

Zoology. — *On the thickness of the layer of blubber in Antarctic Blue and Fin Whales. III.* By E. J. SLIJPER (Institute of Veterinary Anatomy, State University, Utrecht). (Communicated by Prof. G. KREDIET.)

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Fig. 25—27 show that, according to the catch of "Willem Barendsz" up to the second half of January the percentage of immature Blue Whales was very high and that of the pregnant females very low. In the second half of January the curve of pregnant Blue Whales rises sharply. Probably this phenomenon is caused by the return of the majority of

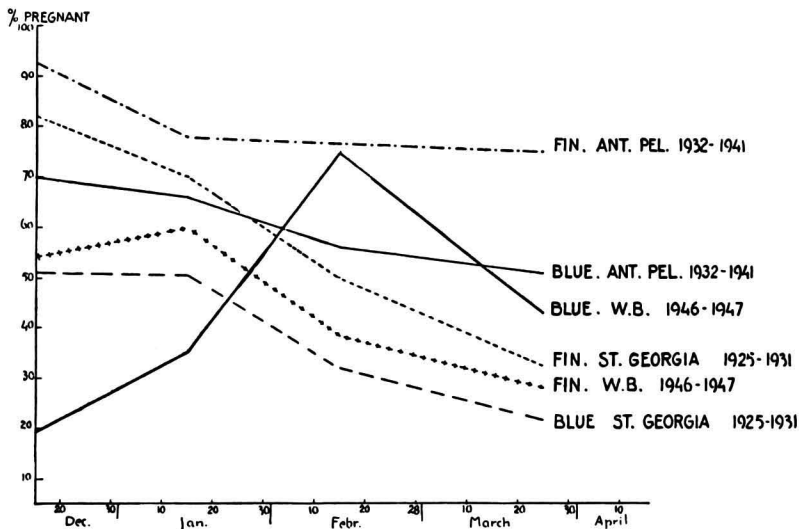


Fig. 24. Curves indicating the variations in the number of pregnant females, calculated in % of the total number of adult female *Blue* and *Fin Whales*, in the catch of f.f. "Willem Barendsz" during the season 1946—1947. Average data calculated per month. The other curves bear on average data from *South Georgia* and *Antarctic pelagic whaling* published by MACKINTOSH (1942).

pregnant Blue Whales from the ice, since the curve falls again in February and shows no rise in March, when the expedition could penetrate into the outer zone of the pack-ice. Apparently then most of the pregnant females were gone. The decrease of the percentage of immature whales with a little rise and fall of the curve in the second half of February, may be explained by the above-mentioned increase of pregnant females and by the fact that probably the majority of immature Blue Whales does not go far into the ice. So the distinct increase of the average length and the percentage of pregnant females in the Blue Whale may be responsible for the sharp rise of the output-curve in January of both seasons.

Now an explanation, however, is still wanting for the fact that in both seasons from the beginning of February the course of the output-curve is

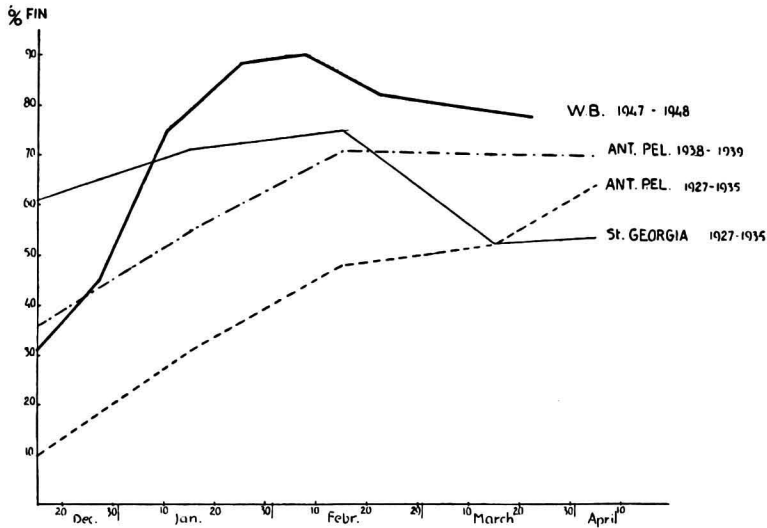


Fig. 25. Curves indicating the variations in the *percentage of Fin Whales* in the catch of f.f. "Willem Barendsz" during the season 1947—1948. For explanation of other curves see fig. 21.

almost horizontal, although the general curve for Antarctic pelagic whaling still rises until the end of the season and although the same is shown by the special output-curves for 1946—1947 and 1947—1948. Fig. 22—27 show that normally during the second half of the season an increase of the

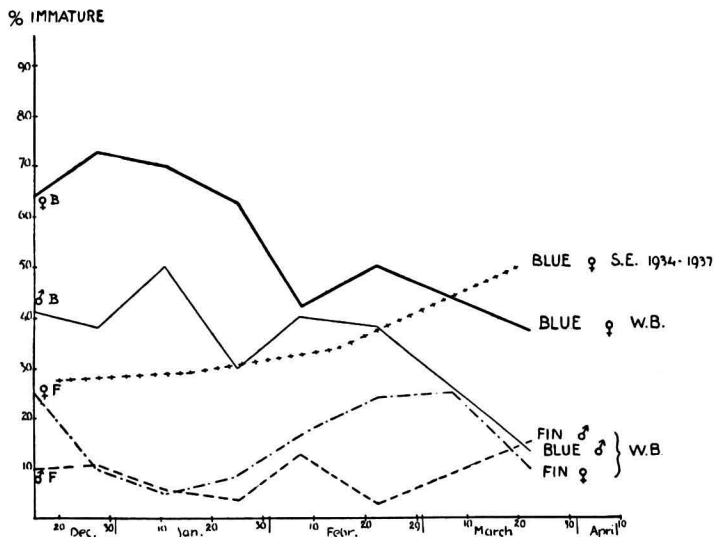


Fig. 26. Curves indicating the variations in the *percentage of immature Blue and Fin Whales* in the catch of f.f. "Willem Barendsz" during the season 1947—1948. For further explanation see fig. 22.

percentage of immature and a decrease of the percentage of pregnant whales may be observed. This means a decrease of the percentage of fat whales, but it may be quite possible that the normal increase in fatness of

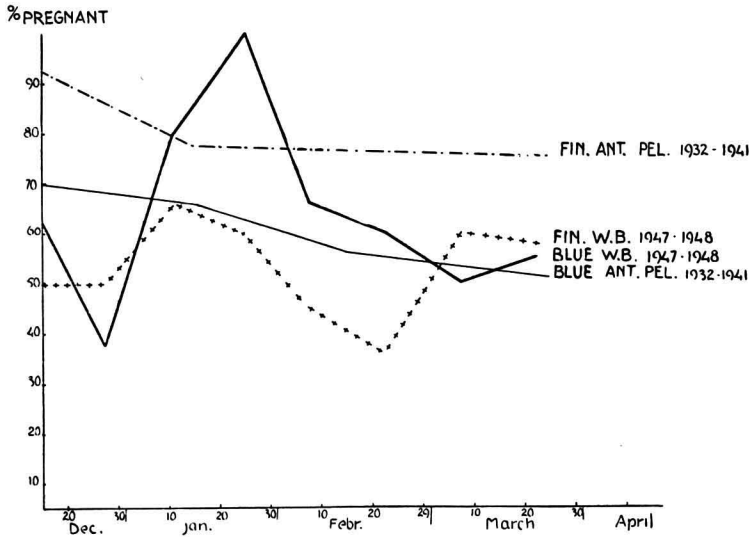


Fig. 27. Curves indicating the variations in the percentage of *pregnant female Blue and Fin Whales* in the catch of f.f. "Willem Barendsz" during the season 1947—1948. For further explanation see fig. 24.

the whales is so high that nevertheless the output in barrels per B.W.U. increases. The curves, however, show also that with regard to the catch of "Willem Barendsz" in both seasons the decrease of the percentage of fat whales has been distinctly greater than in normal years, or that perhaps the increase in January has brought the output-curve on an abnormally high level. Consequently it may be supposed that the general increase in fatness is just compensated by the special decrease in the number of fat individuals. There have been some other seasons in which the general output-curve for Antarctic pelagic whaling shows a horizontal or nearly horizontal course from February onward. Fig. 2 in the paper of HJORT, LIE and RUUD (1938) shows that this has been the case in 1930—1931 and 1932—1933. Unfortunately no sufficient data are available about weather-conditions and other circumstances, nor about the composition of the catch during those seasons.

Now according to the curves for the thickness of blubber (fig. 17, 18) it appears that the left part of these curves and especially their sharp rise may be explained in the same way, as it has been done above for the output-curves, viz, by the special circumstances under which whaling was carried on by "Willem Barendsz". It may be supposed that from the moment at which the southward migrating whales have reached their final feeding-grounds, the amount of fat stored in the different parts of their bodies gradually increases up to the moment at which they migrate north-

ward again. From the horizontal course of the right part of the blubber-curves the conclusion may be drawn for the present, however, that from about the middle or the last part of February onward, there is hardly any further increase in thickness of the blubber. It appears to be highly probable that in the first part of the season the fat is chiefly stored in the blubber, whereas in the second part it is chiefly stored in the meat, bone and internal organs. We got a vague impression that storage in the internal organs chiefly takes place at the very end of the season.

6. *The migrations of Whales.*

MACKINTOSH and WHEELER (1929), KELLOGG (1929), RAYNER (1940) and many other authors have shown that in the Southern spring the whales migrate southward and in the Southern autumn northward. With the exception of a small stock that remains in the surroundings of South Georgia or perhaps also at other places, the Antarctic whales live during the winter in the subtropical and tropical waters. In these waters, however, there is practically no food for them and the decrease in thickness of their layer of blubber has been clearly demonstrated by MACKINTOSH and WHEELER (1929). Consequently it might be possible to get a certain impression about the migration of the whales from the thickness of their blubber, since generally it may be supposed that a lean whale must be a whale that has been quite recently arrived from the northern waters.

MACKINTOSH and WHEELER (1929), RISTING (1929), HARMER (1931), WHEELER (1934) and MACKINTOSH (1942) have collected a number of data about the migration of whales by comparing the catches of South Georgia (54° S.), South Shetlands (62°) and Antarctic pelagic whaling (57°—68° S.). According to these researches it appears that the southward migration begins already at the end of September and certainly continues until the end of January. Although the first Blue and Fin Whales appear almost at the same time in the Antarctic waters, it is highly probable that the majority of the Blue Whales migrates earlier in the season than the majority of Fin Whales. The Blue Whales immediately go as far South as ice-conditions permit and then live chiefly in the outer zone of the pack-ice. The majority of the Fin Whales does not go so far South in the first months and although a number of them can be also observed in the outer zone of the pack-ice they chiefly live in a zone just North of the ice-boundary. There are some indications, relating to the Blue as well as to the Fin Whales, that the adult whales and among them especially the big animals and the pregnant females migrate to the South first. They are followed by the smaller adult animals and the non-pregnant females. Finally the immature Whales appear in the Antarctic waters. The majority of these immature animals do not go so far South as their adult relatives. There are also some indications that the pregnant females and the big adult animals go northward at an earlier date than the other

whales, the pregnant females leaving the ice already from February onward. Most of these statements are supported by the data given in fig. 21—27.

The very thin blubber, the small average size of the Blue Whales, their high percentage of immature and their low percentage of pregnant animals during the first period of the season 1946—1947 (56° — 58° S.), as well as the sudden increase in thickness of the blubber at 63° S. indicate that most of the big and pregnant Blue Whales had already passed the zone at 56° — 58° S. and that they were already living then in the ice. The majority of the Blue Whales that were caught belonged to the rear-guard of small and immature animals. The fact that in the first period of 1947—1948 just north of the pack-ice the Blue Whales were lean, as well as the composition of the catch during this period, are in perfect accordance with the above-mentioned facts about the migration of this species.

It appears also from the curves that from the end of January onward the big Blue Whales and especially the pregnant females leave the ice and migrate northward. If the increase of pregnant and big whales at the end of January 1948 had been caused by an invasion of southward migrating animals, the blubber-curve and the output-curve would not have shown such a big and sudden increase in fatness of the whales. This opinion is supported by the fact that when the ship could go further southward in March 1948, no increase of the number of pregnant females was observed. The curves also show that the majority of the immature Blue Whales remains outside the boundary of the pack-ice.

From the shape of the curves for the percentage of Fin Whales the conclusion might be drawn that their main body arrives later in the Antarctic waters than that of the Blue Whales and that they live chiefly North of the pack-ice. If the curves for pregnant and immature whales, however, are compared with the curves for blubber-thickness, they show that, at least in area II, there is no such distinct succession of different groups of animals (pregnant, adult, immature) as may be observed in the migration of the Blue Whale. In future special attention should be given to the remarkable course of the curve for immature Fin Whales (fig. 23 and 26) and to the increase of the percentage of pregnant animals in the beginning of March. Apparently pregnant Fin Whales stay in the Antarctic waters until a later date than pregnant Blue Whales. This would be quite in accordance with the fact that Fin Whales give birth about one month later in the winter-season than Blue Whales (MACKINTOSH and WHEELER, 1929; fig. 149—150). This opinion is also supported by the nearly horizontal course of the curve for pregnant Fin Whales in Antarctic pelagic whaling during the second part of the season and by the distinct decline of the curve for South Georgia.

7. *Summary and conclusions.*

During the Antarctic whaling seasons 1946—1947 and 1947—1948 data about the thickness of the layer of blubber at several different points

of the body of Blue and Fin Whales were collected on board the Dutch floating factory "Willem Barendsz". In both seasons the expedition operated in area II and III (from about 17° E.—36° W.), but according to the latitude South at which whaling took place, the circumstances were not quite normal. During the first period of 1946—1947 the position of the ship was too far to the North whereas in 1947—1948 up to the beginning of March it operated outside the northern limit of the pack-ice.

The mutual relation of the blubber-thickness at various points of the body appears to be almost the same in both species and in any part of the season. The great differences in thickness over the body (fig. 1) depend on demands made by the general body-outlines. Measurements taken at the dorso-median line just cranially of the dorsal fin or at the ventro-median line cranially of the anus, give the best impression about the general blubber-thickness of the animals. Foetuses and calves show a greater relative thickness of blubber than young and adult animals. This may be connected with the absence of fat or with its low percentage.

In young and adult animals the relative thickness of the blubber increases with increasing size of the body. This may be explained by changes in the metabolism. The blubber is thickest in pregnant, thinnest in lactating females. The difference (14 %) in the relative thickness between Blue and Fin Whales may be entirely ascribed to their average difference in size. At present there are no striking indications to doubt that according to their average output of oil one Blue Whale may be put on a level with two Fin Whales.

Throughout Antarctic there are comparatively large seasonal variations in fatness and blubber-thickness of the whales, probably connected with general feeding-conditions. Seasonal variations may be also connected with the average length of the whales that are caught and with the percentage of pregnant females. These facts may also be held chiefly responsible for local variations in fatness and blubber-thickness. Consequently it would be very important, if in future statistical publications on whales the output of oil would not only be calculated per Blue Whale Unit, but also per length-unit of the animals (for example the so-called "calculated whale").

The manner of increase in thickness of the blubber during the whaling season (December—April) appears to be the same in Blue and Fin Whales as well as in the different sex- and size-groups. During the first part of the season the thickness of the blubber may give a fairly good idea about the fatness of the whales. From the middle or last part of February onward, however, there seems to be hardly any further increase in thickness of the blubber. Storage of fat probably takes place chiefly in the layer of blubber first, but afterwards chiefly in the meat, bone and internal organs.

It has been shown that measurements of the layer of blubber may give a better insight in the migration of whales, since it may be generally supposed that a lean whale is a whale that has just arrived from the

northern waters. Thus several conclusions according to the migration of the different kinds (size, maturity, pregnancy) of Blue Whales, previously made by other authors, could be confirmed. With regard to the Fin Whales, however, it was shown that at least in area II, this species does not show the same succession according to the different groups as the Blue Whale. Pregnant Fin Whales stay in the Antarctic waters up to a later date than pregnant Blue Whales. This may be connected with the fact that they give birth about one month later.

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