

On the Sexual Maturity of the Sperm Whale (*Physeter catodon*) found in the North Pacific.

By

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Introduction

Since 1954, sperm whales have been caught by Japanese whaling fleets in the northern parts of the North Pacific. The whaling ground is the waters of the coasts of Aleutian Islands: 175°E-164°W Long and 50°N-56°N Lat. as shown in fig. 1. Before these whalings operated, the data of the biological investigations of the sperm whales in this area had not been got by us. It is interesting ecologically to study the sexual condition, for the school of whales in this area is composed of males alone, furthermore, the comparison of sexual maturity between this school and that in the adjacent waters to Japan (Nishiwaki and Hibiya, 1951, 1952). So, we would like to report as the fourth report on the sexual maturity of the sperm whales.

Our greatful thanks are due to the inspectors and biologist named

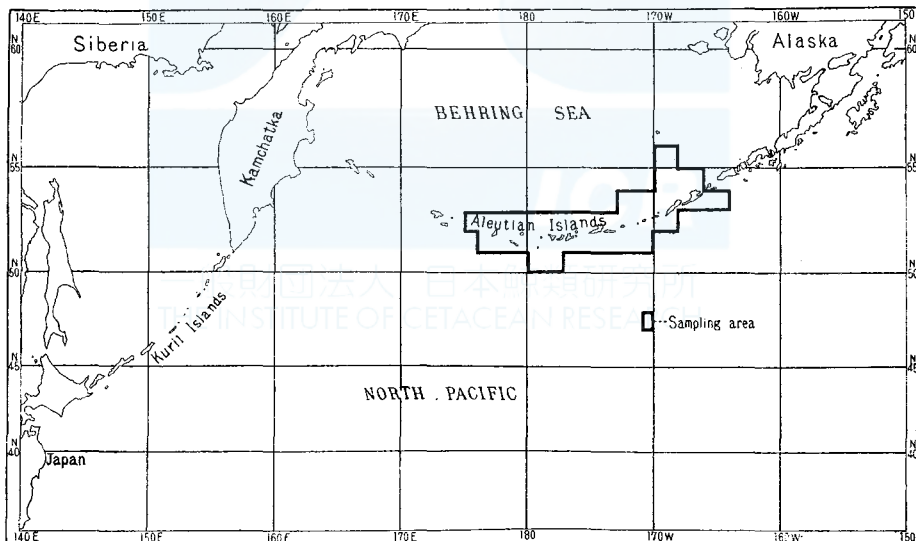


Fig. 1. Location of Sampling area.

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below for their immense cooperation in collecting the material and data for this study.

Government Inspector: Mr. S. Nishimoto, Mr. T. Kawakami,
Mr. N. Ikeda, Mr. K. Iguchi.

Biologist: Mr. K. Fujino.

We wish also to express our thanks to Miss K. Ogura who rendered much assistance in the preparation of histological preparats.

Material and Method

The material for this study are 1060 male sperm whales which were caught and examined their testes in 1954 and 1955. And the histological examination was made on the 106 whales of them.

As the size limit of sperm whale is 38 feet by the case of factory ship whaling, the investigation was made on the individuals 38-57 feet in body length. In them, the samples for histological examination were collected more in small lengthed individuals than large ones (fig. 2), and in the same length relatively light testes were collected many (fig. 6). Therefore the samples were not collected at random.

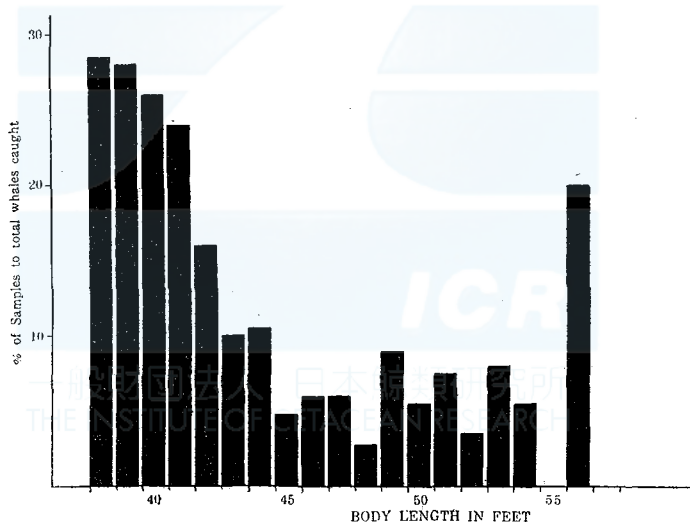


Fig. 2. The ratio of samples to total whales caught in each body length.

The period of the investigation and sampling was from the latter part of May to the latter part of September.

As mentioned above, all the sperm whales caught in the area are males, and we could not investigate the female whales.

The method for the present study is the same as was used in the previous works (Nishiwaki and Hibiya, 1951, 1952).

Tests weight at spermatozoa formation

The lightest weight of testis measured was 0.7 kg. and the heaviest was 13.5 kg. And, the lightest weight of sampled testes was 0.8 kg. and the heaviest was 8.7 kg.

Based on the result of the microscopic examination, those testes in which spermatozoa were found are classified as mature and those in which no spermatozoa were found are classified as immature.

In all testes which were assumed to be mature judged by the condition of seminiferous tubules, spermatozoa were formed, excluded one case of which weight of testis was 1.0 kg. In other testis (1.4 kg.) of this individual spermatozoa were clearly found. And there were several testes which were mature in parts and were immature in other parts. These testes were found in those of relatively light weighted testes.

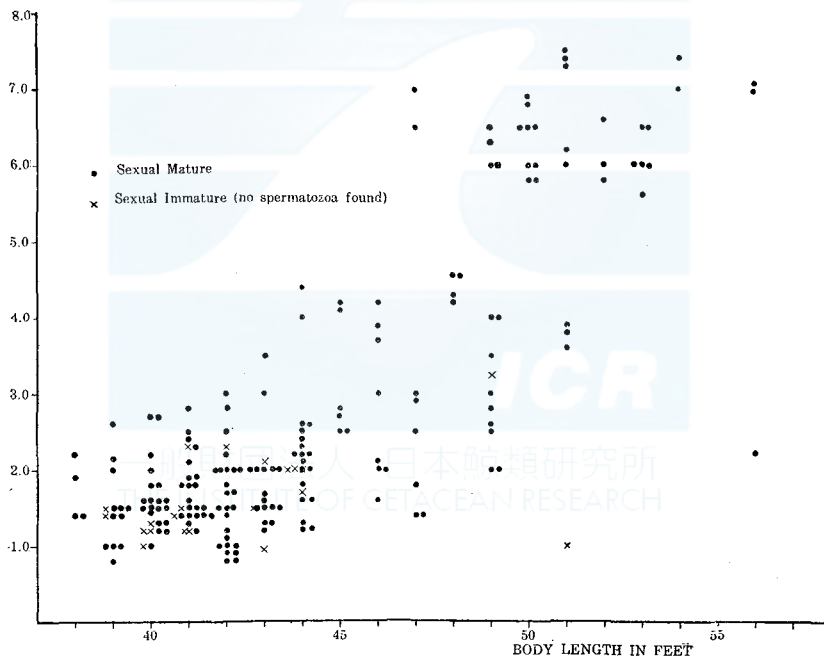


Fig. 3. The weight of testes examined and the body length in the male sperm whales

As shown in fig. 3, the heaviest weight of immature testis was 3.3 kg. but most immature testes were under 2.3 kg. The mature testes were found over 0.8 kg. There were 12 individuals of which one testis was mature but the other one was immature. In one case of them

the weights of the right and left testis differed markedly: the two testes weighed 3.8 kg. and 1.0 kg. But in most of them the two testes weighed very close or slightly different.

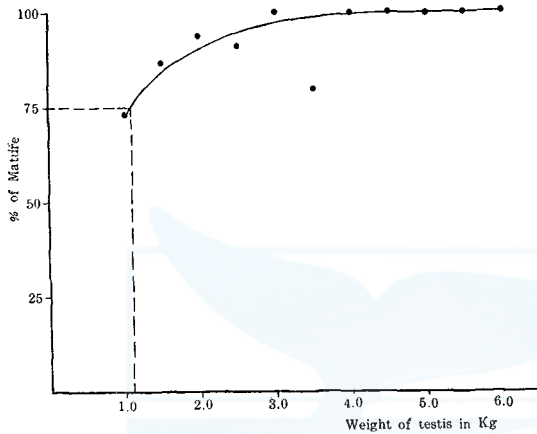


Fig. 4. The percentage of mature testes occurred for each 0.5 kg. testis-weight class.

Table 1. Number of mature and immature testis occurred for each 0.5 kg. testis-weight class

| Weight of Testis | Number of testis examined | | | Percent of + |
|------------------|---------------------------|----|-----|--------------|
| | Total | - | + | |
| 1.0 | 26 | 7 | 19 | 73.1 |
| 1.5 | 54 | 7 | 47 | 87.0 |
| 2.0 | 43 | 3 | 40 | 93.0 |
| 2.5 | 21 | 2 | 19 | 90.5 |
| 3.0 | 10 | | 10 | 100.0 |
| 3.5 | 5 | 1 | 4 | 80.0 |
| 4.0 | 10 | | 10 | 100.0 |
| 4.5 | 4 | | 4 | 100.0 |
| 5.0 | 1 | | 1 | 100.0 |
| 5.5 | 1 | | 1 | 100.0 |
| 6.0 | 13 | | 13 | 100.0 |
| 6.5 | 8 | | 8 | 100.0 |
| 7.0 | 5 | | 5 | 100.0 |
| 7.5 | 4 | | 4 | 100.0 |
| 8.0 | | | | |
| 8.5 | 1 | | 1 | 100.0 |
| — | 206 | 20 | 186 | — |

The result of histological determination of maturity was classified by 0.5 kg. testis weight classes (table 1). In fig. 4 is shown the percentage that mature testes occurred for each testis-weight. The graph indicates that 75 % of the testes are mature at the weight of 1.1 kg. Although it is not enough because we could not get the testes-weight class under 1.0 kg., we regard this figure as the average testis weight of the male sperm whale in the Aleutian waters at the attainment of sexual maturity.

Body length at sexual maturity

We determined those whose both testes were histologically immature as sexually immature individual. The result of determination of maturity by the individuals sampled was classified by 1 foot body length classes. (table 2). The percentage of mature individuals for each body length is shown in fig. 5. As the smallest percentage of maturity is 85 % (in 39 feet), we consider that almost individuals are sexually mature over the 38 feet (limited size for whaling).

Therefore if 75 % mature body length is regarded as the body length at sexual maturity, that will be under 38 feet. As stated above, these material were not collected at random from each body length

of captured whales, and their testes weight were lighter on the average than the total whales caught excluded 38 and 39 feet. Therefore over 40 feet actually mature rate will be higher than the data.

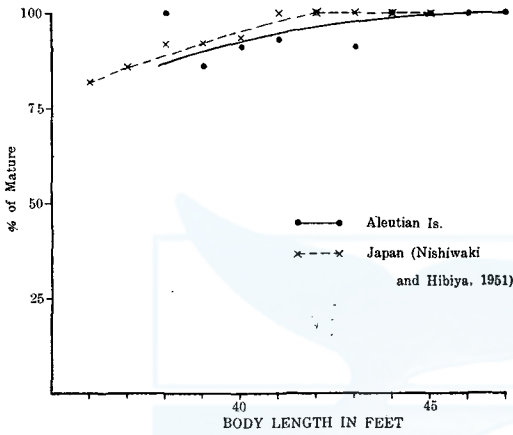


Fig. 5. The percentage of mature whales occurred for each body length class.

Table 2. Number of mature and immature whales occurred for each body length class.

| Body Length | Number of whales examined | | | Percent of + |
|-------------|---------------------------|---|-----|--------------|
| | Total | - | + | |
| 38 feet | 2 | | 2 | 100.0 |
| 39 | 7 | 1 | 6 | 85.7 |
| 40 | 12 | 1 | 11 | 91.7 |
| 41 | 13 | 1 | 12 | 92.3 |
| 42 | 14 | | 14 | 100.0 |
| 43 | 9 | | 9 | 100.0 |
| 44 | 11 | 1 | 10 | 90.9 |
| 45 | 3 | | 3 | 100.0 |
| 46 | 4 | | 4 | 100.0 |
| 47 | 4 | | 4 | 100.0 |
| 48 | 2 | | 2 | 100.0 |
| 49 | 7 | | 7 | 100.0 |
| 50 | 5 | | 5 | 100.0 |
| 51 | 5 | | 5 | 100.0 |
| 52 | 2 | | 2 | 100.0 |
| 53 | 3 | | 3 | 100.0 |
| 54 | 1 | | 1 | 100.0 |
| 55 | | | | |
| 56 | 2 | | 2 | 100.0 |
| — | 106 | 4 | 102 | — |

Discussion

The body length of the male sperm whale at sexual maturity has been calculated by some reporters (table 3).

Table 3. The body length of the male sperm whale at sexual maturity, calculated by some reporters.

| Body Length at sexual maturity | Locality | Reporter |
|--------------------------------|----------------------------------|----------------------------------|
| 37'9"~41'0" | Antarctic water | Matthews (1937) |
| 41' | " | Nishiwaki (1955) |
| 42' | South-east coast of Kamchatka | Matsuura and Maeda (1942) |
| under 38' (35'~37') | Coast of Japan | Nishiwaki and Hibiya (1951, '52) |
| 36' | Coast of British Columbia | Pike (1954) |
| 35' | Coast of Kuril Is. and Kamchatka | Sleptsov 1955) |

In the value of the whale found in the North Pacific, the result of Matsuura and Maeda (1942) is specially high, but that was based on

observations with the naked eye; and the number of whales observed, was not so large, so that their conclusion can hardly be definite. The results of other reporters (Nishiwaki and Hibiya (1951, 1952), Pike (1954), Sleptsov (1955)) are almost the same.

However, they are not enough to determine the thorough body length at sexual maturity, because the limited size for whaling has been established to be 35 feet in coastal whaling and to be 38 feet in factory ship whaling.

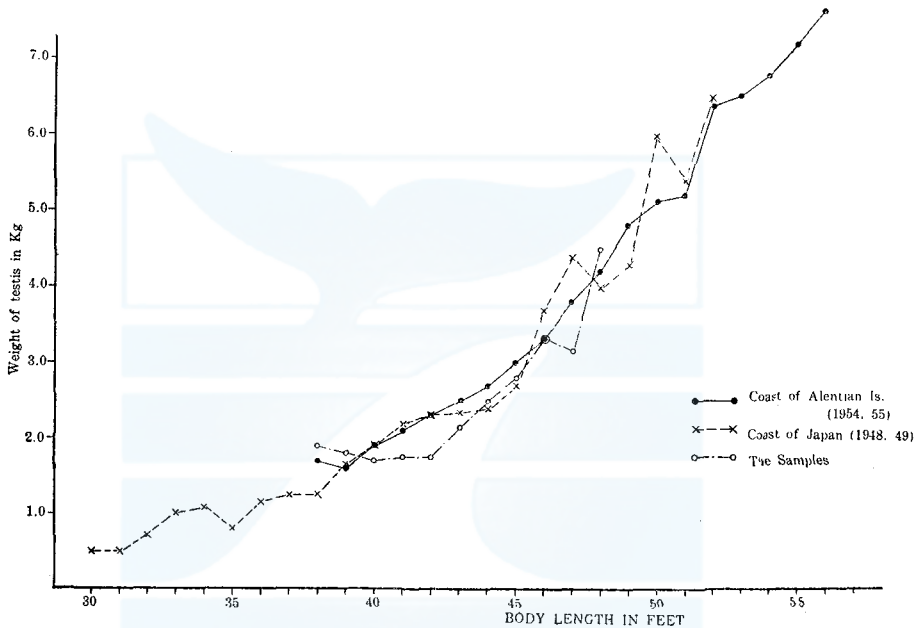


Fig. 6. Geometrical mean weight of heavier testis of the both testes and body length in sperm whales caught in adjacent water to Aleutian Islands and Japan.

Fig. 6 shows the relationship between body length of male sperm whale and the geometrical mean weight of heavier testis of the both testes. And fig. 5 shows the relationship between the body length and the sexual maturity by the histological examination of the testes. According to the two figures, we cannot find the difference between the school found in the waters of Aleutian Island and that found in the adjacent waters to Japan. It is dangerous to estimate the identity of the two stocks, but the body length of the male sperm whales at sexual maturity will be the same in various waters of the North Pacific.

Now, the school of the sperm whales in the adjacent waters to Japan is so-called "harem", on the other hand the school in the waters of Aleutian Island is composed of "lone bull". Judging from the sameness in the condition of testes of the two schools, the "lone bull"

will be not sexually impotent and they are not always composed of old whales.

The body length of which testis is 1 kg. (75 % of sexual maturity) is estimated to be 35 feet as shown in fig. 6. Therefore the body length at sexual maturity may be the same. However, for the sexual maturity of the male sperm whales, microscopic observations are absolutely necessary. And in our examination the variation of immature testes weight is considerably wide, so it is dangerous to separate mature and immature whales by means of only the weight of their testes.

The body length of the male sperm whale at sexual maturity found in the Antarctic waters is over 38 feet (Matthews (1937), Nishiwaki (1955)). And the 75 % mature testis is 1.5 kg. in weight (Nishiwaki (1955)), these values differ from that of the North Pacific, but according to our data in the curves of mean testes weight of north and south hemispheres we cannot find the difference. On this subject we will investigate further.

Mackintosh & Wheeler (1929) and Chittleborough (1955) stated that there was seasonal variation in testes of blue, fin and humpback whales. Our investigation had been taken place during the month of May to September. But we found individuals which have dense spermatozoa in seminiferous tubules in their testes and there are some one which has very dilute spermatozoa in seminiferous tubules. Furthermore we haven't taken the samples of other seasons. So we cannot discuss the seasonal variation of sexual activity in male sperm whales.

Conclusion

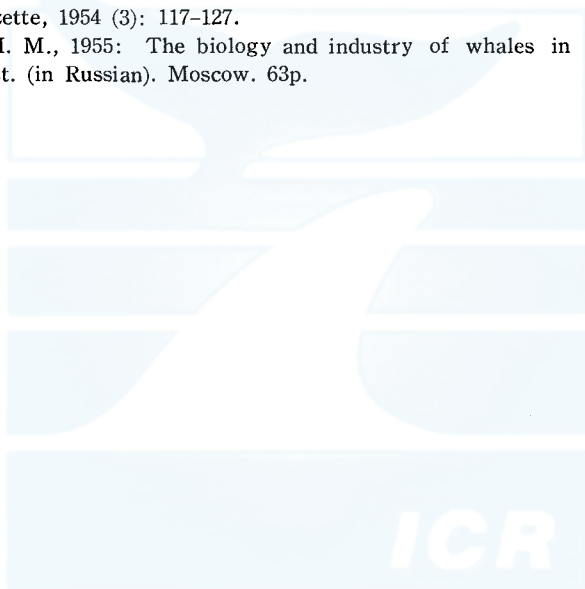
The school of sperm whales taken in the coast of Aleutian Islands consist of lone bulls. And by the investigation of testes sampled from the school, it is estimated that the testis becomes mature at the average weight of 1.1 kg., and almost individuals over 38 feet in body length attain sexual maturity. It is not clear that from where the school migrates, but when we compare the school with that found in the waters to Japan, there is no difference in the two.

The above mentioned body length is smaller than the body length at which the male sperm whales in the Antarctic waters attain sexual maturity. On this subject, further studies will be necessary.

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