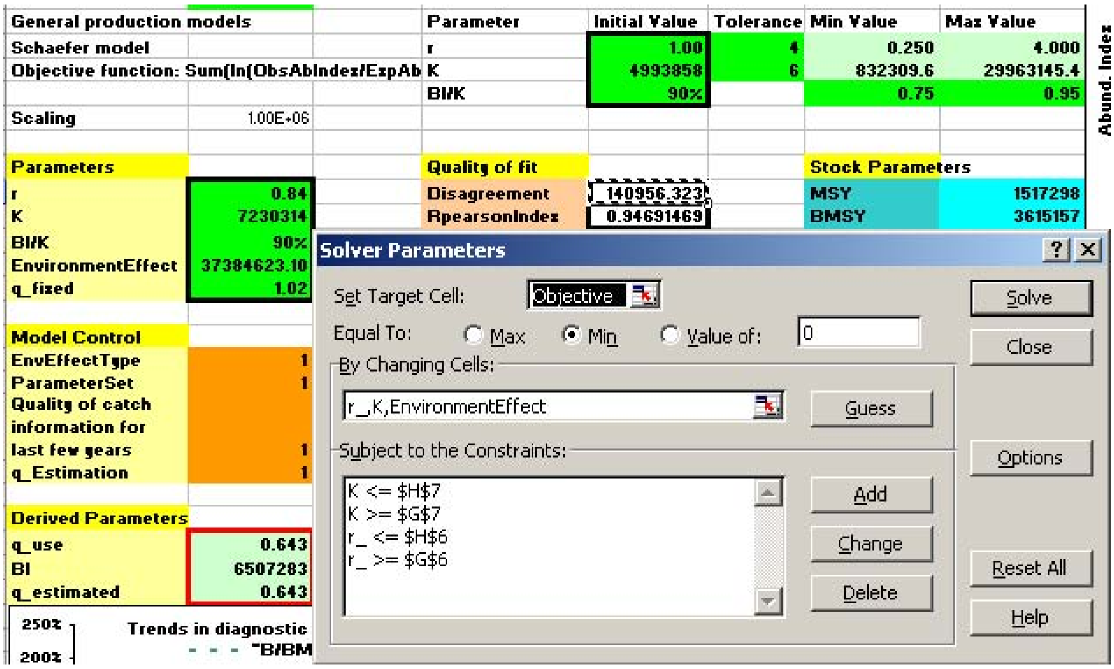


Figure 7. Setting the parameters for the solver routine

After pressing “Solve”, the following dialog should be seen.

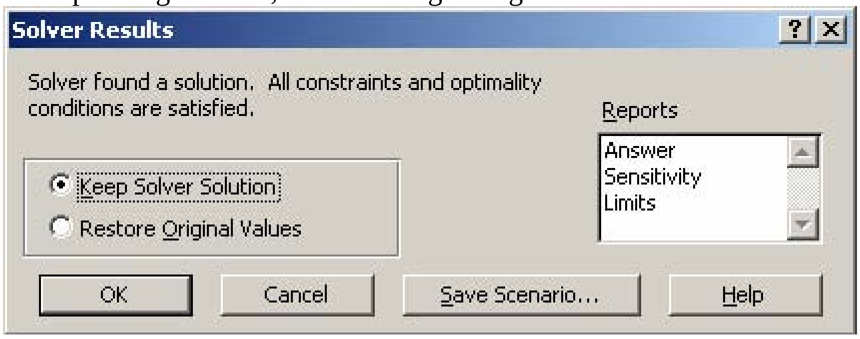


Figure 8. Dialog indicating the successful completion of the model fitting procedure

After pressing the OK button, the diagnostics can be assessed.

3) Diagnostics of fit

Like any model fitted to data, it is essential to assess the quality of the fit of the model to the particular data set used in each run. The model will almost always produce an estimate, but the reliability of the model fitting that produced these estimates should always be checked before accepting the results.
There may be several reasons why a production model may not fit well a particular data set. Some of the most common ones are;

- Lack of contrast in the data
- “One-Way trip”
- Abundance index does not represent the whole stock
- Catch data are not representative of all catches, but come from only a part of the fleet, or are fixed estimates

To help assess the quality of this fit, a few indicators are provided.

a) Objective Function

The actual value of the objective function (Figure 9) is the first measurement of the goodness-of-fit of the model. High values indicate a better fit. However, it is difficult to evaluate exactly what is “high”, and this is thus not usual as a diagnostics statistic.

Quality of fit	
Disagreement	1498416.332
RpearsonIndex	0.848396537

Figure 9. Cells holding the values of the objective function of the model fit, and of the Pearson linear correlation coefficient r

b) Pearson linear regression coefficient between the predicted and observed abundance indices

This coefficient (Figure 9) will not detect a non-linear relation but will measure how closely the predicted abundance indices follow the observed ones. High values should be aimed for.

c) Plot of predicted vs observed abundance indices

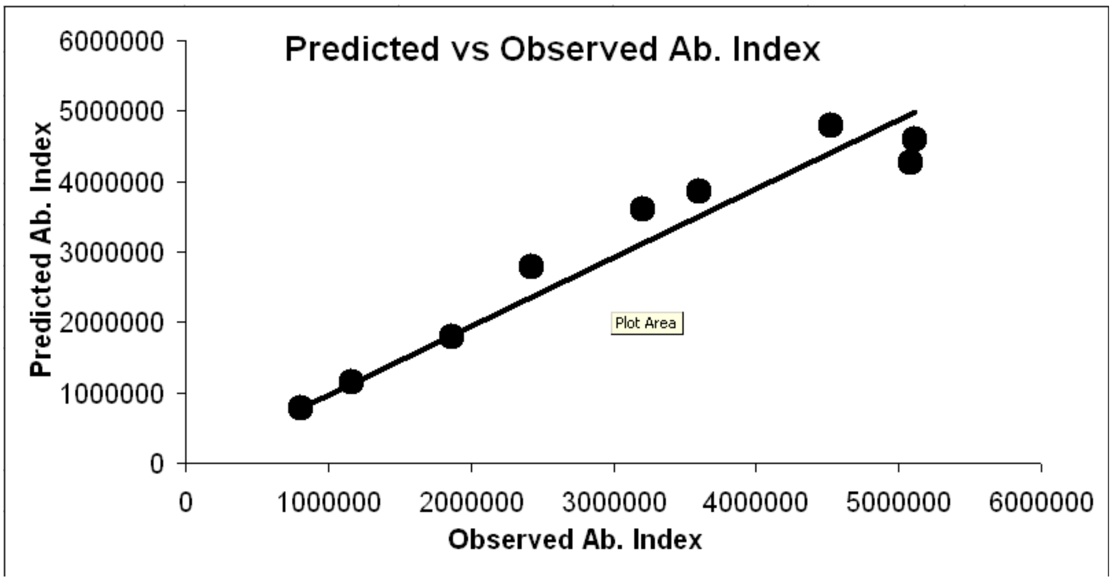


Figure 10. Plot of the relation between the predicted and the observed abundance indices

This plot can be used to detect severe deviations from the linear relationship between the observed abundance indices and those predicted by the model

This plot presents, in a graphical way, the relation between the Abundance Index observed (or iven to the model) and the Abundance index estimated by the model, on the basis of the estimated biomass.

The desirable characteristics for this plot is a linear relation between the predicted and observed indices, with slope 1.

Undesirable characteristics include:
a) a flat plot (no relation between predicted and observed);
b) A non-linear relation (cyclic, asymptotic or curved relation)

d) Residual plot

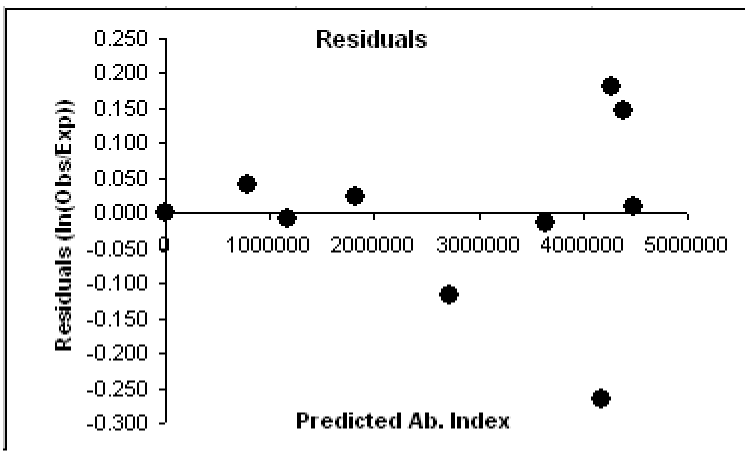


Figure 11. Plot of residuals used to assess if there are indications of any lack of fit in the adjustment of the model to the data

The residual plot is used to evaluate whether there are trends in the deviations between the observed and predicted abundance indices data. As long as the residuals are reasonably well-dispersed, with no patterns, there is usually no reason to concern. Unusually large or small residuals concentrated at a given range of the predicted abundances, however, should be looked into carefully, as they may indicate a model misspecification, or problems with the data.

e) Trends in biomass indices and total catch data

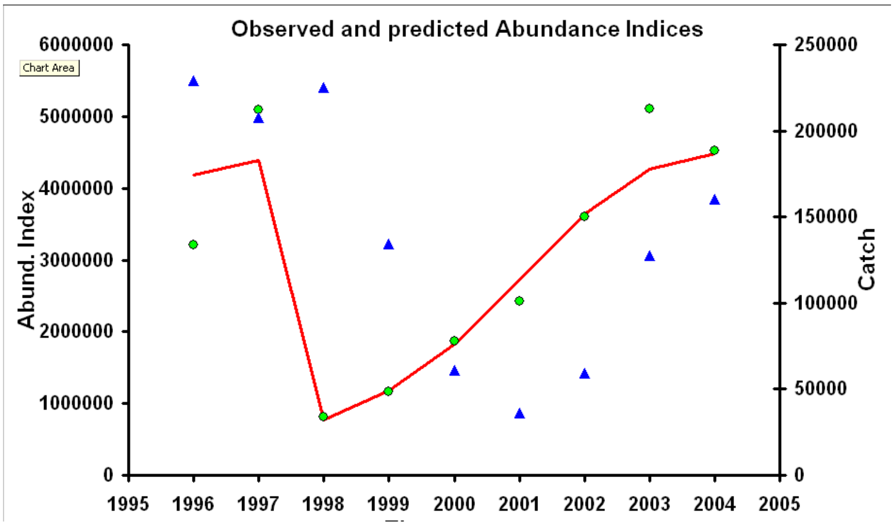


Figure 12. Plot of the trends in observed and estimated abundance indices, as well as of the reported catches, for each year in the period analysed

The model is based on the assumptions that stock biomass tends to grow to a maximum level that can be sustained by the environment, and that this growth is decreased by the catches taken from it.

So, generally speaking, stock biomass trends should reflect the catches taken from it. A year with very high catches should see a reduction in stock biomass the following year, and vice-versa, a year with low catches should be followed by an increase in stock biomass.

Therefore, checking the plot of catches and stock abundance indices for these patterns gives a first indication of the reliability of the fit of the model to the data. A pattern where similar catch levels at similar Biomass levels are followed by both increases and decreases in biomass will in general indicate a contradiction between the data and the model. This may indicate several difficulties with the data, of which the most common are incomplete or inaccurate catch data, or abundance indices that do not represent the whole stock (e.g. they miss the larger adults or the juveniles). In some cases, however, a sudden change in the reaction of the stock to exploitation may also indicate that there was an environmental change or pulse that modified the average biomass growth rate of the stock (e.g. exceptional conditions that lead to a peak in recruitment). If the change in environmental conditions can be demonstrated by other, external data (e.g. similar anomalies arising simultaneously in several stocks, or Sea Surface Temperature data, or precipitation indices) then this can be included in the model by the introduction of an Environment level, for that year, that will account for the positive or negative changes in the growth conditions (intrinsic rate of increase and carrying capacity) observed or assumed for that year.

4) Interpretation of results

Once the model is satisfactorily fitted to the data, it is important to interpret the results from this fit. The model implementation provides several auxiliary ways to view and interpret the data.

a) Current (last year) situation

Usually, stock assessment scientists and managers are most concerned with the status of the stock in the last year of data. So, the model implementation computes several numerical and graphical diagnostics of the condition of the stock and the fishery in the last year (Figure 13).

Stock Parameters	
MSY	120000
BMSY	600000
Cur_Stock	445544
B/BMSY	74%
Cur_SustProd	112048
Cur_PercProd	93%
CurY	160457
FMSY	0.20
FCur	0.36
FMSY/Fcur	56%
FSYCur	0.25
Fcur/FSYCur	143%
DBCur	-48409
DBCUr/Bcur	-11%
CurY/MSY	134%

Figure 13. Summaries of the status of the stock and the fisheries in the last year of data

Of the different indices presented, the ones highlighted in yellow are the ones most important for the stock diagnostics, and of these, special importance is given to the ratios B/BMSY and FCur/FSYCur.

The first of these ratios indicates the current status of the stock biomass relative to the Biomass that would provide the Maximum sustainable yield, and provides an indication of the current stock status relative to a target stock status. In most situations, one would want the stock to be slightly above BMSY, i.e., with a B/BMSY ratio slightly above 1.

The second indicates the value of the yield currently being extracted from the stock, relative to the yield the same stock can provide while keeping its abundance constant for next year, i.e. to the sustainable yield of the stock. Values of this ratio below 1 indicate that the stock biomass will tend to grow, while values above 1 indicate a situation leading to a decline in stock biomass.

To ease the interpretation of the results for the last year of data, the estimated stock Biomass for the last year of data and the corresponding catch are presented relatively to the Biomass that would produce the Maximum Sustainable Yield and to the Sustainable Yield, respectively, in the plot in the chart sheet "CurrentSituation" (Figure 14).

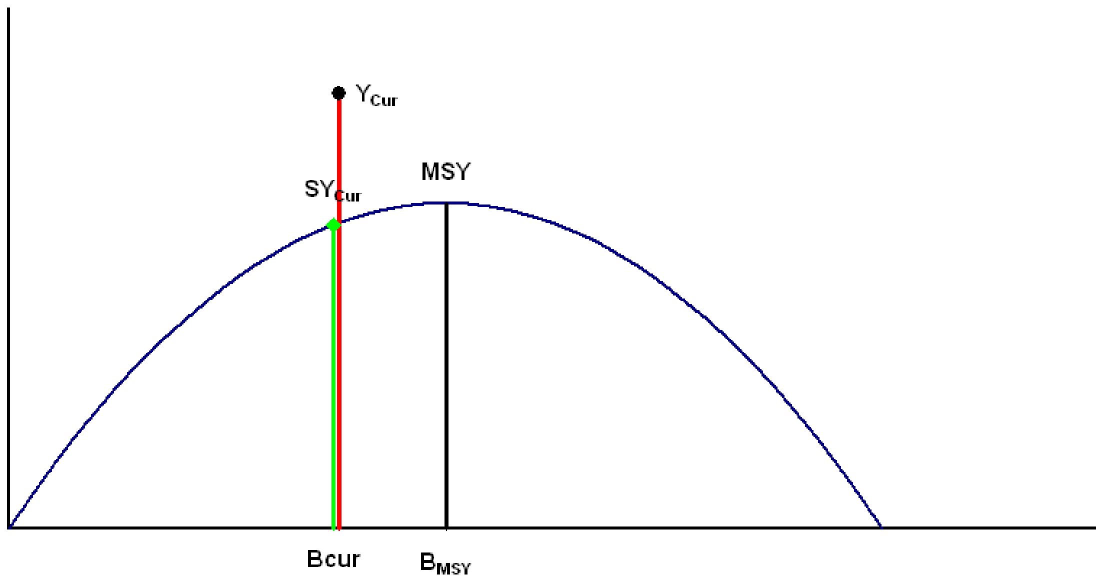


Figure 14. Graphical presentation of the status of the stock and the fishery in the last year of available data, relatively to the Reference Points estimated for the stock

b) Time-patterns

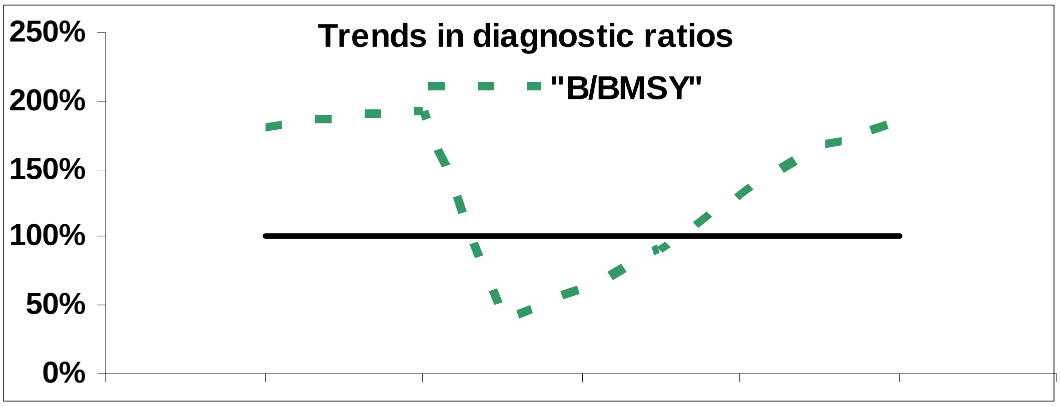
Besides the situation in the last year of data, it may be useful to assess the trends in these indices along the period analysed. All these indices are calculated for each year in the main spreadsheet, but for ease of presentation and interpretation they are also presented graphically (Figure 15).

Three main indicators are presented:

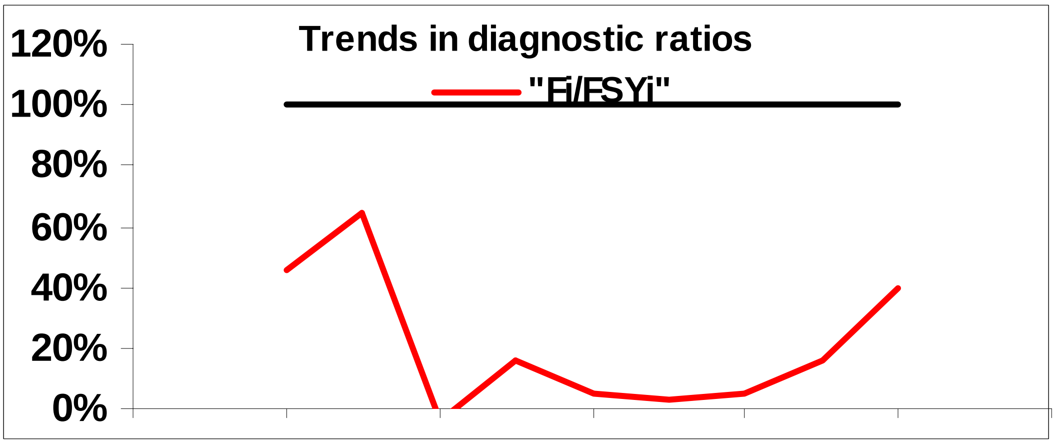
a) Ratio B_i/B_{MSY}. This ratio indicates whether the estimated stock biomass, in any given year, is above or below the Biomass producing the Maximum Sustainable Yield.

b) Ratio F_i/F_{SYi}. This ratio indicates whether the estimated fishing mortality coefficient, in any given year, is above or below the fishing mortality coefficient producing the sustainable yield in that year. Values below 100% indicate that the catch taken is lower than the natural production of the stock, and thus that stock biomass is expected to increase the following year, while values above 100% indicate a situation where fishing mortality exceeds the stock natural production, and thus where stock biomass will decline.

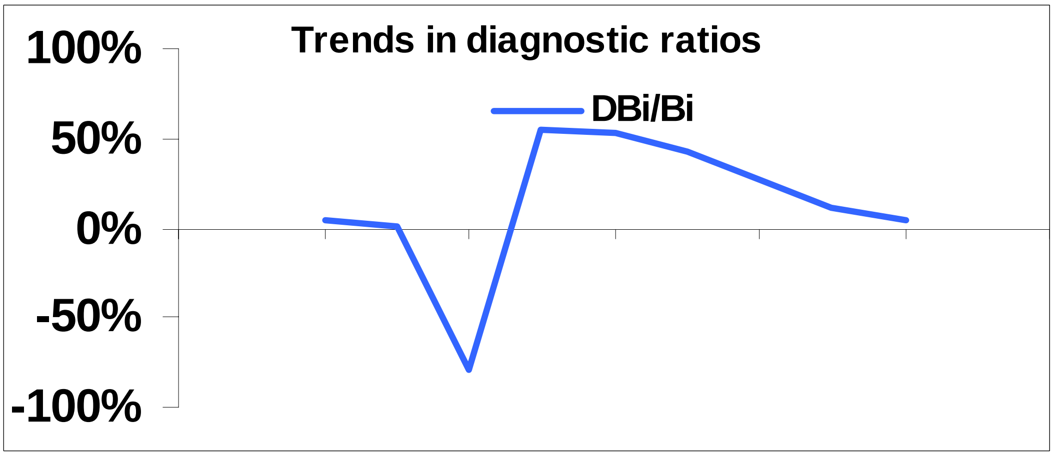
c) Ratio DB_i/B_i. This ratio indicates the change in estimated Biomass relative to current Biomass (in any given year). Positive values indicate a year of increase in Biomass, while negative values reflect years of declining biomass.



a)



b)



c)

Figure 15. Graphical presentation of the evolution of the main stock status diagnostics along the period included in the analysis. a) Ratio $B_i/B_{MSY;}$ b) Ratio F_i/F_{SYi}; c) Ratio DB_i/B_i.

APPENDIX/ANNEXE III

DESCRIPTION DE LA PÊCHERIE ARTISANALE DE SARDINELLES EN MAURITANIE

La pêcherie artisanale de sardinelles est pratiquée à Nouadhibou depuis 1988. Deux périodes d'activité différentes ont marqué cette pêcherie en zone Nord (Nouadhibou): 1) la période de 1988 à 2001 et 2) la période de 2002 à 2004.

a) Période 1988 à 2001

La pêche à la sardinelle dans cette période n'est pas une activité continue donc qui se fait au jour le jour. La fréquence des sorties des sennes tournantes est fonction des besoins de certaines sociétés en appâts utilisés pour la pêche à la ligne à main ou au palangre (en Wolof Arma ding). Deux sennes tournantes sont mobilisées à cette fin avec trois sorties moyennes par semaine soit 12 sorties par pirogue et par mois.

b) Période 2002 à 2004

Avec la création de sociétés de transformation, on assiste à Nouadhibou à l'émergence d'une pêcherie de sardinelle qui cesse d'être orientée aux simples besoins d'appât pour la pêche à la ligne ou à la palangre. La sardinelle est désormais transformée en farine ou traitée pour son exportation. La création de sociétés de transformation va engendrer la naissance et l'émergence dans le secteur artisanal mauritanien de bateaux senneurs.

Dans la suite de la description de la pêcherie, il sera abordé les unités de production, l'effort de pêche et l'estimation de la capture.

Les unités de production

La sardinelle est capturée à Nouadhibou par de grandes pirogues en bois et également par les bateaux artisanaux.

a) Pirogues en bois

Elles sont appelées également pirogues simples ou sénégalaises, leurs longueurs varient entre 18 et 24 mètres. Elles sont équipées généralement de moteur hors-bord de 40 CV avec un équipage total moyen de 19 marins répartis entre la pirogue dite porteuse de filet (14 marins) et celle dite porteuse de poissons (5 marins). La pirogue porteuse de filet peut être en bois ou en plastique. Sa puissance motrice est de 40 CV et sa taille varie entre 12 et 14 mètres.

b) Bateaux senneurs artisanaux

Les senneurs artisanaux, conçus pour ne pas utiliser le chalut sont des bateaux qui ont des caractéristiques physiques identiques à celles des glaciers industriels. Leur longueur varie entre 18 et 25 mètres. Leur coque est en bois ou en acier. Ils sont équipés de moteurs in-bord de puissance supérieure à 90 CV et inférieure à 200 CV. Au nombre de 14 (8 nationaux et 6 étrangers), les senneurs effectuent de sorties variant de 1 à 10 jours et ont un équipage de 9 à 15 marins.

Saisonnalité

La sardinelle est pêchée à Nouadhibou (période actuelle) pendant toute l'année avec des pics en juin, juillet et août quand les captures journalières varient entre 12 000 et 18 000 kg.

Les captures de sardinelles pendant les autres périodes de l'année restent relativement faibles et se situent entre 2 500 kg et 7 500 kg par jour.

L'espèce dominante dans les captures est la *Sardinella aurita*, suivie de la *Sardinella maderensis.*

Il est à noter que les senneurs pêchent également la courbine (mars, avril et mai) et le mulet (octobre, novembre et décembre).

Détermination des captures de sardinelles

Le traitement est basé essentiellement sur les données d'échantillonnage au débarquement (retour de pêche), de suivi de l'effort de pêche.

La méthode de traitement des données pour la détermination de la capture totale consiste en l'application du modèle simple suivant :

F2 = Moy[capt/j] x [[∑(Sortie/j)]/ [∑(Nbr. Jrs enq. effort)] x Vect]

Remarques:

- Les captures de plus d'une journée (pirogues effectuant des marées) ont été ramenées à l'unité d'observation qui est le jour.

- Le vecteur « V » a été fixé dans les régions autres que le PNBA à 26 jours en supposant que les vendredis sont des jours de repos pour la pêche. Dans le PNBA il est fixé à 30 jours en raison du suivi dont font l'objet les activités de pêche dans la zone.

Remplissage des mois sans observation

Il s'agit d'une reconstitution des captures pour les mois où il n'y a pas eu d'observations afin d'approcher la valeur réelle des captures réalisées dans un site donné ou, d'une manière générale, de la capture totale. La méthode consiste à chercher une valeur moyenne à partir des quantités ou valeurs les plus proches du mois où il n'y a pas eu d'observations.

The fifth meeting of the FAO Working Group on the Assessment of Small Pelagic Fish off Northwest Africa was held in Nouadhibou, Mauritania, from 26 April to 5 May 2005. The meeting continued to focus on data quality and on the analysis of trends in the basic data (landings, catch, effort, abundance, length and age distribution) and trends in the fishery independent survey data. The structure of the report is the same as that of the previous Working Group report (FAO, 2004), with the addition of two chapters, one on bonga (*Ethmalosa fimbriata*) and one on anchovy (*Engraulis encrasicolus*). The results of the assessments indicate that the sardine stock in Zone C is not fully exploited and the Working Group hence noted that the total catch level may be temporarily increased but should be adjusted to natural changes in the stock. A constant monitoring of the stock abundance and structure, by scientific surveys, independent from catch data, should be ensured, to detect unanticipated changes that may require urgent management measures. As regards the central stock of sardine (Zones A+ B), it is recommended not to increase catches above the average level of the last five years. The stock of round sardinella was found to be fully exploited and it was hence recommended not to increase catches of sardinella above the current level (2004). As a precautionary approach, the Working Group recommended not to increase catches above the average level of the last five years for the horse mackerels and not to increase catches above the 2004 level for chub mackerel. For bonga the Working Group recommended as a precautionary measure that the catch level should not exceed the average over the last five years and for anchovy the catch level should not exceed the average over the last three years.

La cinquième réunion du Groupe de travail de la FAO sur l'évaluation des petits pélagiques au large de l'Afrique nord-occidentale s'est tenue à Nouadhibou, Mauritanie, du 26 avril au 5 mai 2005. La réunion a encore insisté sur la qualité des données et l'analyse des tendances des données de base (débarquements, capture, effort, abondance, distribution de tailles et d'âges) et tendances des données de campagne. La structure du rapport est la même que celle du rapport précédent (FAO, 2004) avec l'addition des deux chapitre, un sur le bonga (*Ethmalosa fimbriata*) et un autre sur l'anchois (*Engraulis encrasicolus*). Les résultats des évaluations indiquent que le stock de sardine dans la Zone C n'est pas pleinement exploité et le Groupe a donc noté que l'effort de pêche actuel peut être provisoirement accru, mais qu'il devrait être ajusté aux changements naturels du stock. Une surveillance constante de l'abondance des stocks et de leur structure, par des campagnes scientifiques, indépendantes des données de captures, devrait être assurée, afin de détecter les changements non anticipés que pourraient exiger des mesures urgentes d'aménagement. En ce qui concerne le stock central de sardine (Zone A+B), il est recommandé de ne pas augmenter les captures au-dessus du niveau moyen des cinq dernières années. Le stock de sardinelle ronde a été pleinement exploité et il a donc été recommandé de ne pas intensifier les prises des sardinelles au-dessus du niveau actuel (2004). Par mesure de précaution, le Groupe de travail a recommandé de ne pas augmenter les prises au-dessus du niveau moyen de ces cinq dernières années pour les chinchards et de ne pas augmenter l'effort des prises au-dessus du niveau 2004 pour le maquereau. Pour le bonga, le Groupe de travail a recommandé, à titre de précaution, que le niveau de capture ne dépasse pas la moyenne des cinq dernières années et, pour l'anchois, que le niveau de capture ne dépasse pas la moyenne des trois dernières années.

ISBN 978-92-5-005608-1 ISSN 0429-9337

9 789250 056081

TR/M/A0828Bi/1/11.06/1300