The following supplement accompanies the article

Distribution of Soviet catches of sperm whales *Physeter macrocephalus* in the North Pacific

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Supplement. Definitions of catch areas and issues regarding the determination of catch numbers and locations

Here, we attempt to describe the nature of the data underlying this paper, and the various problems and challenges associated with understanding them. Reconstruction of Soviet sperm whale catches and their distribution was based upon available information from annual whaling fleet scientific reports, and occasionally from whaling inspectors' reports. Former Soviet biologists who worked with the whaling fleets (and who in some cases wrote the reports) confirm that these 2 sources are the most reliable.

As the USSR's whaling expanded to cover most of the North Pacific, whalers referred to particular areas to describe their search effort and catch results. Many of these areas were based simply upon common geographical names (especially in the years prior to 1965); examples include the Kuril Islands, Olyutorsky Bay, the Commander and Aleutian Islands, and the Bering Sea. None of these areas were specifically defined in the reports, which assume a general understanding of where each area is.

With further expansions of the Soviet whaling effort, operations began to cover large pelagic areas of the North Pacific. The extent of these mainly new whaling areas (termed the Eastern, Central, and Western Regions in the reports) were defined each year based upon where the fleets were working; as the coverage expanded, so sometimes did the boundaries of the 3 regions. Because most of the reports describe catches and all associated biological information based upon these 3 regions as well as others labeled only with common geographic names, there is usually no simple way to obtain an understanding of the precise distribution and sex ratio of the catches. While in some (but not all) reports groups of catches were plotted on maps, all detailed information about the numbers and sex composition were referred to in the report text with reference to the various regions.

In those cases where catches were actually plotted on maps (1 example is given in Fig. 2 of this paper), the reports concerned provide a single point for a few days' catch with only a range of animals killed in each location (e.g. 1–50, 50–100, 100–500, although the range of these 'bins' varied in different years' reports). Consequently, if these points in the report maps are used calculate catch density on a high-resolution scale, it creates a biased view of catch distribution: some of the areas will have thousands of catches, while adjacent regions will have close to zero, due to the way that they were plotted in the report maps. While it might eventually be possible to analyze the catches by smaller areas (e.g. by 1–2°, 5°,

or 10° squares), this will require the creation of a separate database that will be predicated upon many assumptions regarding the actual positions and composition of catches.

An example may serve to illustrate the problems involved. Fig. 2 in the main text of this paper shows whale catches (all species, including sperm whales), from the combined scientific report for 1969 for the Slava and Dalniy Vostok whaling fleets. The numbers of sperm whales killed in each location are represented by closed triangles, with different-sized triangles representing different ranges; the location of each point (and therefore of the catches) is based upon the approximate center of the catch distribution in that spot. The map gives no information about when these catches were made during the 1969 whaling season, and locations are not broken down further to the individual whale level. However, the text of the same report provides tables summarizing the number of sperm (and other) whales killed each month in different regions; an example (for the Eastern Region) is given below in Table S1.

Because catch locations are not broken down within each month, to obtain higher-resolution information on locations it is necessary to combine these data with information from the the International Whaling Commission (IWC) database which provides the daily noon positions of each factory ship as reported by the USSR.[1] Accordingly, the noon position data give a good idea of where the factory fleets were operating each day, and this knowledge can sometimes be combined with the monthly catch summaries to assign catch numbers to areas. However, the precision of these assignments varies depending upon how much the fleet moved. For example, if a fleet remained in one region for most or all of a particular month, assignment of catches to that area is relatively straightforward; if, however, the fleet traveled over a wider range, catch assignments become more difficult.

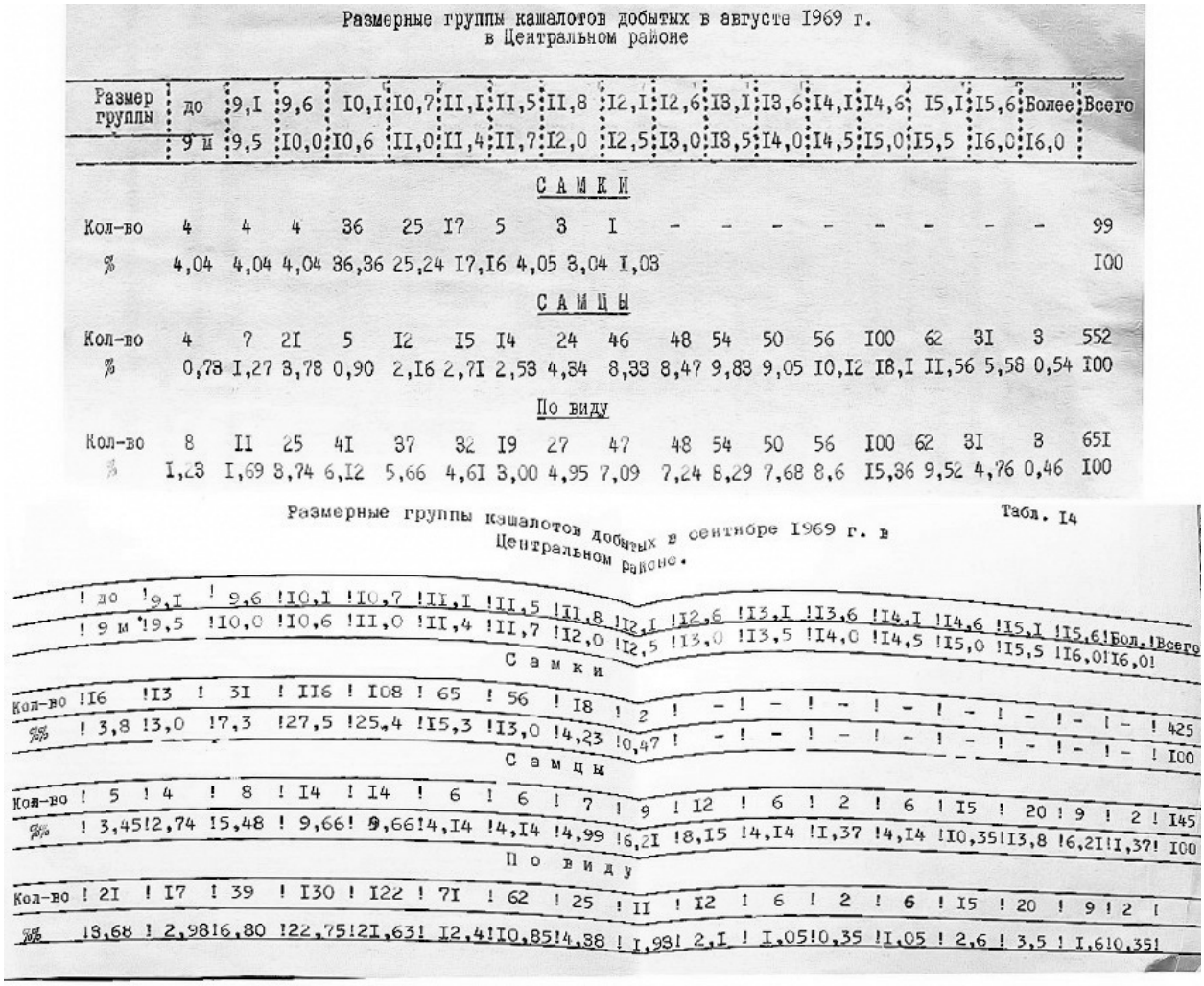
In the example from 1969 described above, the track of the factory ship Dalniy Vostok is shown in Fig. 3 of the present paper. Catches were made in August primarily in the northeastern section of the Central Region, but also farther north, just south of the central Aleutians; September catches were made over a wide area of the Central Region. Beyond this, the report text provides some additional details, for example, the fact that most of the catches in August were of mature males. Further resolution is not possible.

The issue is further complicated by the fact that the amount of detail in each report, and whether or not maps are included, varies widely from year to year, with corresponding variations in the precision of what can be extracted. Table S2 gives a brief summary of the level of detail provided in each of the various reports.

Given this variation (and other confounding factors), the creation of a comprehensive dataset that can be used to examine catch distribution in more detail will require major effort with multiple assumptions, which should be tested and clearly explained, with potentially multiple ways to extract and display the data. Such an undertaking is well beyond the scope and size of the current project, although it is being investigated for additional work in the near future.

[1] Work in progress indicates that, by and large, these noon positions were reported accurately, although occasional excursions to kill protected species such as North Pacific right whales *Eubalaena japonica* were not reported to the IWC

Table S1. Number of sperm whales (by sex and length bins) killed by Soviet whalers in the Eastern Region during August and September, 1969. The 2 sections shown below refer to catches made in August and September, respectively, with each monthly table giving (in order from top to bottom) females, males, and both sexes combined, expressed as numbers of animals and the percentage of the total. For example, the first section (August) shows 4 females and 4 males (total: 8 animals) in the <9 m length bin (these would have been calves)



Размерные группы кашалотов добытых в августе 1969 г.
в Центральном районе

Размер группы	до 9 м	9,1 – 9,5	9,6 – 10,0	10,1 – 10,6	10,7 – 11,0	11,1 – 11,4	11,5 – 11,7	11,8 – 12,0	12,1 – 12,5	12,6 – 13,0	13,1 – 13,5	13,6 – 14,0	14,1 – 14,5	14,6 – 15,0	15,1 – 15,5	15,6 – 16,0	Более 16,0	Всего
САМКИ																		
Кол-во	4	4	4	36	25	17	5	3	1	–	–	–	–	–	–	–	–	99
%	4,04	4,04	4,04	36,36	25,24	17,16	4,05	3,04	1,03									100
САМЦЫ																		
Кол-во	4	7	21	5	12	15	14	24	46	48	54	50	56	100	62	31	3	552
%	0,78	1,27	3,78	0,90	2,16	2,71	2,53	4,34	8,33	8,47	9,83	9,05	10,12	18,1	11,56	5,58	0,54	100
По виду																		
Кол-во	8	11	25	41	37	32	19	27	47	48	54	50	56	100	62	31	8	651
%	1,23	1,69	3,74	6,12	5,66	4,61	3,00	4,95	7,09	7,24	8,29	7,68	8,6	15,36	9,52	4,76	0,46	100

Табл. 14

Размерные группы кашалотов добытых в сентябре 1969 г. в Центральном районе.

	до 9 м	9,1 – 9,5	9,6 – 10,0	10,1 – 10,6	10,7 – 11,0	11,1 – 11,4	11,5 – 11,7	11,8 – 12,0	12,1 – 12,5	12,6 – 13,0	13,1 – 13,5	13,6 – 14,0	14,1 – 14,5	14,6 – 15,0	15,1 – 15,5	15,6 – 16,0	Бол. 16,0	Всего
Самки																		
Кол-во	16	13	31	116	108	65	56	18	2	–	–	–	–	–	–	–	–	425
%	3,8	3,0	7,3	27,5	25,4	15,3	13,0	4,23	0,47	–	–	–	–	–	–	–	–	100
Самцы																		
Кол-во	5	4	8	14	14	6	6	7	9	12	6	2	6	15	20	9	2	145
%	3,45	2,74	5,48	9,66	9,66	4,14	4,14	4,99	6,21	8,15	4,14	1,37	4,14	10,35	13,8	6,21	1,37	100
По виду																		
Кол-во	21	17	39	130	122	71	62	25	11	12	6	2	6	15	20	9	2	
%	8,68	2,98	6,80	22,75	21,63	12,4	10,85	4,38	1,98	2,1	1,05	0,35	1,05	2,6	3,5	1,61	0,35	

Table S2. Information on catch details available from Soviet reports. Fleet abbreviations: DV: Dalniy Vostok; Vl: Vladivostok; SR: Sovetskaya Rossiya; Sl: Slava. Report abbreviations: SR: Scientific report; InspR: whaling inspectors' report

Year	Fleets	Reports available	Map of catches?	Noon positions?	Information content
1964	DV, Vl	SR	no	yes	DV catch numbers are given by periods of from 3 to 30 d; sex ratio is given by area and month; Vl catches by month only
1964	SR	SR	no	yes	Monthly catches and sex ratio only
1965	SR	SR	yes	yes	Monthly catches and sex ratio only
1966	DV	InspR	no	yes	Monthly catches and sex ratio; no detail about areas or catch composition
1967	DV	InspR	yes	yes	Daily positions and catches; sex ratio by month; no detail on sex ratio by area
1967	DV, Vl	SR	yes	yes	DV & Vl (together) catches and sex ratio for the season; DV catches and sex ratio by month; description of whaling areas and some details of catches, but no data on catches by area/month
1968	DV, Sl	SR	yes	no	DV &Sl (together) catches and sex ratio by areas; no monthly catch data
1968	DV	InspR	no	no	Monthly catches by sex; some description of the whaling results
1968	Vl	InspR	no	yes	Monthly catches by sex; some description of the whaling results
1969	DV, Sl	SR	yes	yes	DV, Sl catches and sex ratio by month and areas
1969	Vl	InspR	no	yes	Monthly catches by sex
1970	DV, Vl	SR	yes	yes	DV, Vl (together) catches and sex ratio by area and month
1971	DV, Vl	SR	yes	yes	DV, Vl (together) catches and sex ratio by area and month