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Analysis of the contribution of the Netherlands commerial CPUE data to ICES stock assessments in the years 1995-2000

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Summary

The contribution of the Dutch commercial CPUE data to the stock assessments of North Sea plaice and sole in the years 1995-2000 has been analysed. The CPUE series are based on the total landings at age in the Dutch beam trawl fishery and the total effort (in HP days at sea) of this fishery. It is shown that the contribution of the sole CPUE data to the final XSA assessments is higher that the contribution of the plaice CPUE data.

It is discussed what the general role is of commercial CPUE data in the calibration process of a stock assessment model. The reason for the higher contribution of the sole CPUE data is explained. It is further discussed what the potential caveats are for the use of commercial CPUE data and how that applies to e.g. North Sea plaice.

Introduction

The EC Council Regulations establishing a Community framework for the collection and management of the data needed to support the common fisheries policy (EC 2000; EC 2001) prescribe that national analysis should be carried out on the contribution of national commercial catch per unit effort (CPUE) data to the stock evaluations of those fish stocks where these data are used.

In this report the results of the contributions of the Netherlands CPUE data for North Sea plaice and sole are analysed. Cpue of Dutch fisheries have not been used in assessments for other stocks.

Material and methods

Two calibration time series based on commercial CPUE have been provided to the ICES Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak (WGNSSK) in the years 1995-2000: one for North Sea plaice and one for North Sea sole. These two species constititute the main target species for the Dutch beam trawl fisheries.

The calibration series are constructed from two sources of data:

- total catch numbers at age by year and by species from landings by the Dutch beam trawl fleet. These estimates also constitute the contribution of the Dutch fleet to the total international catch at age data.
- total effort of the Dutch beam trawl fleet (in HP days at sea) estimated by LEI (Smit et al. 1996; Smit et al. 1997; Van Wijk et al. 1999; Van Wijk et al. 2000; Van Wijk et al. 2001)

The contribution of the Dutch commercial CPUE data to stocks assessments of North Sea plaice and sole was analysed with reference to the relevant working group reports (ICES 1995; ICES 1996; ICES 1997; ICES 1998; ICES 1999; ICES 2000). For both stocks the XSA assessment method (Shepherd 1999) has been applied in each of the years 1995-2000. In XSA, a relative weight is attributed to each of the calibration series that contribute to the overall survivor estimates by age. The relative weights can be interpreted as a measure of belief that the XSA model attributes to the calibration series based on the fit to the catch at age data and to the variance within the calibration series.

We have lifted the relative weighting in the calibration process from the ICES working group reports for the years 1995-2000. The relative weighting have been compared between years and between stocks.

Results

The relative weights of the calibration data in the final assessments 1995-2000 have been summarized in tables 1 (North Sea plaice) and 2 (North Sea sole). The relative weights for the Dutch commercial CPUE data have also been displayed graphically in figure 1.

For plaice, the Dutch commercial CPUE data has had a weight of between 30 and 45% on the most exploited ages (4-8). There appears to be a trend over the years that the contribution of the CPUE series to the estimation of the survivors at older ages (e.g. >10) has diminished over the most recent years. A second notable feature is that the weighting in the 1999 assessments appears to stand out from the other years. This is likely to be due to a change in the model settings (population shrinkage has been omitted in that year) which has shifted the balance between the different sources of information that contribute to the survivor estimates.

For sole, the Dutch commercial CPUE data has a very consistent pattern between years. As for plaice, the CPUE data receives most of the weight on the more exploited age groups (>3), but the overall weight in the calibration is higher than for plaice (i.e. between 40-60%). There is no signal of decreasing contribution of the CPUE data to the estimation of survivors at the older ages in more recent years.

Discussion

Commercial CPUE series have been used widely as an index of stock abundance(Gulland 1964; Harley et al. 2001). For North Sea flatfish (plaice and sole) the assessment model has been used with two commercial CPUE series[1] and two survey series in the period studied (1995-2000). For both stocks, one commercial CPUE series was derived from the Dutch beam trawl fleet and the other from an English commercial fleet (i.e. Seine and/or beam trawl).

The XSA model that has been applied to both plaice and sole has the general properties that it attributes weight to the different calibration series based on the fit to the commercial catch at age data and on the internal variance within the series. The Dutch beam trawl fleet has a relatively large share in the total landings of plaice (~40%) and sole (~80%). This implies that the weight of the commercial CPUE series that are based on the catch at age data can also be expected to be high, because the signal in the catch at age data is to a large extend mirrored in the CPUE data.

The potential influence of technological creeping on commercial CPUE data has been analysed in a EU funded project on the relationship between fishing effort and fishing mortality (Marchal et al. 2001). The study showed that technological improvements could distort the relationship between CPUE and stock abundance. The effort signal that is used in the construction of commercial CPUE data appears to be crucial in the understanding of the role of CPUE data as a calibration series.

For North Sea plaice, commercial CPUE data has no longer been used for calibration purposes since ACFM 2001(ICES 2002). The reason for this change in practice was the increased awareness that commercial CPUE data in TAC limited fisheries, may give a very distorted image of stock developments when the total effort estimate is not corrected for the targetting in the fishery. It is recognized that there is a need to compare commercial CPUE data with survey data independently of a stock assessment model, so that the agreement between different sources of information can be tested prior to modelling these data sources (e.g. Fox and Starr 1996)

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Tables

Table 1. Scaled weights by age of the different data sources in the assessments of plaice in the North Sea.

Stock	Plaice in IV
wgnssk / acfm	wgnssk

		Age													
Year	Data	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1995	Average of NL comm	0.043	0.229	0.287	0.312	0.348	0.377	0.349	0.4	0.411	0.456	0.476	0.445	0.418	0.285
	Average of UK comm	0	0.022	0.056	0.166	0.186	0.168	0.234	0.24	0.292	0.258	0.28	0.304	0.326	0.491
	Average of Surveys	0.756	0.658	0.58	0.445	0.367	0.334	0.329	0.269	0.213	0.192	0.137	0.112	0.099	0.077
	Average of shrinkage	0.201	0.091	0.077	0.077	0.099	0.121	0.087	0.09	0.083	0.094	0.107	0.139	0.157	0.147
	Average of DK trawlers														
1996	Average of NL comm	0	0.199	0.231	0.295	0.308	0.361	0.331	0.405	0.419	0.425	0.459	0.476	0.43	0.384
	Average of UK comm	0	0.004	0.017	0.144	0.215	0.197	0.247	0.264	0.31	0.34	0.324	0.305	0.3	0.351
	Average of Surveys	0.546	0.573	0.573	0.476	0.378	0.33	0.319	0.23	0.176	0.141	0.105	0.08	0.058	0.051
	Average of shrinkage	0.454	0.224	0.178	0.085	0.1	0.111	0.102	0.102	0.096	0.094	0.112	0.139	0.213	0.213
	Average of DK trawlers														
1997	Average of NL comm	0	0.185	0.231	0.319	0.323	0.338	0.355	0.385	0.401	0.407	0.379	0.323	0.275	0.245
	Average of UK comm	0	0	0.011	0.079	0.188	0.262	0.272	0.327	0.365	0.388	0.457	0.524	0.591	0.612
	Average of Surveys	0.594	0.62	0.595	0.512	0.403	0.306	0.27	0.199	0.161	0.139	0.093	0.079	0.06	0.049
	Average of shrinkage	0.406	0.194	0.163	0.091	0.086	0.094	0.104	0.089	0.072	0.066	0.071	0.074	0.073	0.094
	Average of DK trawlers														
1998	Average of NL comm	0	0.106	0.193	0.29	0.33	0.352	0.335	0.388	0.436	0.352	0.272	0.219	0.209	0.19
	Average of UK comm	0	0	0	0.076	0.211	0.282	0.291	0.317	0.336	0.46	0.565	0.651	0.637	0.625
	Average of Surveys	0.548	0.679	0.643	0.535	0.342	0.265	0.275	0.203	0.14	0.105	0.075	0.051	0.05	0.048
	Average of shrinkage	0.452	0.215	0.164	0.099	0.117	0.101	0.099	0.092	0.088	0.083	0.088	0.08	0.104	0.137
	Average of DK trawlers														
1999	Average of NL comm	0	0.53	0.462	0.427	0.428	0.434	0.451	0.48	0.521	0.397	0.29	0.218	0.207	0.201
	Average of UK comm	0	0	0	0.085	0.253	0.347	0.374	0.367	0.323	0.473	0.595	0.674	0.667	0.638
	Average of Surveys	0.601	0.259	0.42	0.371	0.19	0.094	0.057	0.034	0.03	0.026	0.012	0.008	0.003	0
	Average of shrinkage	0.399	0.211	0.118	0.115	0.129	0.124	0.12	0.119	0.126	0.104	0.102	0.1	0.123	0.162
	Average of DK trawlers														
2000	Average of NL comm	0	0	0.213	0.331	0.293	0.305	0.32	0.341	0.323	0.259	0.216	0.158	0.146	0.141
	Average of UK comm	0	0	0	0.092	0.19	0.255	0.319	0.36	0.387	0.477	0.564	0.666	0.663	0.661
	Average of Surveys	0.55	0.765	0.522	0.334	0.241	0.114	0.063	0.046	0.033	0.037	0.024	0.006	0.003	0
	Average of shrinkage	0.451	0.229	0.252	0.118	0.085	0.08	0.08	0.073	0.073	0.078	0.073	0.081	0.105	0.118
	Average of DK trawlers	0	0.006	0.012	0.125	0.192	0.246	0.219	0.18	0.184	0.149	0.123	0.088	0.084	0.08

Table 2. Scaled weights by age of the different data sources in the assessments of sole in the North Sea.

Stock	Sole in IV
wgnssk / acfm	wgnssk

		Age													
Year	Data	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1995	Average of NL comm	0.005	0.097	0.243	0.316	0.4	0.484	0.488	0.548	0.622	0.576	0.483	0.507	0.5	0.47
	Average of UK comm														
	Average of Surveys	0.693	0.726	0.65	0.527	0.484	0.371	0.396	0.245	0.197	0.171	0.104	0.086	0.042	0.012
	Average of shrinkage	0.302	0.177	0.107	0.157	0.116	0.145	0.117	0.207	0.181	0.252	0.413	0.407	0.457	0.518
	Average of DK trawlers														
1996	Average of NL comm	0.085	0.207	0.29	0.378	0.409	0.493	0.472	0.559	0.616	0.584	0.472	0.439	0.509	0.466
	Average of UK comm														
	Average of Surveys	0.642	0.604	0.592	0.502	0.386	0.371	0.378	0.309	0.157	0.164	0.118	0.078	0.05	0.022
	Average of shrinkage	0.273	0.19	0.117	0.12	0.205	0.134	0.15	0.132	0.227	0.252	0.41	0.483	0.441	0.512
	Average of DK trawlers														
1997	Average of NL comm	0	0.078	0.232	0.304	0.395	0.403	0.425	0.515	0.58	0.558	0.559	0.554	0.552	0.575
	Average of UK comm	0	0.024	0.141	0.137	0.139	0.207	0.178	0.125	0.104	0.071	0.078	0.05	0.03	0.029
	Average of Surveys	0.782	0.729	0.495	0.442	0.335	0.255	0.289	0.207	0.167	0.11	0.104	0.067	0.039	0.037
	Average of shrinkage	0.218	0.168	0.132	0.117	0.13	0.136	0.109	0.153	0.149	0.259	0.259	0.329	0.409	0.359
	Average of DK trawlers														
1998	Average of NL comm	0	0.078	0.246	0.331	0.398	0.476	0.47	0.555	0.531	0.469	0.33	0.411	0.422	0.466
	Average of UK comm	0	0.033	0.115	0.147	0.132	0.121	0.091	0.117	0.147	0.184	0.211	0.186	0.131	0.138
	Average of Surveys	0.751	0.715	0.52	0.383	0.338	0.248	0.269	0.189	0.1	0.094	0.041	0.041	0.02	0.023
	Average of shrinkage	0.249	0.175	0.119	0.139	0.131	0.155	0.17	0.138	0.223	0.254	0.419	0.362	0.427	0.373
	Average of DK trawlers														
1999	Average of NL comm	0	0.095	0.259	0.363	0.476	0.563	0.626	0.587	0.562	0.441	0.37	0.319	0.458	0.476
	Average of UK comm	0	0.031	0.081	0.142	0.146	0.128	0.118	0.106	0.149	0.189	0.244	0.189	0.153	0.087
	Average of Surveys	0.793	0.706	0.536	0.365	0.206	0.131	0.077	0.053	0.046	0.022	0.011	0.002	0.002	0
	Average of shrinkage	0.206	0.167	0.123	0.131	0.171	0.177	0.179	0.255	0.243	0.348	0.375	0.489	0.387	0.437
	Average of DK trawlers														
2000	Average of NL comm	0	0.101	0.257	0.356	0.476	0.575	0.625	0.621	0.548	0.439	0.328	0.314	0.419	0.562
	Average of UK comm	0	0.027	0.082	0.121	0.133	0.117	0.107	0.117	0.108	0.169	0.203	0.156	0.078	0.09
	Average of Surveys	0.796	0.725	0.546	0.378	0.236	0.117	0.067	0.049	0.036	0.03	0.006	0.003	0	0
	Average of shrinkage	0.205	0.148	0.115	0.145	0.155	0.192	0.201	0.213	0.307	0.362	0.463	0.527	0.503	0.348
	Average of DK trawlers														

Figure

Figure 1. Scaled weights by age of the Netherlands commercial CPUE in the assessments of plaice (left) and sole (right) in the North Sea.