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One hundred years of catch statistics for the Northeast Atlantic

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Abstract

ICES has published fishery statistics since 1904, beginning with data for 1903, and has, for many years, presented landings data in electronic form in the Eurostat/ICES database covering the period 1973 to the present. This electronic database has been extended to include all landings data available from volumes of ICES *Bulletin Statistique des Pêches Maritimes* covering the period 1903–1972. The data for 1950 and later are available for downloading from the Eurostat and ICES websites, while the data for 1903–1949 are available only on the ICES website. The data format for 1950–2008 is in the form of annual time-series by species and area, while the 1903–1949 data are presented as Excel books (one for each country), with one spreadsheet for each year. The data are available from the ICES website (http://www.ices.dk/fish/statlant.asp). The Excel files for 1903–1949 are available as zipped versions of the individual Microsoft Excel country files, while the data for 1950 to the present on the Eurostat website (http://epp.eurostat.ec.europa.eu/portal/page/portal/statistics/search_database) are presented in Eurostat's eDAMIS system.

The data sources are the national statistical offices, but in some countries, the collection and compilation of fishery statistics is handled by specialized organizations.

The geographical breakdown is according to the ICES system of subareas, divisions, and subdivisions (Figures 1a and 1b; from the *CWP Handbook on Fishery Statistical Standards* (FAO, 2003)). The area coding for older data has been converted into the coding used today because the original area breakdown was different. Where areas were changed after about 1960, the principle of only subdividing areas, but not creating cross-cutting new areas, was followed.

Data presented in the databases have not been corrected for non-reported landings, where these may have occurred. Therefore, in some cases, the data differ from those presented in ICES fish stock assessment working group reports.

Today, the data on the Eurostat website (Eurostat/ICES database) are constantly updated with corrections and amendments that the countries provide after the submission deadlines. However, this updating was previously done through footnotes and the occasional supplementary table in the printed version of the following years, or, in some cases, not at all. It has been a major effort to go through the archives in the ICES Secretariat and update the data with such amendments and corrections.

The data for the period 1950–2008 may be used as a coherent time-series of landings as reported to ICES by the national statistical offices, covering all species which have any major occurrence and covering the entire ICES area.

The transfer of data into electronic form and, at the same time, review of the data going back into the ICES Secretariat's archives was recognized by ICES and Eurostat as a project of mutual interest to be undertaken within the terms of the ICES/Eurostat Partnership Agreement.

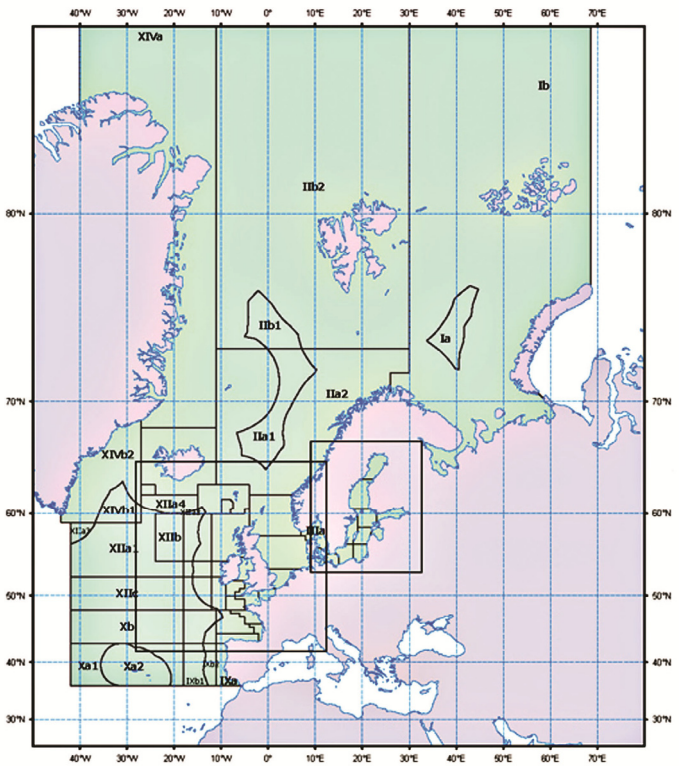


Figure 1a. ICES subareas and divisions. Source: ***CWP Handbook of Fishery Statistical Standards*** **(FAO, 2003).**

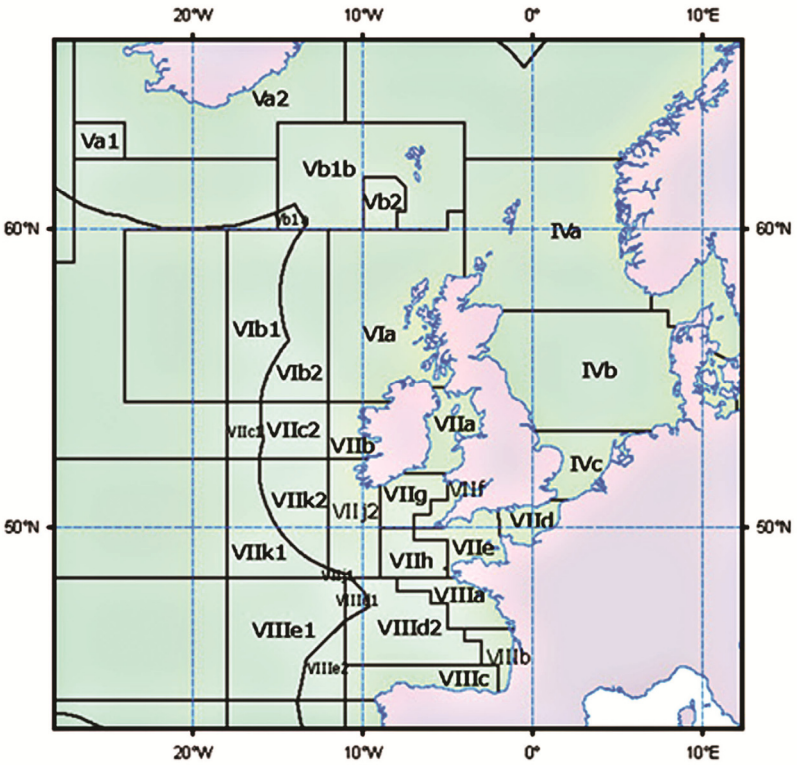


Figure 1b. ICES subdivisions around the British Isles. Source: ***CWP Handbook of Fishery Statistical Standards*** **(FAO, 2003).**

1 Introduction

One of the main purposes of collecting data from catches is to gather the information necessary to secure a viable management of the marine resources. The availability of fishery statistics of high quality is a prerequisite for this task. The data also form the basis for research in connection with regulations, strategic analysis, analysis of structure of fishing fleets, and the consequences of administrative actions on the industrial economy. Figures from the fishery statistics are a part of the national accounts, which are an essential information source for the analysis of the economic development and structure. Fishery statistics are also used by public authorities, the general public, research institutions, students, media, financial analysts, interest groups, and national and international organizations.

The International Council[1] decided at its third meeting (Hamburg, February 1904) that the Bureau should undertake the elaboration and publication of statistics dealing with fisheries, (especially those which were important from an international point of view). The Council decided to publish catch statistics in annual volumes of *Bulletin Statistique des Pêches Maritimes* (renamed *ICES Fisheries Statistics* in 1988; the series has been discontinued). The first volume of *Bulletin Statistique* presented data for 1903.

The main objective of the Council was to create a database that would allow the comparison of landings from different countries. The basis was the national statistical reports that were in existence at the time. However, these reports were not based on a common set of standards, and in order to address overfishing issues, it was recognized that the statistics needed to be comparable.

Catch statistics covering the period before 1903 do exist at an international scale. Kyle (1905) reviewed the national reports for the period 1892–1902 and attempted to present data for those years on a comparable basis. However, these data are not part of the database that is now available on the ICES website.

The Eurostat/ICES database (http://epp.eurostat.ec.europa.eu/portal/page/portal/eurostat/home) includes data broken down by species, year, and ICES subareas, divisions, and subdivisions. The breakdown that is currently in use is presented in Figures 1a and 1b (from the *CWP Handbook of Fishery Statistical Standards*; FAO, 2003); this system was described in ICES (1987) and was updated in 2004. However, the geographical breakdown has not been static throughout the century, and this project made a significant effort to assemble the data on a comparable geographical basis. Since 1974, the breakdown has been stable, with the introduction of subdivisions for the Baltic Sea in response to the needs of the International Baltic Sea Fisheries Commission (IBSFC; established in 1973, dissolved in 2007).

Until recently, the electronic database of catch statistics maintained by ICES and Eurostat contained data only from 1973 onwards. However, there is considerable interest from fishery managers, scientists, environmentalists, and others in extending the database to include earlier years. Such long-term dataseries are expected to give insight not only into trends in ecosystems that have been exploited by humans, but also into the variability of the status of such systems. An important impetus for the

[1] Prior to 1955, the International Council for the Exploration of the Sea was referred to as the International Council or the Council. Starting in 1955, the acronym ICES was used (Rozwadowski, 2002).

historical work was the History of Marine Animal Populations (HMAP) project (2000–2010), funded under the Census of Marine Life (CoML; ICES, 2008).

Since 1999, the data have been disseminated in electronic form on CDs and through ICES website. Data on the website have been updated constantly with corrections and amendments provided by countries after submission deadlines, an update that was done previously through footnotes and occasional supplementary tables in the printed version of the following year. A major feature of this project has been to go through the archives and update the data with such amendments and corrections. In this way, raw material appropriate to extending the catch database is made available.

The conversion of data into electronic form and, at the same time, review of the data going back into the ICES Secretariat's archives was recognized by both ICES and Eurostat as being a task of mutual interest, to be undertaken within the terms of the ICES/Eurostat Partnership Agreement.

The project comprised the following:

- processing data in the ICES hard-copy archives for 1903–1972;
- validation of data in the Eurostat/ICES database for 1973–2005.

In 2008, ICES convened a Working Group on Historical Data on Fisheries and Fish (ICES, 2008). The report of that group summarizes attempts to construct long-term time-series, including data on catch and effort. However, none of the time-series presented in that report has the same scope as those presented here.

2 Methodology of the review

The data source is the national statistical offices, although some countries have set up specialized organizations for the collection of their fishery statistics. Data are not corrected for non-reported landings where they may have occurred. Attempts have been made to correct these data for non-reported catches, and several ICES working group reports include such corrections. The Fisheries Centre at the University of British Columbia (UBC) has published attempts to correct the official reported landings to allow for non-reporting (see http://www.fisheries.ubc.ca/).

The landings are documented by the national statistical offices, and this information has been the basis for the fisheries statistical data considered in this report. The statistics emphasize species of major commercial importance, which, in 1903, covered ca. 30 species and species groups; therefore, these early data are not representative of the full range of species in the landings. However, over time, the number of species included in the reports has increased significantly. There were few reports of shellfish species in the early years, and these reports tended to concentrate on major species (e.g. lobsters, mussels, and oysters). In later years, the reporting of shellfish improved, but often the units used (e.g. numbers or volume) made it difficult to include the data in the worksheets.

The catches are recorded to the nearest 1000 tonnes. Catches of less than 500 tonnes are recorded as "P" (equivalent to "+"). Although not specified in *Bulletin Statistique*, it is assumed that the catches are recorded as the live-weight equivalent of the landed weight. Older issues of *Bulletin Statistique* occasionally reported in volume or in numbers; such data are not included in the database.

The tables in *Bulletin Statistique* include a large number of footnotes explaining the data, and these footnotes are essential to the proper interpretation of the data. Therefore, as appropriate and as far as possible, the notes attached to data in *Bulletin Statistique* have been included in the worksheets. Close attention to the footnotes is particularly important for the older data.

As will be apparent from the above comments, great care should be taken when comparing data for an individual country over time and, in particular, when comparing data between countries.

The geographical areas in the breakdown of the data changed through the years, as did the scope of the statistical reports. There were periods when reports included data for the Northwest Atlantic, and for the Eastern Central Atlantic area with data for the Northeast Atlantic. For the greater part of 1903–1949, the area of capture was in *Bulletin Statistique* recorded as, for example, "Northwest Scotland", that is, not using the division codes currently used by ICES (e.g. Division VIa). The worksheets compiled in this study use the current nomenclature for the ICES areas.

Reports concerning fisheries outside the present-day FAO Major Fishing Area 27 (Northeast Atlantic Ocean) have been removed and, in some cases, national reports were investigated to determine the best method of removal. This process has therefore relied partly on the authors' judgement and affects data prior to 1964.

There has been fishing in the Northeast Atlantic by, among others, Japan and China (Taiwan), mainly for tuna and tuna-like species. Reports of such landings are included in the database. There were no reports of such fishing prior to 1950.

2.1 Additional note on tuna catch statistics

Tuna scientists and fishery managers generally consider the catch statistics submitted to the International Commission for the Conservation of Atlantic Tunas (ICCAT), on the basis of scientists' best estimates, to be of higher quality than the data (based on the live-weight equivalent of the landings) submitted through the STATLANT forms and EU legislation. Consequently, there are often significant differences between the ICCAT and Eurostat/ICES databases.

With the exception of certain countries which have objected, FAO uses data supplied by the ICCAT Secretariat, using a procedure developed by ICCAT that reformats the data from the ICCAT divisions to the FAO major fishing areas. (The ICCAT database can be accessed from the ICCAT web page at http://www.iccat.int/en/accesingdb.htm).

The Eurostat Working Group "Fishery Statistics" concluded in May 2007 that the data submitted on the STATLANT forms and under the EU statistical legislation accurately report the catches of tuna species. Thus, in this study, the Eurostat/ICES data and the earlier data from *Bulletin Statistique* for tuna species are preferred over the ICCAT or FAO data.

2.2 Discrepancies between the FAO and Eurostat/ICES databases

The FAO database presents data for the period 1950–2008 and presents landings in live weight by major fishing areas and species. The Northeast Atlantic Ocean forms one such major fishing area (FAO Major Fishing Area 27). In principle, the FAO data should be identical to Eurostat/ICES data when summed over the geographical breakdown by species and year. This, however, is not true in all cases.

Some of the discrepancies in the 1950s and 1960s are the result of area redefinitions after the publication of the data. ICES has revised its data, correcting for such redefinitions. The area redefinitions concerned the Northwest Atlantic and certain areas in what is now FAO Major Fishing Area 34 (currently referring to the Fishery Committee for the Eastern Central Atlantic (CECAF)). For the earlier part of the series, data referring to these areas were included in the ICES data.

There are also discrepancies in the more recent data. Table 1 compares fisheries production data for 2000–2006, as compiled by the FAO and Eurostat/ICES databases, with the fisheries production for the Northeast Atlantic. Table 1 excludes the production of aquatic plants. For most countries, data from the two databases are very similar. Japan and Taiwan report to FAO, not to Eurostat/ICES, and one country (France) presents a disturbingly high discrepancy. Also, Greenland shows discrepancies since 2004.

Table 1. Total catches extracted from the FAO and the Eurostat/ICES databases for 2000–2006 (excluding the production of aquatic plants). Tonnes live-weight equivalent.

	2000		2001		2002		2003		2004		2005		2006	
	FAO	ICES	FAO	ICES	FAO	ICES	FAO	ICES	FAO	ICES	FAO	ICES	FAO	ICES
Belgium	29 289	29 296	29 698	29 705	28 517	28 519	26 320	26 341	26 239	26 246	24 071	24 092	22 523	22 521
Channel Islands	3 589	3 614	3 927	3 931	3 449	3 451	3 526	3 532	3 201	3 206	3 505	3 506	3 468	3 462
China	–	-	–	-	–	–	–	–	61	–	5587	–	137	–
Denmark	1 533 906	1 533 869	1 510 502	1 510 314	1 441 912	1 441 604	1 035 019	1 030 064	1 087 719	1 087 282	906 842	906 877	864 033	864 170
Estonia	96 266	96 468	88 357	88 678	81 072	81 982	59 490	60 622	68 159	68 882	80 255	81 066	73 672	74 068
Faroe Islands	445 856	445 856	503 187	503 188	517 729	517 738	606 605	606 614	592 443	592 447	559 267	559 270	619 393	619 398
Finland	121 649	121 640	115 274	115 265	106 738	110 028	86 391	86 392	99 162	99 160	95 476	95 472	112 942	112 933
France	423 035	491 473	428 550	494 784	423 305	497 396	416 264	486 665	396 152	466 578	386 948	408 811	403 883	423 057
Germany	177 901	177 906	184 432	184 438	193 625	193 625	234 706	234 705	235 566	235 567	262 676	262 692	259 447	259 447
Greenland	37 826	37 825	34 336	34 338	44 091	44 093	44 955	44 955	29 330	41 428	29 330	40 243	29 330	46 664
Iceland	1 973 008	1 990 441	1 978 335	1 995 846	2 127 459	2 137 583	1 979 088	1 994 958	1 725 892	1 741 762	1 657 624	1 653 998	1 322 820	1 340 290
Ireland	275 411	275 356	281 833	281 616	242 473	241 948	232 165	232 186	245 930	245 577	228 962	228 933	210 667	210 684
Isle of Man	3 552	3 552	3 112	3 112	3 127	3 128	2 984	2 983	2 627	2 627	2 764	2 764	1 209	–
Japan	2 315	–	1 955	–	2 344	–	2 768	–	3 199	–	3 384	–	3 413	–
Latvia	80 329	80 329	76 930	76 930	79 863	79 863	71 978	71 980	82 706	82 706	93 605	93 605	83 972	83 972
Libya	487	–	–	–	–	–	–	–	–	–	–	–	49	–
Lithuania	19 584	19 584	31 381	31 381	32 006	32 006	27 322	27 322	20 082	20 082	17 878	17 878	34 592	34 592
The Netherlands	336 329	336 329	339 041	339 041	300 315	300 317	349 023	349 017	390 823	390 823	429 242	429 242	357 335	357 335
Norway	2 693 350	2 693 365	2 671 999	2 672 013	2 725 409	2 725 420	2 523 733	2 523 733	2 510 744	2 510 852	2 389 720	2 389 257	2 242 883	2 243 822
Poland	143 173	143 177	159 163	159 161	151 561	151 563	146 111	146 113	156 489	156 491	129 352	129 353	118 790	118 790
Portugal	163 053	163 614	159 921	159 430	165 163	164 651	169 738	169 753	190 380	190 380	179 457	179 461	190 724	190 742
Russia	989 122	1 007 230	1 061 932	1 068 675	1 119 898	1 123 990	1 010 327	997 437	893 465	896 144	898 395	901 301	890 741	892 935
Spain	393 080	417 419	434 132	450 366	323 184	323 468	337 430	338 007	303 657	302 735	325 348	335 089	360 283	373 256
Sweden	337 075	337 081	310 583	310 594	293 528	293 529	285 384	285 393	268 557	268 557	254 942	254 943	267 607	267 608
Taiwan	1 131	–	564	–	624	–	208	–	218	–	491	–	–	–
United Kingdom	737 870	737 864	729 704	728 572	679 049	679 089	625 363	625 404	646 980	649 533	658 767	658 832	603 159	603 726
Uruquay	–	–	–	–	314	–	–	–	–	–	–	–	–	–
Total	11 018 186	11 143 288	11 138 848	11 241 378	11 086 755	11 174 991	10 276 898	10 344 176	9 979 781	10 079 065	9 623 888	9 656 685	9 077 072	9 143 472

3 National methodologies for collection, compilation, and dissemination

Methodologies for the collection, compilation, and dissemination of data are available in national publications, but there is no general review covering international statistics. In dealing with incomplete information, the approach has differed between periods, and the coverage has varied.

A major breakthrough towards full statistical coverage of fisheries in international statistics took place after 1945, with FAO taking the lead in this development. The development was institutionalized through the establishment of the Coordinating Working Party on Atlantic Fishery Statistics (CWP), which has served, since 1960, as the premier international and interorganizational forum for agreeing common definitions, classifications, and standards for the collection of fishery statistics. The CWP has developed common procedures for statistics collation, which have streamlined the collation process and reduced the burden on national fishery statistical offices. The CWP is responsible for the key source of standards for fishery statistics, the *CWP Handbook of Fishery Statistical Standards* (FAO, 2003), which covers the concepts, definitions, and related matters as applied to fishery statistics by the international agencies. The CWP established the STANA data-collection programme for Atlantic fishery statistics, which evolved into the present-day STATLANT programme. The STATLANT programme compiles fishery statistics at a global scale, following international standards. The data with which we are concerned are taken from this programme and cover the Northeast Atlantic FAO Major Fishing Area 27. The review work presented in this report followed these standards as closely as possible.

The ICES Statistics Committee (which no longer exists) agreed on a dedicated effort to document the statistical systems and compiled national reports on methodologies between 1972 and 1980. Griffith (1980) reviewed the programmes in the ICES countries.

Eurostat requests countries to provide methodological reports. These reports are available subject to prior agreement by the EU Member States through EuroStat. As Norway and Iceland, through the European Economic Area (EEA) arrangement, are obliged to provide Eurostat with data following standards consistent with those used by Eurostat, this organization sets a *de facto* standard guiding the collection of fishery statistics in the Northeast Atlantic. Only Greenland, the Faroe Islands, and the Russian Federation are outside this system, and their methodologies are documented in national reports.

4 Data submission by country, area, and periods

Since 1950, it has been assumed that all countries that were fishing in the Northeast Atlantic have reported to ICES or to FAO, and that these data covered the entire fishery in FAO Major Fishing Area 27 for species of major importance. The data were broken down by ICES subareas and, in some cases, further to ICES divisions.

In the first two to three decades of the dataseries, the reports concentrated on the northern ICES Member Countries. Data for France, Portugal, and Spain were not included until the 1920s. For the USSR, there are no data before 1950.

Because it was obvious that, for most countries, data reported by the national authorities varied in coverage and content over the period 1903–1949, and thus were not fully comparable over time, data were compiled not as time-series but as separate annual Excel worksheets.

During the period 1903–1949, data were reported by the following countries for the following years:

Belgium	1904–1912, 1920, 1922–1926, 1928–1939, 1941–1949
Denmark	1903–1949
England and Wales	1903–1949
Faroe Islands	1903–1938, 1940–1945
Finland	1903, 1905–1949
France	1921–1922, 1923 (data difficult to interpret), 1924–1949
Germany	1903–1944, 1946–1949
Greenland	1938–1949
Iceland	1903, 1905–1949
Ireland	1903–1949
Latvia	1924–1938
The Netherlands	1903–1949
Northern Ireland	1930–1949
Norway	1903–1949
Poland	1921–1939
Portugal	1927–1949
Russia	1903–1913
Scotland	1903–1949
Spain	1925, 1928, 1940–1949
Sweden	1903–1949
USSR	No data available

The main species that were reported throughout the period include herring, cod, haddock, and plaice, but from the beginning, 20–30 species or species groups were recognized in the statistics. There are very few data on shellfish. Where such data exist, they are frequently expressed in terms of volume or as numbers of individuals.

5 Data for 1950–1972

One of the authors, Eleanor Christiansen, has been involved since 1964 in processing the data submitted by the national authorities on STATLANT 27A forms, and she took the lead in processing these data. Eurostat assisted in the processing of the data, generally reviewing its quality and consistency, and in physically updating the database.

A major input to the work was an MS-ACCESS database developed by the University of British Columbia (UBC) from the annual hard-copy volumes of *Bulletin Statistique*. The UBC Fisheries Centre kindly made this database available to the ICES Secretariat. Within ICES, the database was converted to Excel worksheets, and these were reviewed, adding the 3-alpha species identifiers and generally checking the sheets against the data in the original national submissions and against any subsequent information relevant to these data (for example, subsequent correspondence from the national authorities, data included in national publications, and information included in reports of ICES stock assessment working groups).

It was noted that the UBC files had not paid sufficient attention to the footnotes accompanying the data in the volumes of *Bulletin Statistique*. Furthermore, reports to ICES by the national correspondents in the period 1950–1960 included areas which are not currently part of the ICES Area (FAO Major Fishing Area 27 – Northeast Atlantic). Some of the reports concerned divisions that spanned both the Northeast and Northwest Atlantic (Divisions 14 and 15) and the so-called "Southern waters", or "Moroccan waters", which are now classified in the Eastern Central Atlantic (FAO Major Fishing Area 34).

These annual worksheets were then converted into Excel worksheet format time-series for the period 1950–1972. In order to review the consistency of these data with those in the existing database, the time-series for 1950–1972 was combined with the time-series from 1973 onward in the current computer database. The resultant time-series for the period 1950–2005 was then subjected, both individually and collectively, to a thorough control designed to eliminate discrepancies and inconsistencies in the datasets.

Another source of data used in developing the database for 1950–1972 was the data for catches in the Northeast Atlantic collected by FAO from the national authorities on the FishStat NS1 form and disseminated by FAO using the FishStat Plus format. Although FAO only holds data at the level of the major fishing area (as opposed to data held by ICES and Eurostat at the level of statistical divisions and subdivisions of the major fishing area), it was found that the FAO data were useful in helping to resolve inconsistencies in the ICES data for 1950–1972, particularly regarding species identification. The FAO database has proven to be of great value in resolving some of the discrepancies in the ICES data and in identifying data that could be used in filling gaps in the latter.

On completion of this review, the results were reported to a joint ICES/Eurostat session of the Working Group "Fishery Statistics" in May 2007, and files with the data for 1950–1972 were sent to each of the national authorities with the request that they review the data and submit any revisions that they considered necessary. In fact, very few revisions were received, and the database was converted to FAO's FishStat Plus format, with the result being made available on ICES website. These data have also been added to the Eurostat catch database for the Northeast Atlantic.

6 Validation of the data in the Eurostat/ICES database for 1973–2005

Management of the catch statistics has varied over time. From 1973 onwards, the data were processed by the ICES Secretariat and maintained in a computer database of annual files. The data were published in annual volumes of ICES *Bulletin Statistique*.

When Eurostat became active in fishery statistics in 1976, it decided to accept national submissions on the STATLANT 27A forms as meeting the EU requirements for catch statistics for the Northeast Atlantic. At the same time, it developed a close relationship with the ICES Secretariat, involving the exchange of data between the two organizations. The major difference between data processing in ICES and in Eurostat was that, whereas the ICES data were in annual files, the Eurostat data were maintained as time-series.

With the introduction of FAO's FishStat Plus software in the 1980s for the dissemination of time-series data, Eurostat converted its data for the Northeast Atlantic to the FishStat Plus format and supplied copies of the results to ICES for dissemination through its website.

In 1991, partly to overcome difficulties in obtaining the STATLANT 27A data from the national authorities, Eurostat introduced EU legislation compelling the EU Member States to submit data identical to those covered by the STATLANT 27A forms, albeit in a flat-file format. Under the EEA agreement, the obligation to submit data to Eurostat was extended to the authorities of Iceland and Norway. With the accession of Estonia, Latvia, Lithuania, and Poland to the EU in 2002, the legislation on the submission of catch data was also applied to these countries.

However, it should be noted that, at that time, the ICES Secretariat and Eurostat were both processing the data separately. Because this was a duplication of effort by the limited staff resources of the two organizations (except where data from the USSR (later the Russian Federation), Greenland, and the Faroe Islands were concerned), it was decided to introduce an ICES/Eurostat Partnership Agreement. The main features of this agreement are:

- Eurostat processes all of the catch statistics submitted by the national authorities. Data from those countries not legally obliged to submit data to Eurostat (Russia, the Faroe Islands, and Greenland) would be sent to Eurostat by the ICES Secretariat).
- Eurostat maintains a single database of these catch statistics. Copies of this database (in FishStat Plus or other agreed format) are available to the ICES Secretariat by Eurostat.
- With its specific knowledge of the fisheries of the area, the ICES Secretariat will have the lead role in the validation of the data.
- Contacts with the national fishery statisticians would be enhanced by the organization of joint ICES/Eurostat sessions of the Eurostat Working Group "Fishery Statistics".

ICES and Eurostat will collaborate in joint ventures of mutual interest as a consequence of the more efficient use of staff resources resulting from the Partnership Agreement. (The present work is one example of such a project.)

The success of the ICES/Eurostat Partnership Agreement has been recognized by both organizations and by the national statistical services. However, one aspect that has not

received sufficient attention is the validation of the data, and the present work is an effort to correct this situation.

A number of anomalies and discrepancies have been noted in the database, and currently there are attempts to introduce automatic data-checks at the time of data submission. Lack of staff has meant that the data have not yet been subjected to a thorough validation. These anomalies and discrepancies can be attributed to a number of causes, including:

- inconsistent reporting of data by national authorities;
- the failure of corrections transmitted by national authorities to be recorded in the database.

When the data for 1973–2005 were extended with data covering the period 1950–1972 the emphasis was on obtaining consistency between the two datasets. In a subsequent phase of the overall project, anomalies and discrepancies within the dataset 1973–2005 were detected and corrections made where appropriate.

The validation process involved the comparison of data in the database with data originally reported by national authorities, taking into account any subsequent correspondence with national authorities as well as data appearing in national publications. The reports of ICES stock-assessment working groups were another source of information useful in resolving problems in certain cases.

FAO catch data for this period were also used. Although these data are only available at the level of the FAO major fishing area, they were frequently useful in resolving problems with data at the ICES division and subdivision levels. This was particularly the case where the identity of the reported species was uncertain.

The validation process was completed in early 2009 and reported to the joint ICES/Eurostat Working Group "Fishery Statistics" in May 2009. The national statistical offices were requested to review the results of this validation process and, by the end of 2009, to inform ICES of any revisions they wished to be included. Revisions to the data have been requested and accepted from Belgium, Finland, Germany, and the Netherlands. On completion of this review process, the Eurostat/ICES catch database was updated and the results were published by Eurostat in its database and on the ICES website, as a FishStat Plus format file (available at http://www.ices.dk/fish/statlant.asp).

7 Processing the data in the ICES hard-copy archives prior to 1950

As mentioned above, ICES has information in its archives dating from 1903. It is not surprising that the earliest records are not as complete as the latest, neither in terms of the countries for which data exist nor in the details included in each national submission. Nevertheless, considerable interest has been expressed in having these data in a more readily usable form; hence, the extension of the project to cover the data for the period prior to 1950.

Owing to the somewhat fragmentary nature of the data, which becomes more pronounced the farther back one goes, it was decided not to process the data as time-series (as with the post-1950 data), but to produce for each country an Excel file containing a worksheet for each year that data exist. Another reason for presenting the data in this form was that comments could be included, even for individual data items.

As with the work on extending the database to cover the period 1950–1972, a major input to the work on the data prior to 1950 was the Excel files produced by the University of British Columbia (UBC). These files had been developed from the hard-copy volumes of ICES *Bulletin Statistique* for the period.

As with the files for the post-1950 data, the UBC work did not take full account of the footnotes accompanying the data in *Bulletin Statistique*. These footnotes were added to the files, but the work was further complicated by the form in which data were presented in *Bulletin Statistique*. This had changed markedly over the years, necessitating a time-consuming study of the publications in order to extract the maximum information.

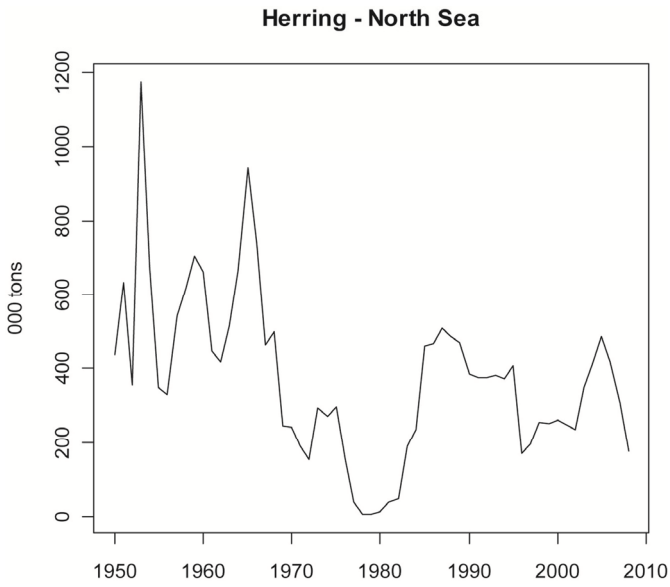
The data were converted using the current coding system of species (FAO's ASFIS (Aquatic Sciences and Fisheries Information System) List of Species for Fishery Statistics Purposes, available at http://www.fao.org/fishery/collection/asfis/en) and the area breakdown as presented in Figures 1a and 1b. In a few cases, this required the construction of additional area codes, which are documented in the notes in the files.

The Excel files for 1903–1949 are available through the ICES website (http://www.ices.dk/fish) as zipped versions of individual Excel country files.

8 Examples of time-series resulting from the study

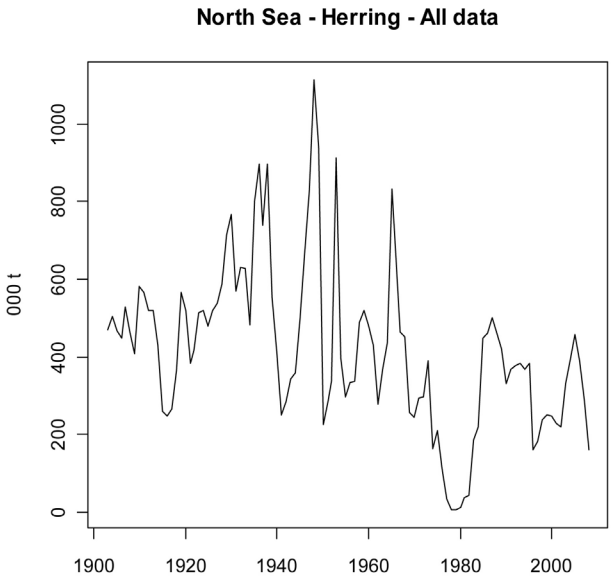
8.1 North Sea herring

The first example shows the time-series of herring landed from the North Sea. The time-series 1950–2008 includes complete coverage by all countries fishing herring in the North Sea; thus it should be possible to interpret this series in a consistent manner.



This time-series has been thoroughly studied by the ICES Herring Assessment Working Group and illustrates the change in yield over time.

The expansion of this herring series to the full period 1903–2008 is shown below. Adding the earlier data involves including data which were collected by different methodologies; hence, the consistency of the time-series is uncertain. The series includes all countries that had any major fishery for herring in the North Sea.

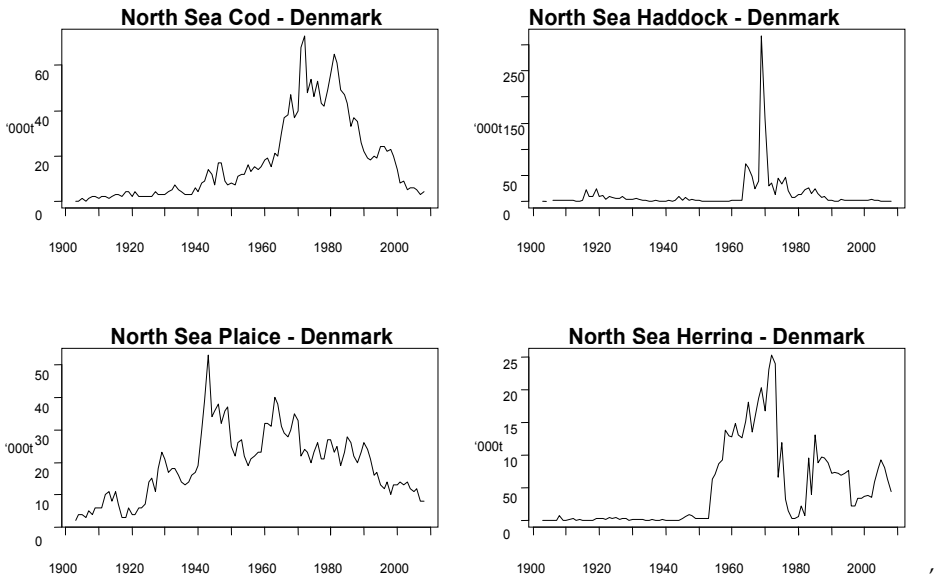


Despite the extreme peaks and troughs, it is possible to give reasonable explanations in terms of the general trends in the fishery.

9 Country data

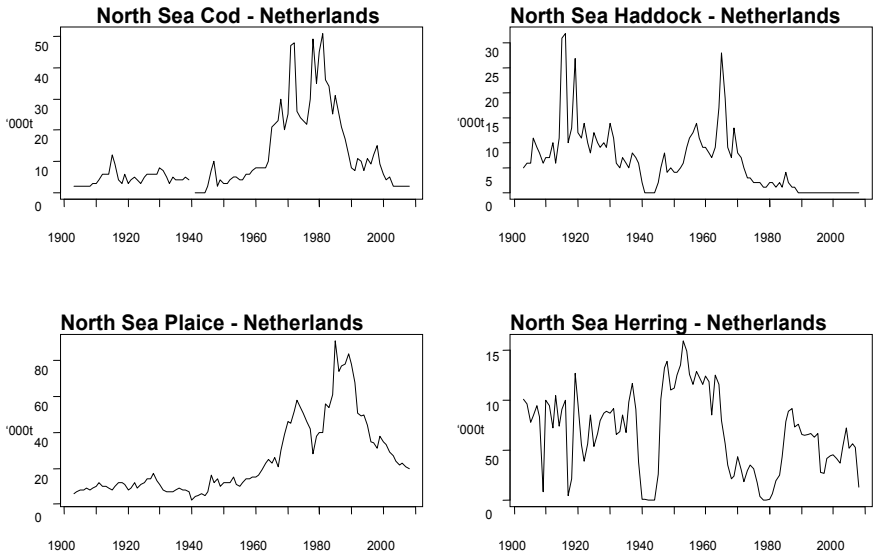
The third example is a group of time-series that has been constructed for each country. Time-series are illustrated below for four species (cod, haddock, plaice, and herring) for five countries/regions (Denmark, the Netherlands, Norway, England, and Scotland) that have reported consistently throughout the century.

9.1 Denmark



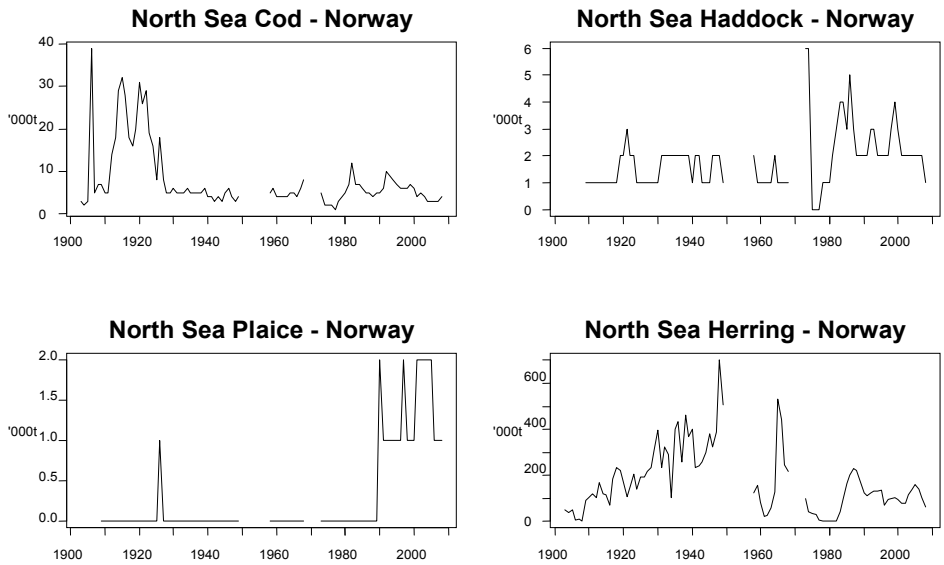
The Danish time-series shows large changes in the Danish fisheries over the century. Part of the increase in plaice landings around 1940 is a result of the reporting system of the time, because Danish landings in Grimsby (England) were probably not included with the Danish landings in the 1930s. The graph for herring shows the onset of the industrial fishery at the beginning of the 1950s.

9.2 The Netherlands



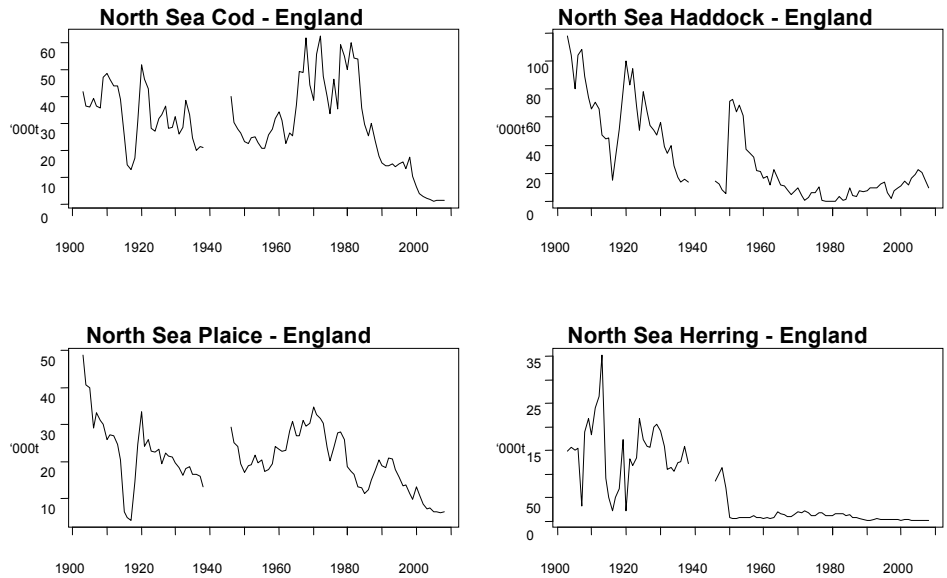
The haddock peak for the Dutch fleet in the early 1970s, and the cod boom, mirrors Danish trends. This peak is based on the gadoid outburst in the North Sea. The reasons for the trough around 1910 are not known.

9.3 Norway



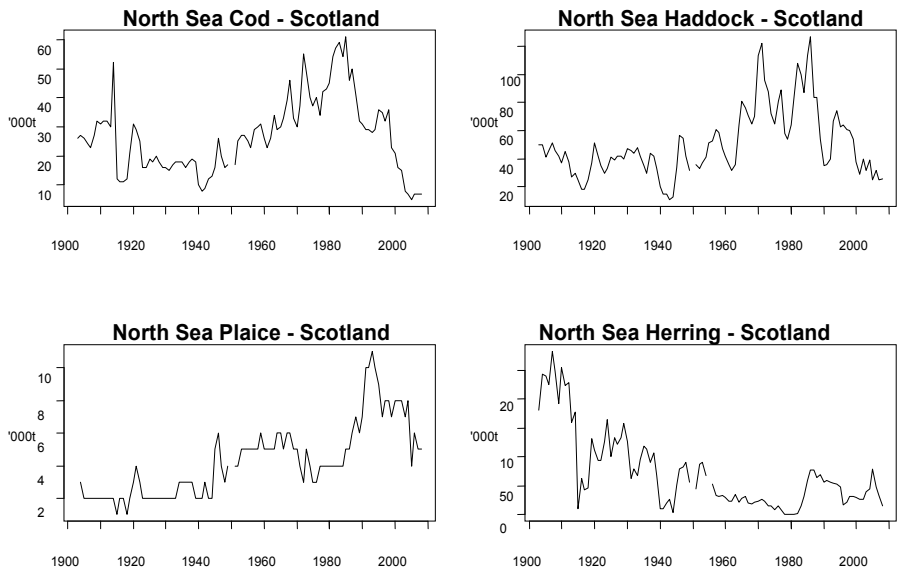
Norway has not been a major player in the haddock and plaice fisheries in the North Sea throughout the century. The Norwegian cod and herring fisheries in the North Sea have changed drastically.

9.4 UK – England



The time-series illustrates the drastic changes experienced by the English fishery during the century, with the disappearance of cod and herring from English landings. The two World War periods are clearly visible: as a trough (1914–1918), and a gap in the data (1939–1945). The haddock peak is also seen in the Dutch and in the Scottish data (Sections 9.2 and 9.5).

9.5 UK – Scotland



The declining importance of the North Sea herring fishery is clear, and the decline in the cod fishery in recent years is also evident. The possibility of non-reporting as a result of illegal, unreported, and unregulated (IUU) fishing for cod is discussed in reports of the ICES Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak (ICES, 2009).

10 Concluding remarks

The data presented here have been studied to the best of our ability, and the result is a "best available dataset" based on the published volumes of *Bulletin Statistique*. As illustrated by the examples above, the fishing sector has changed dramatically over the 100-year period covered, and there has also been significant year-to-year variation.

The procedure for data submission is not well documented, and in the earlier years, seems to have been through the ICES Delegates. Data processing has been a function of the ICES Secretariat since 1904.

The first half of the series is affected by incomplete coverage both by country and species. In several cases, the reporting from an individual country is incomplete, which is noted in the publications. Since 1950, all countries that have fished in the Northeast Atlantic have reported statistics, although, in some cases, with all data lumped for the entire area.

Countries have changed data-collection and compilation methodology several times during the period 1903–2008. Unfortunately, these changes are not fully documented in the international literature, and, hence, it is difficult to assess the consistency of the series. The ICES Statistics Committee compiled information on data-collection methodology by country in the 1970s (Griffith, 1980). Further information exists in national reports. EU legislation currently requires methodological reports as a tool to improve consistency between countries.

The data are influenced by events in society at large; for example, the effects of the two World Wars are evident in the data. In interpreting the data, however, non-reporting because of IUU fishing, particularly after the introduction of total allowable catches (TACs) in the mid-1970s, might have affected reporting, but in some years might also have led to over-reporting in order to establish historical rights when sharing a TAC.

For biodiversity studies, these data must be used with care. There are opportunities for misinterpretations; the number of species reported and the species breakdown have changed over time. Furthermore, there are changes in coverage by countries and by areas as discussed above.

Acknowledgements

A major input to the work on extending the database to cover the period 1950–1972 was the MS-ACCESS database developed by the University of British Columbia (UBC) from the annual hard-copy volumes of *Bulletin Statistique*. The UBC Fisheries Centre kindly made this database available to the ICES Secretariat.

11 References

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12 Abbreviations and Acronyms

ASFIS	Aquatic Sciences and Fisheries Information System
CWP	Coordinating Working Party on Atlantic Fishery Statistics (FAO)
EEA	European Economic Area
Eurostat	EC's body for European statistics
FAO	Food and Agriculture Organization of the United Nations
ICCAT	International Commission for the Conservation of Atlantic Tunas
IUU	illegal, unreported, and unregulated (fishing)
STATLANT	a data collection programme established by CWP
UBC	University of British Columbia

13 Websites

ASFIS List of Species for Fishery Statistics Purposes
http://www.fao.org/fishery/collection/asfis/en

CWP Handbook of Fishery Statistical Standards
http://www.fao.org/fishery/cwp/handbook/H/en

Eurostat/ICES database
http://epp.eurostat.ec.europa.eu/portal/page/portal/eurostat/home

Excel files for 1903–1949
http://www.ices.dk/fish

FishStat Plus format file
http://www.ices.dk/fish/statlant.asp

The ICCAT database
http://www.iccat.int/en/accesingdb.htm

Landings data 1903–2008 (ICES website)
http://www.ices.dk/fish/statlant.asp

Landings data 1950–2008 (Eurostat website)
http://epp.eurostat.ec.europa.eu/portal/page/portal/statistics/search_database