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The herring population of the St. Lawrence Estuary

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Introduction

Herring landings in the Isle-Verte region of the St. Lawrence Estuary (Fig. 1) have averaged 330 tons since 1964. There is considerable year to year variation in reported catches; the trend appears to be downward but is insignificantly different from zero. Although catches are low relative to other areas in the Gulf of St. Lawrence, the fishery is important to the local economy since most of the catch is sold locally either fresh or smoked. Fishing in the area, concentrated between Cacouna and Trois-Pistoles (Fig. 2), starts at the beginning of May, peaks later in May and declines rapidly in June. Catches are low throughout the rest of the year (Fig. 3). Most of the catch is taken by weirs, of which there are 39 in the area. Gillnets are also used but probably supply less than 20% of the total catch.

Côté (unpublished data) using meristic and morphometric characteristics advanced the hypothesis that herring which spawn in the Isle-Verte area are part of a local population.

In May and June 1978, a sampling and tagging program was conducted by the Research Branch of the Quebec Region of Fisheries and Oceans Canada. A total of 29 875 fish were tagged using a Floy Tag # FD68C anchor tag. Fish were caught in a weir, placed in a free-flooding barge, tagged and released.

Results

One of the main characteristics of spring-spawning Isle-Verte herring is their low length-at-age values relative to Gulf of St. Lawrence herring (Fig. 4). Knight's (1969) equation for growth rate, where:

$$B = KL_{\infty}\ e^{-K(\bar{t}-t_o)}$$

B = growth rate at time t

$L_{\infty}\ t_o$ = von Bertalanffy's constants

K = Brody's growth coefficient

$\bar{t}$ = an arbitrary reference time

produces values of B for spring-spawned Isle-Verte herring higher than those for spring and autumn-spawned herring of the Gulf of St. Lawrence (Table 1) at ages higher than 3 years. Thus, differences in observed length-at-age are apparently the result of a slower growth rate in the pre-recruit ages.

One possible explanation for this phenomenon is slower growth of larvae. Able (in press) has shown that larvae in the St. Lawrence Estuary grew at a rate of .15 mm/day from June to October 1974 and at a rate of .17 mm/day from June to September 1975. Ware (MS 1977) mentioned .5 mm/day for spring-spawned larvae of the Gulf of St. Lawrence. Slower growth rate of the Isle-Verte larvae could be explained by lower water temperatures in that area compared to the temperatures on spawning grounds in the Gulf of St. Lawrence (Fig. 5).

Age Structure

The 1974 year-class accounted for 55% of the catch in 1978 (Fig. 6). This year-class was also the most important for spring-spawners in the Gaspé/ Chaleur-Bay area in 1977 (Winters MS 1978).

Migration

Tag returns (Fig. 7) showed an eastward migration after the spawning season. Between August and October, tagged fish were caught at various localities around the Gaspé Peninsula. Apparently, after spawning, herring of this population move towards the Gulf where they mix with herring of other populations on the feeding grounds (Messieh et al. in press). The observed migration corresponds with observations in earlier studies (Côté et Lamoureux, MS 1977) of "dwarf" herring (fish with relatively low size-at-age) in commercial catches during the summer and early fall off the Gaspé peninsula.

Biomass

Lacking the time series of data required for stock assessment by virtual population analysis, we used the method described by Schumacher and Eschmeyer (Ricker, 1975) where:

$$\frac{1}{N} = \frac{(M_t R_t)}{(C_t M^2{}_t)}$$

N = Population size

M_t = total marked fish at large at the start of the th day

C_t = total sample taken on day t

R_t = number of recaptures in the sample C_t.

This method gives us a value for N of 13 476 mt if we assume at least 30% immediate tagging mortality an estimate of 9 400 mt would be more accurate. Obviously this is a very rough estimate, particularly since migration into and out of the Isle-Verte area are both significant, so it should not be used for management purposes.

References

Able, K.W. in press. Ichthyoplankton of the St-Lawrence estuary: composition, distribution and abundance. J. Fish Res. Board Can.

Côté, G. et P. Lamoureux. MS 1977. Etude des populations de hareng (Clupea harengus harengus L.) de la péninsule gaspésienne en 1976. Direction des Pêches Maritimes, Québec, Cahier d'information No. 81: 29 p.

Knight, W. 1969. A formulation of the von Bertalanffy growth curve when the growth rate is roughly constant. J. Fish. Res. Board Can. 26 3069-3072.

Messieh, S.N., G. Côté et J. Boulva. In Press. La pêche du hareng de Gaspé. Naturaliste canadien

Ricker, W.E. 1975. Computation and interpretation of Biological Statistics of Fish Populations. Bull. Fish Res. Board Can. 191: 382 p.

Ware, D.M. MS 1977. The grouping of herring populations in the Southern Gulf of St. Lawrence. CAFSAC RES.DOC. 77/1.

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Age	Spring-spawned Gulf herring	Autumn-spawned Gulf herring	Spring-spawned Isle-Verte area herring
3	22,33	20,24	28,79
4	17,64	16,72	22,00
5	13,93	13,81	16,81
6	11,00	11,41	12,84
7	8,69	9,43	9,82
8	6,86	7,79	7,50
9	5,42	6,44	5,73
10	4,28	5,32	4,38

mm/year.

Table 1. Knight's rate of growth for different herring populations at various ages.

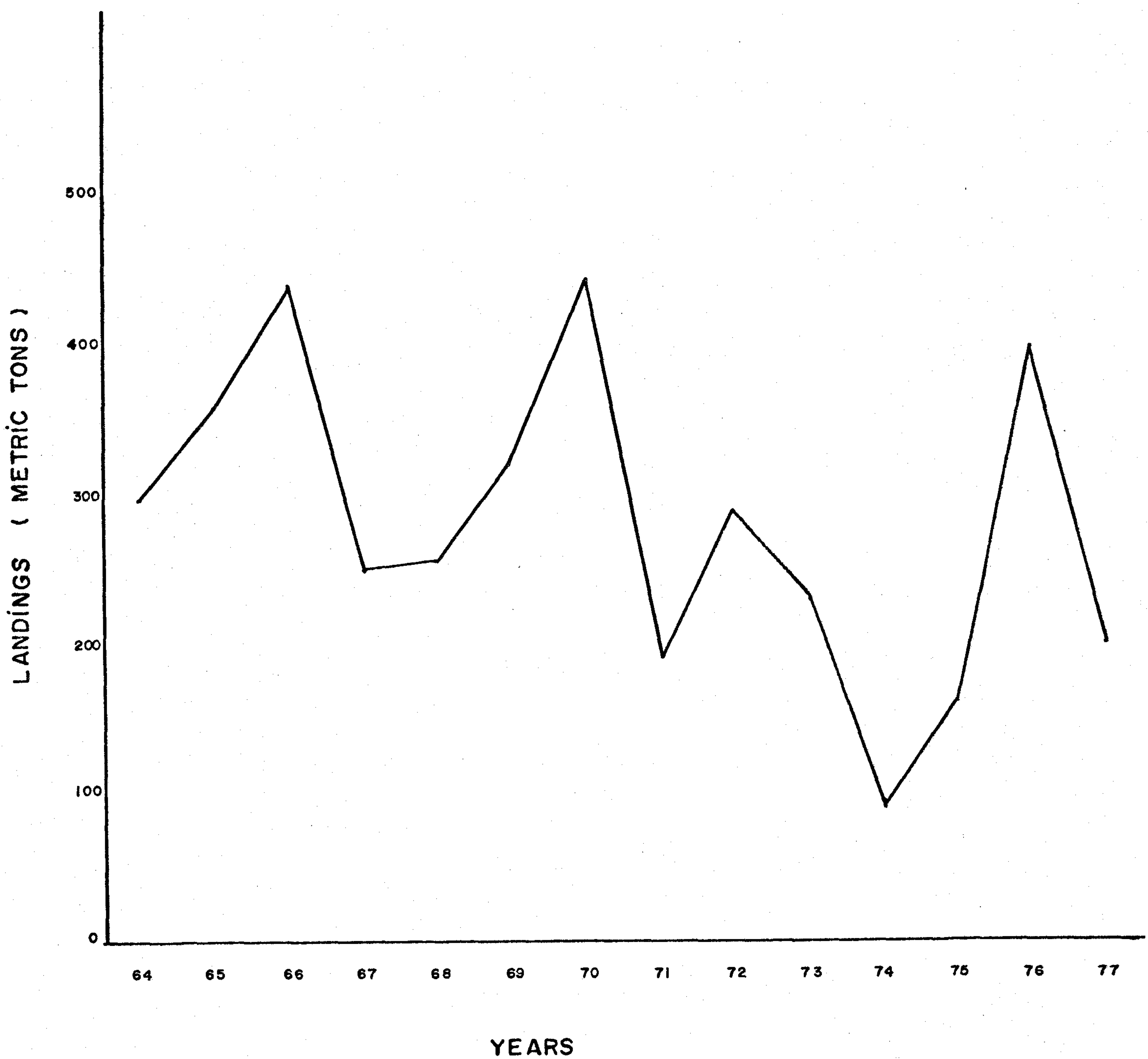

Figure 1. Herring landings in the Kamouraska, Rivière-du-Loup/Rimouski area since 1964.

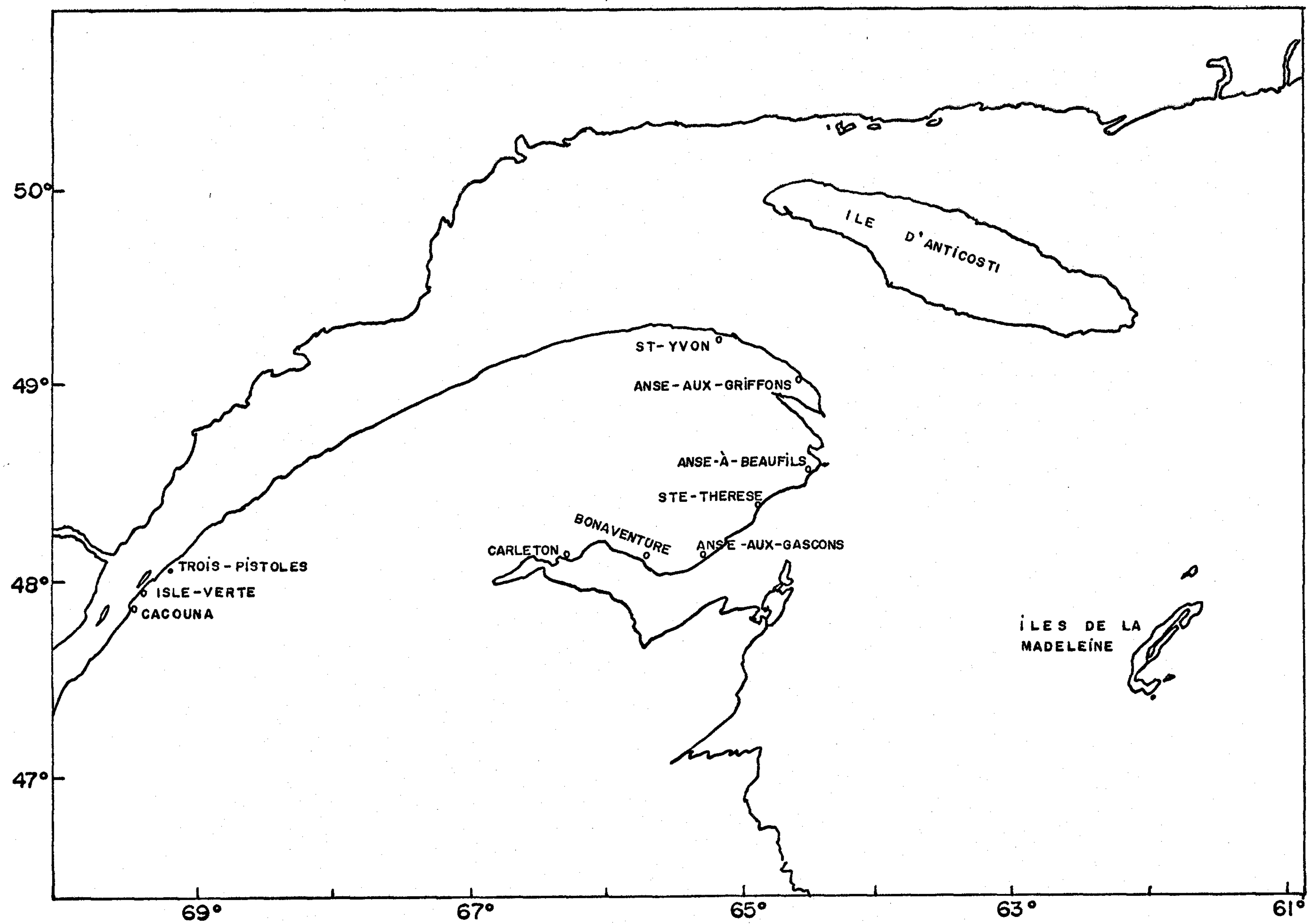

Figure 2. Lower St.Lawrence Estuary and Western Gulf, showing study area.

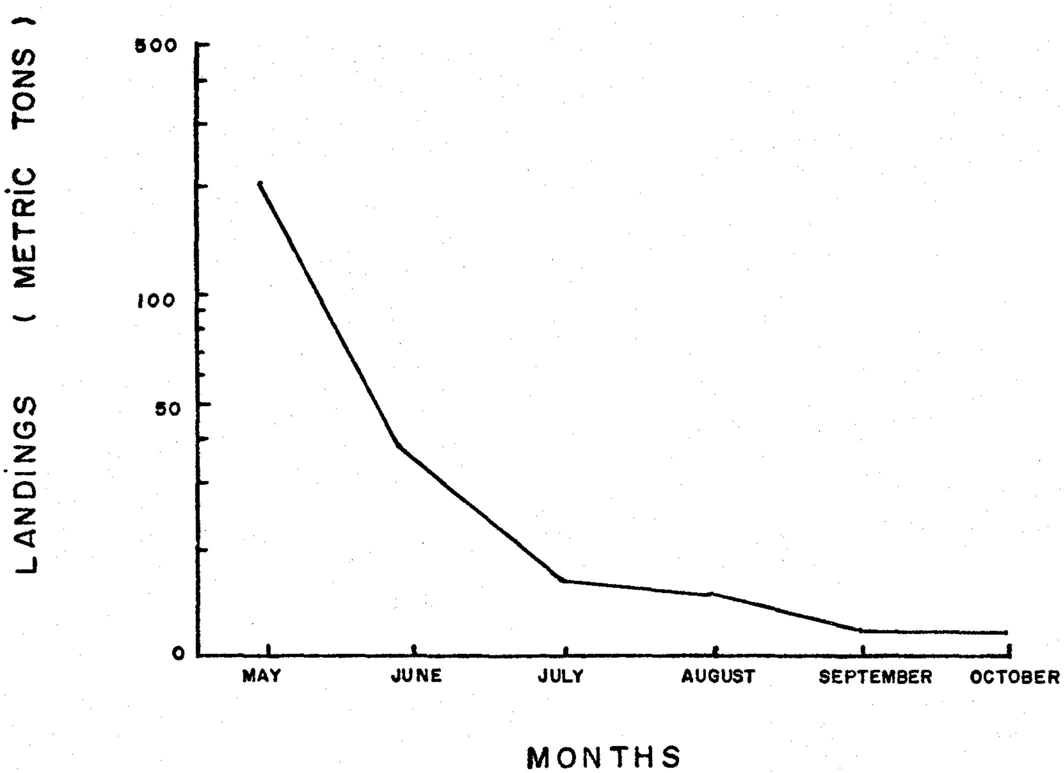

Figure 3. Mean monthly catches in the Kamouraska, Rivière-du-Loup/Rimouski area since 1964.

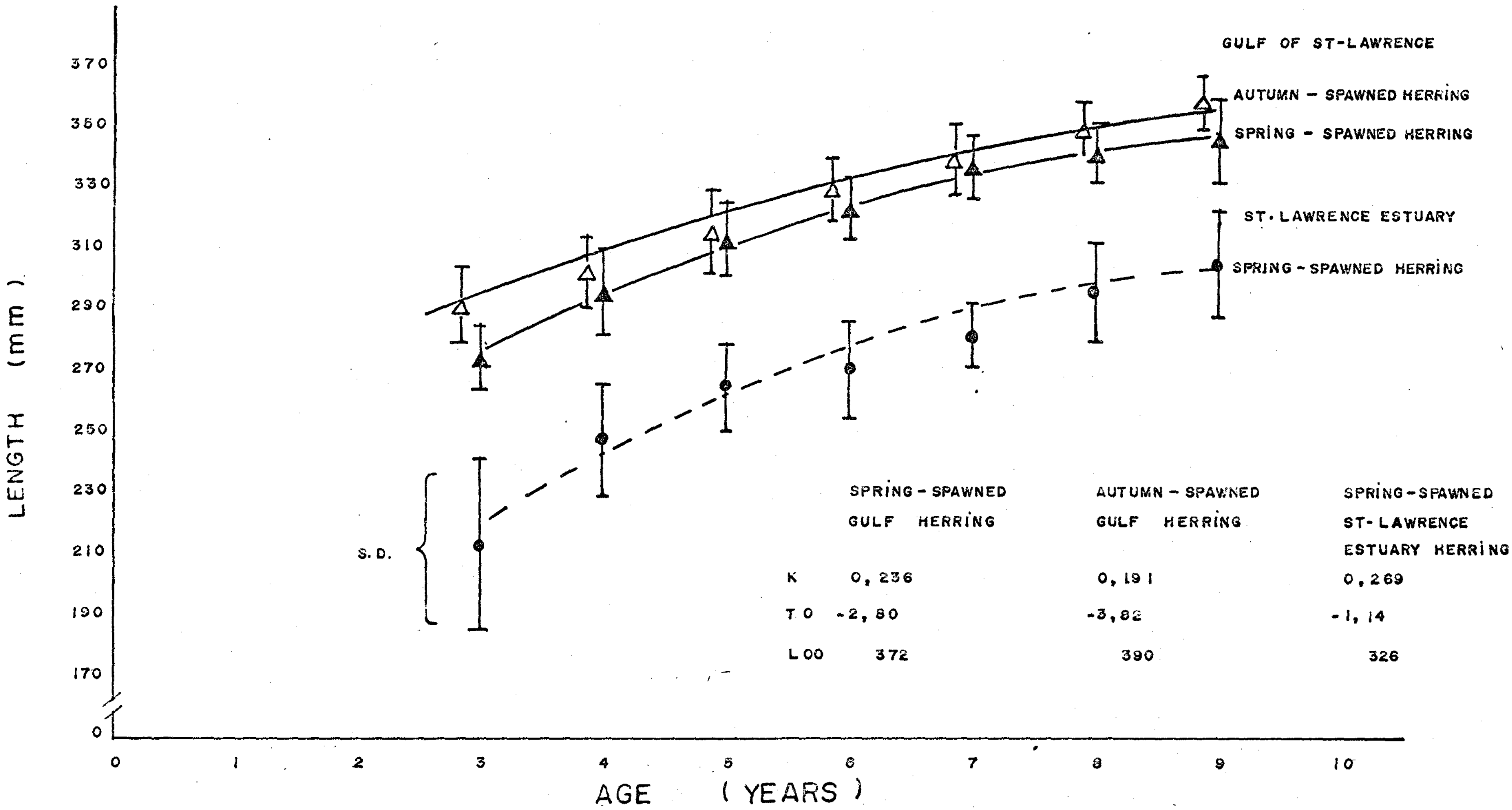

Figure 4. Growth curves (von Bertalanffy) fitted to length-at-age data for spring-and-autumn- spawned herring of the Gulf of St. Lawrence and for spring-spawned herring of the St. Lawrence Estuary.

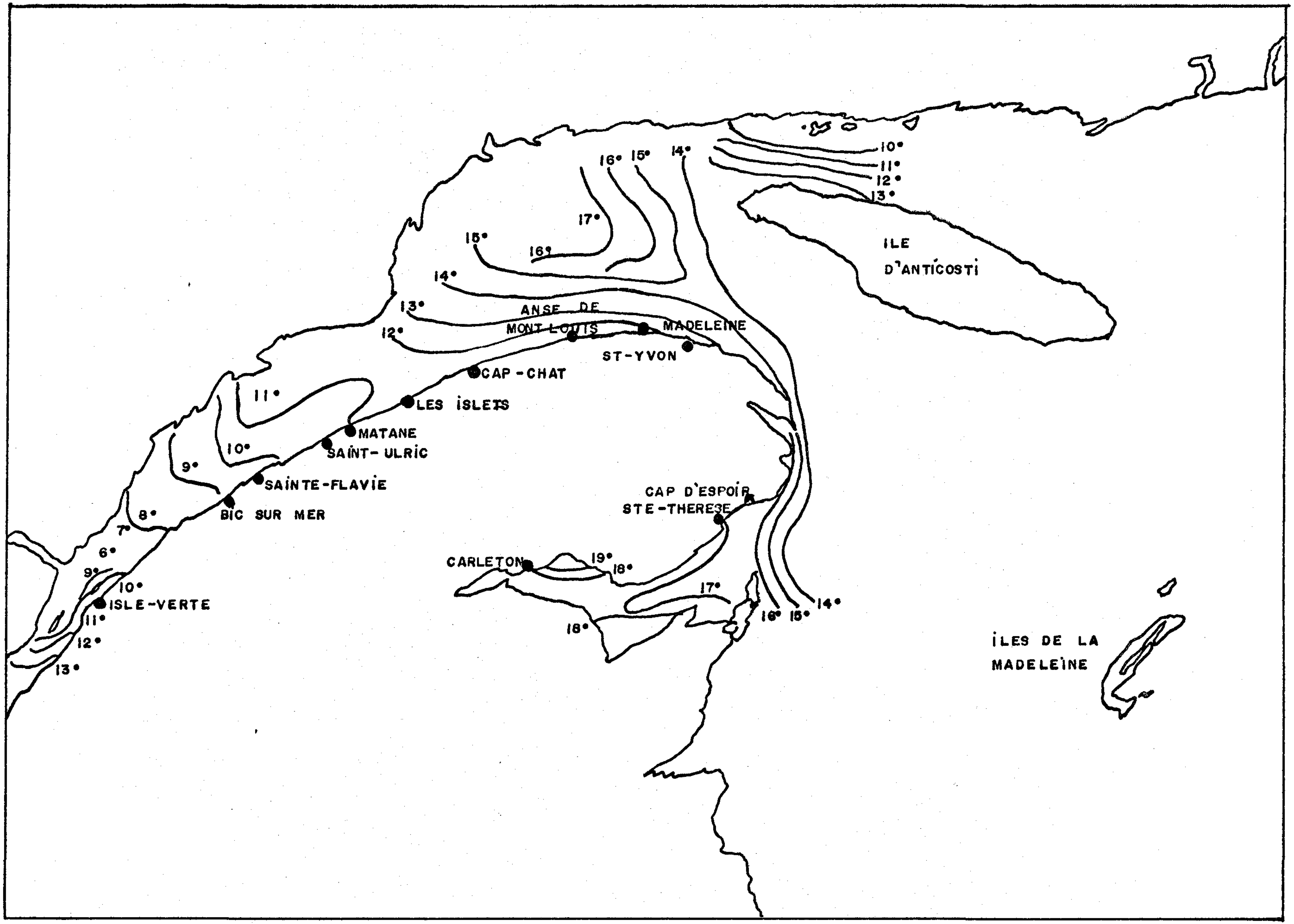

Figure 5. Surface isotherms in the Estuary and Gulf of St.Lawrence in August,1941, (Jean,1967)

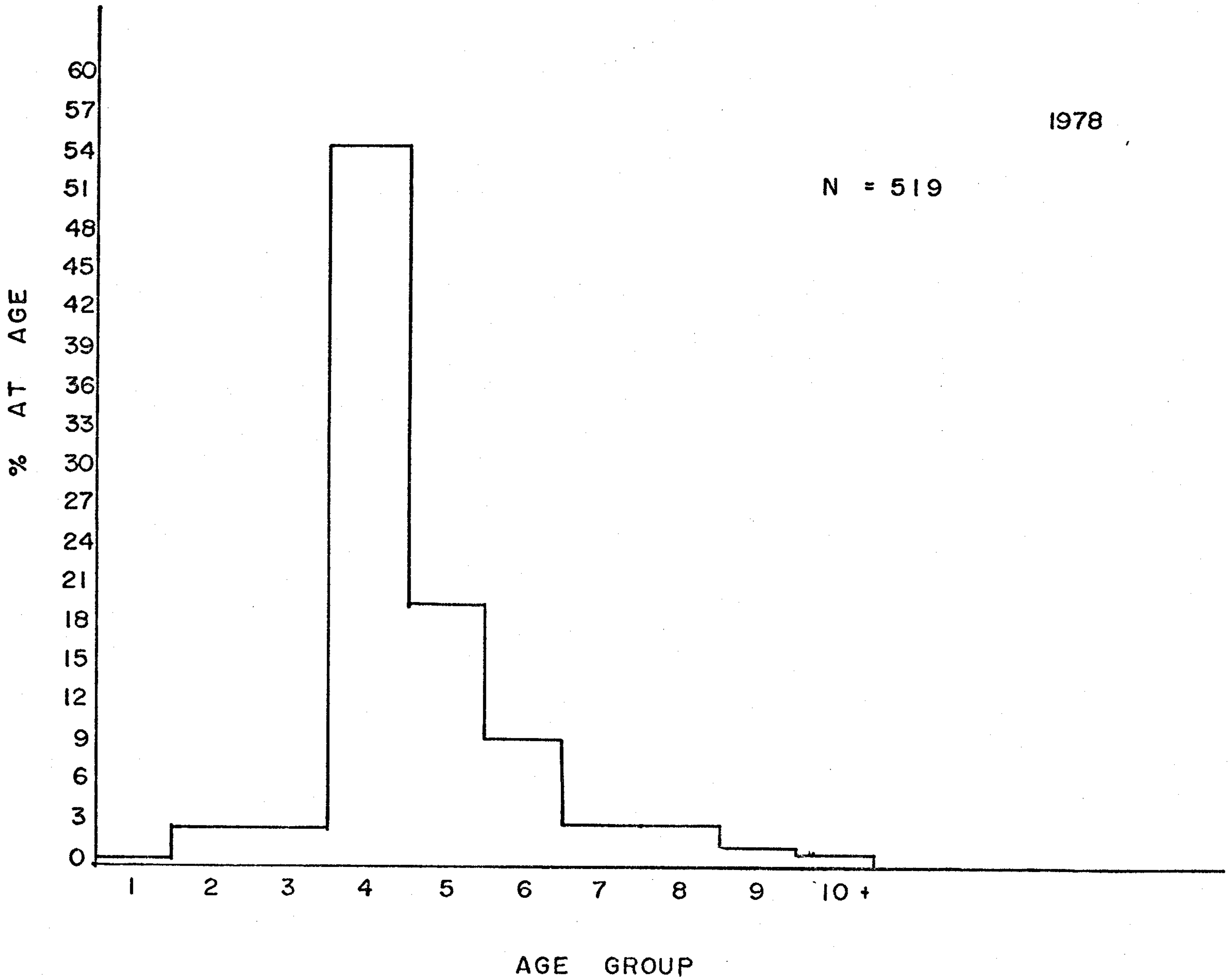

Figure 6. Age group abundance for spring-spawning herring taken in the St.Lawrence Estuary in 1978.

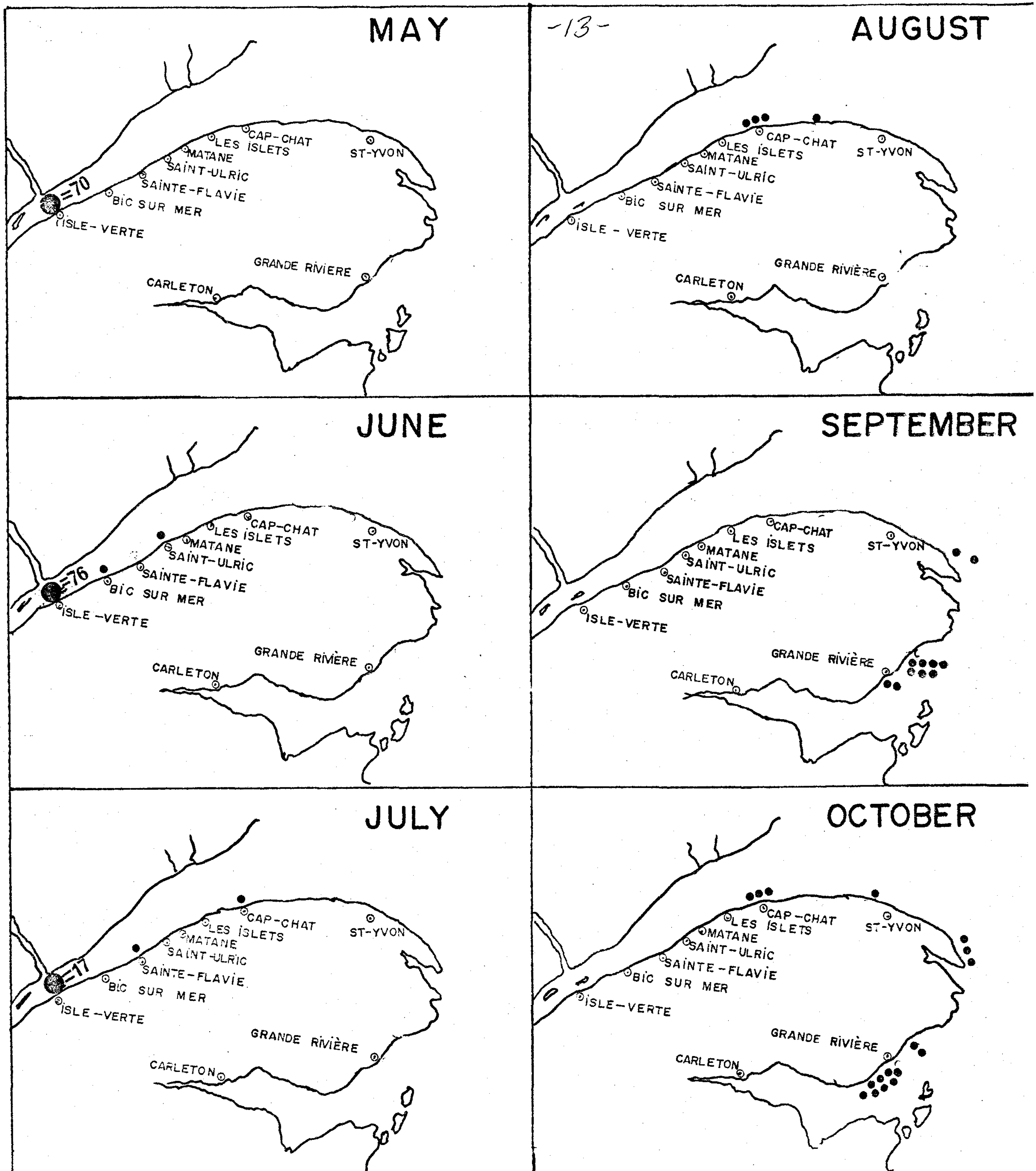

FIGURE 7. TAG RETURNS DURING THE 1978 FISHING SEASON.