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Report

Number: C058/07

5 years of F-project: a final report

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June 2007

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Nederlandse samenvatting

Het F-project was een samenwerkingsproject tussen de beheerder, de visserij en het onderzoek en vond plaats van 2002-2007. Het project had tot doel om de kwaliteit en transparantie van het visserijadvies voor het beheer van Noordzee tong en schol te verbeteren. Er waren drie onderdelen gedefinieerd: F1) verbeteren van bestandsschattingen; F2) verbeteren van gebruik van commerciële vangstgegevens; en F3) verbeteren communicatie. Dit document geeft een overzicht van alle producten die in het kader van het F-project zijn gemaakt.

F1 Verbeteren van bestandsschattingen

Drie verschillende aspecten van bestandsschattingen zijn onderzocht: gebruikte gegevens; modelonzekerheid en kwaliteitsborging. In tabel F1.2, onder paragraaf F1.1, staat een overzicht van alle producten die in dit onderdeel zijn ontwikkeld. Figuur F1.1 geeft een schematisch overzicht van de samenhang van alle producten. Per product wordt in paragraaf F1.2 een korte beschrijving van de inhoud gegeven.

Met betrekking tot gegevens is gekeken naar:
- vangst en inspanning
- marktbemonstering
- discards
- surveys;
- biologische parameters met betrekking tot groei en paairijpheid.

Modelonzekerheid is onderzocht op de volgende manier:
- lopende jaar aanname in de korte termijn prognose;
- historische systematische afwijkingen in de prognose;
- biologische referentiepunten;
- het effect van XSA bestandsschattingen op gesimuleerde schol(-achtige) populaties;
- evaluatie van bestandsschattingen, gegeven verschillende niveaus van exploitatie in het verspreidingsgebied van het bestand;
- Bayesiaanse verkenning van bestandsschattingen met:
    - biomassa dynamische modellen;
    - survey of CPUE modellen;
    - statistische vangst per leeftijd modellen.
- combineren van Bayesiaanse modellen.

In het kader van kwaliteitsborging is een kwaliteitshandboek in twee delen geschreven, over gegevensverzameling; methodes voor opschalen van gegevens; en methodes voor bestandsschatting. Het eerste deel gaat over de nationale situatie, het tweede deel over de internationale situatie.

F2 Verbeteren van gebruik van commerciële vangstgegevens

Het doel van F2 was om visserijgegevens effectiever te gebruiken. Gegevens over het vangstsucces kunnen worden gebruikt om een goede discussie te voeren over wat er gebeurt met de visstand (paragraaf F2.1). Dit soort gegevens zijn duidelijk en eenvoudig te begrijpen voor alle partijen. Daarnaast kan het vangstsucces gebruikt worden in bestandsschattingen, mits het vangstsucces een goede maat voor veranderingen in de bestandsomvang is (paragraaf F2.2).

Een belangrijke activiteit onder F2 was het verbeteren van het vangstsucces als maat voor de visstand (paragraaf F2.3). Het vangstsucces is berekend met behulp van EU-logboekgegevens, die een lage resolutie hebben. Met behulp van gegevens per trek van een referentievloot (de “F-vloot”) kon variatie in het vangstsucces met hoge resolutie worden onderzocht. Deze

referentievloot was een andere belangrijke activiteit binnen F2: gegevensverzameling door in totaal 32 boomkorschepen. Schippers waren betrokken bij het verzamelen van gegevens en bij discussies over de interpretatie van het vangstsucces. Tabel F2.1 en Figuur F2.1 geeft een beeld van de samenstelling van de F-vloot en van de hoeveelheid verzamelde gegevens.

Een overzicht van de opgeleverde producten in F2 wordt gegeven in tabel F2.3. Hierin staat welke rapporten, werkdocumenten, artikelen in Visserijnieuws en wetenschappelijke artikelen zijn verschenen. Onder deze tabel wordt van al deze zaken een korte inhoudelijke beschrijving gegeven.

F3 Verbeteren van communicatie

De communicatie is getracht te verbeteren door:
1. Duidelijke scheiding van rollen en verantwoordelijkheden van beheerder, vissers en onderzoekers;
2. Betere voorbereiding van de beheersdiscussie door middel van onderwijs, informatievoorziening en kadervorming;
3. Meer structurele en transparante discussie over bestandsschattingen en TAC-advies; gezamenlijke evaluatie van het visserijbeheer tot nu toe.

In bijlage 2 staat een Nederlandstalige lijst van producten die binnen F3 zijn gerealiseerd.

Summary

The F-project was a project of cooperation between managers, fishermen and researchers, carried out from 2002-2007. The objective of the F-project was to improve the quality and transparency of the fisheries advice for the management of North Sea sole and plaice. Three sub-projects were defined: F1) improving stock assessment; F2) improving use of commercial data; F3) improving communication. This document gives an overview of all the products that were developed in the framework of the project.

F1 Improving Stock Assessment

Different aspects of stock assessment were investigated: data used, model uncertainty and quality assurance.

Research was carried out on data related to:
- catch and effort;
- market sampling;
- discards;
- surveys;
- biological parameters in relation to growth and maturation.

Products on the subject 'Model uncertainty' were delivered on:
- current year assumption in short term forecast;
- historical bias in prognosis;
- biological reference points;
- the effect of XSA assessment on simulated plaice-like populations;
- evaluation of stock assessments, given different levels of exploitation across the distribution area of the stock;
- Bayesian exploration of stock assessment
    - o by biomass dynamic models
    - o by survey-only (or CPUE- only) models
    - o by statistical catch at age models;
- combining Bayesian models.

A quality manual in two parts was written on data collection; raising methods and stock assessment methods. The first part deals with national data, the second part deals with international data.

F2 Improving use of commercial data

The aim F2 was to use fisheries data in a more effective way. A CPUE time series can be used to have a good discussion on what is happening with the stock. It is a very straightforward source of information, easily understandable for all parties involved. Other than that, CPUE can be used in stock assessments. That is, if CPUE is a good indicator for developments in stock size.

One important activity under F2 was to improve CPUE as an indicator for stock size. CPUE was calculated from low resolution EU logbook data. Haul-by-haul data from a reference fleet (the "F-fleet") were used to look at variation in CPUE on a higher resolution. This reference fleet was another important activity under F2: data collection by in total 32 beam trawl vessels. Fishermen were involved in data collection and in discussions about interpretation of CPUE data.

F3 Improving communication

Improving communication was tried to be achieved via:

4. clear distinction between the roles and responsibilities of managers, fishermen and scientists;
5. better preparation on the management discussion via education, information supply, and capacity-building;
6. more structured and transparent discussion on stock assessments and TAC-advice;
7. joint evaluation of the fisheries management so far.

Introduction

The original aim of the F-project was to improve the quality and transparency of the fisheries advice for the management of North Sea plaice and sole. The F-project was started because there was increasing discontent by the fishing industry, the stock assessment scientist at RIVO (Wageningen IMARES) and the ministry of fisheries on the process and on the communication around the stock assessment and quota setting for North sea plaice and sole.

The discontent of the fishing industry was mainly due to the process of the annual quota setting. According to the industry the procedures used to set the quota are not transparent and they distrust the model and the data used. Also not enough knowledge from the fishery is incorporated in the stock assessment process.

The discontent of scientist from of RIVO was due to the limited time scientist had to inform the fishing industry on research results and on how quota are set, and communication with the industry in general. This had lead to unnecessary misunderstandings between the industry and the scientists about the process of stock assessments.

The discontent of the ministry of fisheries was with the large year to year variability in stock assessments. They also notice a lack of support from the fishing industry for the fisheries management by the ministry.

Between these three parties it was decided to start a project to target these problems. Because a major part of the discontent was aimed at the estimation of fishing mortality (F), the project was called F-project. The F-project was funded by the Dutch government in collaboration with the fishing industry and carried out by Wageningen IMARES (RIVO). The F-project started at the 1st of March 2002 and had at start a proposed duration of 4 years. At the end of 2004 it was decided by the F-project steering committee to expand the F-project with a fifth year. As a result the end date of the F-project was February 2007.

The F project contains three major parts

- F1) improvement of the stock assessment
- F2) improvement in the use of fisheries data
- F3) improvement in the communication

F1 – Improving stock assessment

This chapter gives an overview of the achievements in F1. This part of the project focused on improving stock assessments by investigating different aspects: data used, model uncertainty and quality assurance.

F1.1 Overview of deliverables

This paragraph deals with themes concerning the model used in stock assessments. At the start of the F-project in 2002 a total of 20 products were planned for F1. These products could be categorized into the three different themes:

- Data used in the stock assessment model Products A1-A6
- Model uncertainty Products A8-A17
- Quality assurance Products A18-A21

Of these products, 13 reports (Products A1-A6, A10-A13, A15-A17) and a quality manual (products A18-A21) were planned to be delivered during the course of the project. Two tools (computer packages) were also planned (Products A9 and A14), with a manual for one of these packages (Product A10). Based on the results from these products, three papers (Product A7) were planned for 2003, 2004 and 2005.

During the course of the F project, developments within the international scientific community on model uncertainty progressed. This affected the original contents (Table 2.1) of the products within the subject "model uncertainty". Also the availability of personnel working on the different products changed during the period of the F-project. This affected the products A8 and A9, which were given another subject. Also products A16 and A17 were combined into one report.

Table F1.1. Original deliverable list of products for F1 concerning model uncertainty

A8	Development tool for evaluation uncertainty
A9	Documentation on tool for evaluation uncertainty
A10	Report on uncertainty and bias in VPA models for plaice and sole
A11	Report on sensitivity analysis and scenario's for plaice and sole
A12	Report on indicators for uncertainty
A13	Report on current year assumption
A14	Tool for incorporating uncertainty of VPA in prognosis
A15	Report on bias in prognoses
A16	Report on current reference points for plaice and sole
A17	Report on alternative reference points

With the expansion of the F-project to 5 years, it was also decided to put effort into the development of new stock assessment model using Bayesian statistics, instead of putting effort in estimating uncertainty within the current model. First, the development of estimating uncertainty has progressed outside the F-project over the last years with the use of the FLR (Fish Lab in R) program. With FLR stock assessment models, such as XSA and ICA, were programmed in the statistical program R. This program has the capacity to run multiple assessments within a very short time frame, with all kinds of different model settings and input data. As a result the uncertainty in the model can be explored much more easily. Second, Bayesian statistics are used more and more in fisheries science. With Bayesian statistics, the estimates are given not as point estimates, but as probability distributions. This had effect on the contents of Products A10, A11, A12 and A14, which were altered with the inclusion of the 5 year. At the end of the F project, a total of 15 reports and the quality manual were delivered (Table 2.2, Figure 2.1) .

Several papers have been written, most of which were presented at the ICES annual science conferences during 2003-2005. Two papers have currently been sent to scientific journals, of which one has been accepted (van Keeken et al., 2007). During the course of the F-project it was decided to write results of the different products as papers instead of reports. This concerned the products belonging to the theme "model uncertainty". Following this, product A7 was removed from the deliverables list. However for most of these products it was decided that the results were not sufficient enough to be delivered as a paper. These products have therefore been delivered as a report. Two products belonging to "model uncertainty" were delivered as papers, of which the paper for product A8 was sent to the ICES Journal of Marine Science and the paper for product A15 was presented at the Annual Science Conference for 2005.

Table F1.2. Final deliverable list for F1

Data used in assessment model	
A1, A2, A4	Catch, effort and CPUE data
A1b	Precision in market sampling
A3	Discards data and reconstruction
A3.2	Discards reconstruction
A5	Surveys
A6	Biological analysis on growth and maturation
Model uncertainty	
A8	Effect of XSA assessment on simulated plaice-like populations
A9	Evaluation of stock assessments given different levels of exploitation across the distribution area of the stock
A10	Bayesian exploration of stock assessment by biomass dynamic models
A11	Bayesian exploration of stock assessment by survey-only (or CPUE- only) models
A12	Bayesian exploration of stock assessment by statistical catch at age models
A13	Current year assumption in short term forecast
A14	Combining Bayesian models
A15	Historical bias in prognosis
A16, A17	Biological reference points
Quality assurance	
A18	Workplan quality manual
A19, A21	Quality manual

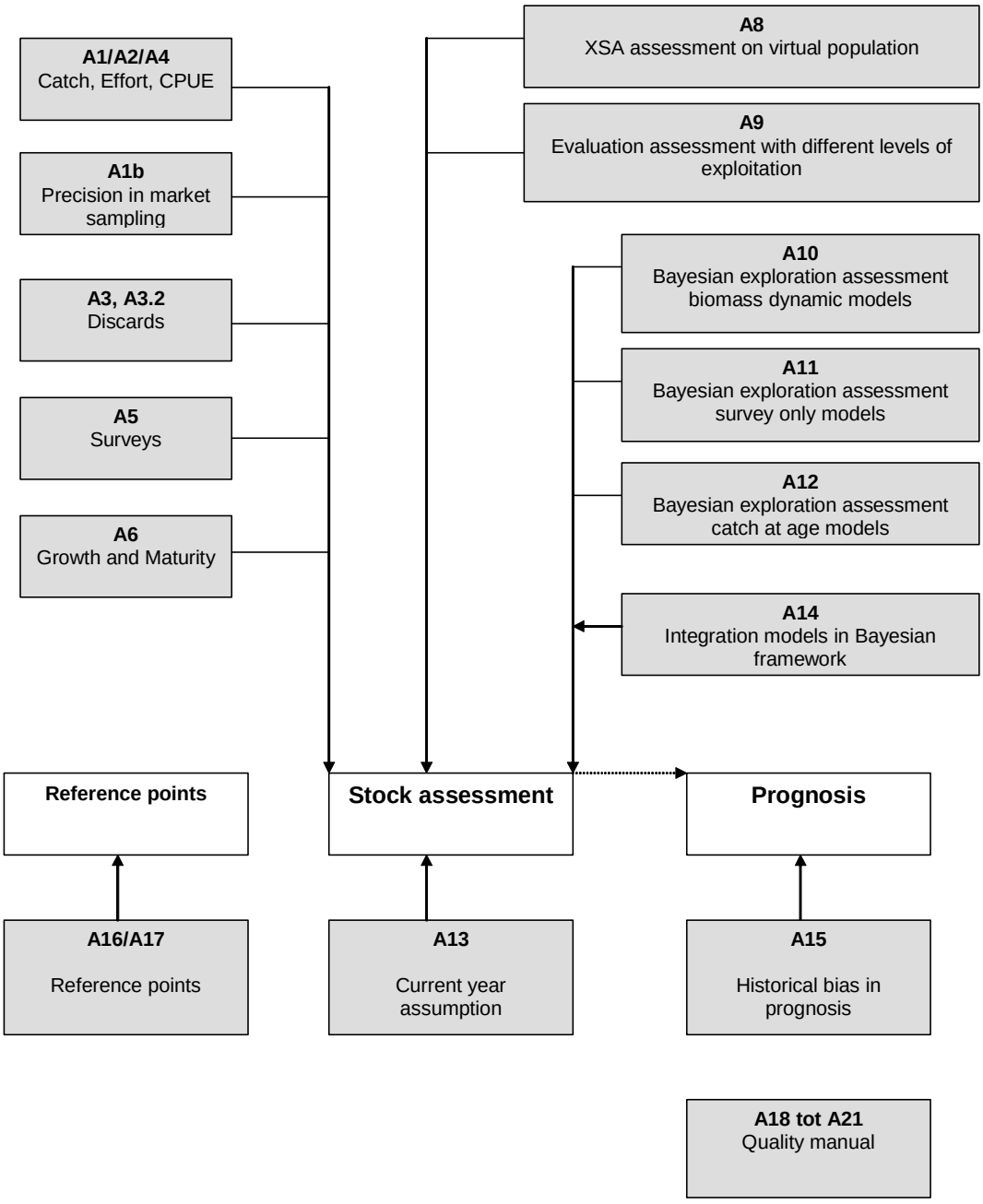

Figure F1.1. Schedule how the different deliverables relate.

F1.2 Description of results

This paragraph describes each product delivered for the F-project part F1. When a product was presented at the ICES Annual Science Conference, or was sent to a journal, this is mentioned. Apart from this, most products were presented at the ICES WGNSSK, which will not be mentioned below.

Data used in the stock assessment model

A1, A2, A4: Landings, effort and CPUE of the Dutch beam trawl fleet 1990-2004
Report: C008.05
Authors: M.A. Pastoors and S.M.B. Kraak
Finished: March 2004

The reports of products A1 (catch data), A2 (effort data) and A4 (CPUE data) were combined into one report, because the data on each of these topics were in more or less the same format and it was felt best to present the data this way. Product A1 gave an overview of catch data per fleet with the length and age structure of plaice and sole and information on the sampling intensity per fleet from 1990-current. Product A2 described fleet effort data since 1990. Seasonal patterns in effort and spatial distribution of the fishery were described. Product A4 described trends in CPUE data of plaice and sole for different fleet segments and different areas in the North Sea. The overall trend in the landings of plaice show a substantial decrease since the early 1990s, in line with the decrease in TAC's. The overall trend in fishing effort of the Dutch beam trawl fleet shows an increase in effort up to 1995 and a decrease thereafter. can also be used as independent sources of information on the development of the fishery.

- The maps of landings, effort and CPUE that were presented in this report, were used to discuss trends in the fishery both over time and space, in line with recommendations of the ICES Study Group on Fishery Information.

A1b: Precision of the catch-at-age estimates from the Dutch market sampling programme.
Report: C044.04
Authors: S.M.B. Kraak and M.A. Pastoors
Finished: June 2004

Product A1b was not included in the original work plan of F1, but was done as an extra analysis following product A1. It dealt with the precision of the numbers-at-age and the mean weights-at-age derived from the Dutch market samples. The method of resampling the market data used for this analysis came from the international EMAS project and was applied to the data on North Sea plaice and sole for 19990-2001. The analysis of the quality of the age sampling for plaice and sole shows that the coefficients of variation (CV) are relatively low at those ages at which high numbers are found. The same is true when comparing the sexes: the females are in general more numerous, and the females have in general lower CVs. From the point of view of stock assessments the variability in estimates for the ages 2-5 seems to be most important, because these ages contribute most to the catch on which the VPA is based. For female plaice the CVs of numbers-at-age at the ages 2-5 are always below 20%, but CVs for males are sometimes above 20%. For sole the CVs of numbers-at-age are often above 20% at the ages 2-5 for both sexes, but the more so in males. For weight-at-age the CVs are always much lower than for numbers-at-age, for plaice as well as sole. In general it was found that the uncertainty induced by the imprecision of the catch at age data was small and the conclusion was that the market sampling programs are adequate.

A3: Analysis of discarding in the Dutch beamtrawl fleet
Report: C034.04
Authors: O.A. van Keeken, F.J. Quirijns and M.A. Pastoors
Finished: April 2004

Product A3 dealt with topics on discarding. The report contained three main items. First, an overview of the historic and recent discard sampling programs was presented, including results from the sampling programs. Second, an analysis on changes in the spatial distribution of North Sea plaice towards more offshore areas was presented. This analysis was continued by a more in depth study (Van Hoppe, 2004). Results from this study were eventually presented in a paper (see below). Third a method with which discards could be reconstructed was presented. However with the method used in this report the estimates of the number of age 1 discards could not be made, and distribution data was not incorporated. However with an adjusted method using corrected fishery mortality it was possible to estimate also discards of age 1 plaice and also takes changes in the spatial distribution of plaice into account. This method was however finished after the completion of report A3, but was presented in report A3.2.

- At the ICES Annual Science Conference in 2003 an article was presented on the effects of discarding on the stock assessment of plaice (Van Keeken et al., 2003: ICES C.M. 2003 / X:17)

- Results from the study on changes in spatial distribution of North Sea plaice were presented at the ICES Annual Science Conference in Vigo in 2004 (van Keeken et al., 2004: ICES C.M. 2004/K:25). Finally these result were published in a paper to the Journal of sea research (Van Keeken et al., 2007).

A3.2: Discard reconstruction method used in the assessment of North Sea plaice in 2004
Report: C032.05
Authors: O.A. van Keeken, M.A. Pastoors and A.D. Rijnsdorp
Finished: June 2005

Product A3.2 described the discards reconstruction model used for the stock assessment of North Sea plaice by the ICES demersal working group in 2004 (ICES, 2004). The reconstruction uses growth and distribution data of plaice as well as selection data. The method is based on the method presented in product A3.1, which corrected landings at age for discards. The disadvantage of that model was that 1 year old fish could not be estimated. With the new method that correct fisheries mortality at age for discards, catch numbers at age can be estimated for all ages in the discard range, including age 1.

This method also dealt with changes in spatial distribution of plaice. However it did not deal with changes in spatial distribution of the fishing fleet. During the duration of the project is was planned to also include product A3.3, the discards reconstruction model extended with an extra analysis of the distribution of North Sea plaice against the distribution of the fishing fleet. However, the discards reconstruction model used for discards corrected values of F coming from a stock assessment using only landings data and no discards data. As a result the estimates of discards derived from these data could be biased. There are other models that might be used to estimate discards independent of landings data. These models will be explored in other projects and therefore it was decided to not carry out this extra analysis of distribution of fish against fishing fleet.

- The model described in report A3.2 is currently in use by WGNSSK for estimating discards of North Sea plaice before 1999 and estimating weights of discards.

A5: Surveys used in the stock assessment of North Sea plaice and sole
Report: C047.05
Authors: O.A. van Keeken, R.E. Grift and A.D. Rijnsdorp
Finished: August 2005

Product A5 dealt with three subjects. First a description of the survey and the raising procedures used to calculate the indices used in the stock assessment of North Sea plaice and sole was given. Second, estimations of the uncertainty in survey indices of North Sea plaice

and sole, conducted during the EU EVARES project (Cotter et al. 2003). For this project correlations within surveys, between surveys and between surveys and stock abundance were investigated, as well as the influence of changed survey setup on the stock indicators such as SSB. For a changed survey setup the effect of e.g. taking out a complete survey or using only half of the number of hauls was investigated. Third the effect of changed spatial distribution of North Sea plaice on the survey indices was investigated. The offshore change in spatial distribution of plaice coincides with the decrease of 1 year old plaice in the DFS survey, but was not detected in the BTS and SNS survey.

A6: Growth and maturity of North Sea plaice and sole

Report: C088.04
Authors: O.A. van Keeken, S.M.B. Kraak and A.D. Rijnsdorp
Finished: December 2004

Product A6 described the changes in growth and maturity. For the changes in growth of North Sea plaice and sole market and survey data were used. The market sampling and research vessel surveys and back-calculation showed the overall pattern with an increase in growth in length of the year classes born between 1960 and 1970, a stable growth for the year classes born between 1970 and 1977, a decrease for the year classes born between 1978 and the mid 1980s, and a rather stable growth for the year classes born in the 1990s for both plaice and sole. In plaice, the abrupt decrease around 1980 contrasts to the rather gradual decline in sole. The trend in length at age 0 is somewhat different suggesting an increase between 1980 and 2003. Particularly low growth indices were observed for plaice for the year classes 1963, 1972, 1985, 1986, 1987, 1996 and 1997, coinciding with above average year class strength. Changes in condition reflected changes in length-at-age in both plaice and sole, although the amplitude of the changes in condition was smaller than in length-at-age.

Analysis of the Dutch commercial catches of North Sea plaice and sole revealed that over the past 45 years these fish have become more likely to be mature at younger age and smaller length.

- Results on the analysis on changes in growth were presented at the ICES Annual Science Conference in Vigo, Spain, in September 2004. (Rijnsdorp et al., 2004: ICES C.M. 2004/K:13).

Model uncertainty

A8: Precisely wrong or vaguely right: simulations of the inclusion of noisy discard data and trends in fishing effort on the stock assessment of North Sea plaice

Paper: ICES Journal of Marine Science
Authors: M. Dickey Collas, M.A. Pastoors and O.A. van Keeken
Finished: December 2006

Product A8 investigated the bias and uncertainty in the XSA model caused by different trends in the fishery and discards on a population with the same characteristics as North Sea plaice. Catches are calculated from this population and with these catches the population is reconstructed using a stock assessment. This estimated population is compared with the known "true" population. This comparison shows that a stock assessment using only landings data results in an underestimation of the true population, which disappears when discards are included. A decreasing fishing effort over the final years results in a decreasing trend in spawning stock biomass over the final years, while an increasing fishing effort shows an increasing trend in spawning stock biomass.

- The paper was sent to the ICES Journal of Marine Science at the end of 2006.

A9: Does XSA works with different rates exploitation in different areas? (Dutch title: Werkt XSA bij exploitatieniveaus die verschillen in verschillende deelgebieden?)

Report: C046.05
Authors: S.B.M. Kraak and N. Daan
Finished: August 2005

Product A9 investigated if the XSA model, which is currently used by ICES, gives correct estimates of the stock status, when the stock is fished with different intensities in separate parts of its distribution area. For this analysis a model was constructed that simulates the population dynamics of a stock, using exploitation rates in two separate areas that can be varied independent of each other. A stock assessment was performed with the simulated catch data to investigate how well the XSA model can re-estimate the (know) patterns in stock status. XSA is able to estimate stock status well (regarding F, spawning stock biomass and recruitment), even if the stock is not fished with equal intensity over its distribution area, such is the case for North sea plaice. However a calibration series has to be used that covers the entire distribution area, and the assumption of a rather stable F over the last years ("shrinkage") cannot be used when F has not been stable.

A10: Stock assessment of North Sea plaice using surplus production models

Report: C032.07
Authors: M.A.M. Machiels, S.M.B. Kraak, L. Borges and H. Boogaards
Finished: February 2007

Product A10 investigated the stock assessment of North Sea plaice with surplus production models. These are simple non age structured model, with which the historical biomass of a population can be estimated based on historical total catches and total effort. The estimates are given not as point estimates, but as probability distributions, based on Bayesian statistics. Four types of surplus production models were explored to assess the state of the North Sea plaice stock: equilibrium condition, time variant multiple regression, time-series fitting with observation error and state space with observation and system errors. These simple models generate information needed to determine the status of the fish stock and the fisheries, like estimates of stock biomass and fishery mortality rate. Moreover, they provide also estimations of target reference points like MSY, Bmsy and Fmsy and if necessary the associated uncertainties around these point estimates. All the results consistently point at a situation of overexploitation, with Bmsy being higher then the current biomass and Fmsy lower then the current estimation range. The model analysis suggests, that despite of having a number of

years, when effort had supposedly declined the indicators show no signs of stock recovery yet. The plaice stock is most probably (consistent, but with large uncertainty) depleted down to 25% of the un-fished biomass.

A11: Bayesian analysis of research vessel surveys: trends in North Sea plaice abundance
Report: C033.07
Authors: H. Bogaards , L. Borges, M.A.M. Machiels and S.M.B. Kraak
Finished: February 2007

Product A11 investigates the stock assessment of North Sea plaice with a "CPUE only model". For this the algorithm of the SURBA model (Marine Lab Aberdeen) will be used. It is a simple age structured model, with which the relative historical population numbers and fisheries mortality can be estimated, based on among other things historical survey CPUE. SURBA is usually used in stock assessments to compare a model that does not use catch data to models such as XSA that do need catch data as input. For this analysis research vessel data were used from two beam trawl surveys (BTS-I and BTS-T, by the research vessels Isis and Tridens respectively) and from the sole net survey (SNS). The BTS-I supplies information on the southern North Sea, the BTS-T on the central North Sea and the SNS on the coastal zones.

The different surveys showed different signals in stock development, such is due to the different areas the surveys cover. Based on the different signals from the individual surveys it is difficult to give a clear conclusion on the stock development of North Sea plaice. Because of this, all three surveys are used in the stock assessment of North Sea plaice. Finally, estimates of the overall measurement error was in the order of 60% CV. Although this might indicate the poor performance of our model, it also might indicate the inherent sensitivity to noise in survey data.

A12: 2006 stock assessment of North Sea plaice using a Bayesian catch-at-age model
Report: C034.07
Authors: L. Borges, S.M.B. Kraak and M.A.M. Machiels
Finished: February 2007

Product A12 investigates the stock assessment of North Sea plaice with another method than XSA, namely a "statistical catch at age model". This is a simple statistical age structured model, with which the historical population numbers and fisheries mortality can be estimated, based on among other things historical catch at age data and one or more calibration series. The difference between this model and XSA is that this model estimates fishery mortality by age and by year (selectivity), while XSA estimates fishery mortality for each age and year individually.

The values estimated by the Bayesian catch-at-age model are similar to the 2006 WGNSSK estimates regarding fishing mortality and recruitment. The SSB is however overestimated and underestimated at the beginning and end of the time series respectively by the Bayesian model. This mismatch between the SSB estimates of the two models may reflect the different assumptions of selectivity at age. The Bayesian catch at age model is a separable model, i.e. fishing mortality is assumed to be a product of a constant selectivity at age by an annual variable fishing level. In practice the Bayesian catch at age model estimates an optimum single selectivity vector that adjusts to the whole time series. The mismatch between the SSB estimated might thus reflect a violation of the constant selectivity at age assumption, particularly in recent years. As a consequence, the model estimates fewer adult fish and higher recruitment in the present, and thus higher number of adults and higher SSB in the short term future. Nevertheless, the Bayesian catch at age model shows the uncertainty associated with the common parameters estimated currently deterministically by ICES.

A13: Analysis of the ICES short-term forecasts of North Sea plaice and sole: dealing with the "current year" assumption.
Report C033.03
Authors: S.M.B. Kraak, M.A. Pastoors and A.D. Rijnsdorp
Finished: July 2003

Product A13 investigated under which of the two assumptions for current year catch (status quo F or the catch taken is equal to the TAC set for the current year) the predictions would more closely approximate "reality" as estimated by the most recent assessment and which of the two assumptions produces more precautionary predictions for the stocks. We also investigate how much each of the input estimates – stock numbers-at-age, weights-at-age, and relative exploitation-at-age – contributes to the inaccuracy of the forecasts. For both plaice and sole, the status quo F assumption lead to less frequent and less severe prediction errors, especially overestimates, of SSB than the TAC assumption. Better estimates of number-at-age would improve the forecasts, but better estimates of recruitment, weights-at-age, and relative exploitation-at-age would not improve the quality of the forecasts.

A14: Integration of three structurally different stock assessment models in a Bayesian framework

Report: C043.07
Authors: S.M.B. Kraak, H. Bogaards, L. Borges, M.A.M. Machiels and O.A. van Keeken
Finished: February 2007

The aim of product A14 was to investigate the possibility to integrate the three models into one "supermodel" in a Bayesian framework. Starting this project, it was thought that in this "supermodel" each of the three models from A10-A12 could be integrated. The data used as input for the "supermodel" could be the commercial catch numbers at age and the abundance indices at age. However, whereas the catch at age model would use the complete data set, the surplus production model would leave out the age information and use the data aggregated over the ages. At the same time, the SURBA model would only use the indices at age and not the catches. The outcome of the "supermodel" may become biased because the models differ in the data they use.

It was concluded that at the moment it was not possible to integrate these particular three models into a "supermodel" in a Bayesian framework in a meaningful way. The models, their assumptions and their data needs are too dissimilar. It may be possible to integrate more similar models into one "supermodel", e.g. models that use the same data but yet differ in some structural assumptions on stock dynamics. The more promising road is to separately develop the SURBA and catch at age models further, and perhaps incorporate priors on structural assumptions within these models, such as the assumption of having only one separable period versus two (or more), which has been explored in the paper on the SURBA model. However it still is difficult to assess which of the models reflect reality best and should therefore have more weighting.

A15: Evaluating fisheries management advice for some North Sea stocks: is bias inversely related to stock size?

Paper: ICES C.M. 2005 / V:20
Authors: M.A. Pastoors
Finished: December 2006

Product A15 presented the comparison of the predicted landings from the scientific advice with the landings made by the fishery for four fish stocks (plaice, sole, cod and whiting). Also the predictions of fishing mortality and spawning stock biomass were compared with the values from the most recent stock assessment. For the two flatfish stocks, plaice and sole, it appears that there is a negative relationship between bias in the spawning stock biomass and the size of the whole population. This seems to show that small stocks are commonly overestimated and large stocks are underestimated. For the two roundfish species investigated this trend appears less clear.

- The paper was presented at the ICES Annual Science Conference in 2005 in Aberdeen (Pastoors, 2005: ICES C.M. 2005 / V:20).

A16 & A17: The determination of biomass reference points for North Sea plaice: The influence of assumptions about discards, weight, maturity and stock-recruitment relationships

Report: C056.05
Authors: S.M.B. Kraak, L.J. Bolle, and A.D. Rijnsdorp
Finished: October 2005

Product A16 en A17 dealt with reference points. Reference points (limit and precautionary approach points of spawning stock biomass and fisheries mortality) are set using the relation between recruitment (R) and spawning stock biomass (SSB). The perception of recruitment in the past are influenced by assumptions about the catch quantity, while the perception of spawning stock biomass are influenced by assumptions about fish weight and maturity. For this product eight stock assessments (changed assumptions about e.g. fish weight and maturity) and accompanying R-SSB relations were compared. The factors changed influenced B_{lim}. Often B_{lim} was near the lowest observed spawning stock biomass (B_{loss}), as was the case by the determination of reference points by ICES in 2004, which indicates that no lower recruitment was observed. But in some occasions, e.g. when maturity data were based on field measurements, B_{lim} was higher. This indicates that in past there were years when spawning stock biomass were accompanied by lower recruitment.

- Results were presented as a poster at ICES Annual Science Conference in 2005 in Aberdeen (Kraak et al., 2005: ICES CM 2005/V:18)

Quality assurance

A18: Work plan quality manual (Dutch title: Werkplan kwaliteitshandboek)

Leaflet
Authors: L.J. Bolle , O.A. van Keeken and M.A. Pastoors
Finished: February 2004

Product A18 comprised the workplan of the quality manual. It described the need for better documentation of both the national data collection process and the process of international data compilation. It also described as annex the proposed contents of a quality control handbook, which were presented in products A19-A21.

A19, A20, A21: Quality manual part I: National data collection and raising procedures,

Report: C041.05
Authors: O.A. van Keeken, L.J. Bolle, and S. Verver
Finished: August 2005

At the beginning of the F-project it was proposed to have two draft versions of the quality manual before finalizing it. The first version of the quality manual, A19, was presented as draft, but the second draft version, A20, was cancelled. It was decided that after the first draft the manual could be finalized. The final quality manual comprises of two reports, a national and an international report.

The first report of the quality manual dealt with the collection of the data by IMARES (RIVO) and the methods used to raise the national data in different sections: data on the fishing fleet, catch data broken down into landings at age and discards at age data, survey data and biological data broken down into age data and maturity data.

A19, A20, A21: Quality manual part II: International data collection and raising procedures

Report: C042.05
Authors: O.A. van Keeken, L.J. Bolle, and S. Verver
Finished: August 2005

The second report of the quality manual dealt with the international raising methods and stock assessment methods used by the working group WGNSSK in different sections: description of

the species and the fleets targeting them, international data used and the models used for stock assessment and forecasts.

- Both reports were used in the WGNSSK as input for the ICES quality manual on both North Sea plaice and sole

F2 – Improving use of commercial data

This chapter gives an overview of the achievements in F2. The aim of this part of the project was to use fisheries data in a more effective way. A fishing fleet is at sea most of the time, gathering data on catches per unit effort (CPUE), so it is obvious that these data can tell us a lot about the status of the stock. Improving use of commercial data can be achieved in two fields: 1.) in communication between different parties and 2) in stock assessment.

F2.1 CPUE in communication

A CPUE time series is one of the most effective means to have a good discussion on what is happening with the stock. It is a very straightforward source of information, easily understandable for all parties involved.

F2.2 CPUE in stock assessment:

In stock assessment of commercial fish stocks, the terminal fishing mortality rates are generally estimated by tuning the estimated stock numbers to independent estimates of the stock, using research vessel survey data and catch per unit of effort (CPUE) series of commercial fleets. Commercial CPUE series generally show a better performance for the older age groups, while the research vessel survey data show a better performance for the younger age groups. However, the potential of bias in commercial CPUE series has raised substantial concern (Gulland, 1964; Harley et al., 2001; ICES, 1988; ICES, 1995).

The ICES Assessment Working Group on Demersal Stocks in the North Sea and Skagerrak used both survey data and commercial CPUE data until the mid nineties. The commercial CPUE was calculated as the ratio of the total annual landings over the total number of fishing days of the fleet. At that time, however, it was realised that commercial plaice CPUE data of the Dutch beam trawl-fleet, which dominated the fishery, were likely to be biased due to quota restrictions (Pastoors et al., 1997). Vessels were reported to adjust their fishing patterns in accordance to the individual quota available for that year. Fishermen changed their targeting behaviour, because they lacked the fishing rights, by leaving productive fishing grounds and moving to areas with lower catch rates of the restricted species with a by-catch of non-quota, or less restricted species. These issues were mainly relevant for plaice, so it was decided not to include commercial plaice CPUE data in stock assessment anymore. CPUE for sole has never been removed from the assessments. One of the objectives of F2 was to re-introduce commercial CPUE in stock assessments as a tuning series. Since 2003, annually a working document with CPUE data was sent to the ICES WGNSSK, requesting these data to be used as a tuning series. (See also paragraph F2.4, under “Working documents for the ICES WGNSSK”.)

F2.3 Improving CPUE as an indicator for stock size

During the project the emphasis shifted from working with a reference fleet that would collect haul-by-haul data covering the entire North Sea fishing area, to more effective use of EU logbook data by combining it with haul-by-haul data from the reference fleet. The reason for this shift was that a complete coverage of the fishing area was not feasible within the project. Furthermore, EU logbooks contain a lot of valuable information that has not been used as effectively as possible. The data gathered by the reference fleet is very important to get insight in the processes that occur at sea, and especially within ICES rectangles. By combining data by haul from the reference fleet with data by trip and ICES rectangle, we obtain informative time series of catch per unit effort (CPUE) of the Dutch fleet.

The focus in F2 was on 2 issues:
1. Data collection by the reference fleet
2. Analyses to improve CPUE as an indicator stock size

Reference fleet

Throughout the project, the skippers of 32 vessels have made their data available for the project: 9 euro cutters and 23 large cutters. This resulted in a dataset with information of more than 76.5 thousand hauls.

Participation

The reference fleet was supposed to consist of 35 vessels: 25 large cutters and 10 euro cutters. The idea was include vessels from different regions, to obtain a representative sample of the beam trawl fleet, covering the total fishing area at the North Sea. Table F2.1 shows what the planned and realized composition of the reference fleet was. As it seems from this table, the coverage was quite close to what was planned. However, this is an overview of the total period within the project. If we would present the table by month or even year, the available amount of vessels was consistently lower than the planned amount of vessels. The participants are listed in appendix 1.

Table F2.1. Number of vessels in the reference fleet. 1) Planned: at the start of the project; 2) Available: participating vessels throughout the project.

Group & Harbour code	Euro Cutters (260-300 hp)		Large Cutters (>300 hp)	
	Planned	**Available**	Planned	**Available**
1. VLI, BR, ARM	1	**0**	2	**3**
2. KG, TH, YE	2	**1**	0	**0**
3. GO, SL, OD, BRU	3	**4**	5	**4**
4. IJM, SCH, KW	1	**0**	1	**0**
5. HD, TX, WR	1	**3**	5	**7**
6. UK, HA, EEM, LO, DZ, ZK, UQ	2	**1**	8	**5**
7. Flag vessels	0	**0**	5	**4**
Total	*10*	**9**	*26*	**23**

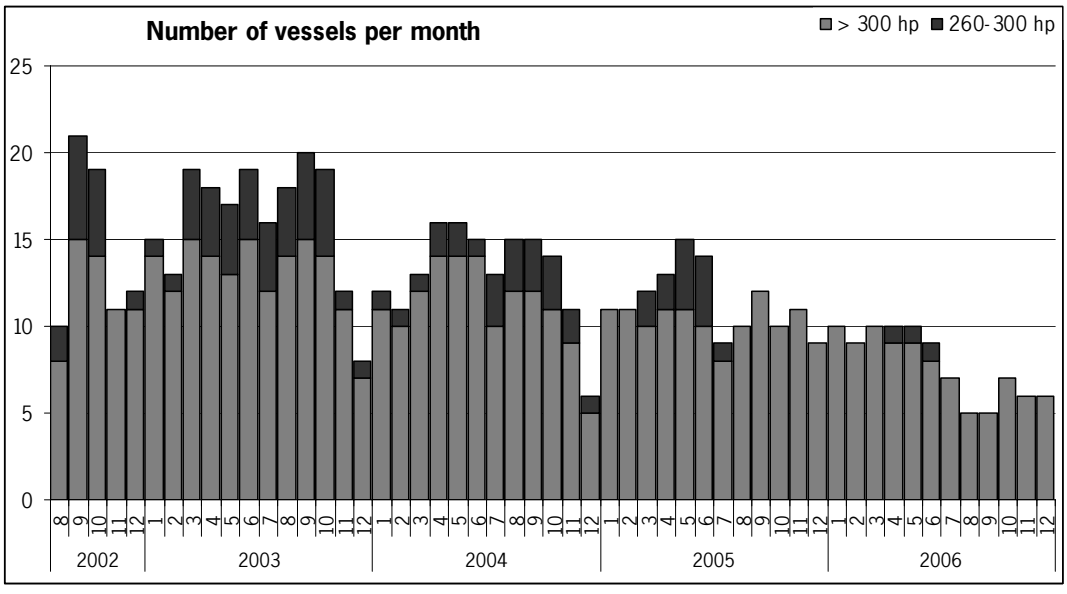

Figure F2.1 Number of vessels per month in the haul-by-haul dataset.

Over time, the number of vessels per month varied between 5 and 21 vessels (Figure F2.1). A decrease in the number of participating vessels towards the end of the project is observed. The

list of participants grew and shrunk throughout the project. New skippers joined the project, where some skippers stopped participating. There were various reasons why skippers cancelled their participation:
- decommissioning of vessels or problems within the company;
- cooperation in another project, which conflicted with participation in the F-project;
- lack of motivation;
- amount of work.

The latter two are reasons that need specific attention, while these can be influenced by the research set-up.

Lack of motivation: Fishermen need an incentive to participate in research projects. The most important incentive is the usefulness of the work in the eyes of the fisherman. If he sees the importance of a research project and if he has the impression that his work contributes to the project, he will keep on participating. Another incentive might be some kind of reward, e.g. extra days at sea; fishing on scientific quota; financial compensation.

Amount of work: The amount of work for participants has to be reduced as much as possible. Due to inefficient catch registration software, the amount of work was larger than it needed to be. In a follow-up of the project, special attention has to be given to use of solid, user friendly software.

Communication with participants

Contact with the participating fishermen was mostly maintained by means of meetings in the different harbours and by mailings. In case of problems with a specific vessel, fishermen were contacted by telephone.

At the start of the project plenary meetings were held in IJmuiden, but it appeared that fishermen preferred to have meetings closer to home and to have meetings in a for them more familiar place. Another advantage of meeting in harbours was that fishermen tend to speak more freely in a smaller group of people.

CPUE as measure for the fish stock

The amount of catch per unit effort depends on various factors. At the start of the F-project with the help of fishermen an inventory was made of factors, that according to them would influence CPUE. In the course of time, through discussions with fishermen and through analyses, a summarizing table of factors influencing CPUE was set-up (table F2.2).

Table F2.2 Factors influencing CPUE.

Category	Factor	Underlying process
Management	Spatial & Temporal reallocation of effort	On a macro scale: between ICES rectangles and weeks On a micro scale: within ICES rectangles and week
	High Grading	Due to limiting quota fishermen sometimes discard marketable fish
Technique	Technology Creep	Renewal of vessels/engines Improving gear Automation
	Rigging	Rigging depends on choice of fishing ground and thus on choice of target species
	Mesh size	Mesh size directly influence size of fish caught
Competition	Interference	Behaviour of fish with high fishing activities
	Other fisheries	Competition for fishing locations
A-biotic	Water characteristics	Flow, Turbidity, Temperature
	Sea bed	Sediment type, Depth
	Weather	Wind conditions
Various	Economy	Fish prices influence targeting behaviour
	Dredging	Dredging disturbs fish production. E.g. in the Westerschelde

The effects of most of these factors on CPUE were investigated. Results of these investigations can be found in various products of part F2 of this project. Paragraph F2.4 summarizes the products.

F2.4 Products in F2

Products created in F2 consist of deliverables B1-B8; working documents for the ICES WGNSSK; articles in the fishermen's weekly 'Visserijnieuws'; and scientific papers. A short list of products is presented in table F2.3.

Table F2.3. List of products in F2.

Deliverables	
B1	Dataset logbook data
B2	Analysis of logbook data
B2b	Description of CPUE as measure for stock size
B3	Catch and effort registration software
B4	Data collection in 2002
B5	Data collection in 2003
B6	Data collection in 2004
B7	Data collection in 2005
B8	Final F2 report
Working Documents for the ICES WGNSSK	
Quirijns & Rijnsdorp	2003: Detailed catch and effort data of Dutch beam trawl vessels
Quirijns, Pastoors & Van Densen	2004: Catch and Effort data of plaice (and sole) in the North Sea: bringing different data sources together
Quirijns	2005: CPUE of plaice and sole
Quirijns	2006: Catch and Effort data of plaice and sole in the North Sea: bringing different data sources together
Quirijns & Poos	2007: Catch and Effort data of sole and plaice in the North Sea
Articles in the Fishermen's weekly 'Visserijnieuws'	
Vissen met de handrem heeft consequenties voor het vispatroon	23-11-2002
Gebruik van de vangstgegevens van het F-project bij bestandsschattingen	18-04-2003
Van logboek tot scholverspreiding	16-07-2003
Vangstgegevens van Nederlandse boomkorschepen naar ICES werkgroep	03-10-2003
Succes bij omvlaggers ook bij ICES op tafel	17-10-2003
Vangstsucces als maat voor de visstand	05-05-2006
Trends in boomkorvisserij: vergelijking tussen UK en NL schepen	01-12-2006
Scientific papers	
Poos & Rijnsdorp	Small scale patchiness of plaice and sole
Marchal et al.	Fishers' foraging behaviour
Marchal et al.	Improving the definition of fishing effort
Poos et al.	Effects of quota regulation on fishing efficiency
Quirijns et al.	Standardization of commercial CPUE
Poos & Rijnsdorp	Interference competition
Rijnsdorp et al.	Dynamics of small scale patch use
Dekker et al.	High Grading

Deliverables

B1: Dataset logbook data

A dataset containing haul by haul data from beam trawl vessels was constructed using data collected in the Microdistribution project (1993-1999); new data collected in the F-project (2002-2007); and data from paper logbooks for the period in between these two projects.

The dataset contains catch and effort information of almost 224 thousand hauls and of 47 vessels. Sole and plaice catches are registered most accurately. Species like turbot, brill, dab, flounder, cod and whiting are registered during some but not all trips.

B2: Analysis of logbook data

Title: Vangstsucces als maat voor het visbestand: een voortgangsrapport
Author: F.J. Quirijns MSc, A.D. Rijnsdorp PhD, O.A. van Keeken MSc, J.J. Poos MSc
Report: C024-05
Finished: May 2005
Language: Dutch

This report describes progress in CPUE analyses carried out from the start of the F-project until the end of 2004. It pays attention to correction for targeting behaviour; to high grading; to rigging of the gear and to choice of fishing ground.

It is explained how we can calculate average CPUE without it being influenced by the spatial distribution of the fleet. Whether the fleet is concentrated in the north or the south, does not matter for CPUE. The next step was to show how CPUE can vary within ICES rectangles. This shows that it is necessary to investigate the effects of targeting behaviour within ICES rectangles as well.

High-grading is another important issue to be investigated. Registered CPUE might be lower than actual CPUE, because a fisherman might have discarded marketable fish. From qualitative information, we know that this happens now an then when quota are limiting or when the quality of the fish is not high enough. It was tried to quantify the amount of high-grading from data collected in the discards sampling program and from EU logbook data. When the report was written, the analyses were not finished yet. So no final results could be presented.

Rigging has an influence on CPUE as well. Using more and heavier chains increases catchability of sole. Using chain mats in stead of V-nets has a similar effect. However, it is important to realize that rigging is closely linked to the sediment type that is fished on. So if sole and plaice distributions are affected by sediment type, which is very likely, CPUE with a certain rigging is more influenced by species distribution than by the rigging itself.

B2b: Flyer on CPUE as an indicator for stock size

Title: Het vangstsucces als maat voor de visstand
Author: F.J. Quirijns MSc, A.D. Rijnsdorp PhD, W.L.T. van Densen PhD
Reference: Quirijns, F.J. Het vangstsucces als maat voor de visstand. Wageningen IMARES, IJmuiden, 4p., 2006.
Finished: July 2006
Language: Dutch

All parties involved in the F-project need to be aware of the methodology used in developing CPUE time series. Eventually everybody should support the methods used and the final CPUE series. A flyer describing how average CPUE is calculated while taking in account the spatial distribution of the fleet was made. This flyer was distributed throughout the industry as an appendix of the fishermen's weekly "Visserijnieuws".

B3: Catch and effort registration software

The implementation of catch and effort registration software consisted of multiple phases: We started in September 2002 with VRIS1.1, a simple software package developed at RIVO. Based on evaluation of this package in November 2002, a new version (VRIS 2.0) was implemented early 2003. Finally, software developed by one of the participating fishermen was installed onboard of all the participating vessels. This software package was similar to VRIS2.0, but contained extra functionalities which enabled automated registration of time, depth and GPS data. Parameters registered are summarized in table F2.4.

Table F2.4. Parameters registered by participants, separated in parameters on a trip basis and on a haul basis.

Trip basis	Haul basis
Week number	Haul number
Vessel code	Date
Type of fisheries	Time of shot
Number of tickler chains	Haul duration
Mesh size	Position of shot and haul
Use of chain mat	Wind direction
Start & return date of trip	Wind speed
Start & return harbour of trip	Depth
Market categories (plaice and sole)	Catch by species
Remarks	

B4, B5, B6 and B7: Data collection in respectively 2002, 2003, 2004, 2005 and 2006

Title: F-Project: Fisheries Data Collection
Authors: F.J. Quirijns MSc, W.L.T. van Densen PhD, O.A. van Keeken MSc, A. Dijkman Dulkes
Reports: C035-03 (B4), C083-04 (B5), C064-05 (B6) and C038-06 (B7)
Language: English (B4 and B5) and Dutch (B6 and B7)

These reports describe data collection from year to year. Information is given on the number of participants; on spatial and temporal patterns in effort and CPUE; on communication with participants; and on reports written for the working group on stock assessment (ICES WGNSSK).

B8: Final report

The final report of F2 is incorporated within the present report. In this report, a summary of the results and references to the relevant products can be found.

Working documents for the ICES WGNSSK

Since 2003, annually a working document was sent to the ICES WGNSSK, including a request to use CPUE as a tuning series in stock assessment for sole and plaice (Quirijns, 2005; Quirijns, 2006; Quirijns et al., 2004; Quirijns and Poos, 2007; Quirijns and Rijnsdorp, 2003). Up to 2007, none of these requests were granted, for different reasons. The working group only compared the outcome of the stock assessments with the CPUE series.

Every year the reasons for not including CPUE as a tuning series were tried to be overcome. Corrections have been made in order to make the series suitable for use in the subsequent year.

In 2007 the remaining objection against using CPUE data as a tuning series, is the lack of age stratification of the time series. In order to include this age stratification, market categories by trip are required from the total fleet. A first step was made in combining CPUE data with age and length distributions from the market sampling. However, this work is ongoing, so it is expected that in 2007 the data can again only be used in comparison with the results from the model runs, but not as a tuning series.

Articles in "Visserijnieuws"

Several articles were written for the fishermen's weekly "Visserijnieuws" (see table F2.3). These articles aimed to inform the industry about issues like:
- the effects of targeting behaviour on CPUE;
- how CPUE data compared to the outcome of stock assessment;
- how CPUE of Dutch and UK flag vessels compare.

Scientific papers

In the period 2002-2007 several papers relevant for F2 were written. Most of these papers were partly financed through the F-project. This paragraph summarises these papers.

Small scale patchiness of plaice and sole

Poos, J.J., Rijnsdorp, A.D. 2007. The dynamics of small-scale patchiness of plaice and sole as reflected in the catch rates of the Dutch beam trawl fleet and its implications for the fleet dynamics. J. Sea Res. 57: 000-000 in press.

Catch rates of sole *Solea solea* and plaice *Pleuronectes platessa* in the Dutch beam trawl fleet operating in the North Sea show spatio-temporal variation. The variation in catch rates reflects differences in abundance of the species. Up to 45% of the variation in catch rates can be explained by the time of day of the catch, the engine power of the vessel and the migration cycles of the species. Also, spatial covariance was found in the residual variation for both species using variograms and covariance functions. The ranges of the spatial structure were in found to be between approximately 20 to 45 nautical miles, indicating patchy distribution of the species. No differences in the ranges of the spatial structures were found between different seasons. Cross-covariance analysis shows the patches lasted up to two weeks. The implication of the spatial pattern in flatfish for the dynamics of effort allocation is discussed.

Fishers' foraging behaviour

Marchal, P., Poos, J. J., Quirijns, F. J.. Linkage between fishers' foraging, market and fish stocks density: Examples from some North Sea fisheries. Fisheries Research 83 (2007) 33–43.

This study has investigated some properties of fishermen's foraging, using Levy flights theory. The case studies examined were a selection of North Sea Dutch and French vessels, for which catch and effort data were collected on a haul-by-haul basis. Foraging behavior could reasonably be represented by a Levy flight process, characterized by an exponentiation factor μ, for both fleets. The properties of fishers' foraging were further investigated for the Dutch fleet using time series analysis. Optimal foraging was found with μ= 1.5, suggesting a slow recovery dynamics of the stocks being harvested. Efficient foraging led to high value per unit effort, while the knowledge of fishing grounds with high stock density is shown to increase foraging efficiency in the short-term future. Only marginal correlations could be found between μ and the other explanatory variables considered (fish prices and fishing effort).

Improving the definition of fishing effort

Marchal, Andersen, Bromley, Iriondo, Mahévas, Quirijns, Rackham, Santurtún, Tien and Ulrich, 2006. Can. J. Fish. Aquat. Sci. 63: 510–533.

The scope of this paper is to quantify, for a wide selection of European fisheries, fishing tactics and strategies and to evaluate the benefits of adjusting the definition of fishing effort using these elements. Fishing tactics and strategies were identified by métiers choices and a series of indices. These indices have been derived to reflect shifts in tactics (within a fishing trip) and in strategies (within a year). The Shannon–Wiener spatial diversity indices of fishing tactics (FT_SW) and strategies (YE_SW) had the greatest impact on catch rates. In particular, FT_SW was always negatively correlated to catch rates. One may anticipate that during a fishing trip, vessels with high FT_SW have been searching fish aggregations for a long time, while vessels with low FT_SW have been more efficient in finding these aggregations. The linkage between YE_SW and catch rates was of a more complex nature. Adjusting fishing effort by means of (i) the métier effect and (ii) the indices of tactics and strategies generally led to a substantial gain in the precision of the relationship between fishing mortality and fishing effort.

Effects of quota regulation on fishing efficiency

Poos, J.J., Pastoors, M.A., Rijnsdorp, A.D.. The effects of quota regulation on fishing efficiency of individual vessels in a mixed fishery. in prep.

This paper examines the effect of individual transferable quotas (ITQs) on the catch efficiency of individual vessels fishing for two target species in a mixed-species fishery, using data of the Dutch beam trawl fleet fishing for sole and plaice. The hypothesis is tested that in a situation of high ITQs relative to the stock size, catch efficiency is determined by technical efficiency only (i.e. vessel characteristics) but if ITQs decrease the efficiency for a target species will decrease due to re-allocation of fishing effort onto other species. Non-linear regression models of ITQ and catch efficiency showed that quota management affected the efficiency of individual vessels for both target species. The relation differed among vessels reflecting differences inITQs for sole and plaice among vessels. The change in catch efficiency between the target species coincided with a shift in fishing areas. No support was obtained for a redirection of fishing effort to an alternative non-quota species (dab).

Standardization of commercial CPUE

Quirijns, F.J., Poos, J.J. and Rijnsdorp, A.D., submitted. Standardizing commercial CPUE data in monitoring stock dynamics: accounting for targeting behaviour in mixed fisheries.

Catch per Unit Effort (CPUE) is commonly used as an indicator for monitoring developments in stock size. To ensure proportionality between average CPUE and total stock size, one of the processes that should be accounted for are the degree of targeting behaviour of the fleet and the management induced responses in fishing behaviour. We studied the effect of restrictive individual quota and targeting behaviour on average CPUE in the Dutch beam trawl fleet. Using haul-by-haul data from a reference fleet, the targeting behaviour of fishing effort was quantified for sole and plaice, on different space and time scales. The fleet positively targets sole on all scales examined, whereas plaice is only targeted positively on a micro-scale. When fishing opportunities for sole are relatively high, the fleet increasingly targets sole in stead of plaice. Target indices for sole and plaice showed a negative correlation. Our findings indicate that catch and effort data by fishing trip can be used to characterise targeting behaviour on a macro-scale, whereas haul-by-haul data can be used to characterise targeting behaviour on a micro-scale. Our index obtained through the method described, can be used to standardize CPUE data for the purpose of biomass monitoring, accounting for bias due to directed fishing.

Interference competition

Poos, J. J. and Rijnsdorp, A. D. 2007. An "experiment" on effort allocation of fishing vessels: the role of interference competition and area specialization. Can. J. Fish. Aquat. Sci. 64 (2): 304-313.

A temporarily closed area established to protect spawning Atlantic cod (Gadus morhua) in the North Sea allowed us to study the response of the Dutch beam trawl fleet exploiting common sole (Solea solea) and plaice (Pleuronectes platessa). A number of vessels left the North Sea 1 month earlier than the normal seasonal pattern. The vessels that continued fishing in the North Sea were concentrated in the remaining open areas. In the first week after the closure, the catch rate decreased by 14%, coinciding with an increase in crowding of 28%. Area specialisation affected the response of individual vessels because vessels without prior experience in the open areas showed a larger decline in catch rate compared with vessels that previously fished in these open areas and were more likely to stop fishing during the closed period. The decrease in catch rate in response to the increase in competitor density allowed us to estimate the strength of the interference competition.

Dynamics of small scale patch use

Rijnsdorp, A. D., Poos J. J., Quirijns, F. J., Hille Ris Lambers, R.. Dynamics of small scale patch use in fishers targeting several fish species. in prep.

In this paper, the dynamics of the Dutch flatfish fishery targeting sole and plaice is studied. It is shown that flatfish occur in patches on a scale of ~100 km2 that persist for 1-3 weeks. Fishers find these local patches by sampling the environment. Tows can be classified as either searching, sampling or exploitation based on the inter-tow distance. The catch rate while exploitation is well above the catch rate while searching. Sampling catch rate is slightly above

the searching rate. Once a patch is found, fishers stay put and until the catch rate drops below a threshold level. Residence time on a ground matched the theoretical expectation based on the decline in catch rate and the searching time. Fishers respond to quota restriction by re-allocating their effort to grounds with a high catch rate of other, less constraint species.

High Grading

Dekker, W. et al.. Currently not suitable for scientific publication yet: needs more analyses before it can be published.

High grading is the process, in which fishermen retain the more valuable parts of their catch, while discarding the rest - or retain the species for which they still have quotum left, while others have become restricted. High-grading disrupts the scientifc assessment of the stocks more than 'normal' discarding procedures: not only is part of the catch unregistered, but sampling the remaining catch becomes biased too. When and where high-grading occurs is not well known. Confidential information indicates that it is practiced at the end of each year, when quota are nearly filled in. However, high-grading also occurs earlier in the year, to dispose off low quality catches (e.g. plaice, just after the spawning season), and to anticipate quota fulfillments later on. Since high-grading is a rather incidental and rare process, it is hard to quantify. Our observers on board commercial vessels, quantifying the common discarding process, have hardly met any high-grading. Consequently, high-grading can only be quantified from large data sets, in which rare cases must be identified.

Landings of flatfish (plaice and sole) are recorded in VIRIS. This data base contains records per ship per year, detailed by week (and haul, although this level of detail is presumably not fully trustworthy). The total data set contains over 100,000 records. However, catch volumes and species composition vary considerably between years, within seasons, and from area to area. Additionally, individual ships have often specialized with regard to species. Consequently, aberrant catch compositions due to high-grading must be carefully distinguished from rare events caused by the combination of extreme periods in extreme areas by highly specialized fishers. A complex statistical model has been developed, based on the assumption that catch composition varies regularly over the seasons and between areas. Preliminary results indicate that a small fraction of all records (150 records) can be clearly separated from the remainder, landing more sole (less plaice) than expected, comprising approx 0.05% of the sole landings.

This preliminary analysis focuses on the contrast between individual records and the common trends over all records. Clearly, improving the understanding of the common trends might yield a higher frequency of detected high-grading. The current analysis is based on smooth trends over time and space, which assumption can be relaxed in more complex analyses, but time did not yet allow for this. Additionally, common practices, such as high-grading at the end of the season, now go undetected, since no individual record will deviate from the rest. Further elaboration of the analysis, relaxing and testing the assumptions and applying more complex methodology, will likely generate interesting results.

F3 – Improving communication

Improving communication was carried out in several ways. This chapter describes all activities that have been undertaken. A (Dutch) list of products can be found in appendix 2. Below, references are made to this appendix (e.g. C0-1 is product 1 from subject C0).

C0 Communication

The F-project (2002-2007) focussed on the improvement of stock assessments, on the more effective use of catch data from the fishery and on the improvement of the communication between managers, fishermen and scientists (C0-1, C10-7). The improvement in communication was tried to achieve via: a. clear distinction between the roles and responsibilities of managers, fishermen and scientists; b. better preparation on the management discussion via education (C1, C2), information supply (C3, C8) and capacity-building (C3, C7); c. more structured and transparent discussion on stock assessments and TAC-advice (C4); and d. joint evaluation of the fisheries management so far (C5).

At the end of the project the communication is still constrained to some extent by: the highly-frequent annual cycle of assessments and decision-making, the yet incomplete fisheries statistics for the North Sea, a management evaluation still to decide on and a relatively small fishing fleet that is represented by two organisations (C0-2, C10-25).

Learning from the communication during the F-project, the steering group decided for a specific structure for the Management Platform in which management, industry, NGO's and scientists will meet from 2007 onwards (short- and long-term management plus research agenda) and for cooperative research using a checklist fort its quality control (C0-3, C10-2).

C1 Educational approach

After the screening of the curriculum on fisheries management in use at the Dutch fisheries training centres, an inventory was made of the difficulties the students have in understanding the mostly graphical information on fisheries management (C1-1). The teachers were advised on how to tackle these cognitive problems. The findings were communicated with the Board of the Fishing Industry responsible for the curriculum (C1-2) and with a group preparing a course and a book on sustainable fisheries on behalf of the training centres (C1-3). A recurrent problem for many is how to understand fishing mortality F as the key parameter in fisheries management (F-project, C1-4).

C2 Course manual

To understand how information is captured by the fisheries students, a series of lessons were given at various fisheries training centres. During these lessons the principles of fisheries management were explained for both students and fishermen (Urk, Stellendam, Den Helder). After a discussion with teachers, a course manual was written in which the students start from the fishing vessels in their own harbour. In 10 steps they learn about the basic principles relationships in fisheries management; relating total catch and catch rates with effort. In the manual they come across: fleet structure and development, net selectivity and discards, food web and patterns in catch rates through space and time (examples C2-1,2).

C3 Information supply and capacity building

During the project information and explanation were given on a series of issues, mostly on request of the fishing industry. During the courses for capacity-building in the fishing industry in 2005 and 2007 a more complete information package was provided.

During the F-project major issues were: the relevance and organisation of research surveys (C3-1,2,3), the indicative value of catch rates (C3-4,5,6, see also harbour visits under F2), reading of the ACFM-advice by industry (C3-7, 8,9), trade (C3-10,11) and enforcement agency (C3-12), the MSY and flatfish management as proposed by the EC (C3-13 t/m 17), and the sustainability of the fishing industry (Unilever) (C3-18,19).

During the courses for capacity-building in the industry, as with the fisheries training centres, ample time was given to the fishermen's own experiences. This was succeeded by chapters on biology, market, economy and management (C3-20 t/m 27).

To assist fishermen and others in developing a long-term view on developments in fleet size and structure and in catch and landings, two historical overviews were made; one of the demersal and one of the pelagic fishery, both based in the Netherlands (C3-28,29).

C4 Communication on assessment and advice

The communication on assessment and advice between fishing industry and research was at the least frustrated (C4-1). How the advice was developed from the assessment and under conditions set by the management was poorly understood. To improve on this a communication plan was drafted (C4-2). It requests the scientists to communicate on data input and on assessment results before and after the WGNSSK (see examples for autumn 2006 C4-3,4). Further, during the presentation of the ACFM-advice scientists give attention to transparency and to the relationship between TAC, spawning stock size and fishing mortality especially (C4-5). The presentation of the advice is directly followed by a discussion between management, industry and scientists on possible implications of the advice and on supplementary research.

C5 Management evaluation

The steering group for the F-project discussed at length about the necessity for an evaluation of the fisheries management so far. Such evaluation is: a. according to the EU principles on good governance; b. informative on uncertainties that can only be assessed afterwards, and c. is a true response to the major problem that the F-project had to answer (bias in F-estimates) (C5-1 t/m 6). During a workshop on the pros and cons of a management evaluation three policy scientists were invited to give their comments (C5-7 t/m 14). The next step towards a possible public evaluation of the fisheries management at the EU-level will soon be made.

C6 More accessible ACFM advice

The quality of the communication depends amongst others on the readability and the accessibility of the ACFM-advice, which has become a more and more public document over the years. An alternative format for the advice has been drafted that is supposed to be more accessible and more informative on the fishery (C6-2,4,5). The draft and the philosophy behind it was presented at a general meeting of ICES assessment groups (C6-1) and for the NSCFP and the SGFI(ICES) (C6-3,6). However, further efforts are better to be directed towards a Dutch version that is tailored to the management discussion in the Netherlands.

C7 Role play on differences in perception

The role play had already been written for an international course on 'Participatory fisheries management'. It informs the participants on the consequences of differences in data aggregation and availability for the communication between managers and fishermen (for version 2006 C7-1,2). It has not yet been possible within the F-project to allocate the 1.5 days necessary for this role play.

C8 Fisheries statistics

One of the administrative shortcomings that constrain the communication is the lack of internationally standardised fisheries statistics for the North Sea as a common ground for discussion. Such statistics should not only refer tot total catches but to effort and catch rates as well. The fishing industry might take a responsibility in communicating such information towards its constituency (C8-1,2,4). But most and for all it is matter of an international, standardised database that can only be maintained by the public administration. A workshop on that issue has been organised and the outcome is presented for the NSCFP and SGFI(ICES) (C8-3,5). Also within the research organisation (IMARES) the public availability of information on surveys and catch rates in the fishery has been discussed (C8-6). Meanwhile survey information has been made accessible at http://www.ices.dk/marineworld/ices-fishmap.asp.

C9 Role separation and responsibilities

One of the problems that deregulated the communication was the uncertainty about the distinct roles and responsibilities of management, science and industry in the management process. This has been discussed in the steering group and the distinct responsibilities have been placed on record (C9-1,2).

C10 Publications

The ways in which the communication from managers to fishers on the science-based management could be improved have been discussed in C10-1. The communicative aspects of cooperative research are summarised in C10-2, including a checklist that should guarantee the quality of such research. The F-project has been used for co-financing the PKFM-project on policy and knowledge in fisheries management (C10-3). This research project gained from the F-project in valuing the communication on fisheries management via the public debate (C10-4).

A series of contributions for the Fishermen's Weekly has been written of advice was given on improving the understanding of the management information. Especially the display of the management options once ACFM has given its advice is of importance here, including explanations for fishing mortality, biological limits and precautionary levels (C10-20 as an example).

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Appendix 1 Participating vessels in F2

In the table below all vessels from which data were made available for the F-project – throughout the entire project – are listed.

ARM22	SL12
ARM44	SL27
BR14	TH5
FD281	TX29
GO20	TX32
GO29	TX36
GO44	TX38
GO5	TX43
GO58	UK153
GY57	UK158
HD29	UK237
HD3	UK243
HD7	UK284
LT62	UK45
OD50	WN1
OD7	WR136
R260K	WR244

Appendix 2 Product list F3

C0 – Communicatie	
1	F-project, 2005. Improving cooperation and communication. Management of beamtrawl fishery. A summary. November 2005. File: Fproject 20051128.**ppt**
2	Densen, W.L.T. van, 2007. Over misverstanden, onzekerheden en houvast in de discussie over het visserijbeheer. F-dag 24 maart 2007. File: F dag 20070324 Verbeterde communicatie.**ppt**
3	F-project, 2007. Voorstel Platform Visserijbeheer 2007-2009. File: Voorstel Platform Visserijbeheer 2007-2009 20070109_1.**doc**
C1 – Onderwijsbenadering	
1	Densen, W. L. T. van, 2002. Versterking van het onderdeel 'Visserijbeheer' in de visserijopleidingen. Notitie voor de Onderwijscommissie van het Productschap Vis. Bijdrage in het kader van het F-project. RIVO, IJmuiden. 33p. File: notitieonderwijsF_versie 2007.**doc**
2	Densen, W.L.T. van, 2002. Aanpassing van het onderwerp 'Visserijbeheer' in de visserijopleidingen. Presentatie voor de Onderwijscommissie van het Productschap Vis. Productschap Vis. Rijswijk. 20 juni 2002 File: f3onderwijs020620.**ppt**
3	Densen, W.L.T. van, 2003. Mogelijke aanpassingen bij het onderwerp 'Visserijbeheer' in het deelcertificaat Visserijkunde. Presentatie voor het cursusoverleg overheid, sector en onderzoek van de Stichting ProSea, Texel 25 en 26 september 2003. File: texel pro sea onderwijs sep 2003.**ppt**
4	Densen, W.L.T. van, 2003. Vis als gras. Voor een snel begrip van de relatie tussen visstand, vangst en visserijsterfte. File: vis als gras.**ppt**
C2 - Lespakket Visserijbeheer	
1	Densen, W.L.T. van, 2004. Visserijbeheer in 10 stappen. Les voor de Visserijscholen. Opleiding SW-4, SW-5 en SW-6. Praktijkweken in 2004, ProsSea, Ecomare, Texel. Versie Urk. 6 april 2004. RIVO, IJmuiden. 27p. File: prosea les visserijbeheer urk.**doc**
2	Densen, W.L.T. van, 2004. Visserijbeheer in 10 stappen. Les voor de Visserijschool Urk. ProSea, Ecomare, Texel 6 april 2004. File: prosea les urk.**ppt**
C3 - Informatiepakket en kadervorming	
Surveys (Zie ook in Visserijnieuws: C8,16)	
1	Densen, W.L.T. van, 2003. Themadag surveys. Presentatie als inleiding op een themadag over wetenschappelijke surveys voor vissers. Visserijschool, Stellendam, 8 februari 2003. File: Themadag Surveys 2003 02 08.**ppt**
2	Densen, W.L.T. van, 2003. Verslag van de RIVO Themadag 'Surveys' op 8 februari 2003 in het STC Stellendam (F-project). RIVO, IJmuiden. 4p. File: Themadag Surevys 2003 02 08 verslag.**doc**
3	Visserijnieuws, 2003. Vissers denken mee met biologen en andersom. Visserijnieuws 14 februari 2003. p. 5. (verslag themadag surveys) File: VN20030214 themadag surveys.**pdf**
Vangstsucces (Zie ook in Visserijnieuws: C10-1,10,14,18,21,22,24)	
4	Densen, W.L.T. van, 2003. Waar zit de schol en hoe werkt dat door in het vangstsucces? Federatie, Urk, 24 juli 2003. File: Waar zit de schol en het vangstsucces.**doc**
5	Densen, W.L.T. van, 2003. Handrem, F-vloot en bedrijfssurvey. Verslag van gesprek over de bedrijfssurvey met de visserijorganisaties. Federatie, Urk, 15 juli 2004. File: over de bedrijfssurvey met de visserijorganisaties.**doc**
6	Densen, W.L.T. van, 2003. Vangstsucces voor tong en schol. Kompas voor visserijbeheer. Presentatie voor Vissersbond Groep 3, Stellendam, 19 december 2003. File: Vissersbond Groep 3 2003 12 19.**ppt**
ACFM advies	
7	Densen, W.L.T. van, 2004. Lezen van ACFM-advies. Toelichting op structuur en inhoud van ACFM-rapporten. Presentatie voor de F-stuurgroep. 20 augustus 2004.

	File: Voorlichting ACFM bij PV.**ppt**
8	Visserijnieuws, 2006. Blijf dicht bij elkaar! Dramatische vangstadviezen genoemd. Visserijnieuws 6 oktober 2006. Met boxen over rolscheiding WGNSSK en ACFM en over van risico- naar doelgericht beheer. File: VN20061006 Schipholaflast boxen.**pdf**
9	Densen, W.L.T. van, 2006. Relaties TAC, SSB en F. Schol en tong in 2005 en 2006. Relatiediagrammen tbv F-stuurgroep. 3 oktober 2006. File: ACFM 2005 en 2006 tong schol assessment.**ppt**
10	Densen, W.L.T. van, 2003. Visstand, visserijdruk en handel. Kabeljauw, schol en tong. Presentatie voor de Nederlandse Zeevisgroothandel Vereniging (NZV), IJmuiden, 5 november 2003. File: zeevishandel 2003 11 05.**ppt**
11	Densen, W.L.T. van, 2004. Is een meer stabiele aanvoer van schol mogelijk? Presentatie voor de Nederlandse Zeevisgroothandel Vereniging (NZV), IJmuiden, 29 september 2004. File: Presentatie nzv 2004.**ppt**
12	Densen, W.L.T. van, 2003. Visserij, beheer en communicatie. Lezing tijdens de VOV-dagen van de AID Vakgebied Visserij op 6 en 7 januari 2003, Apeldoorn. File: aid 2003 01 06.**ppt**
MSY en platvisplan	
13	Densen, W.L.T. van, 2006. Lange termijn beheer van schol- en tongvisserij volgens de EC. Presentatie over EC-voorstel met betrekking tot platvisplan voor de F-stuurgroep. Rijswijk, 8 mei 2006. File: F-stuurgroep LT beheer 20060508_basis.**ppt**
14	Densen, W.L.T. van, 2006. Lange termijn beheer F-stuurgroep 2006-05-08. Notitie naar aanleiding van de bijeenkomst bij PV, Rijswijk. 8 mei 2006. 3p. File: Bij F stuurgroep over EC-plan_20060508.**doc**
15	Densen, W.L.T. van, 2006. Mogelijke communicatieproblemen rond het neerkomen van dit plan bij sector en overheid. Notitie na overleg over MSY bij LNV-DV. 5 juli 2006. 1p. File: MSY EC 20060705 communicatie.**doc**
16	Densen, W.L.T. van, 2004. Toelichting op EC-standpunt over MSY en platvisbeheer. Brainstorm-bijeenkomst van sector. Urk, 8 mei 2004. File: Scholherstelplan urk 2004 05 08d.**ppt**
17	Densen, W.L.T. van, 2005. De scholstand als kapitaal. Wat doen we met de rente? Lezing voor de SGP-afdeling Urk, 26 februari 2005. File: SGP Urk 2005 02 26.**ppt**
18	Densen, W.L.T. van, 2004. F-project and Unilever rating elements. Presentation for Unilever. 30 June 2004. File: 20040630.**ppt**
19	Densen, W.L.T. van, 2005. Plaice management. Quality in search for solutions. Presentation for Unilever, Schiphol, 23 February 2005. File: Unilever RIVO plaice 20050223.**ppt**
Kadervorming (Zie ook in Visserijnieuws: C10-23)	
20	Densen, W.L.T. van, Dessel, B. van & Bogaard, E., 2005. Welke toekomst voor de (Nederlandse) visserij? Wat is nodig voor de kadervorming in de visserij? Cursusmateriaal Kadercursus ProSea-IMARES. Ecomare, Texel, 17 en 18 november 2006. File: prosea visserij 2005 extract-1.**ppt**
21	Densen, W.L.T. van, 2006. Kadervorming bij visserijorganisaties. 16 februari 2006. Notitie. 2p. File: Kadervorming bij visserijorganisaties.**doc**
22	Densen, W.L.T. van, 2007. Vissers rond de tafel. Onderlinge kennismaking deelnemers Kadercursus 6-8 februari 2007 aan de hand van schepen. File: Schepen deelnemers kader 2007_2.**ppt**
23	Densen, W.L.T. van, 2007. Inleiding op onderdeel Visserij. Kadercursus 6-8 februari 2007. File: Inleiding kadercursus 7 februari 2007.**ppt**
24	Densen, W.L.T. van, 2007. Natuur en visserij van invloed op omvang van visbestand. Invuloefening ten behoeve van begripsvorming (IMARES, SUSUSE) / Kadercursus Visserij, 7 februari 2007 / Werkbespreking IMARES, 26 maart 2007 File: Invloed natuur en visserij SUSUSE exercise.**doc**
25	Densen, W.L.T. van, 2007. Wat denken en doen Den Haag en Brussel? Kadercursus 6-8 februari 2007. File: Wat denkt en doet LNV en EC.**ppt**
26	Taal, K., 2007. Inkomsten en uitgaven van de Nederlandse kottervisserij. LEI. Kadercursus Texel, 7 februari 2007.

	File: LEI economie kadercursus 200702.**ppt**
27	Bult, T., 2007. Vloot en aanvoer. Kadercursus, Texel, 6-8 februari 2007. File: Kadercursus NL vloot en aanvoer 3 feb.**ppt**
Korte geschiedenis Nederlandse visserij	
28	Densen, W.L.T. van, 2005. Korte geschiedenis van de Nederlandse visserij 1955-2005. Demersale visserij. Belangrijkste ontwikkelingen in vloot, aanvoer, prijzen en visstand. December 2005. File: Korte geschiedenis Nederlandse visserij 1955-2005.**ppt**
29	Densen, W.L.T. van, 2006. Korte geschiedenis van de Nederlandse visserij 1955-2005. Pelagische visserij. Belangrijkste ontwikkelingen in vloot, aanvoer, prijzen en visstand. Januari 2006. File: Korte geschiedenis Nederlandse visserij 1955-2005_pelagics.**ppt**
C4 - Communicatieplan bij onderzoek en advies	
1	Densen, W.L.T. van, 2004. Communicatie rond ACFM-advies bemoeilijkt door……Presentatie voor de F-stuurgroepvergadering van 24 juli 2004. File: Communicatie rond ACFM-advies.**ppt**
2	Densen, W.L.T. van, 2004. Communicatie rond de presentatie van het ACFM-advies – Communicatieplan ingebracht op de F-stuurgroepvergadering van 24 juli 2004. File: Communicatie rond de presentatie van het ACFM advies.**doc**
3	Kraak, S. & Machiels, M., 2006. Informeren van de F-stuurgroep over voorlopige berekeningen voor de WGNSSK 2006. 17 augustus 2006 (Met aanvullingen over schatting, projectie en voorspelling). File: F-stuurgroep 20060817 pre-WGNSSK aanvullingen.**ppt**
4	Kraak, S., Machiels, M. & Poos, J.J., 2006. Resultaten WGNSSK 2006. Presentatie voor de F-stuurgroep, Rijswijk, 28 september 2006. File: Presentatie WGNSSK 2006 (2).**ppt**
5	Beek, F., 2006. Biologische adviezen visserijbeheer. Oktober 2006. Presentatie van de uitkomsten van het ACFM van ICES. Den Haag, 16 oktober 2006. File: acfm 2006 pres imares pp blauw-frans.**ppt**
	Zie ook in Visserijnieuws: C10-9,11,12,13,20
C5 - Evaluatie visserijbeheer	
1	Densen, W.L.T. van, 2004. Noodzaak voor systematische evaluatieprocedures in het visserijbeheer. Aanleiding: een probleem en een kans. 16 februari 2004. File: Noodzaak systematische evaluatieprocedures3.**doc**
2	Densen, W.L.T. van, 2004. Evaluatie van het visserijbeheer voor schol, tong en kabeljauw over de periode 1990-2004. Presentatie voor Directie Visserij, LNV, 21 september 2004. File: LNV_Evaluatie van het visserijbeheer 2004 09 21 sel.**ppt**
3	Densen, W.L.T. van, 2004. Bestuurlijke evaluatie van het visserijbeheer. Waarom, wie en hoe? Notitie tbv de F-stuurgroepvergadering van 18 november 2004. De voorbeelden zijn gebaseerd op de ACFM-rapporten uit 1989-2003. File: Bestuurlijke evaluatie van het visserijbeheer 20041118.**doc**
4	Densen, W.L.T. van, 2005. Checklist beheerevaluatie. Notitie t.b.v. F-stuurgroepvergadering van 14 april 2005. File: Checklist beheerevaluatie.**doc**
5	Densen, W.L.T. van, 2005. Checklist beheerevaluatie. Presentatie voor F-stuurgroep. Versie 14 april 2005. File: evaluatiechecklist 20050414.**ppt**
6	Densen, W.L.T. van, 2005. Noordzee tong, schol en kabeljauw. TAC-beheer en effectiviteit. 13p. File: TAC-beheer en effectiviteit 20051205.**doc**
7	Densen, W.L.T. van, 2006. Visserijbeheer voor bestuurskundigen. Beheerevaluatie en de kwaliteit van het proces. Presentatie voor bestuurskundigen van TU Delft, Erasmus Universiteit en Universiteit Twente. LNV, Den Haag, 6 april 2006. File: Evaluatie visserijbeheer voor bestuurskundigen 20060406.**ppt**
8	Densen, W.L.T. van, 2006. Visserijbeheer voor bestuurskundigen. Beheersevaluatie en de kwaliteit van het proces. Korte inhoud. Den Haag, 6 april 2006. File: Visserijbeheer voor bestuurskundigen 20060406.**doc**
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Justification

This report

commissioned by: Ministry of Agriculture, nature and Food Quality
P.O Box 20401
2500 EK Den Hague

project number: 439.11012.04

has been produced with great care. The scientific quality has been peer-reviewed and assessed by or on behalf of the Scientific Board of Wageningen IMARES.

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Number of copies: 15
Number of tables: 4
Number of figures: 2
Number of annexes: 2