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HAVE HATCHERIES A ROLE IN SEA-TROUT MANAGEMENT ?

by

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The artificial propagation of sea trout in Ireland has a long history but the fish were never produced in large numbers and they were disposed of at an early stage in development. The evidence suggests that artificial propagation was undertaken as a by-product of salmon management. The circumstances in which artificial propagation of sea trout may be justified are examined and some general reservations are expressed. For the future it seems likely that sea trout will be exploited in wild rather than in put-and-take fisheries. The emphasis should remain on providing the most suitable nursery conditions for the fish to reproduce naturally. Further investigations should however be undertaken on devising suitable methods of propagating sea trout and consideration might be given to re-establishing some of the long lived strains which are now believed to be extinct.

Introduction

Although the artificial propagation of salmonids has been practised since the eighteenth century - and in Ireland since 1852 (Went, 1950) - it has come in for increasing scrutiny and criticism in recent years and is no longer regarded as an automatic first choice of technique for stock enhancement (Harris, 1978). At both the scientific (Ryman, 1981) and popular (Schwiebert, 1979) levels the movement and intermixture of broodstock is thought to have caused loss of genetic diversity and the resulting benefits are questionable.

Most effort in artificial propagation has been directed at Atlantic salmon; sea trout received very little attention. In fact sea trout have been reared in Ireland for as long though not so abundantly as the larger species. The objective of this review is to survey such work as has been undertaken to date, to identify special problems associated with its appraisal and to make general recommendations on sea trout propagation in the future.

Hatchery rearing techniques are used to supplement the management of wild salmonid stocks as well as for fish farming. Sea trout have not as yet been farmed but there is some interest in farming brook trout *Salvelinus fontinalis* (Sutterlin, Harmon and Barchard, 1976) which, in many aspects of its life history is identical to sea trout. The immediate question is whether artificial rearing techniques which have been widely used in game fisheries can benefit sea trout and where deficiencies are likely to occur in their operation.

Sea trout rearing in Ireland

In Ireland sea trout have been artificially propagated over a wide area and a long period though in small numbers. Greatest effort was concentrated in the early years of the century (Holt, 1901-1907). Fig. 1 shows the geographical area in which sea trout are known to occur. (Fig. 1 is based on information contained in Fahy, 1977, supplemented by data from Colin Fleming of the Department of Zoology, Queen's University, Belfast and

on Fahy, 1981a). Fig. 2 illustrates the locations in which sea trout have been cultured, from which it is clear that attempts have been made to rear these fish in catchments which do not support them naturally.

The above could be taken to indicate a haphazard approach to the propagation of this fish. The numbers of sea trout reared artificially have not been great (Fig. 3) and fall very far behind those of salmon and brown trout. As for salmon the disposal of sea trout hatchery produce could take place at various stages as eyed ova, unfed fry, yearlings or smolts, and the bulk of the material was probably distributed at the earlier of these. Hence information on the success of the culture of the later stages of sea trout in Ireland remains to be obtained.

Statistical accounts of the success of sea trout rearing in Ireland are few. Brief analyses of the propagation of Norwegian sea trout (Anon, 1976) and of the effects of heated freshwater on the propagation of Irish sea trout (Anon, 1977) are available. More detailed studies on the culture of Irish sea trout commenced in 1980 (Anon, 1982). In the three years that they have been carried out major mortalities have been recorded at the fry stage; it is not however clear whether these are peculiar to sea trout. On-rearing of post-smolt, in sea cages, has also involved heavy losses but these may be a natural feature of Irish sea trout stocks which are short lived (Fahy, 1978).

Occasionally a note on the progress of sea trout propagation was published in the Annual Reports of the Department responsible for Fisheries. The 1898 Report of the Inspectors of Irish Fisheries contained one such from H.R. Laing describing the rearing of these fish in the Costello Hatchery in Connemara, a part of which it is worthwhile examining in detail:

> "...... I hoped last year to see from my previous three years' sea trout hatching a marked increase of small July sea trout; but, on the contrary, there was a very great falling off (we caught only half the quantity on the rod)......."

This brief statement touches on three elements which complicate the evaluation of sea trout propagation:

First is the difficulty of ascertaining in a sport fishery the strength of stocks from level of angling catches. The two bear no relation to each other (Fahy, 1981b).

Secondly, there is the homing behaviour of the fish. Sea trout are specific to their (usually natal) stream of origin when they reach maturity. This conclusion is arrived at from the fact that sea trout stocks, even those separated by very brief distances, maintain their genetic individuality.

Before reaching maturity however sea trout dash in and out of fresh water systems irrespective of their provenance (Menzies, 1936). The majority of sea trout in Ireland are exploited as post-smolt (finnock)(Fahy, 1981c) and there is a strong likelihood that these fish benefit systems other than those in which they were reared. Artificial propagation, if it is to be successful at all in such circumstances, would have to operate on a regional rather than a single catchment basis.

Finally, the natural fluctuations in a sea trout stock resulting from climatic changes can be considerable (Fahy, 1983) and would be likely to minimise or render superfluous any hatchery effort.

<u>The purpose of artificial propagation</u>

Mills (1971) has listed the circumstances in which artificial propagation is thought to serve a useful purpose as:

a, Where a salmonid has been reduced or eliminated.

The circumstances in which this can occur vary from widespread pollution of the kind which occurred in the River Rheidol in Wales to persistent decimation of stocks by overfishing. On the other hand Henry Lamond (1916) commented:

"In the event of the stock of any of our greater salmon rivers becoming depleted from the effects of pollution, over-netting, poaching or some other known cause or causes, I would not, where the spawning grounds are adequate, attempt to restore or enhance the stock by the establishment of a hatchery. It is extremely doubtful if even very extensive, and therefore proportionately costly, hatching operations would maintain the stock in face of continuing and possibly increasing evils. In the circumstances supposed expenditure would most economically be devoted to attacking the evil, for, if it were once removed, or minimised, nature would speedily restore the stock without adventitious aid".

Lamond did however anticipate a useful role for sea trout hatcheries, when, in the event of a dry summer, the stocks are decimated due to the vicissitudes of weather. This point has been alluded to above. Sea trout are supposed to be at greater risk than salmon because they spawn in smaller streams, frequent pools rather than riffles and are therefore more vulnerable to low water levels. Were this the case, the successful contribution of a hatchery would require that drought conditions be anticipated some two or three years in advance.

b, Where the species has not previously existed and is to be established. Places in which this generally occur are above obstacles like impassable falls which, once removed, open new spawning territory to incoming fishes.

In the case of sea trout, if the system contains them already, it would be prudent to await their migration further upstream. Failing this the ova and milt of fish from the same system might be transplanted further upriver, provided the distance does not exceed the natural range of the fish.

c, To maintain a stock of fish for exploitation in an intensive fishery. Whereas this practice is in general use for brown trout, sea trout which have a high mortality at sea and a protracted return pattern, are a more unsatisfactory subject. Additionally, sea trout achieve greater pre-migratory dimensions than salmon, necessitating a greater food input. They also make less weight at sea so that their rearing is a more costly and less financially rewarding exercise.

Purdom (1979) listed three main kinds of fish farming which he described as:

Extensive, when large areas are farmed at low stocking densities; there is much reliance on natural productivity for feed; carp were the example cited.

Intensive, when fish are held at high densities and are entirely dependent on artificial foods. Rainbow trout could be given as an example here.

Sea ranching, in which juvenile fish are released to the natural environment from which they return to their place of production for harvesting.

Production of sea trout for re-stocking would probably be classified as sea ranching. Purdom regarded intensive farming of salmonids in the U.K. as having a capacity of 15 to 20,000 tonnes annually. He did not regard Atlantic salmon as a suitable subject for sea ranching because of the high cost of smolt production.

General reservations about hatchery activities

In recent years the validity of certain forms of trout accorded species status in the nineteenth century is now confirmed as demes (distinctive taxonomic units) (Ferguson and Mason, 1981) and every stream population of *Salmo trutta* so far examined would seem to possess distinctive genetic characteristics (Fleming, 1982). Specific spawning strategies may have been developed to maintain genetic integrity (Fahy, 1982; Fahy and Nixon, in press). In this context hatchery crosses must be a relatively crude exercise. Ryman and Stahl (1980) examined the consequences of inbreeding in hatchery stocks of brown trout, reported thus and recommended that no stock should be founded or perpetuated using less than approximately 30 parents of the least numerous sex in any generation. Hatchery activities for sea trout in Ireland have been conducted on less rigorous lines.

Distinctive characteristics of importance to sea trout for which there is evidence of a genetic mechanism include:

Longevity: The only long lived stock in Ireland occurs in the Waterville Fishery in Co. Kerry although there is evidence that a similar stock occurred at some time in the Bundorragha system in Co. Mayo (Fahy, 1978).

Fecundity: Short lived sea trout stocks may have a slight tendency towards early maturation (Fahy, 1978).

Homing behaviour: Specific stocks have capabilities to exploit inshore coastal or deeper waters (Svardson and Fagerstrom, 1982).

Conclusions

The present exploitation of sea run *Salmo trutta* is mainly in wild sport fisheries and this is also their forseeable future.

The use of artificially propagated sea trout to supplement natural shortfalls in production is not considered viable, nor is re-stocking on a put-and-take basis. One of the few exceptional circumstances might be where a widespread and persistent environmental contamination occurs. Even then however a natural immigration and regeneration of the stocks would be the desirable means of achieving recovery. Failing this a stock from as close to the affected area as possible should be introduced.

In order to anticipate the replacement of decimated stocks consideration should be given to the most effective way of artificially propagating sea trout. Although much information has been amassed on the hatchery rearing of salmon, comparable data are not available on the smaller species. Collection of detailed facts and figures by the Salmon Research Trust of Ireland is in progress but these, so far, do not permit recognition of problems or advantages peculiar to sea trout.

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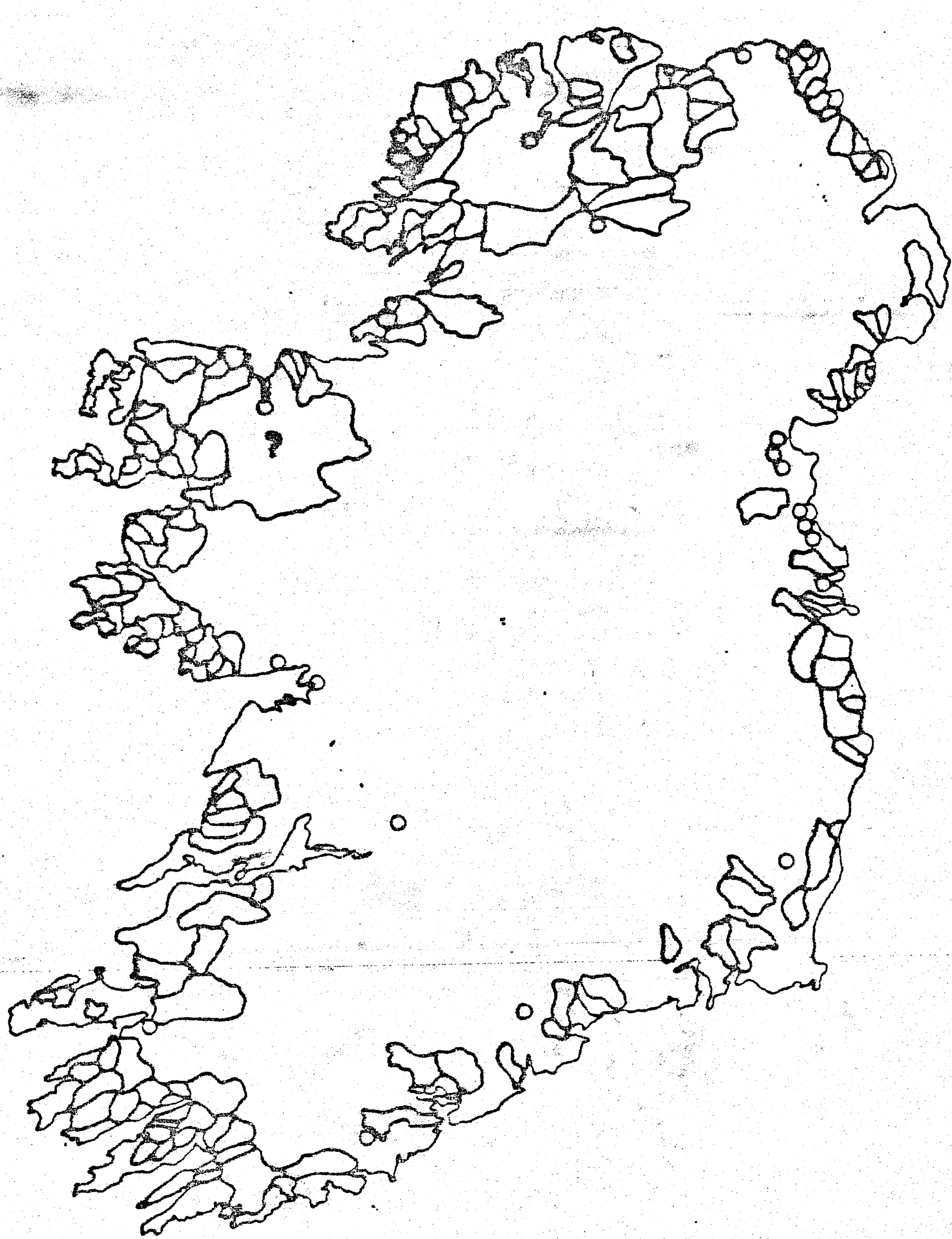

Fig. 1 Records for the occurrence of sea trout in Ireland. The heavy lines enclose catchments and sub-catchments in which the fish probably or certainly spawn. The query indicates that although sea trout have been reported in a system their status there is uncertain. Circles mark the occurrence of the fish in the lower reaches of larger rivers in which they probably do not spawn.

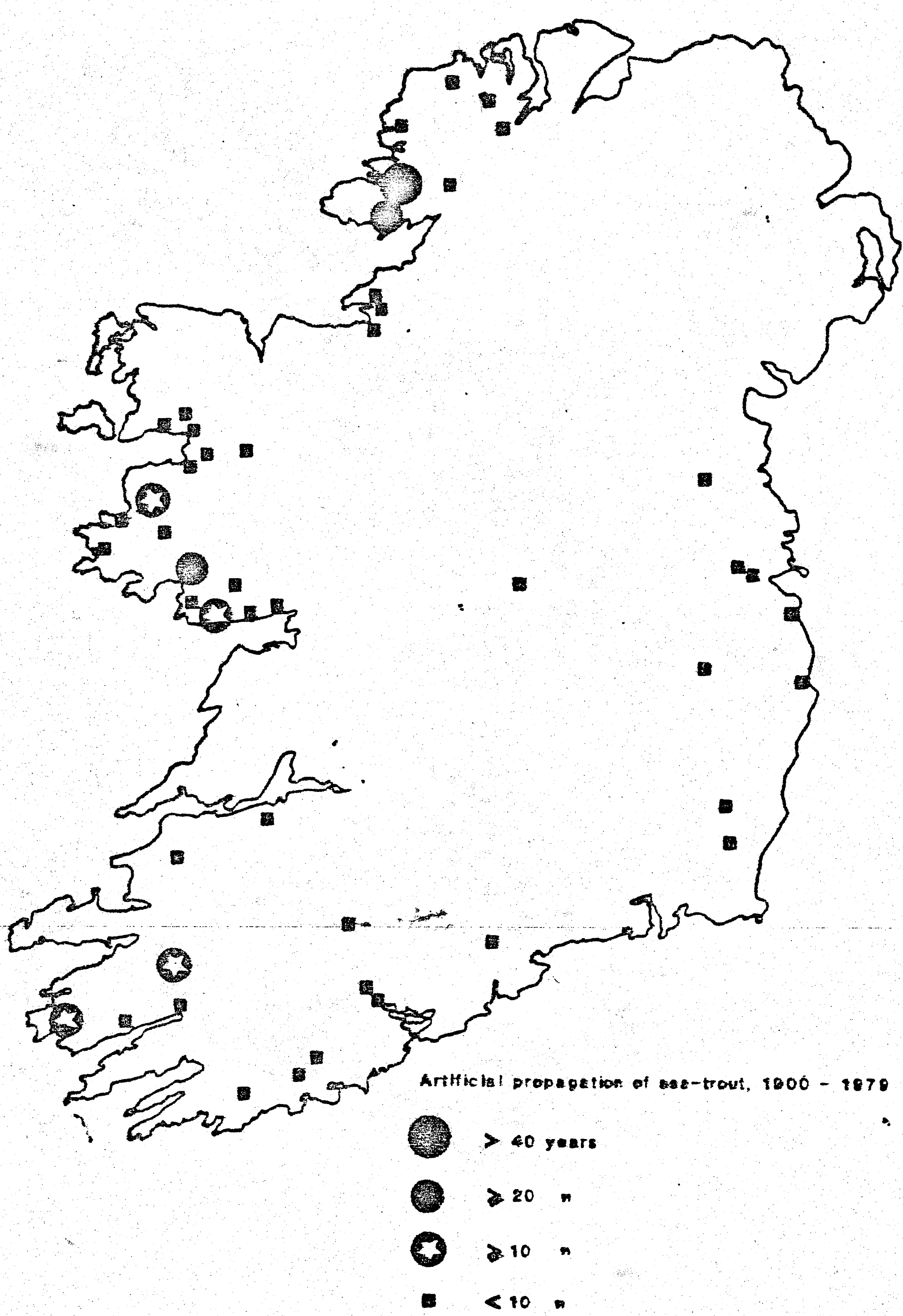

Fig. 2 Sites at which the artificial propagation of sea trout was undertaken, rated according to the ~~extent~~ duration of their use (source: Department responsible for fisheries).

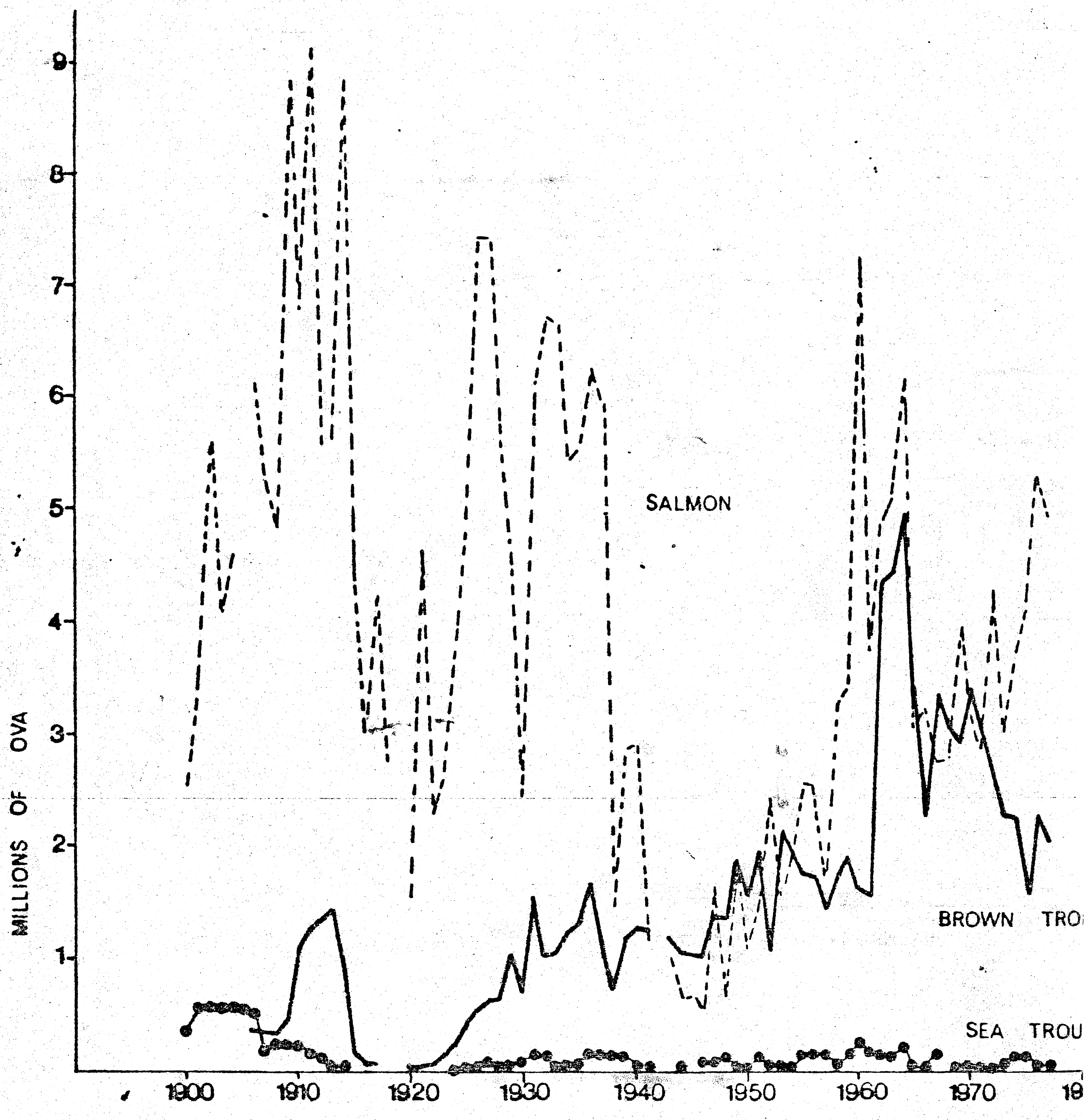

Fig.3 The total output of salmonid ova from Irish hatcheries between 1900 and 1978 (source: Department responsible for Fisheries).