



ANNUAL MEETING - JUNE 1967

Increasing stock of Atlantic Salmon (*Salmo salar*)

Resolution approved by the Special Committee for the International
Biological Programme (SCIBP), 30 March 1967

Attached is a letter of 4 May 1967 received from Dr. E.B. Worthington, Scientific Director of the International Biological Programme (IBP) of the International Council of Scientific Unions (ICSU) drawing the attention of this Commission to a resolution approved by the Special Committee for the International Biological Programme (SCIBP) relating to the redevelopment of salmon stocks in the Baltic Sea and on both sides of the Atlantic.

The Commission may wish to consider the resolution and an accompanying note by Dr. Worthington under Item 12 of the Plenary Agenda.

L.R. Day
Executive Secretary

16 May 1967

INTERNATIONAL COUNCIL OF SCIENTIFIC UNIONS
INTERNATIONAL BIOLOGICAL PROGRAMME

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SCIENTIFIC DIRECTOR: E. B. WORTHINGTON (LONDON)

Our ref: 11.23

SCIIBP 54/67
4 May 1967

To: The Chairmen and Secretaries of ICES, ICNAF, NEAFC
The Chairmen of IBP National Committees in the
following countries for onward transmission to
national fishery research authorities as appropriate.

Belgium	Netherlands
Canada	Norway
Denmark	Poland
Finland	Portugal
France	Spain
German Democratic Republic	Sweden
German Federal Republic	Switzerland
Iceland	United Kingdom
Ireland	United States
	USSR

Copies for information to the Bureau of SCIIBP and
Conveners, Scientific Coordinators and members of
Sections PF and PM

Dear Sir,

Salmo salar

I have to draw your attention to a resolution which was approved by the Special Committee for the International Biological Programme at its Fourth Meeting on 30 March 1967 on the proposal of its two Section Committees concerned, namely those for PF (Productivity of Freshwater Communities) and PM (Productivity of Marine Communities). A copy of this resolution and of the note referred to in it is attached.

SCIIBP would be glad to receive any comments which you may have on the resolution and the note. These could be sent to me, or, if preferred, to the IBP scientists immediately concerned who are:

Section PF
Convener:

Dr. A.D. Hasler,
Laboratory of Limnology,
University of Wisconsin,
Madison, Wisconsin 53706, USA

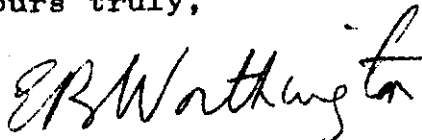
Scientific Coordinator: Dr. J. Rzoska
IBP Central Office,
7 Marylebone Road,
London, N.W.1., UK

Section PM
Convener:

Dr. B.H. Ketchum
Woods Hole Oceanographic Institution
Woods Hole,
Massachusetts, USA

Scientific Coordinator: Dr. C.M. Yonge
13 Cumin Place
Edinburgh 9
Scotland

Yours truly,

A handwritten signature in cursive script, reading "E.B. Worthington". The signature is written in dark ink and is positioned below the typed name "E.B. Worthington".

E.B. Worthington

Salmo salar

Resolution of Fourth Meeting of SCIBP, held
30 March 1967 in Paris.

Sections PF and PM of IBP, being cognisant of the importance of Atlantic Salmon as a protein resource from the North Atlantic Ocean and of its precipitous decline owing to man-induced adversities, being aware also of the new advances in pollution abatement and in new methods of fish culture which could be more broadly applied in order to begin a restoration of salmon stocks, considers that more international effort will be needed in order to increase salmon stocks in the Baltic Sea and on both sides of the Atlantic. The Sections PF and PM also consider that IBP is an appropriate organisation to increase participation in the present programme to which so few countries now contribute, particularly by helping to stimulate any research which is still needed.

Having given attention to the numerous studies done on this Atlantic migratory fish, and having considered a note on Salmo salar by Dr. E.B. Worthington, March 1967, the two Sections recommend:

- i) That, through IBP and SCIBP, the attention of ICES, ICNAF and NEAFC is drawn to this note.
- ii) That the content of this note be considered by all countries which formerly had salmon fisheries.
- iii) That advice be offered to these countries, if desired, in order to ensure that all aspects of redeveloping the salmon stocks, and particularly the massive rearing of smolts, be thoroughly examined by the appropriate authorities in each country.

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SCIENTIFIC DIRECTOR: E. B. WORTHINGTON (LONDON)

SALMO SALAR

Note for consideration by Sections PF, PM and UM of IBP

by E.B. Worthington

A first draft of this note, dated December 1966, was circulated to about a score of salmon specialists and others known to be particularly interested. All of them have made useful comments which have been closely considered in preparing this revised draft.

Salmo salar, although often spoken of as a freshwater fish, derives practically the whole of its food supplies from the sea. Only in the parr stage while it grows from fry to smolt does it depend on freshwater productivity. From IBP's point of view, it is primarily a marine species.

The salmon is an ideal species for commercial fishing because there is no need to go out to catch it. After rapid growth in the sea, the fish return as grilse or adults and catch themselves readily in traps at or near the mouths of the rivers from which they originated. The species is moreover highly palatable and nutritious; the fact that it is also highly priced is caused largely by the enormous reduction of stocks during the past century and a half, and consequent scarcity value. From the viewpoint of this note, the very high economic value of the rod fishery for salmon is a bi-product (though an important one) of the food fishery.

Formerly the salmon provided important fisheries in eighteen countries around the North Atlantic, but in all of these the fishery is now greatly reduced and the fish has vanished or almost vanished from six of them. In Canada, Iceland, Ireland, Norway, Sweden, the UK and USSR salmon fisheries are still important; in Finland, France, Germany, Poland and Spain they are now relatively small. The fish has entirely vanished from Holland, Portugal and Switzerland, and almost from Denmark (except Greenland) and the USA. An historical study of the salmon fishery, made recently by A. Netboy for the Conservation Foundation (paper to Salmon and Trout Association, London Conference, November 1966, and a book in the press) has shown that up till about 1800 the salmon fishery of every one of these countries was substantial, and that in most of them salmon at that time was not a luxury but a food

fish which in season was within the reach of most sections of the population. Although figures of catches over the decades and centuries may not be strictly comparable, and some individual countries are exceptional, it would probably be no exaggeration to say that within the past 150 years the total crop of salmon has been reduced to less than one tenth.

We can assume then that a century and a half ago there were at least ten times as many salmon in the seas as today. Moreover, the development of marine fisheries for other species may have reduced the competitors and perhaps also the predators. Although reduction by a factor of 10 is admittedly arbitrary and the reduction of competition and predation is conjectural, it is difficult to avoid the conclusion that in those parts of the sea where salmon spend their years of growth, there is today a kind of vacuum. The vacuum has doubtless been filled by other species, but there is reason to believe that the salmon could re-establish at least its former stocks - if there were enough smolts entering the sea from the breeding rivers.

The reasons for the enormous reduction in salmon stocks is attributable to the activities of man in making many breeding rivers uninhabitable. In the XIXth Century and the early part of the XXth this was done by industrial pollution, and by erecting many small barriers and by over-fishing. In recent decades anti-pollution laws have made some impact in most of the countries concerned, but new barriers have been erected on an unprecedented scale, mainly for hydro-electric purposes.

Meanwhile, the technique of raising salmon eggs and fry has been developed and great effort and finance have been put into stocking tributary streams which breeding salmon could not reach in adequate numbers. This form of management has undoubtedly had effect, but in cases where thorough research on the fate of such stocked fish has been done, (mainly on species of Pacific salmon, but some on Atlantic salmon in Scotland and Canada), the losses between fry and smolt stage have been very large.

Now, however, new techniques of rearing young salmon from the fry through a year or, if necessary, two years of parr to smolts ready to go to sea have been applied, especially in Sweden. The smolts are transported overland from their rearing ponds to the tideway of rivers, whence after two or three days they migrate to sea, and in almost all cases, return to the estuary where stocked. Today 15% of the total salmon catch of the Baltic countries were in fact stocked as smolts; one out of four smolts stocked survives to return as grilse or salmon. The average cost of rearing each smolt is about \$0.50; the wholesale selling value of each grilse or salmon (at say \$1 per lb) ranges from \$4 to \$30. In other countries, such as Scotland, where smolt rearing has been practised on a much smaller scale, the proportion of grilse or salmon returned from smolts stocked in the tideway has been much lower than in the Baltic. While not as yet perhaps offering an economic return, nevertheless the experiments give promise for the future when techniques are improved.

Smolt rearing makes it possible to cut the river link from the salmon's life history. Although each river has its own practical problems, all salmon entering an estuary can (in theory at least) be trapped; those required for artificial fertilisation and rearing of fry and smolts can be kept on one side, and the

rest marketed or released upstream for rod fishing. The Shannon in Ireland already provides an example of this, and the Tay in Scotland has been advocated for similar treatment. Moreover, even though a river may be uninhabitable to salmon owing to barriers or even to pollution, a salmon run into its estuary can be created by stocking smolts into it.

Thus we reach two conclusions:

- 1) Those parts of the Atlantic which are used by salmon during the growing period could comfortably support ten times as many salmon as they do at present.
- 2) The technique of raising and stocking smolts has reached a stage when, if done on a large scale, the economics of a fishery based wholly on smolt stocking give considerable promise.

It is therefore proposed that each country which has now, or had in the past, a worthwhile fishery for Atlantic salmon should re-examine its present fishery in relation to the past, and consider whether it is not worthwhile to contribute to a major effort designed to re-constitute salmon stocks in the whole North Atlantic. One means of doing this would be for each interested country to establish one or more units for large-scale raising and stocking of salmon smolts into appropriate river estuaries.

Supplementary points to be borne in mind when the above note is considered are as follows:

The note contains nothing that is not already well-known to specialists in salmon. Moreover it attempts to avoid any purely national considerations. Some of the countries concerned may, however, already be tending towards adoption of the principles involved. Thus a Swedish water law lays down that any natural salmon reproduction prevented by barriers must be replaced by artificial stocking, and certain recommendations of the Hunter Committee on Scottish salmon fisheries are concerned with the management of salmon migrations through traps at river estuaries. The Canadian Forest Products J.16, 15 notes that two new smolt rearing stations are being established on the Gulf of St. Lawrence.

To keep the note brief the numerous technical questions have been simplified. It is not intended to suggest, for example, that every country which once had a salmon fishery could now recreate it by stocking smolts - for the estuaries of many former salmon rivers as well as the rivers themselves are hopelessly polluted.

It can be argued that homing instinct implies that salmon is a problem for each country independently, and no advantage would accrue from an international attack. But experience shows that this policy has led almost nowhere except to a steady dwindling of salmon resources in most countries. It is the size of this attack and concerted effort in applying the results of recent study that is at stake. This is where an international concept counts.

It can be argued also that, so long as the recently opened up Greenland fishery for salmon or the possibility of future sea fisheries along migration routes remains uncontrolled, no country

will rear smolts because there is a risk of others deriving the benefit. Against this it may be noted that a joint ICES-ICNAF Committee is now working on the Greenland fishery problem. Moreover, with far more salmon in the sea, such fisheries would become less troublesome than they seem at present.

Massive stocking with smolts would give enhanced opportunity for introducing desirable traits which have been developed in one river system to others, e.g. fish which run at the "right" time of year. It could provide also for taking advantage of favourable climates, e.g. smolts can be raised in 1 year in warm water, whereas it takes 2 years in cold, although their viability may be different.

Salmon diseases - including the current one in UK and Ireland manifest themselves mainly in fresh water, and may be expected to become less troublesome as the freshwater link becomes less essential in the life history.

In UK a large Salmon Research Trust may shortly be established on the initiative of Mr. P. Liddell with the support of the Fishmongers' Company, etc. Such a Trust plans to concern itself with international questions of research and any action deriving from this note should be coordinated with it.

As to the function of IBP, the establishment of smolt factories is development rather than research and as such hardly suitable for our programme. However the pilot stage trials which now seem to be needed - for example stocking smolts and trapping returning fish in a river estuary which is barred to salmon and another which is fed by a polluted river - might find a place in one or more national IBP programmes. Also any fundamental research on physiology, pathology, etc. that might have a bearing on the successful rearing of smolts in very large numbers could well be regarded as within the IBP sphere. Such research could be included in sections of PF and PM with studies on culture of fish and other aquatic organisms.

Future action

ICES already has an Anadromous and Catadromous (formerly Salmon and Trout) Committee. Any activity or meeting organised by IBP which tended to duplicate the work of this body, or of ICNAF and NEAFC would be undesirable. Therefore the Sections of IBP concerned and SCIBP may think it adequate at the present time to draw the attention of ICES, ICNAF and NEAFC to the Note, ask that the content be considered by all countries which formerly had salmon fisheries, and offer support to these bodies if desired in order to ensure that all aspects of redeveloping the salmon stocks, and particularly the massive rearing of smolts, be thoroughly examined by appropriate authorities in each country. At the same time, SCIBP might offer to use its organisation in helping to stimulate any research which is still needed.

Sections PF, PM and UM are asked to consider this note, and if they think the possibilities appropriate for any action by SCIBP, to make proposals.