Middle Ages when the Church and the nobles owned much of the forests. At length, with the Reformation, Gustavus V confiscated all the Church property, and gradually it became the rule that all forests not in private ownership and used for the estates belonged to the State. When the foreign demand arose during the past century, the State again gave away large areas of forests to private people and timber merchants, and heavy unrestricted exploitation took place. A Forestry Institute had been founded in October 1828 by Israel Adolf von Strom, regarded as the 'father' of Swedish forestry, with the object of arousing interest in forestry throughout Sweden. The Institute became known later as the Swedish State College of Forestry, which held its centenary in 1928.

Sweden is divided for forestry purposes into three parts—northern, central and southern. The greater part of the State forests are in the north, where the soils are much poorer and, for climatic reasons as well, the growth is much slower. The Forest Service dates back to the seventeenth century, the duties then being to supervise royal hunting and to keep to the regulations as regards felling and selling forest produce by the people. In 1859 a Board of Forestry was established and six forestry schools were founded. Private forests were still outside any legislation. In 1883 the agricultural sections of State lands were placed under the Board of Forestry, and the name of the Board was changed to Board of Crown Lands and Forests. Under the Board came forests, the Forest Research Institute founded in 1902, and forest education, both higher and lower.

The most rapid progress was made in forest administration from the beginning of the century, one of the chief steps being the reorganization of the accounting system. Separate accounts officers were established in different parts of the country, and this allowed the forest officer, now relieved of much 'paper' work, to devote more time to his forests in the open, instead of chiefly in the office. The Forest Service had been a trading department, and this was changed by the formation of the Royal Swedish State Forestry Industries, Ltd., which is owned by the Forest Service; the supervision of private forests and public non-State forests was placed under a Royal Board of Private Forestry. The staff of the Forest Service is very much on the lines of that in Britain, as also is the forestry education. One difference is that a much greater latitude is given to the district forest officer, who is made responsible, within the administrative policy laid down, for all the work within his charge and has not constantly to refer to superior authority. E. P. Stebbing

THE ROSS GLACIER

By RICHARD BROWN

In view of the forthcoming work in the areas around the antarctic during the International Geophysical Year of 1957–58, it may be appropriate to review some observations on the Ross Glacier in South Georgia, Falkland Islands Dependencies, which date back to the first International Polar Year.

The island of South Georgia, some 120 by 25 miles (the long axis lying north-west–south-east), lies some 1,000 miles east of Cape Horn, between latitudes 54° and 55° S. It is entirely mountainous, the axial chain rising to almost 10,000 ft.

The Ross Glacier (lat. 54° 33′ S., long. 36° 05′ W.) is the chief feature of Royal Bay, a large inlet on the north-east coast of the island. It presents a wide front of ice cliff approximately 120 ft. high, calving into the water at the head of the bay, and rises to a low pass (the Ross Pass) which leads downwards by equally gentle slopes on the far side as the Brogger Glacier, to meet the sea on the south-west coast, where it calves into the waters of Undine South Harbour. The distance from coast to coast is almost 15 miles.

The German Transit of Venus Expedition had its base hut and observatory on the north side of Royal Bay during the years 1882–83. The party was a very hard-working one, for, in addition to the astronomical observations, work was also carried out in the fields of geology, zoology and botany. A survey of the area was made, and plots of the position of the ice front were made on four occasions: August 1882, December 1882, May 1883 and August 1883. There was recession between these dates, particularly the last two, amounting to a total of almost half a mile[1].

The next visitor to Royal Bay was Otto Nordenskjöld in 1902.

Before work in the Cumberland Bay area farther to the north, the surveyor of the Expedition, S. A. Duse, plotted the new position of the snout in April 1902. It was found that the ice-front stood in a position in advance of that of August 1882. The advance had been in excess of the total retreat noted by the German party. Nordenskjöld summarized his own and the German expedition's findings in his book "Antarctica"[2].

In December 1951 the area was visited by the South Georgia Survey, led by Duncan Carse. The true left bank of the glacier was used as a sledge route to the Ross Pass and the interior. The area was accurately mapped; but no glaciological work was undertaken[3]. In January 1955 the position of the snout was plotted by members of the British South Georgia Expedition, as part of the glaciological programme. This new position showed a large embayment near the south edge, and a considerable retreat of the north part of the snout. So far as comparison of the plans (on varying scales) permits, it would appear that the cliffs occupied a somewhat intermediate position between those of May and August 1883, and a considerable retreat from the 1902 position. On the south side of the glacier, recent moraines exist up to 600 ft. from the snout, and it may be that there was further advance after the 1902 maximum, for the 1882–83 and 1902 positions show little variation of the glacier's position on the shoreline, the main variation being in the position of the ice-cliffs in the water.

The glacier is derived from two main accumulation areas: that to the north from the peak ('Sunset Peak'; not an officially recognized name) at the south end of the Allardyce Range and the Ross Pass snowfields, and that to the south from the Salvesen Range, including a separate lobe which produces a large area of complex crevassing on the south side of the main stream of the glacier near the snout.

These two areas are of different altitude; that of the Allardyce is of a lower altitude than that of the Salvesen side by some 1,500 ft. on average.

In late January 1955 the summit of the Ross Pass (1,800 ft.) was surfaced with large irregular patches of firn, with intervening areas of bare hummocky ice. Ablation was proceeding (and continued elsewhere in the island at similar altitudes until March) and it seems likely that in some seasons at least the firn line rises above the level of the pass. This means that in some years the net accumulation of the 'Allardyce part' of the glacier will be very small, confined to the slopes of 'Sunset Peak' above approx. 2,500 ft. The Salvesen accumulation areas, being generally much higher, will not come below the firn line, and any amelioration of climate will be less immediate in its effect on the volume of ice[4]. These areas are further fed from the surrounding cirque of peaks of more than 7,000 ft., from which large amounts of ice fall as avalanches.

It is interesting to note, in connexion with the 1902 position, that the greatest advance was in that part of the ice front associated with the Salvesen accumulation areas. The phenomenon of sudden considerable advance of a glacier is further exemplified by the recent advance of the Harker Glacier in Moraine Fjord, near the administration centre at King Edward Point in Cumberland Bay. There are two glaciers calving into the fjord; the Harker is the one at the head. Photographs taken during the Shackleton Expedition of 1914 compared with those taken up to 1952 show little difference in the position of the snout[5]. At some time after early 1952 there has been an advance of considerable dimensions and the snout has moved forward over flat ground at the head of the fjord for some 300 yards, as well as occupying a more advanced position in the fjord. The nearby Hamberg Glacier has remained quiescent. The position of both these snouts was plotted in December 1954, and their proximity to the settlement makes them very suitable for observations in the future.

South Georgia lies in the unstable area of the Scotia Arc. Whether these glacial surges are derived from ice avalanches of great magnitude caused by earth tremors is not certain, although a few earthquakes have been recorded in the island[6]. Further investigation of this factor might bring to light interesting data ; but it would seem, at the present, that these surges occur only when the glacier is fed from some hanging ice-fall system, as is the case in both the Harker and the 'Salvesen accumulation area' part of the Ross Glacier. Prof. A. Desio has recently described the much larger (though apparently similar in character) advance of the 'Kutiàh Glacier' in the Karakorum Himalaya[7].

Thanks are due to the Governor of the Falkland Islands and to the Falkland Islands Dependencies Survey authorities for the opportunity to carry out this and other glaciological work in South Georgia.

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GROWTH AND SEXUAL MATURITY IN AQUATIC MAMMALS

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In mammals growth is determinate, and there is an average adult size for individual species. The rate of growth is a specific phenomenon presumably fixed by heredity, and different species grow at different rates in the same circumstances and pass at different times through similar phases of development[1].

Owing to the practical difficulties there are few records of weights of aquatic mammals, and length is generally used as a measure of size. It is also a more accurate measure, being less subject to fluctuations than is weight. The average length of the female at puberty and physical maturity is known with some accuracy for the eleven cetaceans and twelve pinnipeds listed in Table 1, being based in most cases on a large number of specimens ; but the length at puberty in the male is known with less accuracy. If we convert the length of the female at puberty to a percentage of the size attained when growth ceases it is seen to be remarkably constant, averaging in cetaceans 85·1 per cent (range 80·0–88·5, $\sigma = 3{\cdot}14$, $V = 3{\cdot}69$) and 86·6 per cent in pinnipeds (range 80·8–92·3, $\sigma = 4{\cdot}10$, $V = 4{\cdot}73$). This agreement is the more remarkable when it is observed that for several of the species considered the average lengths at these epochs in the life-cycle are known only approximately. The general shape of seals and whales shows marked resemblances, being fusiform with short appendages, and the length/weight relationship is probably similar in the two groups. This would help to explain the close similarity in the percentage length at puberty in these two unrelated groups ; but clearly there is a fundamental and precise connexion between growth and sexual maturity.

We have little accurate information on the rates of growth of the various species of cetaceans, chiefly because no accurate method of determining age has yet been applied. Ageing by dentine layers in the teeth shows promise[11,12], and the use of incremental layers in the ear plug of the Mysticeti is being investigated[25].

In the teeth of Pinnipedia annual dentine layers[13] or external ridges[28] have been used with some success for determining the age of specimens, and mass-growth curves can be drawn up for several species (data from refs. 13, 14, 15, 18, 19, 21, 22, 26, 27). It can be shown that for this group the percentage increment in length during the first year may be used for comparative purposes as a measure of the rate of growth. When this increment is plotted against the average age at sexual maturity (Fig. 1) they are seen to be inversely proportional. In other words, the slower-growing species take longer to attain the level of about 86 per cent of the final length and so mature later than the precocious species. Since precocity in seals affects the embryonic growth-rate, the length at birth is also a reflexion of the rate of growth and bears a similar relationship to the age at puberty. A similar rule holds for the males, though maturity tends to be attained at a later age, and owing to the great variation in growth-rates (the polygynous species have a double sigmoid curve[13,22]) the percentage length at sexual maturity is not so constant. Likewise, in the species of whales for which we have