

Temperature of the Waters off South-West and
South Greenland during the International
Salmon Tagging Experiment in 1972

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Abstract. The sea surface temperatures in the region during the time of the Experiment are presented, and the long-term variation of temperature is considered. The development of the Mixed Layer Depth during the period of the Experiment is demonstrated, and a possible connexion between the value of this parameter and the catch per unit effort is suggested.

During the ICES/ICNAF Salmon Tagging Experiment in 1972 surface temperatures were measured and BT casts made by the research vessels involved, viz., "Adolf Jensen", "Cameron", "Cryos" and "Scotia", from beginning of August to mid-October. The following is a preliminary note based on these and other data.

Surface temperatures

The number of observations of surface temperature made in connexion with the Experiment is rather small. However, the Danish Meteorological Institute has kindly placed at my disposal the surface temperatures collected by Danish vessels as part of the marine meteorological observation scheme. On the basis of this material, as well as the above mentioned surface temperatures collected by research vessels, the surface values of the BT casts, and other data available in the ICES Service Hydrographique monthly means of the surface temperature have been calculated for 1°-squares of the standard areas A₁ (60°-70°N, 50°-58°W) and B (55°-63°N, 40°-50°W); see Fig.1.

For these areas surface temperatures are available back to 1876 and monthly anomalies, based upon the period 1876-1915 and averaged over each of the areas A₁ and B, have been calculated for the years 1876-1971 and published in the "Annales Biologiques". The surface temperatures for 1972 mentioned above have now been dealt with in the same way. The resulting monthly anomalies are listed in Table 1.

Table 1. Monthly anomalies ($\Delta^{\circ}\text{C}$) and numbers (n) of observations of the sea surface temperature in Areas A₁ and B during 1972.

	A ₁		B	
	Δ	n	Δ	n
March	-2.0	7	-1.4	50
April	-0.2	49	-0.4	67
May	-0.2	108	-0.6	113
June	-1.0	130	-0.8	136
July	-1.5	97	-1.9	115
August	-0.8	226	-1.2	111
September	-0.3	199	-1.0	124
October	0.0	88	-0.4	109
November	-1.1	20	-1.2	103
December			-1.2	21

As appears from Table 1 positive anomalies are not met with in any of the months, neither in A₁ nor in B. Obviously very cold conditions existed in these regions in 1972, in accordance with the findings of Hermann, Lenz and Blacker (1973).

To tie up the temperatures in 1972 with those of earlier years the anomalies for each of the months April-November (area A₁) or March-November (area B) in the years 1946-1972 have been plotted in Fig. 2a,b. A conspicuous feature for all months is the deterioration that sets in about 1967. In 1969 negative anomalies dominate, and even more so in 1970. In 1971 there is some improvement. In 1972, however, temperatures are again low.

The trend of the temperature for the whole period 1876-1972 is seen from Fig. 3 where 5-year overlapping means of annual anomalies are plotted for the areas A₁ and B. The most characteristic feature is that the temperature, after having fluctuated during the period 1876-1920, rises abruptly: about $1\frac{1}{2}^{\circ}$ in less than 10 years. With the possible exception of the war years, from which no data are available in this series, the temperature anomaly, although declining somewhat after 1930, remained positive for a long period of years. It even increased somewhat in the late fifties and the first part of the sixties, but then from the late sixties declined fairly abruptly.

Sub-surface temperatures

Some information on the sub-surface temperature conditions in the region during the tagging experiment is available from the BT casts made from the research vessels involved. From the BT curves the values of the thickness of the homogeneous upper layer, the Mixed Layer Depth (MLD), have been determined as this parameter may be of some interest seen in relation to the figures obtained for catch per unit effort. For determination of MLD the water was considered mixed if the approximate vertical temperature gradient was less than 0.1°C in any 15 metres.

In order to see whether a variation of MLD with time can be demonstrated the values were grouped according to week numbers:-

- I. Week nos. 32-34, i.e., 30/7-19/8
- II. " " 35-36, " , 20/8- 2/9
- III. " " 37-39, " , 3/9-23/9

The MLD values for these groups are indicated in Figures 4a, 4b, 4c. There is an obvious increase of the MLD values from Group I to Group II, and perhaps a further small increase from Group II to Group III which latter, however, contains relatively few values only.

The development and deepening of a homogeneous layer is promoted by autumnal cooling. However, the reason for the rather sudden intensification of it in weeks 35-36 should perhaps partly be sought in some spells of fairly strong winds (5-7 Beaufort) in these weeks.

As a mixed layer develops and deepens the salmon may be expected to spread in it. As a matter of fact a drop of catch per unit effort from the weeks 32-34 to the weeks 35-36, and a further drop in the weeks 37-39, was demonstrated by Christensen and Lear (1974, Table 8). It is suggested therefore, that the variation of the MLD be taken into consideration when explanations for variations in salmon catch per unit effort are sought.

References

- Christensen, O. and W.H. Lear. 1974: Distribution and abundance of salmon at West Greenland.
- ICNAF Res.Doc.74/43.
- Hermann, F., W. Lenz and R.W. Blacker. 1973: Hydrographic conditions off West Greenland during 1972.
- ICNAF Res.Doc.73/53.

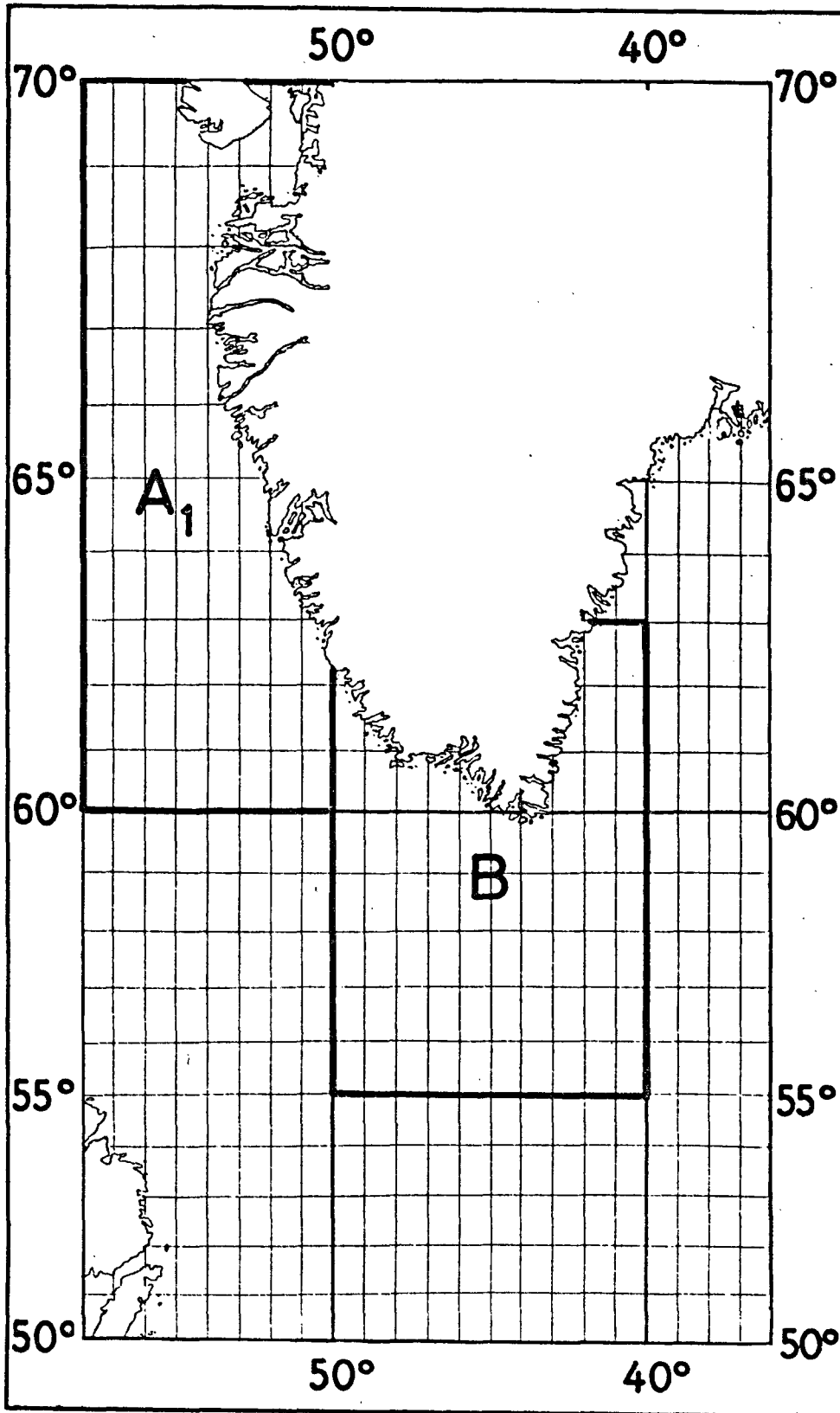


Figure 1

Fig. 2a

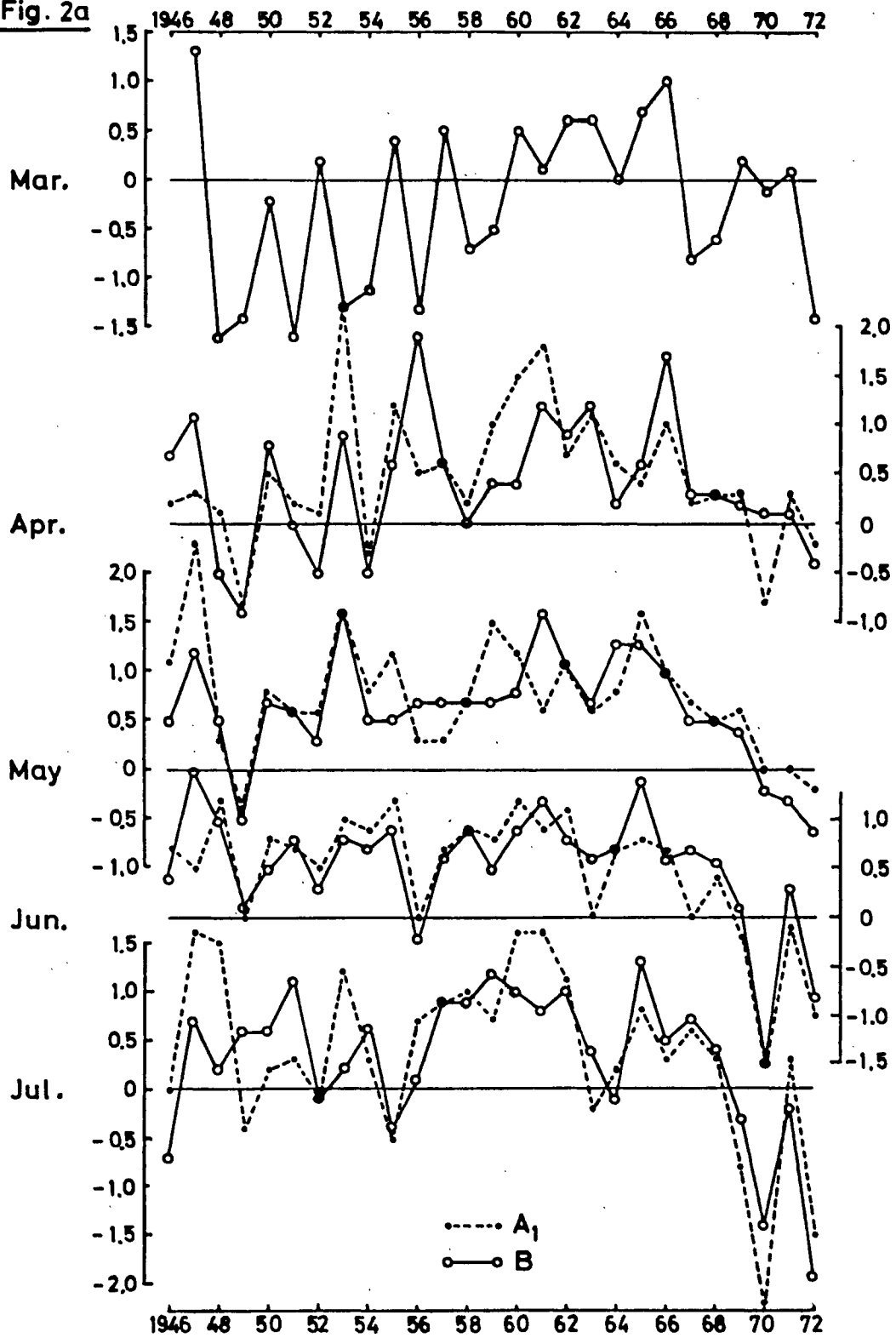
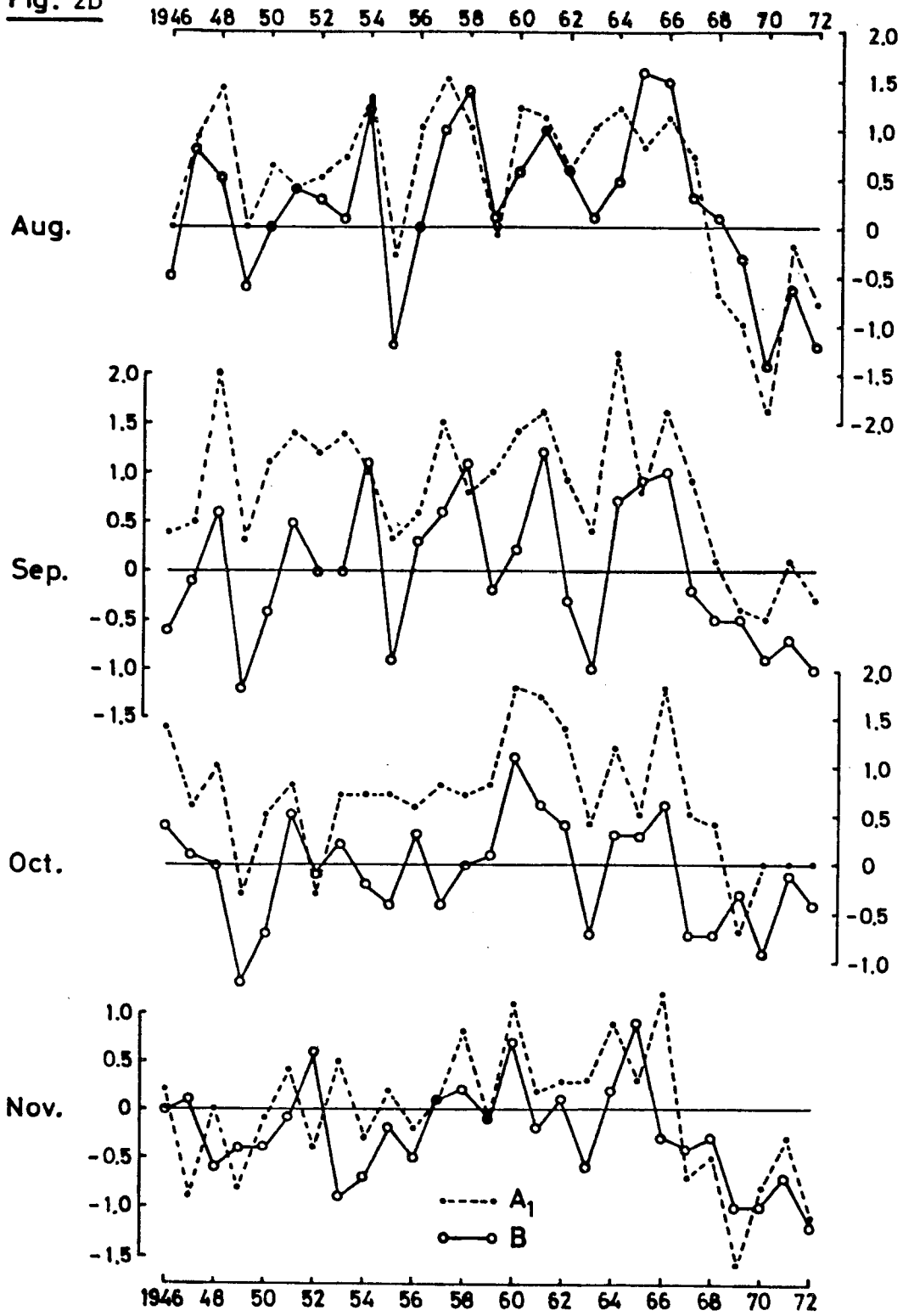


Fig. 2b



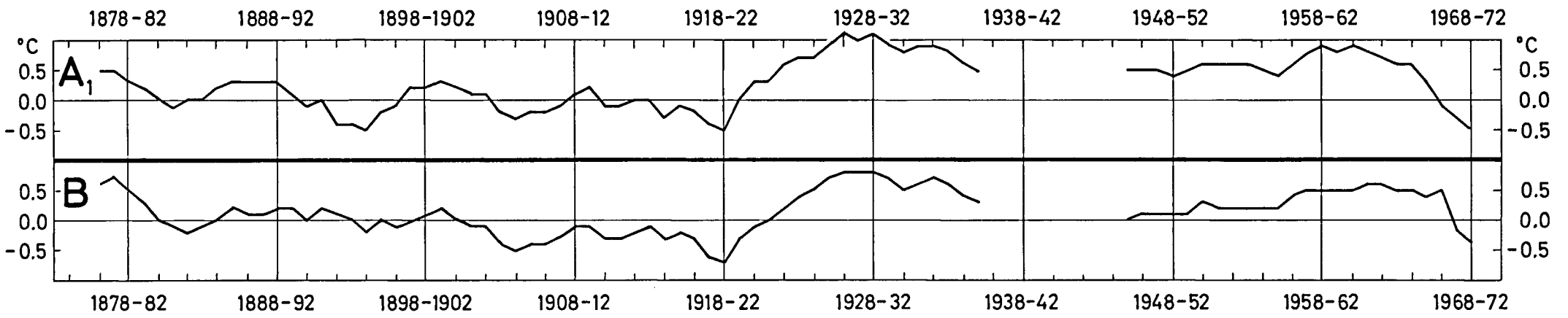


Figure 3

