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THE GROWTH OF QUEEN SCALLOPS (CHLAMYS OPERCULARIS) IN CAGES OFF PLYMOUTH, SOUTH-WEST ENGLAND

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INTRODUCTION

A fishery for the queen scallop (Chlamys opercularis) was established in south-west England during 1972. Initially most of the queens were landed at Brixham, but during the last 18 months the main commercial grounds have been more readily accessible from Plymouth and landings there have risen rapidly from 4,000 cwt (approx 200 tonnes) in 1972 to 27,000 cwt (1370 tonnes) in 1974. Scientists from the Ministry of Agriculture, Fisheries and Food (MAFF) Burnham Laboratory have been studying various aspects of the biology of the queens in south-west England since the fishery developed, in order to assess whether conservation measures are desirable.

One of the most obvious problems was that queen scallops off Plymouth were generally smaller than those normally accepted for processing in the established fisheries in Scotland and northern England. Queens from Plymouth often produced poor yields (as measured by the commercial yardstick of number of adductor muscle meats per pound), which threatened to make processing uneconomical. Initial attempts to gauge whether this was the result of fishing on a young stock, or of poor growth in this area, proved unsatisfactory since, unlike some other commercial bivalves such as Cardium edule and Pecten maximus, the growth band pattern of queens is very variable and difficult to interpret. It was decided to determine the characteristic growth rate and time of ring formation of the Plymouth queen stock by holding captive specimens in submerged cages from early settlement size onwards; this preliminary paper describes some of the results obtained.

METHODS

A site was chosen approximately 3 km off Plymouth in an area of full salinity protected by a breakwater running across Plymouth Sound (Figure 1); depth at the site was 9 metres. A rigid frame was assembled by divers on the seabed and cages were suspended from it approximately 0.5 metres off the bottom. This framework was constructed of tubular steel piping ("scaffold poles") and consisted of a line of three tripods about 2 metres high, supporting a 4 metre cross member. The cages were of two sizes (a) 60cm square and 24cm high for larger queens (b) 30cm square and 15cm high for the very young stages. They were timber framed with concrete bases and covered with an inner layer of 3mm nylon mesh, surrounded by stouter 5mm nylon mesh for protection.

The structure was not fitted with a surface marker so as to avoid interference with the experiment. The cages were located by divers every 2 months and brought

to a surface vessel, where shell length measurements of all queens were taken, and the cages were then quickly returned to the frame.

Research undertaken the previous year had indicated that queen larvae settled on hydroids and bryozoans in the Plymouth area several times during the year, and the original intention was to obtain samples of these tiny queen spat whenever they could be found and to transfer them to a new cage, so that the growth of the various settlements could be followed independently. Spat were not available when the experiment commenced in February 1974 and only a few of the smallest queens found at that time were used (mean length 31mm). In the following months it was discovered that the nylong meshes covering the cages acted as excellent spat collectors. From June 1974 onwards settlements on these surfaces have therefore provided the specimens (usually not less than 50) required for the experiments. All cages were carefully examined every two months so that settlement times could be estimated fairly accurately and the queen spat measured. In some instances new recruits were easily identifiable from the much larger queens already in the cages and both groups could be retained in the same cage.

RESULTS

At the time of writing, the latest measurement of queens in the cages took place in June 1975, roughly sixteen months after the start of the experiment. During this period settlements have taken place in the cages in June, July, September and November 1974 and February and May 1975. Survival of queens from these settlements has been very satisfactory (more than 90% in most cases).

Growth

The young queens, which initially had a mean length of 31mm, have grown well into commercial size. Of the various settlements, spat settling in June 1974 attained a mean size of 31mm by the following February. By combining the two sets of results, a growth curve for queens settling in June has been constructed for a two year period (Figure 2). This indicates that individuals settling at this time can attain the minimum commercial acceptable size (50mm) in 14 months, though it would probably take another six months for most to reach a good commercial size. The growth of the June 1974 recruits will be followed throughout the next year to determine how closely they follow the postulated growth curve.

Growth of other settlements confirms that commercial size is attained in under two years. The growth of spat collected in April 1974 from bryozoans in the Plymouth area, from a probable March settlement, is plotted in Figure 3; these spat attained a 50mm mean size by June 1975. The growth of queens settling later in

the same cage is also plotted, and emphasises the significance of early settlement. Spat settling in July were still very small by June 1975, having a mean length of only 35mm; later settlements produced even smaller individuals. Thus by June 1975 the 1974 "year class" contained queens whose length varied from 24mm to 54mm.

Ring formation

Figures 2 and 3 indicate that growth rarely ceases during the first two years, though there is normally a considerable slowing down during the autumn and winter. An annual growth ring normally appears when the growth rate accelerates after March and the queens then grow extremely rapidly until August. During this period up to 80% of the whole year's growth can occur. The size of a queen when this rapid growth phase commences is obviously dependent on the time of settlement the previous year. Taking an example from Figure 3, March settled queens laid down the first ring at 37mm whereas the first ring of the July settlement occurred at 20mm; later settlements laid down growth rings at mean lengths as small as 14mm. The clarity of the ring varies greatly amongst individual queens and in some cases a definite ring cannot be detected.

Queens settling during the late autumn or winter seem to grow at a relatively rapid rate following settlement and probably do not form an annual ring until the next winter. In this case the first ring often results from a slowing down of growth during spawning. Other queens exhibit this ring between the first and second annual rings. The spawning ring is usually laid down at the time of the queen's first main spawning in May or June and it is usually incomplete or less distinct than the annual rings.

The results of the cage experiments have proved very helpful in understanding the significance of growth banding on queen scallops. The plotting of growth curves from the back measurement of annual rings can now be attempted with greater confidence and two such plots are shown in Figure 4. This compares samples from the Mewstone grounds off Plymouth (the nearest commercial area to the experimental cage site) with those from the Yorkshire coast. The mean sizes of the first rings of the two stocks are the same, but subsequent growth of Yorkshire queens seems much more rapid, indicating that a relatively poor yield must be expected from commercial catches of Plymouth queens. The growth of the natural Plymouth stock appears to be slower than that which occurred in the cages, though the small first ring of the natural stock indicates a late settlement and direct comparisons will not be possible until more results are available from the cage experiments.

ACKNOWLEDGEMENTS

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SUMMARY

The settlement of queen scallops (Chlamys opercularis) in cages suspended in Plymouth Sound, south-west England has been found to occur in every season of the year except midwinter. Maximum growth occurs during the period May-August and queens settling at this time can reach the minimum commercial size (50mm) in just over a year. The settlement of queens at different times of year results in a large size variation in any one calendar year and in the Plymouth area grouping into year classes is not meaningful. The rate of growth is low in winter and shell growth bands normally appear in March, except in very late settling queens which continue to grow throughout the first winter. A greater understanding of the significance of growth banding in queens has allowed interpretation of growth rings on shells from various areas, and confirms that growth in the Plymouth area is poor.

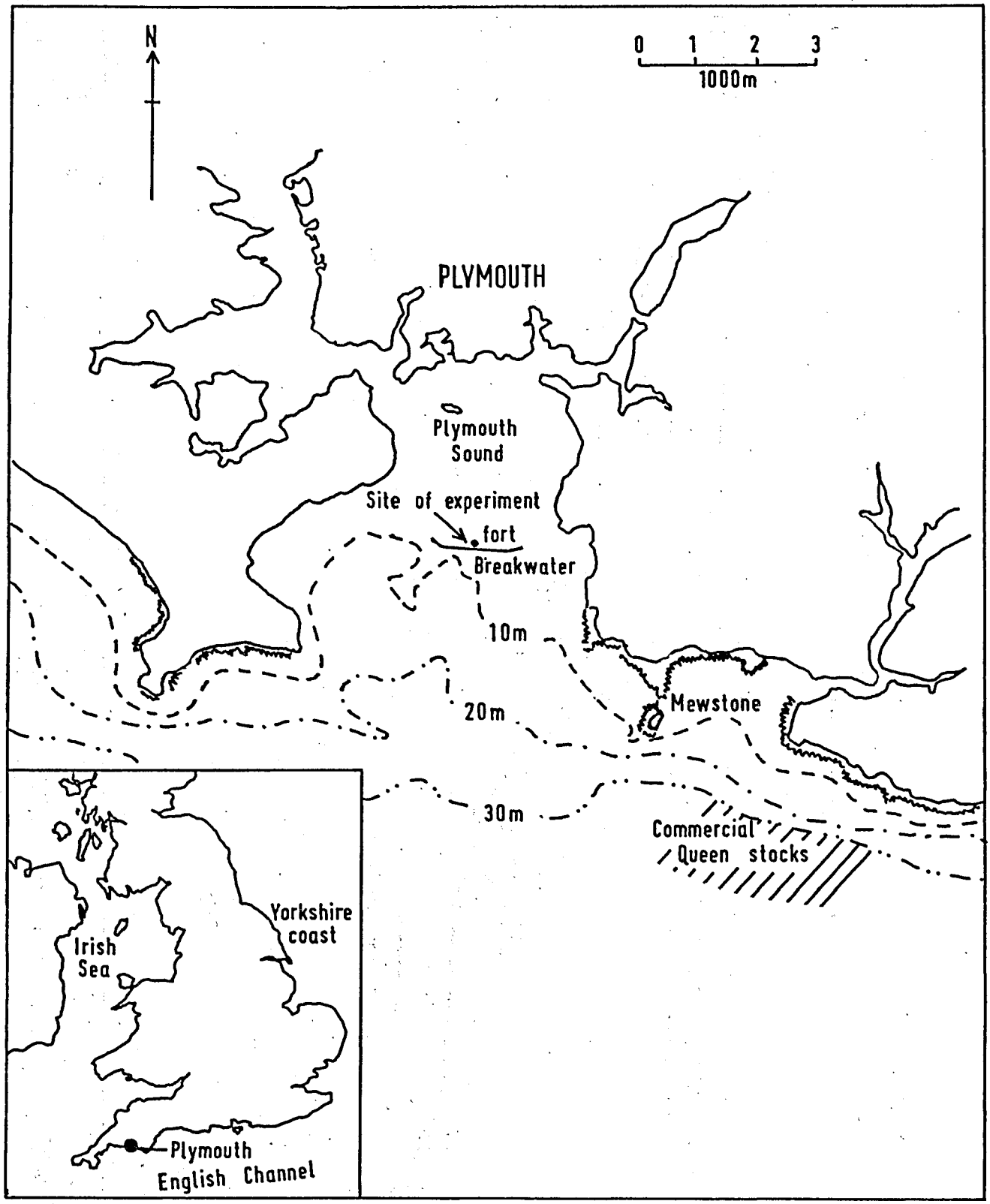

Fig 1. Plymouth - positions of the experimental site and the nearest commercial queen beds at Mewstone.

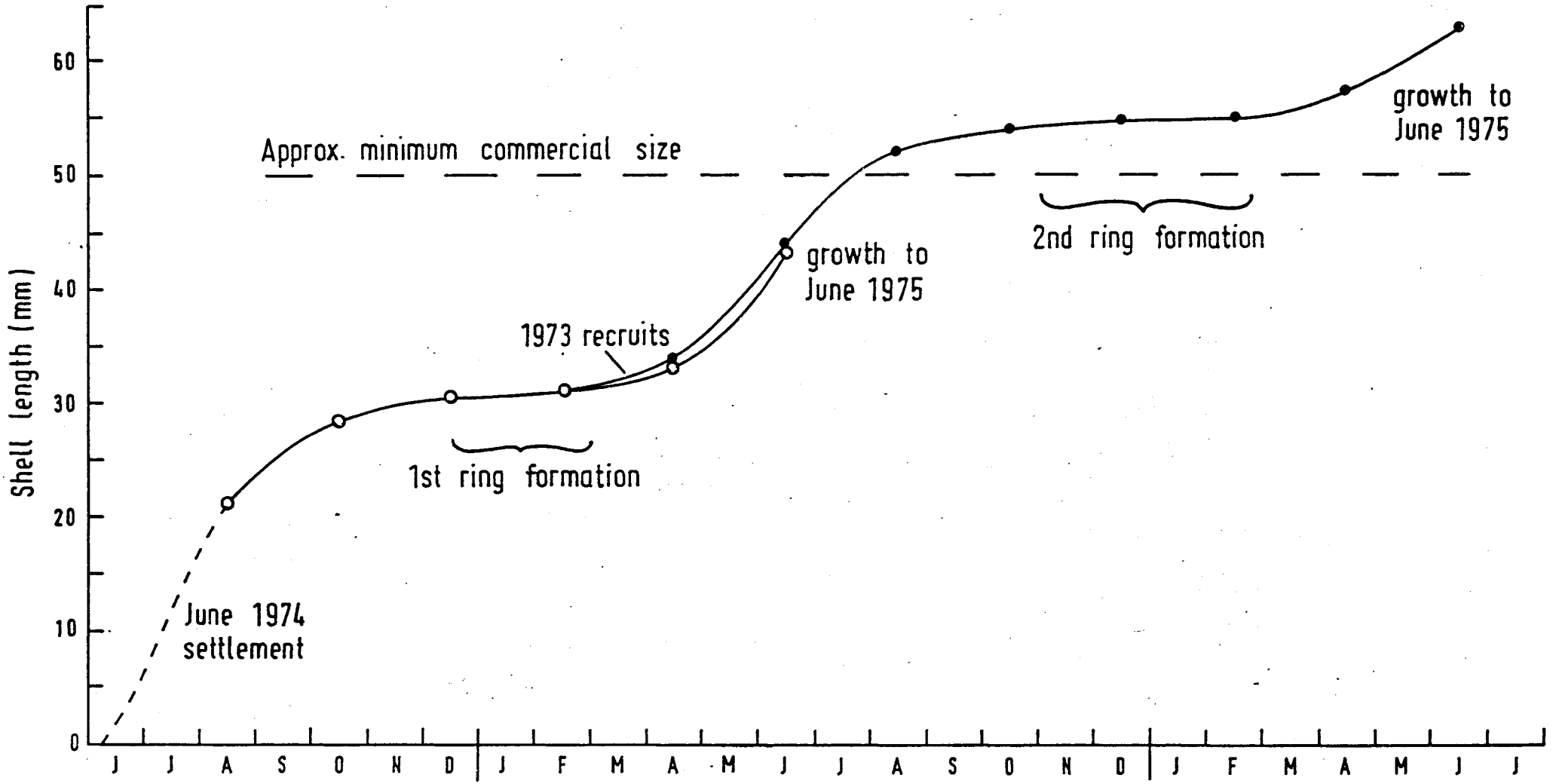

Fig. 2. Postulated growth curve for Plymouth queen scallops settling in June. Based on queens attaining a similar mean size (31mm) in February 1974 & 1975.

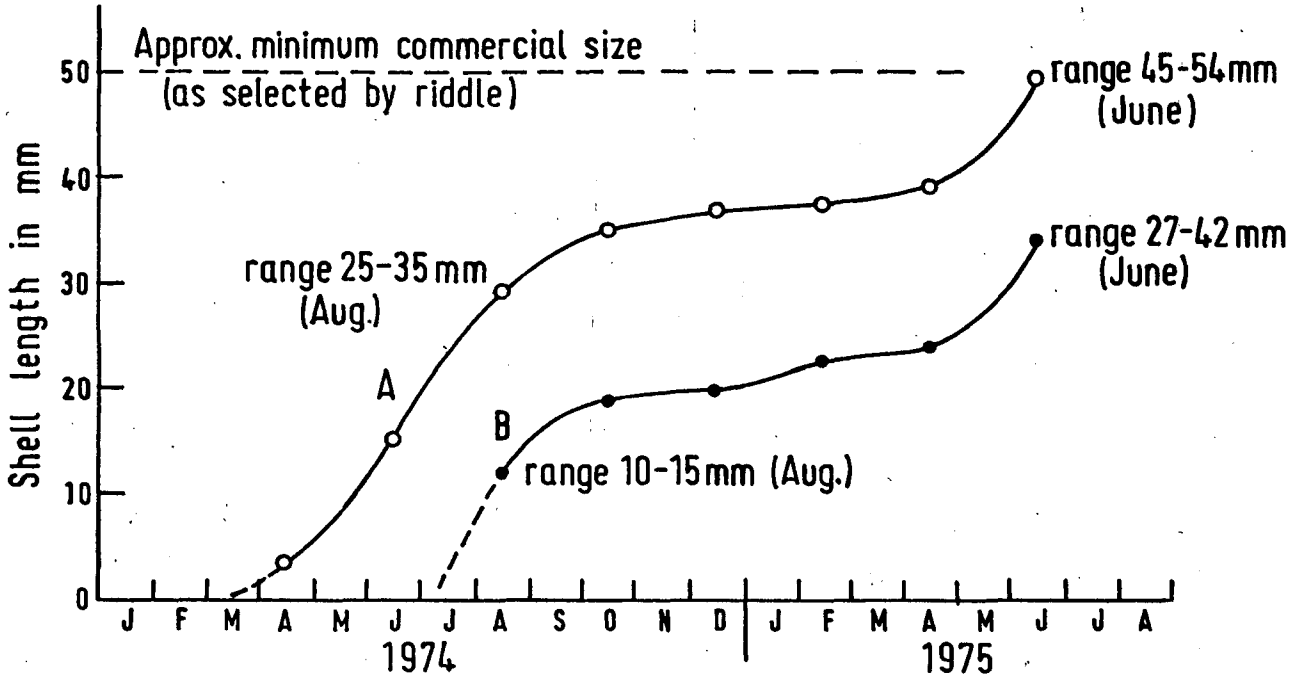

Fig. 3. Mean growth of Plymouth queens which settled in March 1974 (A) and July 1974 (B).

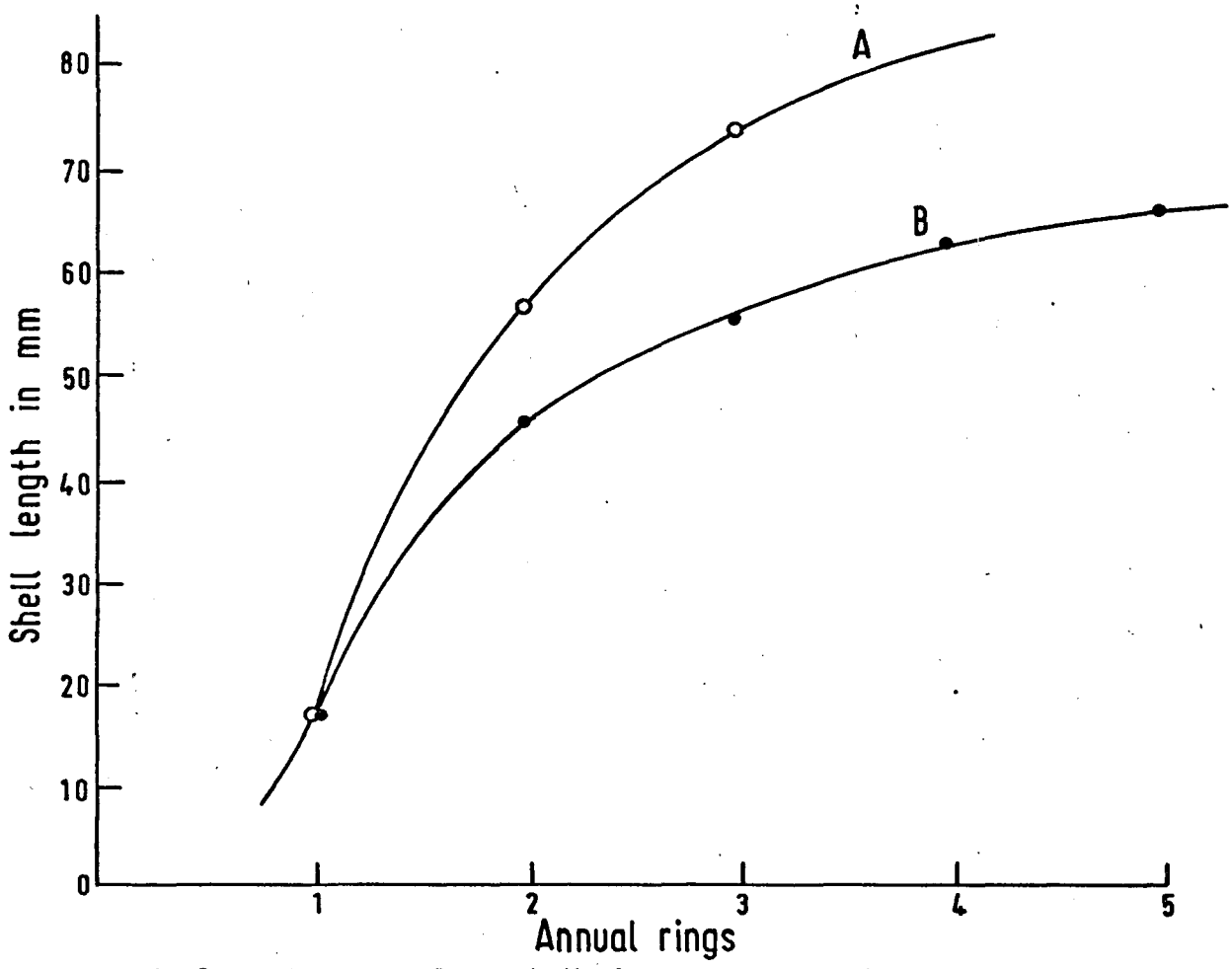

Fig. 4 Growth curves from shell ring measurements.
A - Yorkshire coast B - Mewstone grounds, Plymouth.