REFINEMENT OF THE ESTIMATION OF CATCH OF NORTH AMERICAN
AND EUROPEAN ORIGIN SALMON AT WEST GREENLAND

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Introduction

All derivations of the North American origin fish in the Atlantic
salmon catch at West Greenland have strictly been on the basis of weight
(Reddin, Burfitt and Lear 1979), even though the identification of in-
dividuals by continent of origin is in numbers of fish. It is known
that weights of North American and European fish differ, North American
salmon generally being smaller than their European counterparts. This
could have a considerable effect on the actual weight of North American
salmon or European salmon caught in the commercial fishery of West
Greenland. This paper presents a new technique in calculating weights
of the North American and European components in the salmon catch at
West Greenland.

Methods

The data used were collected by research vessel sampling during August
1978, at West Greenland. The continental origins of salmon caught were
identified by using a discriminant function developed by Lear and Sandeman
(1974). The analysis of the 1978 data was presented by Reddin, Burfitt
and Lear (1979).

The parameters used were:

C_G - the catch in numbers of salmon at West Greenland

Y_E - the catch in weight (kg) of European origin
salmon at West Greenland

Y_N - the catch in weight (kg) of North American
origin salmon at West Greenland

Y_G - the catch in weight (kg) at West Greenland

Y_N' - the catch in weight of North American origin
salmon as derived by percent

Y_E' - the catch in weight of European origin salmon
as derived by percent

N_E - the number of European origin salmon caught at West Greenland

N_N - the number of North American origin salmon caught at West Greenland

P_E - the proportion, in numbers, of European origin salmon at West Greenland

P_N - the proportion, in numbers, of North American origin salmon at West Greenland

$\overline{W}_N$ - mean weight (kg) of North American origin salmon at West Greenland

$\overline{W}_E$ - mean weight (kg) of European origin salmon at West Greenland

$\overline{W}_G$ - mean weight (kg) of salmon at West Greenland

Wherever possible the 95% confidence interval is presented in parentheses (upper, lower).

Results and Discussion

The following is an example calculation using data from ICNFA Statistical Division 1B:

$$C_G = Y_G \times 1/\overline{W}_G$$

$$= 238,000 \times 1/3.41$$

$$= 69,795 \text{ salmon caught in 1B in 1978.}$$

Since

$P_E = 0.531 \ (0.608, \ 0.454)$ and $P_N = 0.469 \ (0.546, \ 0.392)$,

therefore

$N_E = C_G \times P_E$ and $N_N = C_G \times P_N$

$= 69,795 \times 0.531$ $= 69,795 \times 0.469$

$= 37,061$ salmon $= 32,734$ salmon.

The catch of European origin fish are all 1-sea-winter salmon; but the North American origin fish consist of 71 1-sea-winter fish, 3 multi-sea-winter fish and 1 previous spawner.

Therefore

$$Y_E = N_E \times \overline{W}_E \qquad \text{and} \qquad N_{N-1SW} = N_N \times P_{N-1SW}$$

$$= 37,061 \times 3.72 \text{ kg} \qquad\qquad\qquad = 32,734 \times 71/75$$

$$= 137,867 \text{ kg} \qquad\qquad\qquad\qquad = 30,988 \text{ salmon}$$

$$N_{N-MSW} = N_N \times P_{N-MSW}$$

$$= 32,734 \times 3/75$$

$$= 1,309 \text{ salmon}$$

$$N_{N-PS} = N_N \times P_{N-PS}$$

$$= 32,734 \times 1/75$$

$$= 436 \text{ salmon}.$$

Therefore

$$Y_N = N_N = N_{N-1SW} \times \overline{W}_{N-1SW} + N_{N-MSW} \times \overline{W}_{N-MSW} + N_{N-PS} \times \overline{W}_{N-PS}$$

$$= 30,988 \times 2.98 + 1,309 \times 5.37 + 436 \times 2.2$$

$$= 92,344 \text{ kg} + 7,031 \text{ kg} + 960 \text{ kg}$$

$$= 100,335 \text{ kg}$$

$$Y'_E = Y_G \times P_E \qquad\qquad \text{and} \qquad\qquad Y'_N = Y_G \times P_N$$

$$= 238,000 \times 0.531 \qquad\qquad\qquad\qquad = 238,000 \times 0.469$$

$$= 126,378 \text{ kg } (144,704, \ 108,052) \qquad = 111,622 \text{ kg } (129,948, \ 93,296)$$

Although using weight instead of numbers leads to an estimate of the European component of 126,378 kg instead of 137,867 kg, and an estimate of the North American component of 111,622 kg instead of 100,335 kg, the results are not significantly different (p>0.05). In spite of this, it is clear that using weight instead of numbers is incorrect and does overestimate the North American component and underestimate the European. The 95% confidence interval on the "by weight" method is 144,704 to 108,052, and clearly 137,867 kg is within that range, as is the North American proportion. Thus, there is very little, if any, advantage in using this more complicated method in evaluating past fisheries. But there may be distinct advantages to consideration of potential fisheries models where slight refinements in one aspect may be significant when viewed in terms of the whole model.

References

Reddin, D.G., R.F. Burfitt and W.H. Lear. 1979. The stock composition of Atlantic salmon off West Greenland and in the Labrador Sea in 1978 and a comparison to other years. CAFSAC Res. Doc. 79/3.

Lear, W.H. and E.J. Sandeman. 1974. Use of scale characters and a discriminant function for identifying continental origin of Atlantic salmon. ICNAF Res. Doc. 74/40, Ser. No. 3226, 12 p.