Short communication

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The occurrence of ambergris in sperm whales caught by Soviet whaling flotillas

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Abstract

Ambergris is a solid waxy secretion of the digestive system of sperm whales, historically used in the perfume industry. The original documentation of 29 cruises made by the scientific groups of the Soviet whaling flotillas "Slava", "Soviet Ukraine" and "Yuri Dolgoruky", between 1961 and 1978 were analyzed for the presence of ambergris. In total, 59 814 sperm whales (*Physeter macrocephalus*) were examined, with ambergris found in 240 specimens (0.4 %), of which 159 were males (0.44 %, n = 35 994) and 81 females (0.34 %, n = 23 820). The average weight of ambergris was 18.3 kg (17.9 kg in males and 19 kg in females). Two isolated sperm whale herds, south of Madagascar and south of New Zealand and Tasmania, contained the largest ambergris secretions.

Keywords: Ambergris, sperm whales, *Physeter macrocephalus*, distribution, whale database, Soviet whaling

Introduction

Ambergris (lat. *Ambrosiaca grisea*) is a specific waxy substance, which is formed in the intestines of, mostly, sperm whales. The nature and history of ambergris has been discussed in many books and papers (e.g., Schafer, 1981; Tomilin, 1937, 1957, 1962; Clarke, 1954, 2006).

The purpose of this short paper is to present unique original data collected by biologists during whaling of 3 Soviet flotilias. The data are not complete, with data from only three flotilias used. Even for these some information (e.g., ambergris weight) was not always present. It is therefore only possible to produce a preliminary analysis and formulate some hypotheses, which should be confirmed or refuted by further studies, when more data is available.

Materials and methods

"Whale inspection logs", "Whale passports", "Haul reports" by biologists of scientific groups of whaling flotillas "Slava" (5 cruises), "Soviet Ukraine" (15 cruises) and "Yuri Dolgoruky" (9 cruises), from the period from 1961 to 1978, were processed. Unfortunately it was not possible to find data about ambergris for other Soviet flotilias, e.g. "Aleut", "Vladivostok", "Far East" and "Soviet Russa". Also, even for examined whales some ambergris could be undetected and discarded, because the search for ambergris was not required, so the occurrences below provide only the lower margin.

Table 1 presents all occurrences with whale sex, length and coordinates, and ambergris weight, if it was weighted.

Maps of the distribution of caught whales were compiled, and weights of ambergris were analyzed when available.

Results

In total, 59,814 sperm whales were examined during this period, including 35,994 males and 23,820 females. Ambergris was found in 240 whales, which is 0.4 % of the total number of sperm whales caught. Ambergris was found in 159 males (0.44 %), and 81 females (0.34 %).

Table 1. Ambergris occurrence.
Fleet codes: SL – Slava, SU – Soviet Ukraine, UD – Yuri Dolgoruky.
Negative latitudes mean south, positive – north. Negative longitudes mean west, positive – east. Latitudes and longitudes are in degrees.

Fleet	Date	Latitude	Longitude	Sex	Length, m	Ambergris Weight, kg
SL	12/25/1961	-54	-61	M	15.8	
SL	12/25/1961	-54	-62	M	14.2	
SL	2/5/1963	-64.8833	149.7667	M	13.5	21.3
SL	2/6/1964	-61.4	83.88333	M	15.4	3
SL	2/18/1964	-63.6	152.7	M	15.1	1.5
SL	2/19/1964	-64.0833	157.1	M	15.8	
SL	3/5/1964	-48.1167	170.2	M	15	12
SL	3/13/1964	-43.4167	-178.717	M	14.2	
SL	3/17/1964	-43.1833	172.9667	M	15.7	
SL	3/18/1964	-43.1833	172.9667	M	13.5	
SL	3/18/1964	-43.1833	172.9667	M	13.5	
SL	3/22/1964	-42.5667	169.8167	M	14.8	7
SL	3/23/1964	-43.8667	168.3667	M	16.4	
SL	4/18/1964	-43.8	147.3333	M	12.3	2.5
SL	4/19/1964	-44.2833	146.2833	M	11.7	
SL	4/19/1964	-44.2833	146.2833	M	11.6	
SL	4/20/1964	-42.8833	145.0167	M	11.6	20
SL	4/20/1964	-42.8833	145.0167	M	13	20
SL	4/20/1964	-42.8833	145.0167	M	16.1	30
SL	4/20/1964	-42.8833	145.0167	M	13.7	1
SL	4/21/1964	-42.1333	144.3	M	15.3	10
SL	4/21/1964	-42.1333	144.3	M	15	
SL	4/21/1964	-42.1333	144.3	M	10.2	
SL	4/22/1964	-42.3833	144.75	F	11.7	15
SL	4/22/1964	-42.3833	144.75	F	11.6	20
SL	4/22/1964	-42.3833	144.75	F	10.6	20
SL	4/23/1964	-42.6667	144.8333	M	16	10
SL	4/25/1964	-41.6667	144.3	F	11	
SL	12/6/1964	7.833333	73.16667	F	9.7	
SL	12/7/1964	5.9	74.16667	M	10.8	37
SL	12/13/1964	-2	74	M	14.4	0.52
SL	12/24/1964	-31.25	81	F	9.2	9
SL	1/14/1965	-32	93	M	10.7	21
SL	2/8/1965	-40.75	143.3833	M	16	90
SL	2/8/1965	-40.75	143.3833	M	14.5	33
SL	2/9/1965	-41.1667	142.1667	F	11.1	5
SL	2/9/1965	-41.1667	142.1667	F	10.6	53
SL	2/9/1965	-41.1667	142.1667	F	11	5
SL	2/10/1965	-42.6333	141.5333	M	11.1	0.25
SL	2/11/1965	-41	142	F	11.6	1.5
SL	2/13/1965	-43	144	F	10.5	0.5
SL	2/15/1965	-44	148	F	11.1	5
SL	2/15/1965	-44	148	F	10.6	8
SL	2/16/1965	-43	149	M	11.7	0.2
SL	2/16/1965	-43	149	M	15.6	0.2
SL	2/16/1965	-43	149	M	12.7	16
SL	2/20/1965	-45	148	M	12.1	0.3
SL	2/20/1965	-45	148	M	12.3	0.3

Fleet	Date	Latitude	Longitude	Sex	Length, m	Ambergris Weight, kg
SL	2/26/1965	-60	151	M	13.7	0.7
SL	3/18/1965	-44	147	M	12.2	2
SL	3/19/1965	-44	148	F	11.4	1.2
SL	3/19/1965	-44	148	M	11.1	23
SL	3/19/1965	-44	148	M	13.5	86
SL	3/26/1965	-41	149	F	11.1	0.3
SL	3/29/1965	-21	149	M	12.5	1.3
SL	3/29/1965	-41	149	M	10.9	1
SL	3/30/1965	-43	145	F	10.6	10
SL	3/30/1965	-43	145	M	10.6	0.9
SL	3/30/1965	-43	145	M	10.6	0.3
SL	3/31/1965	-43	145	M	16.1	7.1
SL	4/9/1965	-43	145	F	10.8	3.5
SL	11/12/1965	-14.7333	51.65	F	9.4	9
SL	11/12/1965	-14.7333	51.65	F	8.9	1
SL	12/9/1965	-33.5	45.83333	M	14.7	0.7
SL	12/10/1965	-32.0667	44	F	10.2	3.8
SL	12/10/1965	-32.0833	44.03333	F	10.4	0.26
SL	12/17/1965	-32.6667	44.46667	F	10.3	70
SL	12/21/1965	-31.7667	42.3	M	14.2	1.6
SL	1/30/1966	-55.9333	58.86667	M	13.3	0.77
SL	4/12/1966	-46.8167	165.9833	M	12.6	27
SL	4/12/1966	-46.9667	166.0333	M	14	2.5
SL	4/12/1966	-47	165.45	M	14.3	0.6
SU	11/27/1962	-41.3333	-56.8	M	13.1	2.4
SU	1/25/1963	-63.9	102.7167	M	14.7	
SU	1/25/1963	-63.9	102.7167	M	15	
SU	2/2/1963	-64.9	118.25	M	15	2.75
SU	2/2/1963	-64.6	118.4	M	14.7	0.68
SU	2/27/1963	-65.1667	15.005	M	16.3	6.2
SU	2/27/1963	-64.65	155.9	M	14.7	4.95
SU	2/28/1963	-64.8	158.4	M	15.2	0.6
SU	2/8/1964	-60.15	14.01167	M	15	
SU	4/27/1964	-43.3833	144.5333	M	12.6	100
SU	10/26/1964	10.43333	47.53333	M	10.2	
SU	10/26/1964	10.43333	47.53333	M	9.7	
SU	10/26/1964	-11.4667	47.53333	M	13	
SU	10/27/1964	13.11667	46.21667	M	10.2	
SU	10/27/1964	13.11667	46.21667	M	8.3	
SU	11/16/1964	-3	52.16667	M	13.3	20.5
SU	11/19/1964	0.383333	52.23333	M	13.5	20
SU	11/19/1964	0.383333	52.23333	M	10.5	20
SU	2/13/1965	-49	147.5	M	14.4	90
SU	2/15/1965	-41.3333	149	M	11.6	1.5
SU	2/15/1965	-41.5	148.5	M	11.8	27
SU	2/15/1965	-41.5833	148.5833	F	9.1	50
SU	2/15/1965	-41.6667	148.6667	F	9.2	1.5
SU	2/16/1965	-42.4167	148	F	9	
SU	2/16/1965	-42.5	148.4167	F	10.1	
SU	2/27/1965	-42.5833	148.5	M	14	3
SU	12/10/1965	-36.3	111.3667	M	14.1	37

Fleet	Date	Latitude	Longitude	Sex	Length, m	Ambergris Weight, kg
SU	1/5/1966	-62.0833	15.01	M	15.4	
SU	1/12/1966	-64.6667	174.75	M	14.2	
SU	1/20/1966	-67.9667	179.4167	M	14.5	
SU	1/24/1966	-64.8333	163.2333	M	14.8	26
SU	11/15/1966	21.5	69.95	M	11.4	
SU	12/27/1966	-64.1333	112.3667	M	15.7	
SU	12/27/1966	-64.1167	113.1333	M	14.6	1.5
SU	12/27/1966	-69.8333	-155	M	14.8	
SU	3/23/1967	-66.2333	162.7667	M	16	0.7
SU	4/10/1967	-45.8833	166.0667	M	15.4	86
SU	4/10/1967	-47	165.3333	M	15.4	
SU	4/10/1967	-46.9833	165.0333	F	11.6	
SU	12/18/1967	-32.9167	44.86667	M	13.8	32
SU	2/4/1968	-67.1667	174.3333	M	15.7	
SU	2/6/1968	-69.15	178.4333	M	16.1	
SU	4/1/1967	-68.05	178.7667	M	14.9	2
SU	4/1/1967	-68.5	173.9667	M	15.3	25
SU	11/23/1968	-31.3833	0.816667	M	13.3	1
SU	11/23/1968	-31.1333	0.716667	M	12.9	48
SU	1/20/1969	-61.75	-61.15	M	16.3	
SU	4/8/1969	-58.1833	148.4833	M	14.9	0.5
SU	4/9/1969	-59.0833	148.25	M	15	1.1
SU	4/12/1969	-42.2333	149.05	M	11.6	5
SU	4/13/1969	-42.25	148.8333	M	11.1	42
SU	4/18/1969	-44.0333	143.5167	M	11.1	0.75
SU	4/24/1969	-33.8	127.6833	M	12.2	
SU	4/29/1969	-34.6833	120.6667	M	11.2	27
SU	4/29/1969	-34.8333	120.6667	F	10.9	10
SU	5/3/1969	-31.5	114.8333	M	11.7	5
SU	12/25/1970	-34.6333	4.033333	M	13.1	64
SU	1/9/1970	-35.5667	12.28333	F	11.4	0.11
SU	2/8/1970	-47.05	54.33333	M	12.2	3.54
SU	4/6/1970	-42.5	49.66667	M	11.6	80
SU	4/6/1970	-41.15	50.16667	M	14	0.8
SU	4/13/1970	-35.6833	45.21667	F	10.2	
SU	4/15/1970	-32.4667	43.33333	M	10.4	10
SU	4/5/1971	-36.3	58.53333	M	12.5	
SU	4/12/1971	-35.0333	45.36667	F	10.8	
SU	4/12/1971	-34.3333	45.41667	F	10.6	
SU	4/12/1971	-34.2667	45.28333	M	12.5	50
SU	4/12/1971	-34.2667	45.28333	F	8.9	
SU	4/13/1971	-34.2667	45.28333	F	11.7	
SU	4/13/1971	-33.15	45	F	10.5	
SU	4/15/1971	-32.4833	44.88333	F	10.2	94
SU	2/7/1972	-53.9	-2.41667	M	14.7	65
SU	2/24/1972	-49.8333	49	M	13.6	
SU	4/19/1972	-31.1333	4.333333	F	8.8	20
SU	4/26/1972	-30.2	38.3	F	10	15
SU	5/8/1972	-27.75	41.45	F	9.5	
SU	12/4/1972	-58.2667	45.25	M	14.9	80
SU	4/24/1973	-33.9667	12.53333	F	10.4	1.85

Fleet	Date	Latitude	Longitude	Sex	Length, m	Ambergris Weight, kg
SU	4/4/1974	-36.65	155.0667	F	9.8	40
SU	4/4/1974	-36.65	155.0667	F	9.7	45
SU	11/15/1975	-27.3333	13.98333	F	10.5	
SU	11/22/1976	-28.8333	13.5	M	13.6	3
SU	12/1/1976	-33.6667	45.26667	F	10.5	20
SU	12/7/1977	-31.95	30.81667	M	11.1	
UD	22628	-62.9333	115.7333	M	14.1	6
UD	23322	-35.25	18.46667	M	9.9	
UD	23326	-35.9333	-5.3	M	15.3	60
UD	23429	-64.5333	67.51667	M	13.7	28
UD	23475	-36.6	70.28333	F	10.3	0.65
UD	23481	-34.15	64.51667	F	10.2	5.3
UD	23460	-48.1667	71.18333	M	12.3	0.6
UD	23468	-35.8	70.73333	M	10.8	5.39
UD	23380	-48.3333	70.83333	M	14.8	28
UD	23831	-35.1167	123.7833	F	10.7	130
UD	23821	-35.1667	115.5	M	11.9	
UD	23824	-35.4833	116.6167	M	12.7	3.55
UD	23822	-35.4167	115.3833	M	11.9	
UD	23822	-35.35	115.8333	M	11.7	
UD	23823	-35.55	117.1667	F	10.6	0.88
UD	23823	-35.55	116.8333	M	11.3	23
UD	23823	-35.6	116.8833	M	9.5	18
UD	23825	-33.55	116.2667	M	12.2	20
UD	23826	-35.3	119.5833	M	10.8	0.46
UD	23825	-35.5	118.0833	F	10.6	
UD	23825	-35.75	117.55	F	9.6	20
UD	23823	-35.55	117.1667	F	10.4	65
UD	23823	-35.5333	116.8333	F	10.6	40
UD	23828	-35.9	119.2833	M	12.2	19
UD	23822	-35.1	115.3333	M	12.5	13
UD	23842	-34.3333	132.25	M	11.3	
UD	23827	-34.9167	119.1667	M	13.1	
UD	23827	-35.2167	120.95	F	10.7	
UD	23830	-35.2667	118.75	F	10.5	27
UD	23830	-34.9833	120.9833	M	9.7	
UD	23829	-35.1167	118.6833	F	9.9	20
UD	23830	-35.1167	119.0667	F	10.3	1.5
UD	23832	-34.75	123.4667	F	9.5	2.89
UD	23838	-33.6667	130	M	9.5	
UD	20553	-35	132.5333	F	10.5	3.1
UD	23840	-35.5	133.8333	M	10.5	2.2
UD	23841	-35.55	134.5833	M	12.2	1.5
UD	23841	-35.5833	134.6667	M	11.7	
UD	23840	-35.4167	133.7333	F	11.1	28
UD	23841	-35.5	135	M	12.2	0.75
UD	23841	-35.4	134.6	M	12.4	12.9
UD	23840	-35.0667	134.6	M	12.3	9.5
UD	23841	-35.3167	133.6833	M	10.6	0.25
UD	23847	-35.5	115	M	11.3	
UD	23847	-35.5833	115.5833	M	11.8	

Fleet	Date	Latitude	Longitude	Sex	Length, m	Ambergris Weight, kg
UD	23845	-33.6	127.1333	F	10.3	
UD	23836	-34.4333	126.25	F	10.7	21
UD	23837	-35.7	129.3333	F	10.4	4
UD	23837	-33.6	129.95	F	10.3	
UD	23838	-33.85	130.5	F	9.8	11.7
UD	23838	-33.6667	130	F	9	
UD	23859	-29.2667	113.7167	F	10.4	60
UD	23859	-29.0833	113.3	F	10.9	
UD	23860	-28.5	113.25	F	10.5	
UD	23861	-27.3	112.3167	F	10.6	8
UD	23833	-34.7833	125.3167	F	10.5	0.18
UD	23833	-33.7833	126.2667	F	10.5	19
UD	23834	-33.8333	126.3667	F	9.4	16
UD	23834	-34	127.25	F	11	2
UD	23852	-32.45	164	F	10.9	1
UD	23854	-32.7667	113.95	F	10.7	2.25
UD	23855	-31.8333	115.25	F	10.8	
UD	23847	-35.6	114.6667	M	11.7	1
UD	23847	-35.6167	115	M	13.1	
UD	23856	-32.0667	113.95	F	10.5	
UD	23726	-56.6167	44.3	M	12.9	9.7
UD	23837	-32.8333	114.6667	M	12	4.2
UD	23870	-26.5333	110.6333	F	10	12.3
UD	23870	-25.7	110	F	9.8	3
UD	24083	-55.4	6.5	M	14.7	2
UD	23805	-55.5833	19.33333	M	14.7	2
UD	24422	-33.4167	-4.26667	M	12.3	3
UD	24476	-62.9667	28.55	M	15.3	203
UD	25552	-55.75	23.33333	M	12.6	1.9
UD	25552	-55.6667	23.41667	M	12.6	12.6
UD	25651	-45.7333	149	M	10.8	6.2
UD	25677	-31.7833	114.4667	F	10.2	60
UD	25674	-28.6167	113.2167	F	10.9	15
UD	25604	-64.7167	59.53333	M	14.6	2
UD	25649	-47.6833	148.9833	M	13.8	4
UD	25591	-60.85	101.3333	M	13.5	
UD	25910	-34.6667	-3.05	M	13.6	4
UD	25987	-54.5333	-45.6167	M	14.5	3.5
UD	26310	-54.3333	-57.2667	M	13.2	3.3

The distribution of sperm whales caught by the flotillas is illustrated by the map (Fig. 1).

As can be seen, sperm whales were caught in all the oceans of the Southern Hemisphere with relatively the same density. But sperm whales with ambergris were overwhelmingly found in the Indian Ocean (Fig. 2).

In 171 cases, the discovered ambergris was weighed - 112 times in males, and 59 times in females. It should be noted that some whales had multiple nodules of ambergris, and Table 1 shows their total weight. The average weight of ambergris was 18.3 kg, for males – 17.9 kg, for females – 19 kg.

Figure 3 shows the places of occurrence of ambergris concretions weighting more than or equal to 50 kg (Fig. 3).

The map reveals two "local herds" (two populations) of sperm whales; one cluster was located south of Madagascar along the meridian to Antarctica, while the

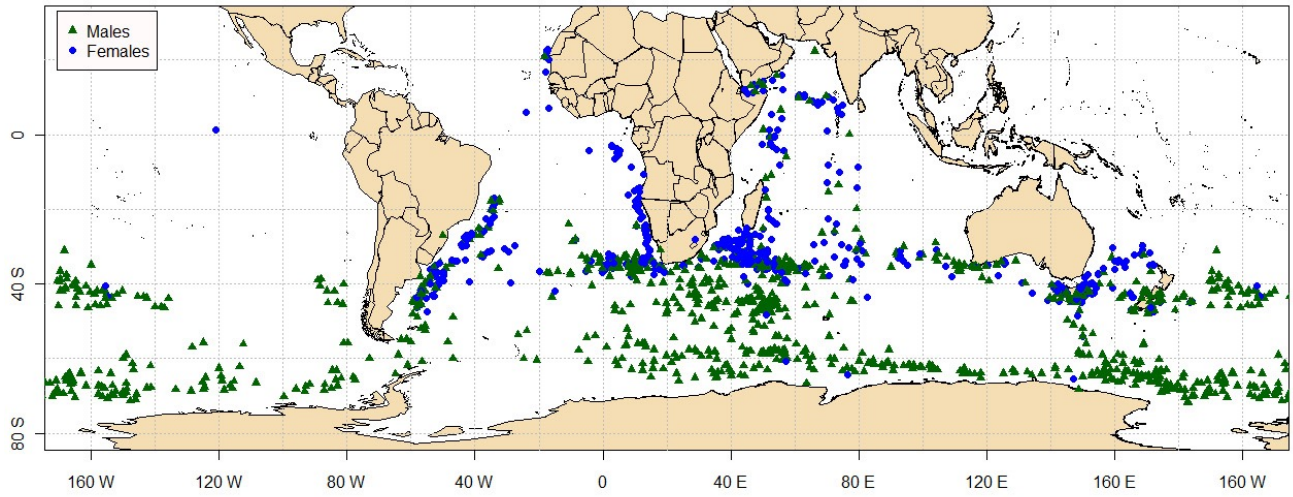

Figure 1. Distribution of sperm whales caught by flotillas "Slava", "Soviet Ukraine" and "Yuri Dolgoruky" for the period 1961-1978.

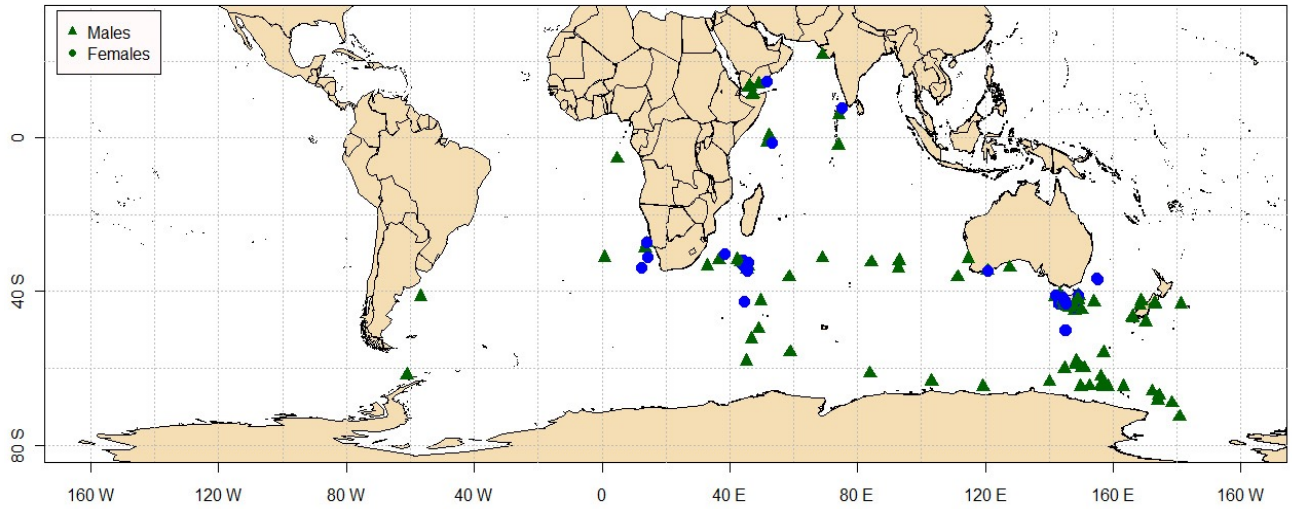

Figure 2. Distribution of caught sperm whales in which ambergris was found.

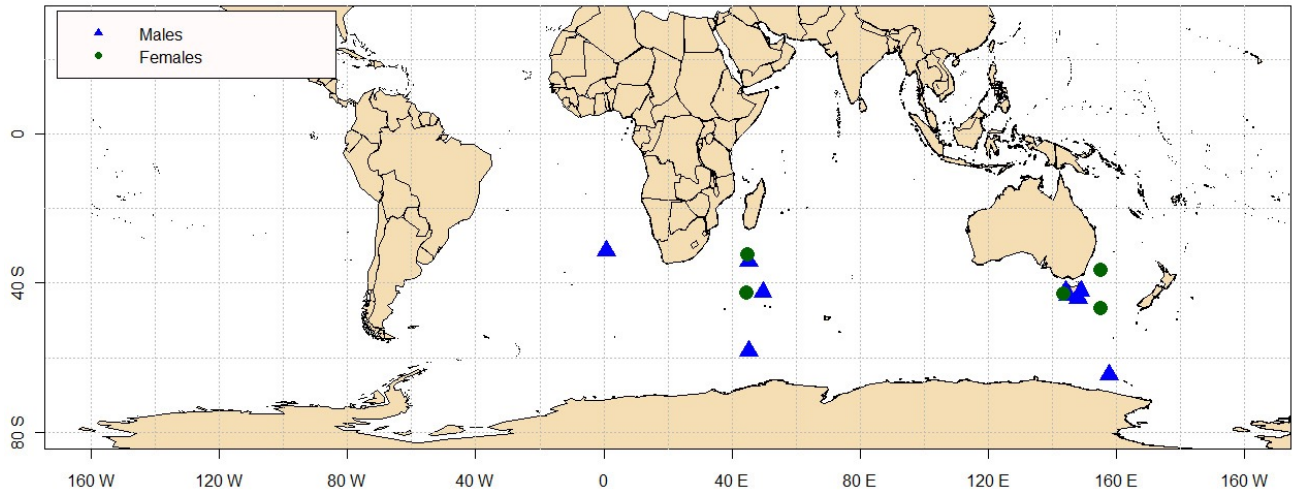

Figure 3. Distribution of sperm whales with large ambergris boulders.

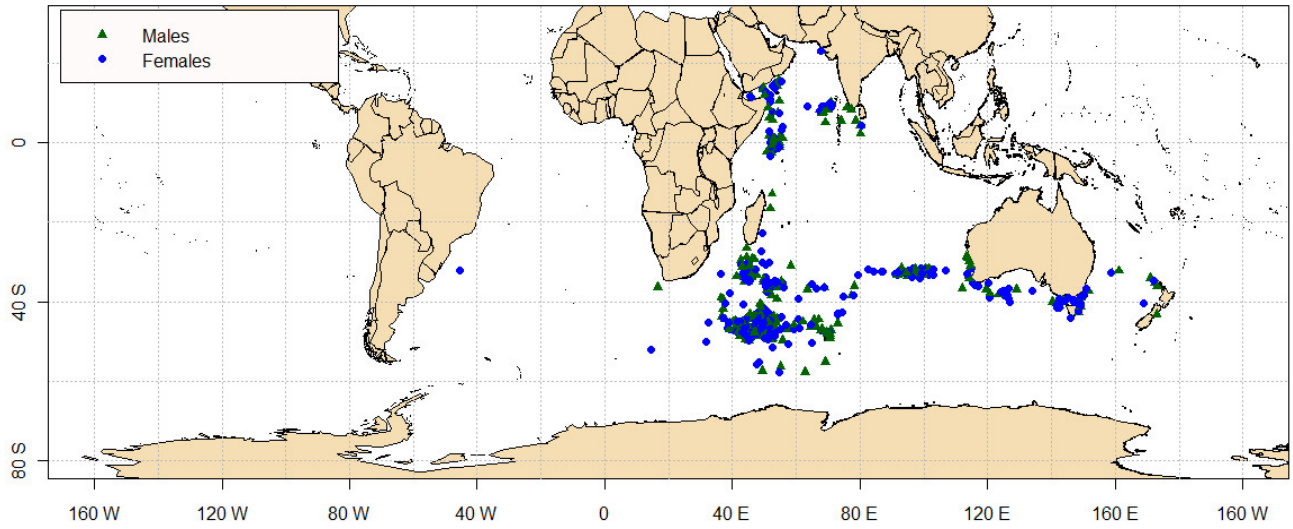

Figure 4. Distribution of pygmy blue whales (*Balaenoptera musculus brevicaudis*, Ichihara, 1961).

second was from Australia and Tasmania, south to the Balleny Islands.

Discussion

In a number of studies it is stated that ambergris is found in male sperm whales, while in females it is either completely absent or extremely rare, and ambergris concretions are smaller than in males (Schwediawer, 1783; Hardy, 1949; Ivashin, 1966). The current data indicates that ambergris is found in both male and female sperm whales (Table 1). In percentage terms, the occurrence of ambergris in females is just a little lower (0.34 % of cases) than in males (0.44 % of cases). Also the weight of ambergris found in females is almost the same as that in males.

It was noticed that the zone of ambergris occurrences practically coincided with the range of pygmy blue whale (*Balaenoptera musculus brevicauda*, Ichihara, 1961) (Fig. 4).

The reasons for the coincidence of the distribution of sperm whales with ambergris and the range of pygmy blue whales are not yet clear. To clarify this issue, separate studies will be required, with a thorough analysis of the trophic relationships in these two species of whales, as well as the ecological situation in the Indian Ocean region and adjacent waters.

Conclusions

In the period from 1961 to 1978, 59,814 sperm whales were caught during 29 whaling seasons by the whaling flotillias Slava, Soviet Ukraine and Yuri Dolgoruky; 35,994 of these were males and 23,820 females. The constructed whale distribution map showed that in the Southern Hemisphere, sperm whales were caught in all oceans (the Atlantic, Indian, Pacific and Southern Arctic). Ambergris was found in 240 sperm whales, which was 0.40 % of the whales examined. In males, the percentage of ambergris found was 0.44 %, and 0.34 % in females.

The distribution map of sperm whales with ambergris showed that the vast majority of them were from the Indian Ocean.

Ambergris was weighed in 171 cases. The average weight of ambergris in males was 17.9 kg, and in females it was 19 kg.

The distribution map of sperm whales with large ambergris boulders (weighing more than 50 kg) revealed the presence in the southern part of the Indian Ocean of two isolated local concentrations (populations) of sperm whales - Madagascar and Australian-Tasmanian.

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