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Change in weight of Atlantic salmon at West Greenland and its relationship to numbers of fish caught per tonne *

by

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Abstract

The increase in weight of Atlantic salmon of North American and European origin caught at West Greenland is correlated with date of capture. Linear regressions calculated for 1972-73 data showed 28% less salmon were caught per tonne in a fishery with a mean date of 13 October compared to a mean date of 30 July. This effect is assumed to occur in all years and for all sea ages. Losses from the West Greenland fishery to home waters stocks and fisheries has increased in years with earlier harvest dates as opposed to those with later harvest dates. Recent trends have been for earlier opening and earlier closing dates for the West Greenland fishery.

Introduction

Stocks of Atlantic salmon migrating annually to West Greenland spend 3-4 months there feeding on capelin, sand launce, amphipods, other invertebrates and fish fry (Lear 1979). Their increase in weight is quite rapid, Munro and Swain (1979) noting that 1-sea-winter salmon caught during October 1-15 were 0.65 kg heavier than fish caught during August 1-15, 1972.

This fact was not considered when the 1974 ICES/ICNAF Joint Working Party on North Atlantic Salmon met to assess the losses to homewaters stocks and fisheries; because at that time the fishery ran from August through to November. Since then, the foreign drift netters have been excluded from the West Greenland fishery and the catch by Greenlandic vessels has been restricted to 1,191 tonnes by International Agreement. To ensure that the quota is equitably distributed amongst the communities along the west coast of Greenland the fishery has been regulated to open in early August and to close in early September when the quota is reached (Anon. 1979). Since the quota is regulated by catch weight and salmon caught earlier in the season are lighter, the numbers of salmon caught per tonne of fish landed could be significantly affected.

This paper analyzes the growth of salmon at West Greenland and demonstrates the effect the timing of the fishery could have on the numbers of salmon caught there.

*also CAFSAC (Canadian Atlantic Fisheries Scientific Advisory Committee) Res. Doc. 80/9

Methods

The whole weights examined in this paper were collected from salmon caught in July to October of 1972-73 by research vessels operating along the coast of West Greenland. The 1972 data was previously reported by Munro and Swain (1979), Lear and Sandeman (1974) and Reddin and Burfitt (1979). The 1973 data was collected by H. Lear (unpublished data) and reported by Reddin and Burfitt (1979). The 1969-78 mean proportion of 41% (59% European) by numbers of North American origin salmon is used in this analysis (Reddin, Burfitt and Lear 1979).

The duration of time that each salmon had spent at sea before capture was derived by assuming a mean date for smolt migration of June 1 in the year previous to its capture at West Greenland. The year was divided into periods of two weeks to facilitate data anlaysis as follows: 1. July 30-August 12 (days 425-438); 2. August 13-26 (days 439-452); 3. August 27-September 9 (days 453-466); 4. September 10-23 (days 467-480); 5. September 24-October 7 (days 481-494) and 6. October 8-21 (days 495-508). Linear regressions by the method of least squares were calculated for mean weight on mean day within each of these periods for 1-sea-winter salmon of which 256 were North American and 574 European origin. Linear regressions of weight on time were calculated separately for data collected at West Greenland in 1972 and 1973 for 1-sea-winter salmon of North American and European origin because of the known difference in mean weights (Reddin and Burfitt 1979).

Results and Discussion

The data for individual years were combined (Fig. 1) because the results of regressions calculated from 1972 and 1973 data showed no significant differences when compared by ANCOVA in either slopes (North American, $P > 0.10$; European, $P > 0.05$) or means (North American, $P > 0.25$; European, $P > 0.10$).

The mean whole weights of 1-sea-winter salmon of North American origin caught at West Greenland (1972-73) increased significantly by 0.60 kg from day 434 (8 August) to day 500 (13 October) ($t = -4.11$, $P < 0.01$). A linear regression of weight on time for these salmon was positively correlated and proved to be significant at less than the 5% level (Fig. 1).

The mean weights of 1-sea-winter salmon of European origin caught at West Greenland (1972-73) increased significantly by 1.05 kg from day 433 (7 August) to day 500 (13 October) ($t = -4.72$, $P < 0.01$). A linear regression of weight on time for these salmon was also positively correlated and proved to be significant at less than the 1% level (Fig. 1).

The data from other years supported this trend although the series was not a long enough to confirm it. There is no reason to suspect that this would not be the case for both North American and European salmon in all years. It can also be assumed that the weight of salmon of other sea age groups caught at West Greenland also increases with time spent at West Greenland.

Because the weights of both European and North American 1-sea-winter salmon are positively correlated with time at West Greenland, the number of 1-sea-winter salmon caught per tonne decreases with date of capture for both North American and European origin salmon (Fig. 2). In 1978, the exploited stock consisted of 97.9% 1-sea-winter salmon, 1.0% 2-sea-winter salmon, and 1.1% previously spawned salmon (Reddin and Burfitt 1979). The other sea ages would have contributed less than 3% to the landed catch; thus losses of 1-sea-winter salmon are indicative of losses in the total catch. If it is assumed that the proportions of North American and European fish remain constant with time and only the effect of the decrease in number of fish harvested per tonne because of this weight increase is considered; it is clear that the losses to North American and European home waters stocks and fisheries decreases with date of harvest at West Greenland. An estimate of this loss would be the difference in numbers of fish harvested between mean dates of the fishery. For example, a mean date of 13 October would have harvested 28% less fish per tonne caught than one with a mean date of 30 July (Fig. 2), thus 209 European and 145 North American origin salmon per tonne were harvested on 30 July and 149 European and 104 North American orign salmon per tonne were harvested on 13 October. Obviously, this is an extreme example because the mean dates of the fishery have never been this widely separated; but as total bimonthly landings are not available for most years it is difficult to give a more realistic example. However, it demonstrates that an important consideration in any assessment of the effects of the West Greenland fishery on homewaters stocks and fisheries would be the date of the fishery at West Greenland.

The increase in weight of salmon with time has been recognized as fact by the Ministry for Greenland. Some elements for regulating the salmon fishery at West Greenland by this Ministry include "recognizing that a total catch of about 1,191 tonnes would account for less fish if the mean weight increased, it was considered advisable to introduce an opening date for the fishery" (Anon 1979). So that all fishermen will have an equal opportunity to share in the catch, the quota has been divided into a free quota of 959 tonnes (1979); around 900 tonnes in other years, and the remainder of the quota is reserved for the small boat fishermen. In 1975, the opening date for the free quota was 20 August (Anon 1979), and the closing date was 12 September. In 1979, the opening date for the free quota was 1 August (some southerly areas opened 20 July) and the closing date was 27 August. The 1975 fishery would have harvested 9% less fish per tonne of 1SW salmon caught than the 1979 fishery, assuming the relation of weight on time was the same as in 1972-73.

Recent trends have been for earlier opening and earlier closing dates for the West Greenland salmon fishery. In 1971, before the quota was established fish were caught from August through to November. The closing dates for the free quota have varied from 25-30 September in 1975 to 27 August in 1979. Similarly, the opening dates for the free quota have varied 20 August in 1975 to 1 August 1979 (Anon 1979). Thus, more fish have been caught each year to fill the quota and assuming that all other factors are equal; losses to homewaters stocks and fisheries in numbers of fish harvested per tonne of salmon landed at West Greenland have also increased yearly since 1975. By delaying the harvest date this trend could be reversed and the effect of the West Greenland fishery on homewaters stocks and fisheries decreased without changing the quota of 1191 tonnes.

Conclusions

1. North American and European origin Atlantic salmon increase in weight with date of capture at West Greenland.

2. In 1975, West Greenland fishery harvested 9% fewer fish per tonne of 1-sea-winter fish landed than it did in 1979 because of the later harvest date.

3. Recent trends have been for earlier opening and earlier closing dates for the West Greenland fishery.

4. Losses of salmon from the West Greenland fishery to homewaters stocks and fisheries has increased in years with earlier harvest dates as opposed to those with later harvest dates.

5. An assessment of the effects of the West Greenland fishery on homewaters stocks and fisheries should include consideration for date of harvest at West Greenland. Losses to homewaters stocks and fisheris can be decreased by delaying the opening date of the West Greenland fishery without changing the quota.

References

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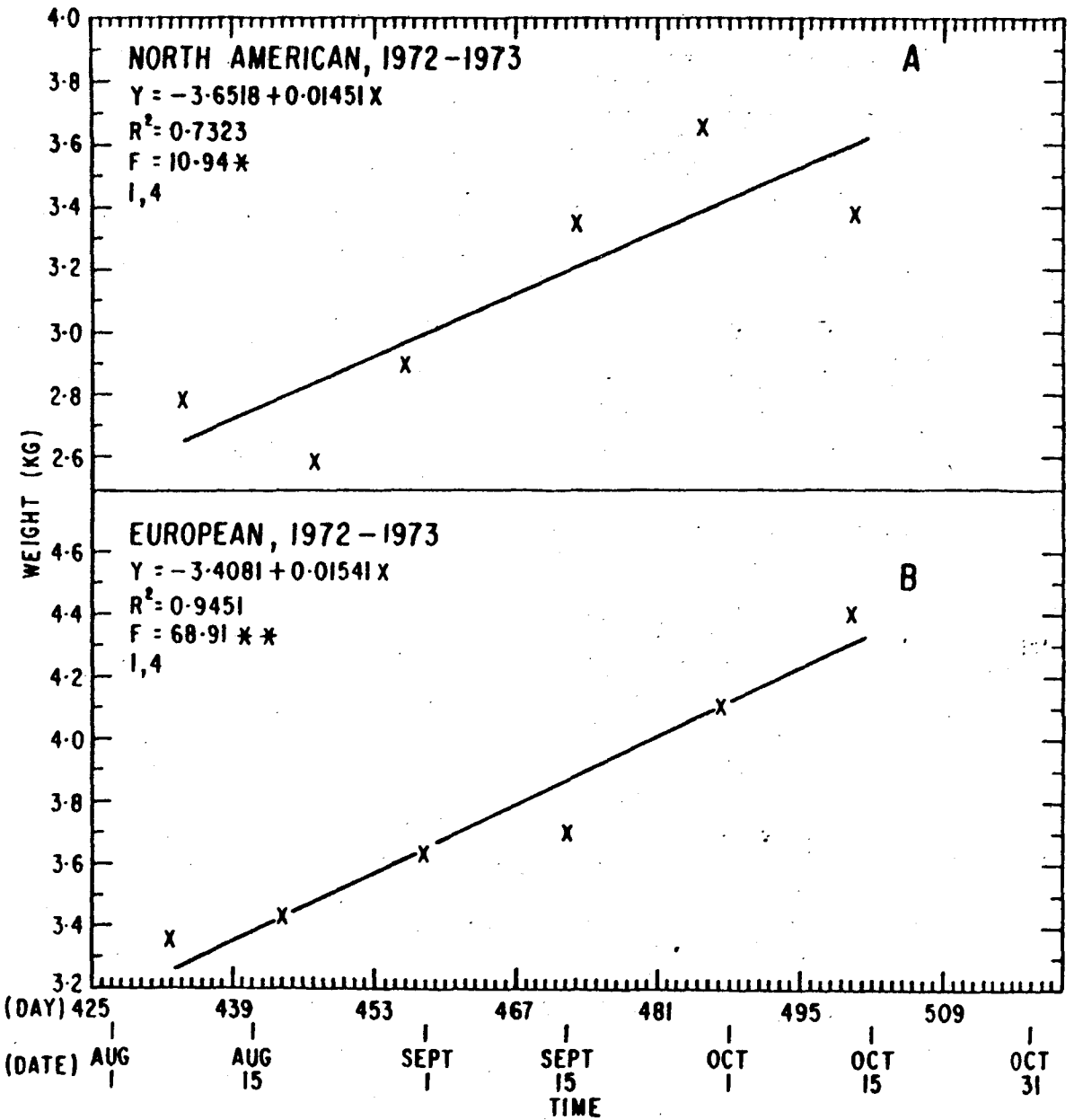

Fig. 1. The increase in weight of one-sea-winter salmon caught at West Greenland in 1972-73. A-salmon of North American origin B-salmon of European origin.

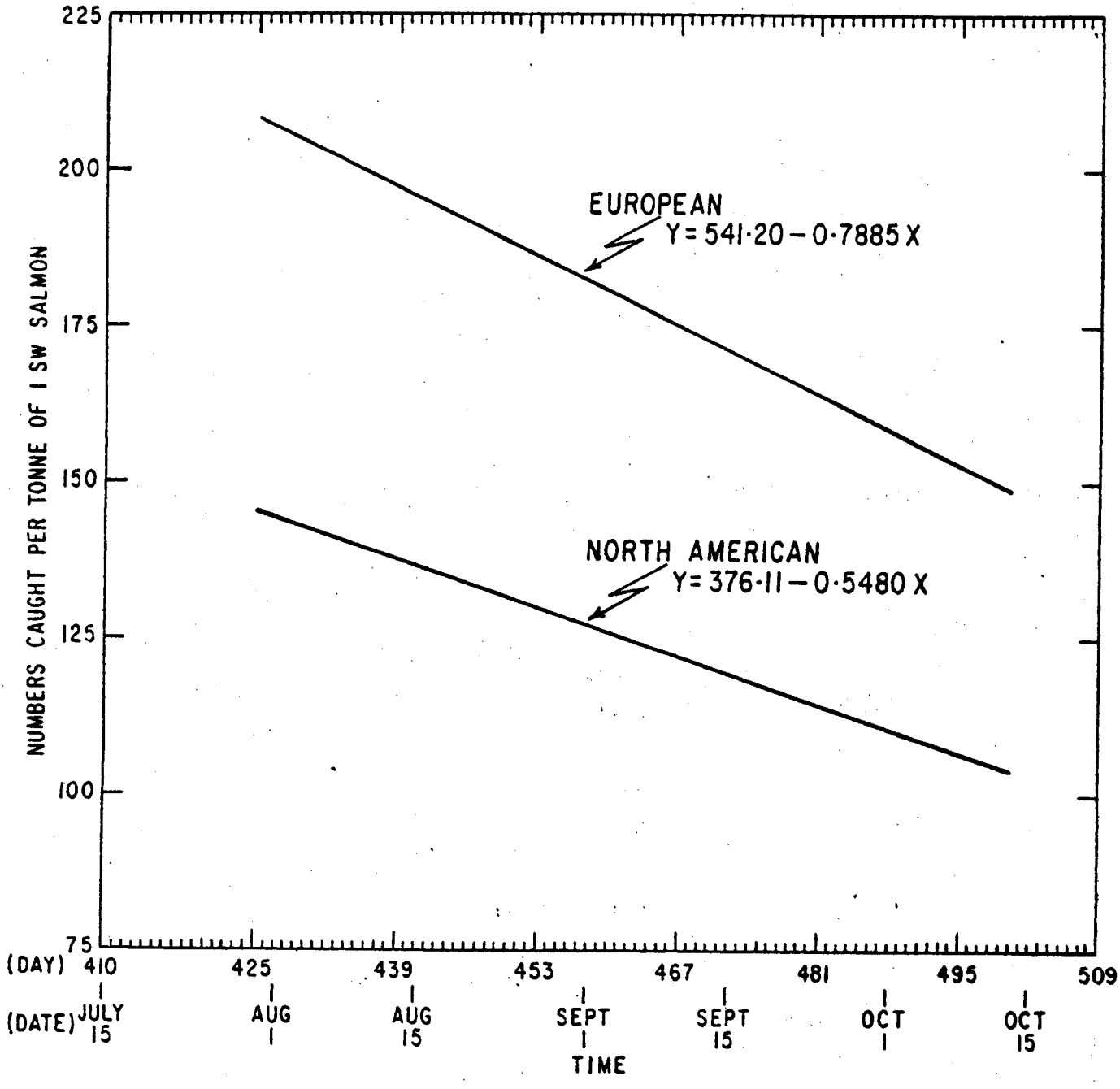

Fig. 2. The decrease in numbers caught with each tonne of one-sea-winter salmon landed at West Greenland assuming a proportion of 41:59 for numbers of salmon of North American:European origin. This does not consider any tendency for North American:European proportion in the catch to vary with time due to a change in the relative weights.