

Report on the Biopsy Dart Sampling Feasibility Study during the  
12th IWC/IDCR Southern Hemisphere Minke Whale Assessment  
Cruise, 1989/90

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ABSTRACT

During this experiment, twenty-five whale schools were approached for biopsy sampling during a total experiment time of 13.0 hrs. Sixteen of these schools were approached to within the optimum firing range of the equipment and 29 shots were made. there were 9 hits, 3 ricochets and 17 misses.

It is feasible to obtain a limited number of tissue samples from most baleen whale species; blue whale, fin whale, sei whale, minke

whales and humpback whale.

Minke whales proved to be the most difficult of all the species pursued, as the animals usually stayed just beyond the 30m firing range of the air gun. Obtaining a tissue sample from a minke whale appears to take more time than to successfully implant a Discovery mark since more time is spent in chasing and retrieving the sample.

## INTRODUCTION

A feasibility study on the effectiveness of biopsy dart collection of skin samples from Southern Hemisphere minke whales was recommended by the Scientific Committee of the International Whaling Commission (IWC) in 1988 (IWC, 1988). A collection experiment was conducted using a crossbow-powered biopsy dart system during the 11th IWC/IDCR Southern Hemisphere minke whale assessment cruise but no samples were obtained (Kasamatsu, Mermoz, Zorin, and da Silva, 1989). It was concluded that a crossbow was an unsuitable delivery system for obtaining biopsy samples from minke whales in Antarctic waters.

A new biopsy sampling system was subsequently developed at the Institute of Cetacean Research (ICR) (Kasamatsu, Iwata, and Nishiwaki, 1990) and utilized during the 12th IWC/IDCR Southern Hemisphere minke whale assessment cruise conducted in IWC Management Area I. Details of the cruise are given in the cruise report (Joyce, Ensor, Kira, Hara, Mermoz, Nishiwaki, Sanpera and Tsutsumi, 1990).

## MATERIALS

A new biopsy dart sampling system was developed at the ICR specifically for this study. The firing system was a modified air-powered rescue-line gun (Figure 1). The biopsy dart system was composed of three parts: a biopsy dart, a mounting shaft, and a retrieval line (Figure 2).

The stainless steel biopsy dart was a modification of designs used in previous biopsy sampling studies (for example see Amos and Hoelzel, 1988; Lambertsen, 1987; Mathews, Keller, and Weiner, 1988). The dart had core opening of 11.0mm. and penetration was limited to 6.0cm by a 14.0mm diameter stopper on the dart. The dart had a total length of 8.0cm and a mass of 100g.

The biopsy dart was mounted on an alumait shaft with nylon sleeves. The sleeves provided a tight seal for the dart within the gun barrel. The mounting shaft had a length of 19.2 cm and a mass of 220g. and the nylon sleeves had a diameter of 40.0mm.

The retrieval line was a 60m braided nylon line attached to the mounting shaft loosely and coiled in a plastic tub for free playout. The line has a rated breaking strength of 120kg.

Details of the development and intial testing of this biopsy system are presented in Kasamatsu, et al (1990).

The equipment was designed to be used from the forecstle deck of the research ships, the Shonan Maru and Shonan Maru No.2, are converted whalecatchers and are 70.55m long, have 916 tonne displacements and a forecstle deck height above water of 6.5m.

## METHODS

### Test firing the equipment

The test-firing was conducted just prior to the initiation of the biopsy sampling study. Firings were taken from the forecstle deck of the Shonan Maru on 29 December while in Antarctic waters. Seven trials were conducted with firing ranges of 25-40m using fishing floates as targets. Trials were conducted both with the ship stationary (four trials) and underway (three trials).

### Biopsy sampling

The sampling was conducted as a moderate-priority activity of the research cruise in order not to compromise the sightings survey, which is the principal activity of the program. The sampling was attempted only in the research area's stratum, which extends approximately 60 nmiles seaward of the pack ice/land boundary. The sighting rate for minke whales was expected to be higher in this area, thus maximizing the opportunity for sampling. The experiment was conducted from the Shonan Maru 29 December-19 January in the eastern sector of the Area and from aboard the Shonan Maru No.2 20 January-10 February in the western sector of the Area.

Two Biopsy darts were lost during the initial stage of the experiment when the retrieval line was severed at the point of attachment to the mounting shaft. The retrieval line was

subsequently modified by the addition of a short wire leader at this point of attachment. There were no further losses of equipment and the modification did not appear to affect the flight of the biopsy dart system.

Sampling was attempted whenever a whale of any species was sighted, if the diversion would not affect the sightings survey, and the whale group was considered easy to approach. No attempts were made to collect samples of solitary or long-diving minke whales, nor from such hard to approach species as Southern bottlenose whales. Sampling was also curtailed if poor water clarity prevented the tracking of the whales underwater and therefore interfered in the chasing of the animals. Sampling minke whales had the highest priority in the study.

## RESULTS

### Test firing the equipment

Test firing of the equipment was considered satisfactory. The maximum effective range was about 30m. and the flight of the dart system was straight and accurate. At ranges greater than 30m the dart system appeared to stall, resulting in a sharply curved trajectory. This effect was most pronounced when the ship was underway, particularly when moving into the wind.

### Biopsy sampling

Twenty-five whale schools were approached for biopsy sampling during a total experiment time of 13.0 hrs. Sixteen of these schools were approached to within the optimum firing range of the equipment and 29 shots were made. There were 9 hits, 3 ricochets and 17 misses. Results are summarized in Table 1.

Tissue samples were obtained from all the Hits except from one trial, when the biopsy dart system was lost when the retrieval line broke. The ricochets all occurred in trials conducted at short firing ranges of approximately 15m, most of misses were at firing ranges greater than 30m. A total of eight tissue samples were obtained from five species: minke (4), blue (1), fin (1), sei (1), and humpback (1). Sampling results, by species, are summarized in Table 2.

Tissues samples were of two types: six samples consisted of a

circle of skin with blubber attached; two samples consisted of only a shaving of skin. The latter samples probably resulted when the dart struck the whale at an oblique angle. Details of the tissue samples are shown in Table 3 and Plate 1.

## DISCUSSION

This feasibility study shows that it is possible to obtain biopsy samples from five species of baleen whale in the Antarctic.

Two previous studies on biopsy sampling have been conducted in Antarctic on minke whales. A preliminary study to develop a suitable biopsy dart was conducted in 1988 and reported by Kato, Hiroshima, Fujise, and Ono (1988). A further experiment to test the feasibility of taking biopsy samples from minke whales was conducted during the 11th IWC/IDCR Southern Hemisphere minke whale assessment cruise (Kasamatsu, et al, 1989). In that experiment, the crossbow used to deliver the biopsy dart did not provide adequate power and no samples were collected. Those trials also encountered difficulties due to the tangling of the retrieval line.

In the present study the modified rescue line gun did provide adequate force for the collection of tissue samples. Additionally, the increased power allowed a different type of line to be used and line tangling occurred in only three trials (10% of the total). The tangling that did occur was probably due to the unsystematic coiling of the line and undetected uncoiling due to the wind during long periods of chasing. These problems can easily be addressed in any future studies.

A major problem encountered during the study in the 11th cruise was the difficulty of approaching minke whales to within the effective firing range of the equipment. Since the greater power of the equipment used in present study increases the effective sampling range of the dart, more animals could be approached within range for sampling.

This was an effective test of the limitations of the sampling system because of the difficulty in approaching minke whales to within the effective firing range of the biopsy darts, especially in Antarctic conditions and from large platforms such as the Shonan Maru and Shonan Maru No.2. Amos and Hoelzel (1988) reported similar difficulties in sampling minke whales despite less severe

sampling conditions. This suggests that sampling the larger, slow moving species, especially those inhabiting coastal waters such as right and humpback whales, could be sampled more easily and efficiently than this sampling of minke whales.

The pursuit of minke whales was abandoned ten times during the study because it was too difficult to approach these groups within the effective firing range of the sampling system. Obtaining a tissue sample from a minke whale appears to take more time than to successfully implant a Discovery mark since more time is spent in chasing and retrieving the sample.

This experiment has demonstrated that tissue samples can be obtained from most, if not all, baleen whale species in the Antarctic. However, it should be noted that considerable time is necessary to take tissue samples, especially from minke whales in the Antarctic. The other problems identified in the experiment are presently being addressed and we recommend that experimentation be conducted during future IWC/IDCR cruises to test and improve the equipment while establishing a collection of tissue samples from the different species in the Antarctic.

#### ACKNOWLEDGMENTS

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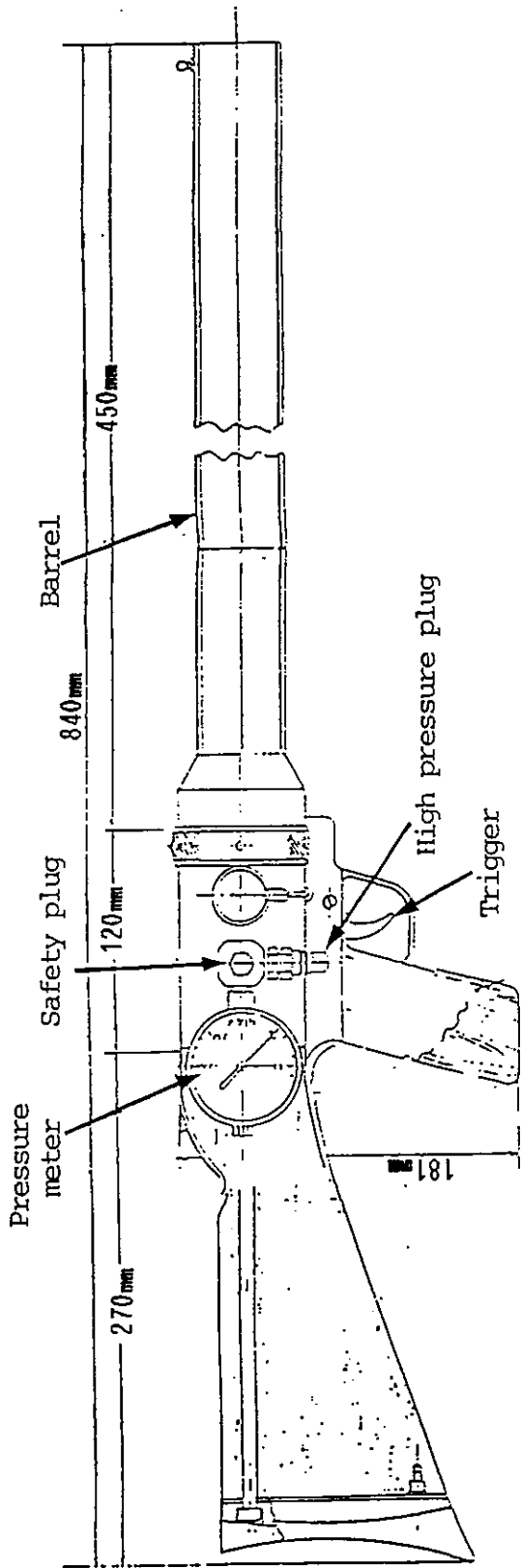


Figure 1. Design and demensions of the rescue line gun modified for use in the biopsy dart sampling exprimint. (cited from Kasamatsu et al. 1990)



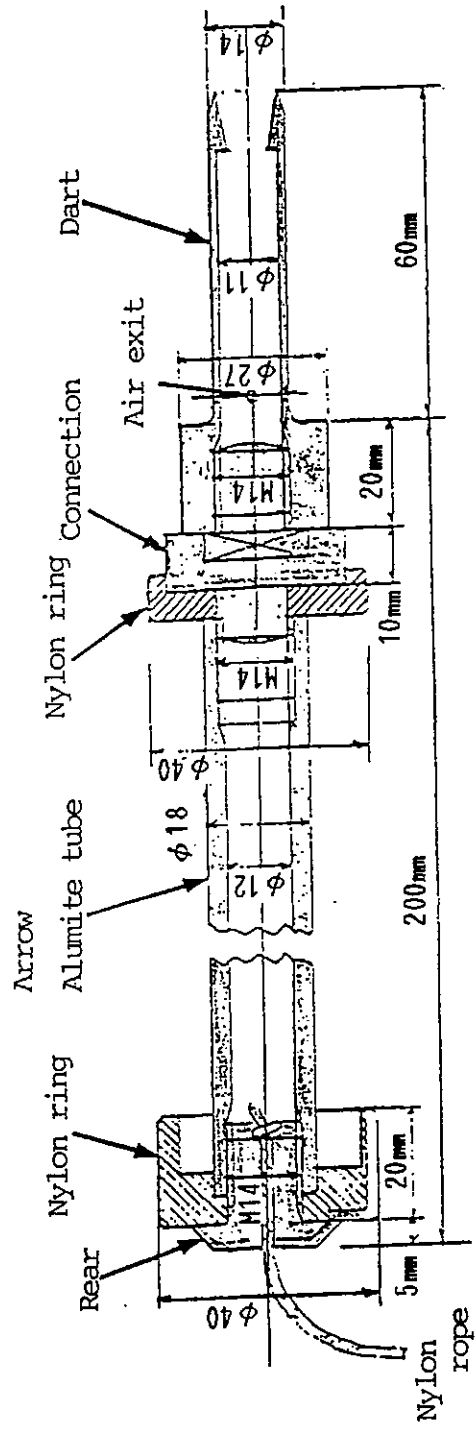


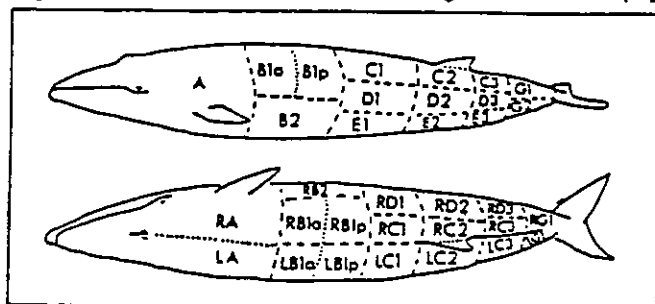
Figure 2. Change arrow to Biopsy dart system. (cited from Kasamatsu et al. 1990)

Table 1. Summary of biopsy sampling attempt (shots taken) during the cruise.

Vessel	Date Yr. Mo. Dy.	Wind speed (kts.)	Sea state Beaufort	Sight. number	Species	Verdicts	Firing dist. (m)	Posi- tion struck	Remark
SM1	89. 12/29	05	1	002	Minke	Miss	30	-	
	89. 12/30	15	3	001	Humpback	Miss	30	-	(1)
	89. 12/31	06	2	001	Humpback	Miss	30	-	
	89. 12/31	06	2	001	Humpback	Miss	25	-	
	89. 12/31	06	2	001	Humpback	Hit	30	RB1P	
	89. 12/31	06	2	001	Humpback	Hit	20	RC2	(1)
	90. 01/15	10	3	015	Fin	Miss	40	-	
	90. 01/15	10	3	015	Fin	Hit	30	RD2	(2)
	90. 01/16	19	5	025	Minke	Miss	30	-	(2)
SM2	90. 01/16	19	5	025	Minke	Miss	27	-	
	90. 01/20	07	2	005	Sei	Miss	30	-	
	90. 01/20	07	2	005	Sei	Hit	30	RC1	
	90. 01/21	10	3	001	Blue	Hit	20	LC1	
	90. 01/21	08	3	007	Minke	Hit	35	LC1	
	90. 01/23	06	2	020	Minke	Miss	30	-	(2)
	90. 01/23	06	2	020	Minke	Hit	38	LB1P	
	90. 02/01	13	4	006	Minke	Miss	35	-	
	90. 02/01	13	4	006	Minke	Ricochet	15	-	
	90. 02/01	13	4	006	Minke	Ricochet	15	-	
	90. 02/01	13	4	006	Minke	Ricochet	15	-	
	90. 02/01	13	4	006	Minke	Miss	40	-	
	90. 02/01	08	3	016	Minke	Miss	35	-	
	90. 02/01	08	3	022	Minke	Miss	35	-	
	90. 02/02	10	3	001	Fin	Miss	43	-	
	90. 02/02	10	3	001	Fin	Miss	40	-	
	90. 02/07	10	3	006	Minke	Hit	32	LC2	
90. 02/07	08	3	011	Minke	Hit	32	LD2		
90. 02/08	08	2	003	Minke	Miss	30	-		
90. 02/08	08	2	003	Minke	Miss	18	-	(2)	

Remark: (1) Line broken, dart and arrow lost.

(2) Tangled retrieval line affected flight of the biopsy dart system.



Symbols used to identify the strike position

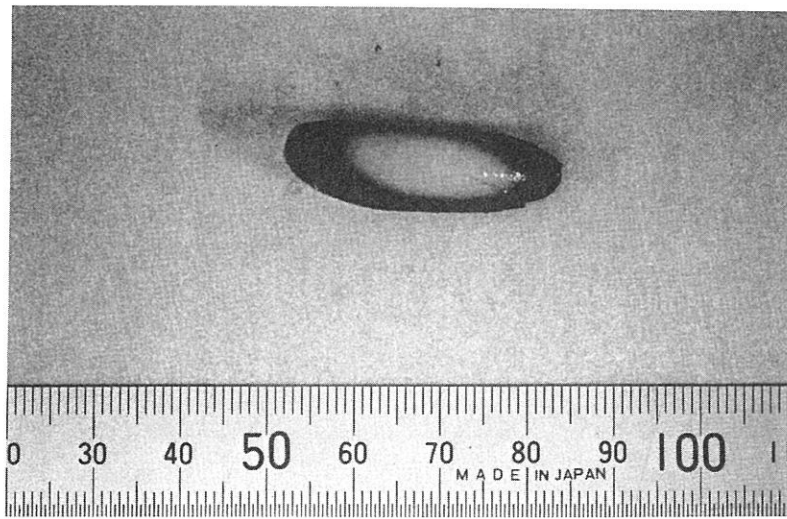
Table 2. Results of the Biopsy sampling feasibility experment by species

Species	H i t s	Missess	Ricochets	Samples
Blue	1	0	0	1
Fin	1	3	0	1
Sei	1	1	0	1
Minke	4	10	3	4
Humpback	2	3	0	1

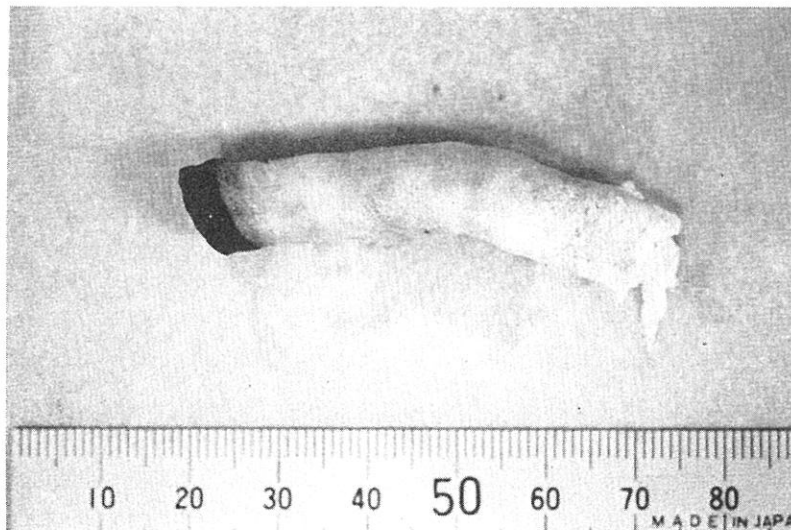
Table 3. Type, Length, and Weight of Biopsy tissue samples.

Species	Type	Length(mm)	Weight(g)
Blue	S. B	55.25	3.6
Fin	S. B	54.80	2.6
Sei	O. S	39.00	0.8
Minke	S. B	55.00	3.9
	O. S	37.15	0.6
	S. B	54.50	3.4
	S. B	64.80	2.6
Humpback	S. B	37.15	2.3

Remark : S. B—Circle of skin with blubber attached.  
 O. S—Only of a shaving of skin.



a only of a shaving of Skin



a Circle of Skin with Blubber attached

Plate 1. Obtaining Biopsy Skin Samples.