

Vhf and satellite tagging of minke whales at Svalbard in 2007 – update on minke whale surfacing rates

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ABSTRACT

We present results from a dive time experiment on a minke whale off Spitsbergen in August 2007 and compile a table summarizing all such data collected by radio tagging methodology over the years 1989-2007. The 2007 minke whale was followed over a period of five days showing mean half-hour intersurfacing intervals varying over the range of about 30-100s and a mean blow rate of 62 blows/hour, which is in accordance with data collected previously. One minke whale was also satellite tagged in the same general area and both whales seemed to adopt a pattern of rapid movement between several possible feeding areas within a larger general area.

MINKE WHALES, RADIO-TAGGING, DIVING, SURFACING RATE, NORTHEAST ATLANTIC

INTRODUCTION

The methods used in Schweder et al. (1997) and Skaug et al. (2004) depend on availability of data on surfacing rates and patterns of minke whales. In 1991 the *Ad Hoc Working Group on $g(0)$* discussed the use of dive time data for abundance estimation (IWC, 1992) and expressed a preference for such data as collected from radio tracking experiments. While the group recognized that dive sequences from VHF tracking could include surfacings that would not normally be visible to an observer and thus result in a positive bias in estimates of $g(0)$, this was preferred to visually derived dive time data which, on the other hand, could involve problems with missed surfacings, combining surfacings from two or more whales and selection bias due to the short time period over which visual data usually are collected.

The Norwegian survey program to collect data for new abundance estimates of minke whales at regular intervals has been provided by annual partial surveys, which over six-year periods cover the relevant management areas in the Northeast Atlantic. The intention of collecting dive time data has been an integral part of the surveys. Originally the hope was to use satellite linked instruments attached to minke whales with the potential to collect surfacing patterns over wider time frames, geographical areas and other covariates than is usually possible with VHF tracking. This proved to be an unsuccessful approach and therefore the efforts so far have been directed to collecting surfacing data by means of VHF tracking only.

In 2007 one new VHF data set was obtained, which is described in this paper. In total, 19 dive time series of varying lengths have now been collected, of which 11 series have been collected over the period 2001-2007.

METHODS

For the VHF tagging, we use radio-tags built waterproof, with a frequency-range between 142,00 MHz and 143,00 MHz, and with a power supply of two units of 3.2 V lithium batteries. The total weight of these units is approximately 120 grams each. The attachment of tags is through an anchor-attachment to the blubber layer. All arrows were pre-creamed with an anti-bacterial substance, basimysin. The radio units were applied with the launching system ARTS (Aerial rocket transmission system, Heide-Jørgensen *et al.* 2001).

The tracking equipment was a combined solution of ATS (Applications Technology Satellites) instruments, and a line transect PC-GPS unit for downloading of signals. The ATS device included a receiver (R2100), a direction finder (Direction indicating display) and an antenna (Yagi antennas), while the PC-GPS unit was a special designed kit developed during the Norwegian line transect survey program.

VHF TAGGING IN 2007

During the period 13 August to 2 September 2007 instrumentation, biopsy sampling and photo ID work were conducted from the vessel *Måøybuen*, operating in the waters off northern Norway, Bear Island and Svalbard. On 18 August around midday 1220hrs a VHF tag was put on a minke whale in position 76°19'N 17°38'E (Figures 1 and 2b). From ID photos it was evident that this was the same whale encountered a couple of hours earlier but at that time was not approachable for instrumentation. The tag was applied to the whale's right side laterally between the flipper and dorsal fin. At this time the minke whale apparently was feeding with many relatively short dives, moving in a circle of about 5 nautical miles diameter. After a while it moved north-westerly to an area with birds, several fin whales, one humpback whale and about 10 minke whales, all apparently feeding on small fishes.

The VHF whale was followed for five days with the last contact on 23 August at 1210hrs in position 76°29'N 18°52'E. The track of the whale (or correctly, the track of the following vessel) is shown in Figure 2b. The tagged whale itself was seen with certainty on three occasions during the five-day track. The first time was on 19 August 1840hrs when it was observed about 100 m from the vessel. The second time was on 21 August 1024hrs at about 50 m distance from the vessel, the tag was also seen and seemed to be in a good position. The last time the whale was seen was on 22 August 2100hrs and on this occasion it was closely followed by another minke whale. The tagged whale moved between areas where also other whales were observed, for example on 22 August it spent the day in an area where about 30-40 other minke whales were seen as well as 20-25 fin whales and one humpback whale. These "kernel" areas must have been areas of high prey densities and presumably associated with feeding behaviour.

For comparison with surfacing series presented earlier (Øien et al. 2007), movement pattern, dive time frequency and mean dive time over half-hour intervals throughout the tracking period are shown in Figure 3. In Table 1 are summarised all VHF data collected in connection with the Norwegian marine mammal program, including key estimates for the whale tagged in 2007. As seen, the surfacing behaviour of this whale is similar to the others presented there.

Testing of a suction cup tag was conducted on a humpback whale on 30 August. The tag was applied with the ARTS launching system and stayed attached for about two hours.

SATELLITE TRANSMITTERS IN 2007

The satellite transmitters used were of the type SPOT5, manufactured by Telonics Inc., USA. The tags were programmed to have a duty cycle of 24 hours transmitting in August, followed by 24 hours active transmitting on the dates 1, 8, 15, 22 and 29 in the following months.

When, on 22 August, being in the high whale density area mentioned above, three satellite tags were applied by use of the launching system ARTS (Arial rocket transmission system, Heide-Jørgensen *et al.* 2001) on two minke whales and one fin whale.

The data from the satellite transmitters were transferred through the Argos Data Collection and Location Service. The accuracy of the location data are coded by Argos into several classes. In this paper we have used the location classes 3 (best), 2 and 1, while locations attributed to classes 0, A, B and Z (deemed invalid) were discarded.

Only one of the whales, a minke whale assumed to be relatively small, and which was instrumented on 22 August at 0905hrs in position 76°31'N 18°59'E, produced signals. The tag was fastened at the back

between the blow hole and the dorsal fin. By selection of location classes as mentioned above, several daily positions (2-16 per day) were collected over the period 22 August to 1 September. After this date, several positions were received for 8 September but after that contact with the whale was lost. The track of this whale is shown in Figure 2a. The calculated displacements per day varied between about 30 and 60 km, and the accumulated displacement between accepted locations over the 10-day period from 22 August – 1 September was 472 km. Compared to the VHF tagged whale, this one moved over larger distances but apparently followed a similar pattern by revisiting previously known areas.

During the survey with *Måøybu*en biopsy samples were collected from three minke whales, 11 humpback whales, 12 fin whales and one killer whale. Identification photos were collected from 8 minke whales, 9 humpback whales, 13 fin whales and one blue whale.

ACKNOWLEDGMENT

These investigations have been conducted as part of the Norwegian minke whale survey program and received funding from the Norwegian Research Council. George McCallum is thanked for photo documentation and Siri Hartvedt for producing maps. We would like to thank RESTECH for an excellent cooperation during the development of the launching and instrumentation system ARTS (Arial Rocket Transmitter System).

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Table 1

Mean intersurfacing intervals and blow rates for the VHF radio tracking data collected in connection with the program for abundance estimation of Northeast Atlantic minke whales. The mid part of the ID number indicates the year of collection of the data. Also shown are estimates based on all data collected. *Small Management Area* locations for the VHF experiments are given in the last column (*SMA*).

<i>ID</i>	<i>Intersurfacing interval, s</i>	<i>SD</i>	<i>Min</i>	<i>Max</i>	<i>Blows/whale/hour</i>	<i>SMA</i>
mi-1989-01	83.47	9.64	10	404	43.13	EW
mi-1989-02	72.08	2.56	7	505	49.94	EW
mi-1991-01	63.03	7.92	7	381	57.12	EW
mi-1991-02	84.12	3.66	7	394	42.8	EW
mi-1991-03	89.43	5.54	5	550	40.25	EW
mi-1991-04	75.51	10.20	10	340	47.68	EW
mi-1992-01	54.66	3.47	6	230	65.86	ES
mi-1992-02	81.41	2.10	7	463	44.22	ES
mi-2001-01	66.85	5.5	4	385	53.85	EW
mi-2001-02	99.21	2.09	4	480	36.29	EW
mi-2002-01	59.43	4.58	9	262	60.58	EN
mi-2002-02, all data	72.86	1.85	1	502	49.41	EW
mi-2002-02, Beau \leq 4	73.84	2.60	1	479	48.75	EW
mi-2002-03	123.64	3.63	1	534	29.12	EW
mi-2002-03, Beau \leq 4	109.42	9.98	9	410	32.90	EW
mi-2003-01	59.40	2.09	1	398	60.61	ES
mi-2004-01, all data, Beau $>$ 4	77.10	7.51	5	335	46.69	EW
mi-2004-02	88.17	5.13	1	572	40.83	EW
mi-2006-01	50.10	1.75	1	372	71.86	EW
mi-2006-02, all data	81.92	2.13	3	602	43.94	EW
mi-2006-02, Beau \leq 4	88.30	2.69	3	560	40.77	EW
mi-2007-01, all data	57.84	0.75	1	537	62.24	ES
mi-2007-01, Beau \leq 4	64.84	1.35	1	537	55.52	ES
All data	75.80	17.65			47.49	N=19

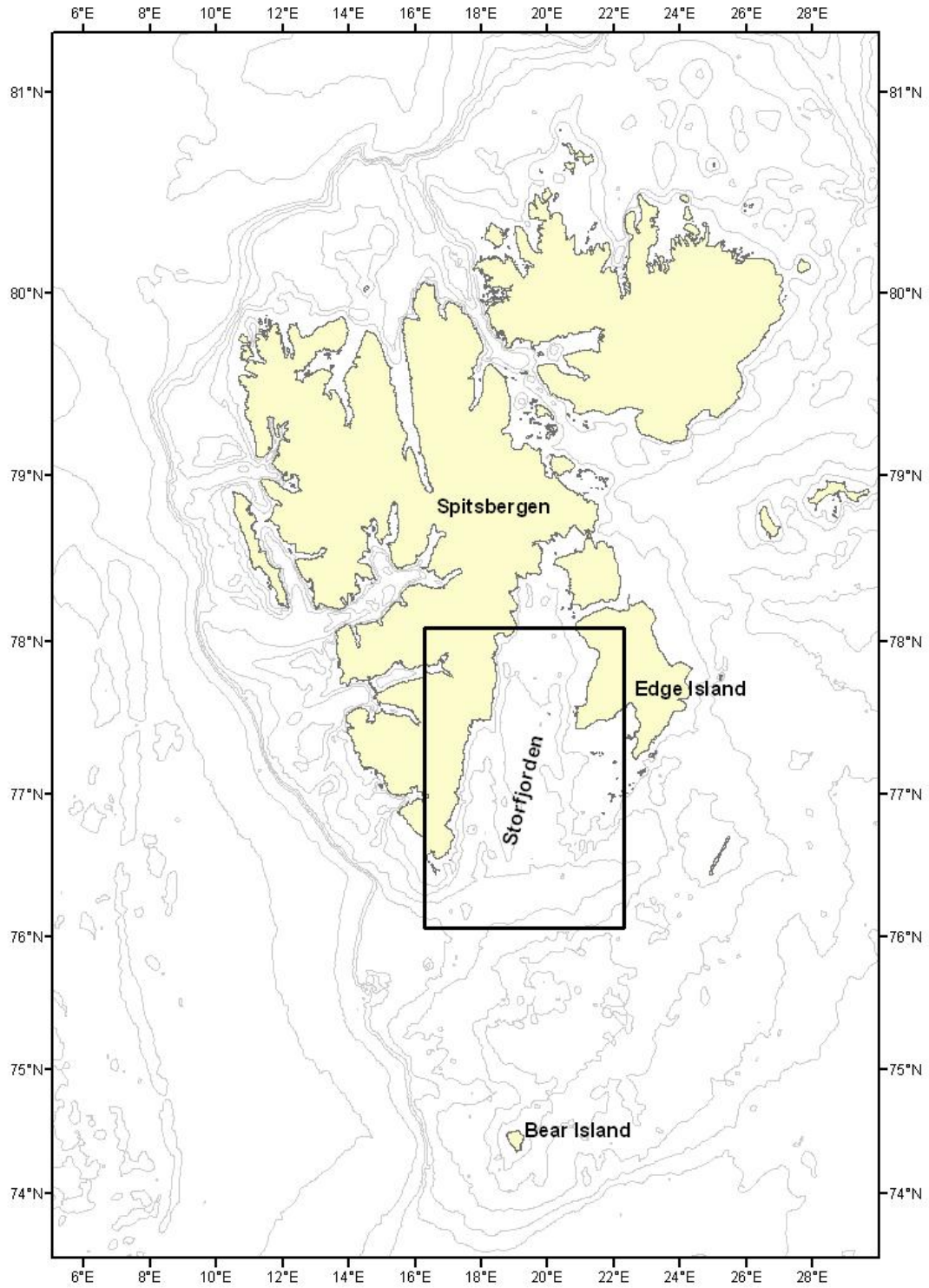


Figure 1. Location of the area where one minke whale was instrumented with a VHF radio tag (mi-2007-01 in Table 1) and one minke whale with a satellite tag. The square represents the map extracted in Figure 2a.

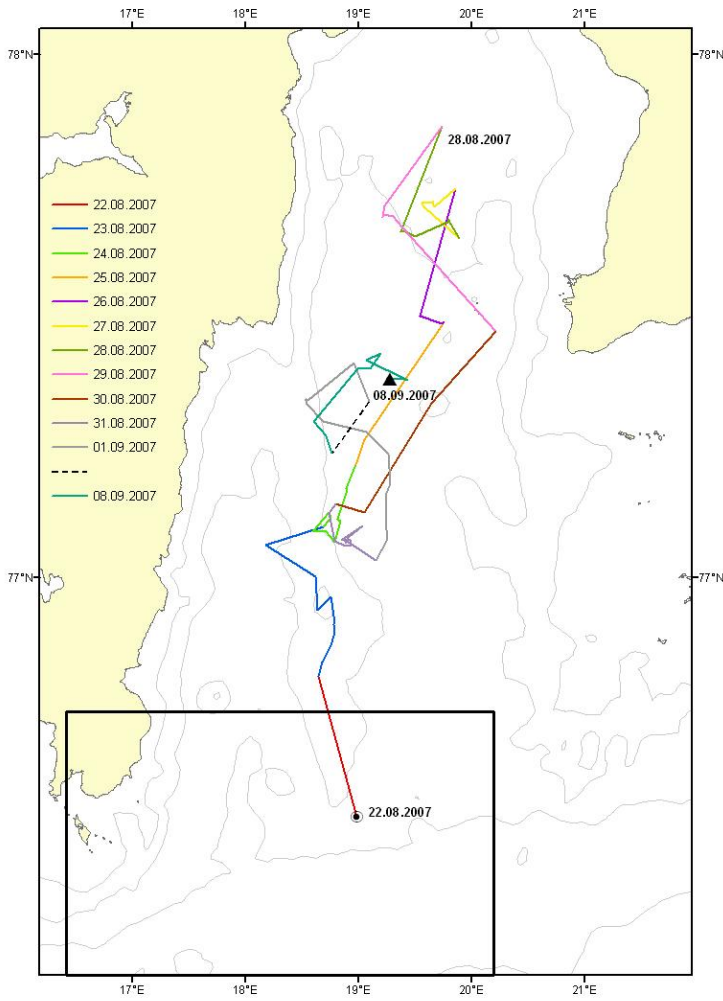
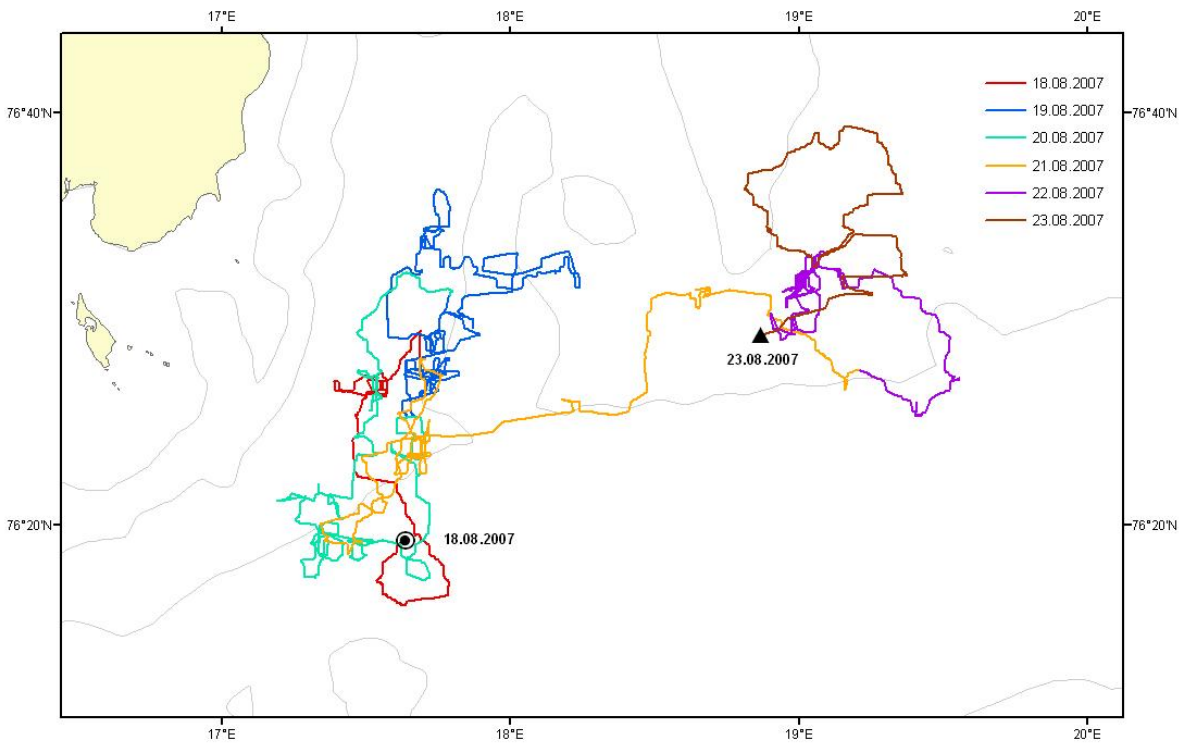


Figure 2. (a, to the left) The track of the satellite tagged minke whale. The square is the map extracted below (2b), showing the track of the VHF tagged minke whale (mi-2007-01 in Table 1).



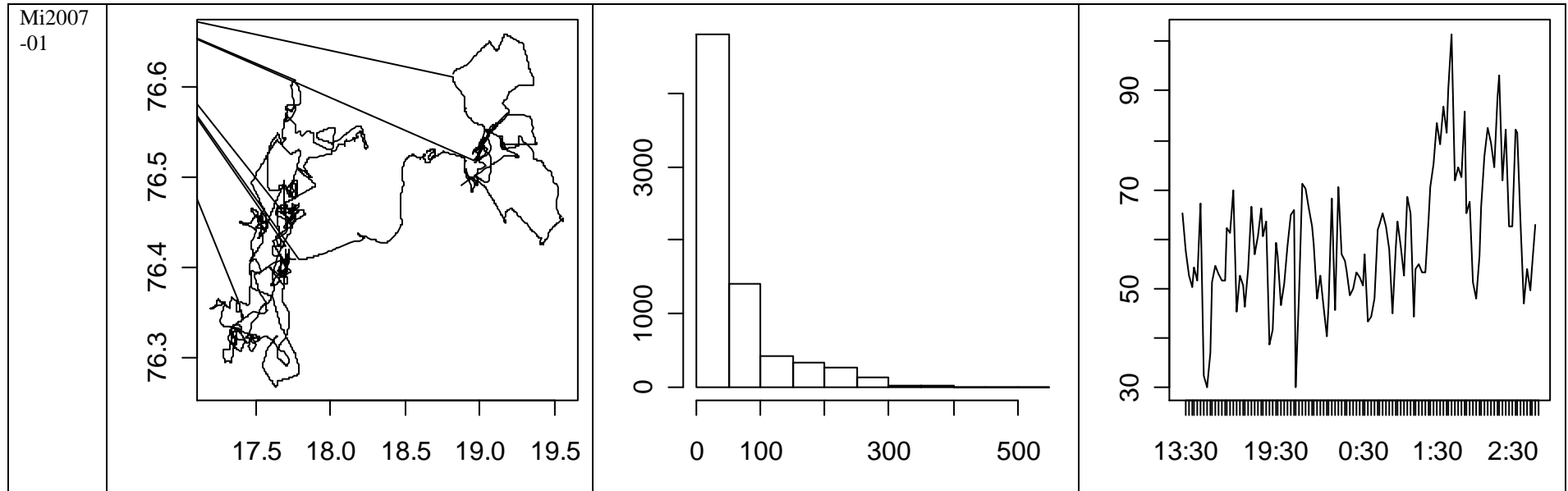


Figure 3. The panel shows for the 2007 VHF tagged minke whale: The track of the vessel which followed the radio tagged minke whale (*left panel*); The frequency distribution of dive times (*mid panel*); and mean dive times calculated over half-hour intervals (*right panel*).