

# The role of ICES in the assessment and management of resources in the Baltic Sea

Evald Ojaveer

Ojaveer, E. 2002. The role of ICES in the assessment and management of resources in the Baltic Sea. – ICES Marine Science Symposia, 215: 582–589.

The first recommendation of ICES concerning the exploitation of resources in the Baltic Sea (presented in 1905) suggested protecting small plaice in the Kattegat. Later, controlling the number of seals was advised. Between the World Wars, recommendations were aimed at regulating the fisheries for flatfish, salmonids, and crustaceans. They resulted in some agreements between the countries in the region for the protection of flatfish. A mechanism for the comprehensive regulation of the exploitation of living resources in the Baltic was achieved by the signing of the Gdansk Convention and the establishment of the International Baltic Sea Fishery Commission (IBSFC) in 1973. ICES has regularly submitted both qualitative and quantitative recommendations to the IBSFC for managing the main Baltic fish stocks (cod, herring, sprat, salmon, and sea trout). However, generally higher exploitation rates than recommended have been adopted by the IBSFC. The assessment and management of fish resources in the Baltic Sea are complicated as important fish species (cod, herring) have developed local populations with different abundance dynamics, which should be treated separately.

Keywords: advice, crustaceans, ecosystem, fish stocks, management, seals.

*Evald Ojaveer: Estonian Marine Institute, Viljandi Road 18B, 11216 Tallinn, Estonia; tel: +372 6 281 568; fax: +372 6 281 563; e-mail: e.ojaveer@ness.sea.ee.*

## Introduction

In the history of the International Council for the Exploration of the Sea (ICES), matters concerning the Baltic Sea have been treated by various committees, which all have had their influence on the decisions and recommendations adopted during the corresponding periods. When ICES was established in 1902, the majority of its Member Countries bordered the Baltic Sea. It was well understood that the brackish Baltic Sea had special status and problems. Therefore, at the first meeting of ICES, a separate committee (Committee C) was established for handling Baltic matters. Taking into account the diversity of problems in the Baltic Sea, two sub-committees were formed in February 1903: Sub-Committee C1 for the northeast areas and Sub-Committee C2 for the southwest regions of the Baltic. In 1909, the Baltic Committee was suppressed, but was revived again in 1921. In 1925, it was divided into sub-areas (the Baltic Area and the Transition Area), which were reorganized into corresponding committees in 1932. The delimitation of the areas was agreed in 1934; the Baltic Area (i.e., northeast part) included the sea east of Bornholm while the Transition Area (i.e., southwest regions) extended from the longitude of Bornholm, to 8°E, including the Belts, the Kattegat, and the Skagerrak).

Beginning in 1951, the problems of the Baltic and Transition Areas were handled by the corresponding sub-committees of the Northern Seas Committee. In 1954, the sub-committees were merged into the Baltic - Belt Seas Committee. During the period 1966–1973, no specific committee for Baltic issues existed, the problems of this area being mainly treated in the Demersal Fish (Northern) and Pelagic Fish (Northern) Committees. During 1973–1996, there was a Baltic Fish Committee, and since 1997, the Baltic Committee has been responsible for handling Baltic Sea matters (IBSFC, 1975; ICES, 1903, 1934, 1998a; Went, 1972).

ICES was created, to a great extent, to solve practical problems of its Member Countries. Therefore, together with the creation of databases for developing scientifically sound recommendations and arranging investigations and work programmes, an inquiry was conducted in 1906 among the Member Countries to ascertain their priorities in marine problems. Concerning the Baltic Sea, Denmark was interested in identifying the best international mechanism for prohibiting the landing of undersized plaice from the Kattegat and improving the fisheries (e.g., salmon). Finland hoped to establish an international agreement between the Baltic Sea states to maintain the salmon stock and increase the catch by stocking. Russia was interested in resolving the question

of the utility of salmon hatcheries. Sweden wished to clarify the relation between the Baltic Sea and atmospheric conditions and was interested in the international regulation of problems concerning salmon and sea trout and information on herring migrations in the Baltic (ICES, 1906).

The creation of ICES had a notable impact on the activities of national bodies connected with the investigation and management of fisheries in the Baltic Sea. The Livonian Department of the Imperial Russian Society for Fish Culture and Fisheries arranged the First International Baltic Sea Fisheries Congress in Riga in 1910. The Congress was organized for discussions on fisheries (including regulation of mesh sizes and other protective measures) for salmon, sea trout, flounder, eel, herring, and sprat in the Baltic, types of fishing boats, fish rearing, and seals. The second Congress was held in Malmö, Sweden, in 1914. At both Congresses, people active in the ICES sphere (e.g., A. F. Trybom, C. Drechsler) played an important role (Schneider, 1915).

## The period of qualitative recommendations

### The first recommendation

In 1905, Committee C presented and the Council accepted a statement and a recommendation on the fisheries in the Baltic (ICES, 1905):

- 1) The Committee stated that it was possible to augment the catch of migrating eels. The statement was based mainly on Dr Johannes Schmidt's discovery that eels spawn in the ocean, not in the Baltic or freshwater.
- 2) It recommended that an international treaty be concluded between the nations fishing in the Kattegat, the object of which would be the prohibition of the landing of plaice under an appropriate minimum size.

The recommendation initiated a lengthy struggle for reasonable management of flatfish as well as all other exploited species. Plaice in the Kattegat were especially well suited for the start of legislatively imposed protection of small fish as this was a clearly delimited, intensely exploited, small population where the economic impact was measurable.

However, in those times, another real problem existed for fishermen in the Baltic: competition with seals for fish.

### Seal problem

In the early 1900s, the populations of ringed and grey seals were numerous in the Baltic Sea, and seal bounties were paid in some Baltic countries (Harding and Härkönen, 1999). At the August 1909 Council meeting, it was recommended that countries around the Baltic

should take steps to control the number of seals, initially by offering rewards. The question of exterminating seals in the Baltic was referred to a small sub-committee. In 1910, this sub-committee confirmed that the complaints of serious damage being done by seals to fishing gear and fish were justified and recommended that countries bordering the Baltic and Kattegat agree to pay rewards for killing seals. At the 1912 Council meeting, when Denmark, Germany, and Sweden had agreed to the Council's previous recommendation and Russia had agreed to start similar actions, the Council recommended that rewards for killing seals be introduced, beginning no later than 1 January 1914 (Went, 1972). The implementation of the recommendation adopted on the eve of World War I was interrupted by the war and the resulting political changes in some countries around the Baltic Sea. Mainly under the pressure of hunting, the seal populations rapidly decreased in the 1920s and 1930s (Harding and Härkönen, 1999). The seal problem was once again raised in the combined Baltic and Transition Area Committees in March 1931 (ICES, 1931) when, from a fisheries point of view, the desirability of regulating the number of seals in the Baltic was expressed. However, no concrete recommendations were made. Because of a gradual decline in the abundance of seals [mainly due to hunting, but in the 1970s and 1980s also owing to the pollution of the marine environment with organochlorines, which markedly increased the percentage of sterile females (HELCOM, 1996)], the problem became less acute. The most recent report on seals from ICES to the IBSFC (ICES, 1995) stated that only a small fraction of the three seal species had survived. At present, all seal species are protected in the Baltic, and their abundance has exhibited some increase (HELCOM, 1996).

### Protection of flatfish and salmonids before World War I

In the report to the 1907 ICES annual meeting, Sub-Committee C1 reported mainly on salmon and sea trout, while Sub-Committee C2 referred to the preparation of a convention between Denmark and Sweden intended to prohibit the landing of plaice in the Kattegat under a certain size limit (ICES, 1907). In 1912, substantial plans were prepared for salmon investigations (Went, 1972).

In 1913, a draft convention for protective measures for plaice and flounder in the Western Baltic by Germany and Denmark was agreed by the Council. However, the outbreak of war prevented further deliberations.

### Rationalization of fisheries after World War I

In 1921, an important recommendation was accepted which required the collection of statistical data by squares, including the Baltic Area (Went, 1972). A spe-



Table 1. Recommendations for protection of living resources in the Baltic area proposed in the 1920s and 1930s (ICES, 1928, 1930, 1932, 1934, 1937; Went, 1972).

Year	Species	Area and protection measure
1928	Plaice	Baltic and Belt Sea. Prohibition of trawling and fishing with Danish seines at depths less than 20 m, size limit 24 cm, closed season for protection of spawning fish.
1930	Plaice	Danish, Norwegian and Swedish fishery. Size limit 27 cm, prohibition of trawling on nursery grounds.
1932	Flounder	Baltic Sea. Increase in size limit, closed season, closed areas.
1934		Area between the lines Gedser–Arenshop and Utlängen to the German–Polish frontier.
	Plaice	Size limit 23 cm.
	Flounder	Size limit 21 cm.
1936	Plaice	Baltic Sea. Size limit 24 cm.
1937	Flounder	1930 Convention Area. Increase in the size limit. Protection of the species during spawning season.
1927	Salmon	Baltic Sea. Size limit 35 cm, international agreement to prohibit salmon fishery near the estuaries, enlargement of territorial waters for controlling the fishery, protection of natural and artificial propagation, investigations on races and migrations of salmonids.
1932	Salmon	Baltic Sea. Implementation of effective size limit.
1935	Salmon	Baltic Sea. Implementation of uniform protective measures, size limit 50 cm.
1938	<i>Pandalus borealis</i>	Protection of <i>P. borealis</i> stock (mesh regulation).

Table 2. International agreements for protection of fish stocks in the Baltic area in the 1920s and 1930s (ICES, 1928, 1931, 1933; Went, 1972)

Year	Participants	Agreement
1927	Denmark and Germany	Convention on plaice in the Western Baltic (size limit 24 cm, closed season 15 February–31 March).
1931	Denmark, Free City of Danzig, Germany, Poland, and Sweden	Convention for protection of flounder and plaice in the Baltic.
1933	Denmark, Norway, and Sweden	Agreement for introduction of size limit (25.7 cm) for plaice in the Skagerrak, Kattegat, Sound, and the Baltic.

cial biological meeting was held from 4 to 8 June 1934 on size limits for fish and mesh regulation. The following year, each Member Country presented details of any size limits introduced in the fishery. This was a very important step forward as it constituted the database for the Council's scientific recommendations. In the same year, the Council suggested that all Member Countries adopt mesh regulations and size limits for fish. In

November 1936 and March 1937, conferences for the protection of undersized fish were held in London (Went, 1972). These activities furnished the background for concrete developments in the protection of living resources in the Baltic area (Table 1).

The resources in the Baltic Sea had been rather intensively exploited. Studies on possible overfishing in the Baltic started earlier (in 1851) than in other seas (von

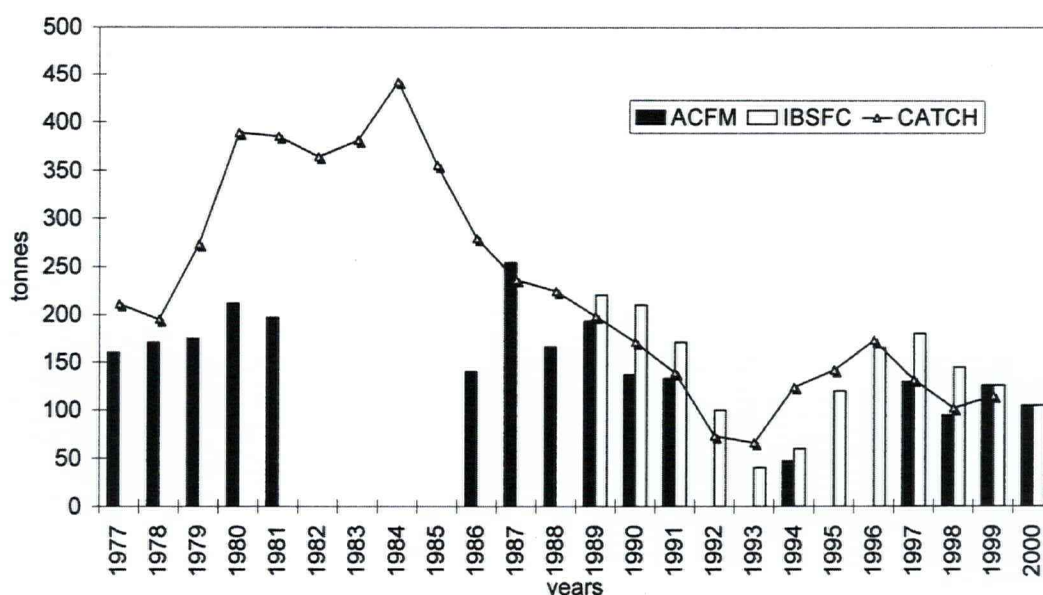


Figure 1. Predicted catch of cod by ICES, the IBSFC TAC, and the total actual catch in Subdivisions 22–32 in the Baltic Sea. A ban on the cod catch was recommended by ICES for 1993, a considerable reduction in catches without numerical advice in the years 1992, 1995, and 1996. No TAC was agreed by the IBSFC before 1989 (IBSFC, 1982, 1992b, 1999; ICES, 1978, 1989, 1995, 2000a).

Baer, 1860). This is probably why the necessity for collaboration on stock protection was understood earlier in the Baltic and the respective agreements had already been concluded in the 1920s before the 1936 and 1937 meetings in London [e.g., some agreements are listed in Table 2; the Estonian-Latvian Convention on Fish Protection in 1925 (Ojaveer *et al.*, 2000)]. The ICES recommendations presented in this area in the 1920s and 1930s are listed in Table 1, and the agreements that are probably connected with these recommendations are given in Table 2.

### Regulation of crustacean fisheries

In 1946, the Transition Area Committee recommended that a meeting of experts be held to consider measures for the protection of the stocks of *Pandalus borealis*, *Nephrops norvegicus*, and *Homarus vulgaris*. The meeting in October 1947 recommended protection measures, but no success was achieved until 1950 when the Transition Area Committee made a new proposal to discuss the matter with the participation of the Norwegian government. A meeting was held in Oslo in February 1951, and the participants from Denmark, Norway, and Sweden proposed a minimum mesh size of 30 mm and a minimum size for Norway lobster of 15 cm, and suggested that a committee be established to propose further protective measures (ICES, 1950, 1952).

## The quantification period

### Organization of comprehensive cooperation

Griffith (1999) called the 1960s and 1970s the quantification era in the life of ICES. Quantification in the exploitation of fish stocks required management of large marine areas. However, given the existing political situation, the possibilities for comprehensive regulation of the exploitation of fish stocks in the Baltic were problematic in the 1950s. Not all countries around the Baltic Sea belonged to ICES. However, this situation gradually changed. The Federal Republic of Germany (FRG) acceded to ICES in 1952. In 1953, the Council supported and transmitted the proposal by the Baltic Area Sub-Committee to the governments of Denmark, Finland, the FRG, and Sweden for the conservation of Baltic salmon. The proposal called for a ban on driftnets from December to March, a minimum fish size of 50 cm, a minimum mesh size of 160 mm, and a minimum hook size of 19 mm (ICES, 1954). Unfortunately, no agreement was achieved.

In 1955, Poland rejoined ICES and the USSR also joined. In 1957, the Council passed a resolution prepared by the Baltic - Belt Seas Committee to encourage a meeting of fully accredited representatives of the governments of the Council's Baltic Member Countries to discuss an international convention for the Baltic - Belt Seas including size limits for a number of species and



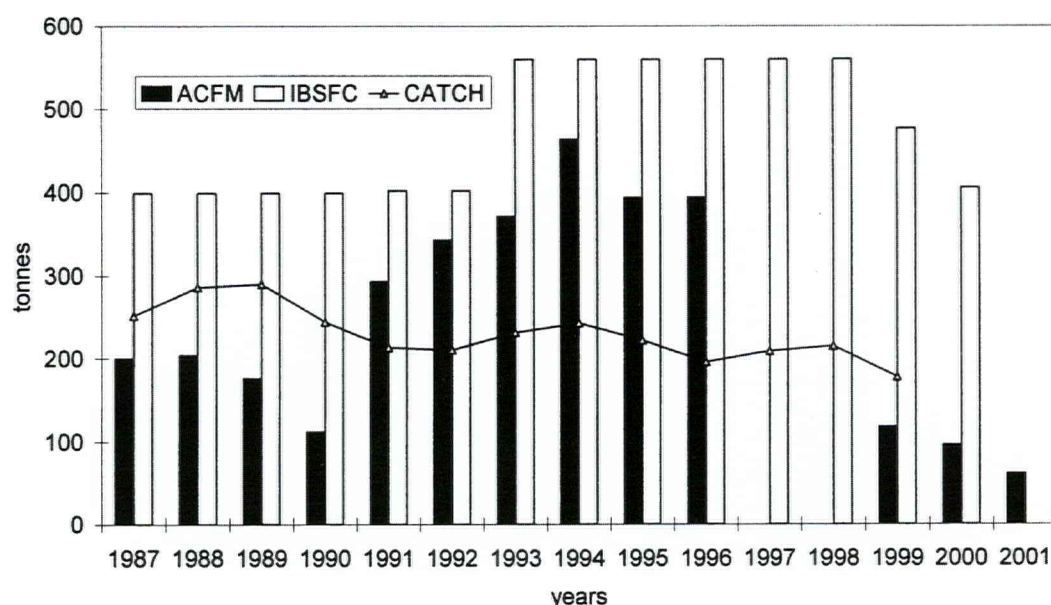


Figure 2. Predicted catch by ICES for Subdivisions 25–29, 32, IBSFC TAC (for Subdivisions 22–24 and 25–29, 32) and the total catch of herring in Subdivisions 25–29 and 32 in the Baltic Sea. The ICES advice for 1994 was 317–463 t and no advice was given for 1997 and 1998 (ICES, 2000a).

conservation measures for salmon and sea trout. In 1958, the Baltic - Belt Seas Committee repeated its recommendation (Went, 1972). However, no major international activities for the protection of fish stocks in the Baltic Sea were undertaken before the 1970s.

A special meeting on "Cod and Herring in the Baltic" was held in Helsinki immediately before the 1971 ICES annual meeting. A number of recommendations were adopted by the Council that year for the promotion of investigations and the collection of data for the assessment of fish stocks in the Baltic. In 1973, a new Baltic Fish Committee was established. Its Chair was included, as an *ex-officio* member, in the Liaison Committee responsible for maintaining liaison with the various fisheries commissions and providing them with scientific advice.

### Gdansk Convention and the International Baltic Sea Fishery Commission

Possibilities for finding a comprehensive solution for regulating the exploitation of living resources greatly increased with the diplomatic conference arranged in Gdansk in 1973. The Convention on Fishing and Conservation of the Living Resources in the Baltic Sea and the Belts was signed by all states bordering the Baltic Sea, and the International Baltic Sea Fishery Commission (IBSFC) was established. The diplomatic conference turned to ICES with a request to analyse the state

of the exploitation of the stocks of herring, sprat, cod, and flatfish in the Baltic and to advise as to regulations which might be used for approaching optimum yield of the stocks of the said species (IBSFC, 1975). In Article IX of the Convention, it is stated that the IBSFC shall seek the services of ICES and other international technical and scientific organizations (IBSFC, 1992a).

Two ICES working groups for the assessment of pelagic and demersal stocks (with members including scientists from the German Democratic Republic) were established. These groups first met in early 1974 and provided the Liaison Committee with data to support the advice to the IBSFC. In October 1974, the first session of the IBSFC adopted the Fishery Rules for the Baltic Sea, welcomed the report of the Liaison Committee containing the requested advice, and asked ICES to make recommendations on the most reasonable protective measures for herring and sprat stocks in the Baltic, to carry out additional research on flatfish in the northern and eastern subdivisions of the Baltic, and to give advice on netting material.

### Advice on assessment and management of the main commercial fish stocks in the Convention Area

ICES has played the key role in providing advice on the management of fish resources of the Baltic Sea. It has regularly assessed herring, sprat, cod, salmon, and sea



trout stocks, supplied the IBSFC with the results of the assessments and background information on the stocks mentioned as well as on flatfish, and also presented corresponding management recommendations and other requested advice. The concept of exploitation of resources within safe biological limits has been the cornerstone of the ICES recommendations during the whole period of advising the IBSFC. Biological reference points, in terms of fishing mortality and biomass indicators, have been used to provide information on the status of stocks in relation to predefined limits that should be avoided to ensure that stocks and their exploitation rates remain within safe biological limits.

To evaluate and illustrate the advice and management decisions on the most abundant Baltic fish stocks (sprat, herring, and cod), Figure 1 gives data on cod, as an example, including the ICES advice based on the results of analytical assessments, the total allowable catches (TACs) agreed by the IBSFC, and the actual catches in the Baltic Sea during 1977–2000.

The method applied by the Advisory Committee on Fishery Management (ACFM, which replaced the Liaison Committee in 1977), does not require the presentation of numerical advice during periods of good stock condition; the decision was left to the managers for cod during 1982–1986 and for sprat in 1993, 1994, and 1997. ICES recommended a ban on cod fishing in 1993, a year of very low stock biomass, and for sprat for the same reason in 1982 and 1983 (ICES, 1998b, 2000a).

In general, the IBSFC has based its TACs on the ICES advice, notably during the periods of decrease in the spawning stock biomass and low stock levels with the risk of stock depletion. However, the IBSFC has often adopted higher TACs than those recommended by ICES (Figure 1; ICES, 2000a).

Also, ICES has regularly supplied the IBSFC with recommendations and voluminous background material for the introduction of proper management of salmonid (salmon and sea trout) stocks in the Baltic. The main goal has been the improvement of the condition of natural stocks. Poor reproductive conditions, decreasing genetic variability, and the disease M 74 constitute serious threats to the populations. Uncertainties in the basic data have not allowed the presentation of regular numerical advice on salmon catches (ICES, 1999, 2000a).

### Specific assessment and management problems connected with brackish water in the Baltic Sea

In the brackish Baltic Sea, the assessment and management of fish stocks are complicated by the existence of a number of biological sub-systems. These sub-systems are based on consistent differences in salinity and other abiotic parameters in their areas (Ojaveer and Elken, 1997). Local fish populations are components of these sub-systems; therefore, they usually have different abundance dynamics. As a matter of fact, local popula-

tions represent the adaptation of marine fish species to the environmental conditions in various parts of the Baltic.

The markedly heterogeneous nature of environmental conditions and fish stocks in the Baltic was known long ago. Already before the creation of ICES, information had been published which indicated that herring had developed local units in the Baltic (e.g., Kessler, 1864; Heincke, 1898). This is also true of cod (Bagge *et al.*, 1994). Conspicuous differences in the sea areas from the Skagerrak to Bothnian Bay were the main cause for the division of the original ICES Committee C into two sub-committees in 1903. It was stated in the "Reasons for the maintenance of the Transition Area Committee besides the Baltic Committee" (ICES, 1932) that both the hydrographic conditions and the compositions of the stocks of commercial fishes differ significantly in the areas of these sub-committees.

In order to achieve proper management of fish stocks, ICES has repeatedly advised the IBSFC to set separate TACs for each stock area of the important fish species (IBSFC, 1982, 1991). However, until now, the IBSFC has failed to take into account this basic nature of living resources in the Baltic and has allocated the national quotas for the fishing zones of its member countries as a rather constant fraction of the total TAC of the species in the Baltic (IBSFC, 1992b, 1999).

Experience has shown that the recognition of the presence of biological sub-systems in the Baltic has a very important impact on the quality of the assessments. From the 1970s until the end of the 1980s, the ICES Working Group on Assessment of Pelagic Stocks in the Baltic treated the main herring stocks separately. By and large, the resulting advice reflected the dynamics of the stocks. For the composition of the forecast for 1991 and subsequent years, the number of Baltic herring assessment units was decreased from eight to four; the stocks in Subdivisions 25–29 + 32 (the Baltic Proper east of Bornholm, the Gulf of Riga, and the Gulf of Finland) were merged to create a single herring assessment unit for this large area (ICES, 1991). However, the combined assessment of a number of stocks (differing substantially in abundance dynamics and up to 300–400% in the average weights-at-ages) in the newly created assessment unit yielded unreliable results. In contrast to the very optimistic prognoses of stock condition and catches in this unit in 1991–1996, the actual catches declined (Figure 2). Consideration of the results by ACFM indicated that the assessment was uncertain owing to the stock complexes in this area (ICES, 1998b, 1999, 2000a). ICES has recently initiated a review and evaluation of the information on the Baltic herring stocks to create a scientifically well-founded system for the assessment of the herring stocks in the area in question (ICES, 2000b).

It is obvious that to obtain reliable assessment results as well as to introduce sustainable management of the resources, the natural units should be taken as the basis



for assessment, and the main stock units with different abundance dynamics should be treated separately. However, in the brackish Baltic Sea, the need for separate assessment and management of rather small stock components makes the sustainable approach to resource management complicated and probably more expensive than in the oceanic areas which have a more uniform environment and large stock units.

## Summary

ICES has had decisive influence in the organization of the protection and management of living resources in the Baltic since the first years of its existence. During the first seven decades of ICES, its efforts were directed to the protection of young (small) fish and crustaceans, as well as to the regulation of the impact of seal populations on fisheries. The lengthy struggle for comprehensive international regulation of fisheries in the Baltic Sea after World War II resulted in the signing of the Gdansk Convention. ICES has regularly supplied scientific advice for the management of the main Baltic fish stocks since the first session of the IBSFC. However, because of the complicated nature of the population structure of commercial fish stocks in the brackish Baltic Sea, experience and time are required for the organization of sustainable management of fisheries based on natural stock units.

## Acknowledgements

The author thanks Dr T. Smith and other reviewers whose remarks substantially contributed to the improvement of the article.

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