ON THE OILS CONTAINED IN VARIOUS BLUBBERS OF NORTHERN ELEPHANT SEAL, *MIROUNGA ANGUSTIROSTRIS*

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INTRODUCTION

The elephant seal or sea elephant is the largest of all the marine carnivores and belongs to the seal family. There are two species, the Northern and the Southern. The former (*Mirounga angustirostris*) is found off the coast of California, while the latter (*Mirounga leonina*) is distributed over a wide range in the Southern seas.

As to the study on the seal family oil, we find various reports on the seal (*Phoca vitulina*) oil, including Tsujimoto's work on the Saghalien seal oil and Ueno and Iwai's study on the Antarctic seal oil (Bauer & Neth, 1924; Tsujimoto, 1916; Ueno & Iwai, 1939; Williams & Makhrov, 1935).

However, the oil of the elephant seal has remained unexplored to this day, still less the differences in the properties of the oils contained in the various parts of its body.

The writer was fortunate enough to obtain elephant seal oils from various blubbers and examine their properties.

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MATERIAL

In January, 1955, three Northern elephant seals were caught off the coast of Mexico, and the 'Nihon Dōbutsuen' (Japan Zoological Gardens) bought them in December of that year. Two of them died soon after their arrival in this country, and the third one was shown to the public at the 'Sekai Dōbutsu Hakurankai' (World Animal Exhibition) held in Kyoto, where it also died on the 7th of June, 1956. It was dissected on the 11th of June at the Faculty of Agriculture & Veterinary, University of Nihon in Tokyo (fig. 1). As its internal organs had already been spoiled, there was no proving the cause of its death. Fortunately, however, there was no trace of putrefaction in its blubber.

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The details of the Northern elephant seal used in this experiment are shown in table 1. After its capture, the elephant seal had been usually fed with living mackerel and sometimes with living carp.

Fig. 1. Elephant seal, *Mirounga angustirostris*.

TABLE 1. DETAILS OF ELEPHANT SEAL

Sex	Presumptive years	Presumptive body weight (kg.)	Body length (m.)	Girth of abdomen (m.)	Girth of neck (m.)	Fore flippers (cm.)	Hind flippers (cm.)
Male	5-6	2000	4.40	2.96	1.67	50 52	66 70

EXPERIMENT AND RESULTS

Oils were extracted from various blubbers as shown in table 2 and fig. 2. The sampling methods for oils are shown in table 2.

Physico-chemical studies were conducted with the sample oils, the results of which are shown in table 3.

Unsaponifiable matter and mixed fatty acids were obtained from the oils, and their properties were examined by oridinary methods (tables 3 & 4).

Solid-and liquid fatty acids were separated by the lead-salt alcohol method (Twitchell, 1921), and their properties were examined in an ordinary manner. The melting points of the solid fatty acids were determined in a capillary tube. The results obtained are shown in tables 5 & 6.

The writer of this paper summarized the results obtained as follows :

TABLE 2. KINDS OF BLUBBER AND OIL

Sample	Kinds of blubber	Thickness of blubber (cm.)	Oil content in blubber	Sampling method for oil
A	Dorsal blubber of thoracic and abdominal cavity	7–10	high	Pressing method
B	Blubber of frontal (part betwen eyes)	1– 2	low	Pressing method first and then parching
C	Dorsal blubber of thoracic cavity	10	high	Pressing method first and then parching
D	Dorsal blubber of abdominal cavity	7	high	Pressing method first and then paching
E	Vetral blubber of thoracic and abdominal cavity	—	—	Pressing method
F	Ventral blubber of neck	1– 2	low	Pressing method first and then parching
G	Ventral blubber of thoracic cavity	9	high	Pressing method first and then parching
H	Ventral blubber of abdominal cavity	2	low	Pressing method first and then parching
I	Ventral blubber of pelvis	1– 2	low	Pressing method first and then parching
J	Ventral blubber of hindmost part	below 1	low	Pressing method first and then parching
K	Blubber of tongue	very thin	low	Extracting method with alcohol and ether

(1) The properties of the oils contained in the various blubbers showed only very slight differences. The most remarkable is the difference in the degree of unsaturation of each oil. It is interesting to note that the degree of unsaturation in the tongue oil is very low as in the case of the tongue oil of the sei-whale experimented by Sakai & Mori (1953). The degree of unsaturation of the frontal oil is also very low.

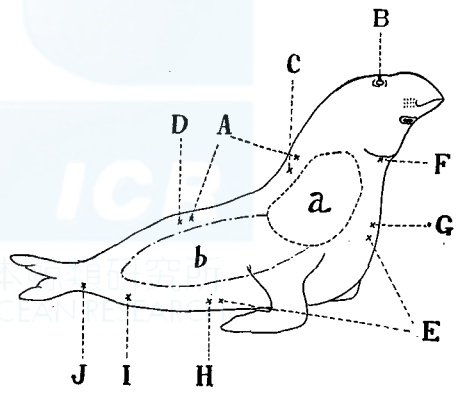

Fig. 2. Blubbers of elephant seal.
a: Thoracic cavity.
b: Abdominal cavity.

(2) The acid value of the sample oils is very high. This seems to be due to the large quantity of fatty acids produced at the time of decomposition of the oil by the action of lypase. Apparently the lypase content in the blubber of the elephant seal is comparatively high, and the fat metabolism in its body seems to be active.

TABLE 3. PROPERTIES OF OILS AND UNSAPONIFIABLE MATTERS

Sample	Appearance (at 25°C.)	$d_{4^\circ}^{15^\circ}$	$N_D^{30^\circ}$	Acid value	Sapon. value	Iodine value	Unsapon. matter (%)	Unsapon. matter	
								Appearance (at 30°C.)	Iodine value
A	Yellowish orange liquid	0.9251	1.4646	13.0	184.9	136.4	1.46	Yellow, viscous liquid	84.2
B	Reddish brown liquid	0.9170	1.4610	27.5	187.4	105.5	0.65	Yellowish brown solid	88.6
C	Reddish brown liquid	0.9195	1.4635	17.5	181.5	130.2	0.66	Yellowish brown solid	117.2
D	Reddish brown liquid	0.9187	1.4626	16.4	188.6	118.0	0.61	Brown solid	98.6
E	Yellowish orange liquid	0.9275	1.4650	11.6	185.3	140.9	1.42	Brownish orange solid	76.3
F	Reddish brown liquid	0.9180	1.4623	23.2	179.3	116.4	1.81	Yellowish brown solid	102.8
G	Brown, viscous liquid	0.9202	1.4641	21.4	182.6	134.2	1.04	Yellow solid	113.9
H	Reddish brown liquid	0.9210	1.4638	20.8	186.9	133.4	1.03	Yellowish brown solid	114.1
I	Reddish brown liquid	0.9173	1.4616	20.9	186.0	110.4	1.08	Yellowish brown solid	109.3
J	Reddish brown liquid	0.9188	1.4630	15.3	184.5	123.1	0.52	Yellow solid	103.1
K	Reddish brown liquid	0.9121	1.4597	28.5	175.6	90.4	1.67	Yellowish brown solid	100.1

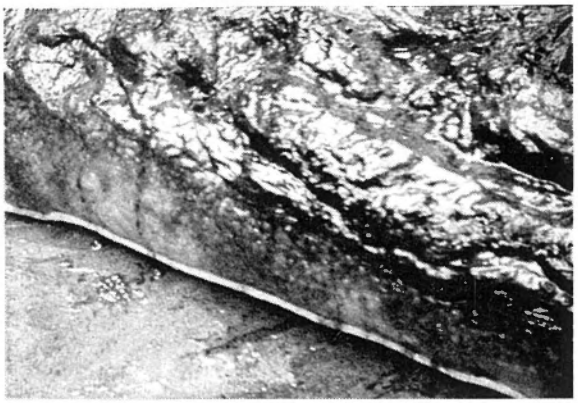

Fig. 3. Dorsal blubber of thoracic cavity of elephant seal.

TABLE 4. PROPERTIES OF MIXED FATTY ACIDS

Sample	Appearance (at 30°C.)	$N_D^{30°}$	Iodine value	Neutralization value	Average molecular weight
A	Yellow liquid	1.4590	138.2	189.6	295.9
B	Reddish orange liquid	1.4552	108.6	193.3	290.3
C	Yellow liquid	1.4578	133.2	187.2	299.7
D	Yellowish orange liquid	1.4565	122.9	195.4	287.1
E	Orange liquid	1.4598	142.8	190.6	294.4
F	Orange liquid	1.4564	120.1	183.9	305.1
G	Yellowish orange liquid	1.4589	136.9	188.3	298.0
H	Yellowish orange liquid	1.4589	135.2	193.1	290.5
I	Yellow liquid	1.4559	113.2	190.2	295.0
J	Yellowish orange liquid	1.4572	126.3	188.2	298.0
K	Yellowish orange liquid	1.4450	94.2	181.5	309.1

TABLE 5. PROPERTIES OF SOLID FATTY ACIDS

Sample	Percent. in mixed fatty acids	Appearance (at 25°C.)	$N_D^{50°}$	Melting point (°C.)	Iodine value	Neutralization value	Average molecular weight
A	25.11	Yellowish white solid	1.4347	42.5-45.0	23.1	211.5	265.3
B	25.07	Dark brown solid	1.4345	42.0-44.5	23.4	207.2	270.8
C	26.43	Yellowish brown solid	1.4350	43.0-45.0	24.6	195.4	287.1
D	30.73	Brown solid	1.4363	45.0-47.0	26.9	202.8	276.7
E	25.05	Yellowish brown solid	1.4355	43.5 46.5	25.6	214.7	261.3
F	33.19	Yellowish brown solid	1.4365	47.5 49.5	27.2	204.3	274.6
G	29.76	Yellowish brown solid	1.4359	45.5-47.5	26.5	209.1	268.3
H	31.51	Yellowish brown solid	1.4368	47.0-48.5	28.1	213.9	262.3
I	26.71	Yellowish brown solid	1.4351	44.0-47.0	25.3	226.1	248.2
J	28.64	Yellowish brown solid	1.4360	43.0-47.0	26.6	207.3	270.7
K	27.77	Brown solid	1.4354	44.0-47.0	25.9	203.5	275.7

TABLE 6. PROPERTIES OF LIQUID FATTY ACIDS

Sample	Percent. in mixed fatty acids	Appearance (at 25°C.)	$N_D^{30°}$	Iodine value	Neutralization value	Average molecular weight
A	74.89	Yellow liquid	1.4598	175.4	181.6	309.0
B	74.93	Yellowish orange liquid	1.4570	136.2	187.5	299.3
C	73.57	Orange liquid	1.4593	170.3	182.9	306.7
D	69.27	Reddish orange liquid	1.4585	164.1	191.8	292.6
E	74.95	Reddish orange liquid	1.4601	180.6	177.1	317.0
F	66.81	Reddish orange liquid	1.4588	165.1	172.9	324.5
G	70.24	Reddish orange liquid	1.4605	183.6	178.4	314.5
H	68.49	Reddish orange liquid	1.4606	182.1	181.7	308.8
I	73.29	Reddish orange liquid	1.4575	144.7	175.9	319.0
J	71.36	Reddish orange liquid	1.4588	166.5	178.6	314.2
K	72.23	Reddish orange liquid	1.4566	120.1	171.9	326.4

(3) The amount of unsaponifiable matter in each oil is comparatively small, registering only about one per cent. This fact seems to show that the blubber of the elephant seal is a pure fat accumulation depot.

(4) There is no remarkable difference in the average molecular weights of the mixed fatty acids obtained from different oils. The average molecular weight is lower in solid fatty acids than in liquid fatty acids.

SUMMARY

The oils contained in various blubbers of Northern elephant seal (*Mirounga angustirostris*) have been studied.

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