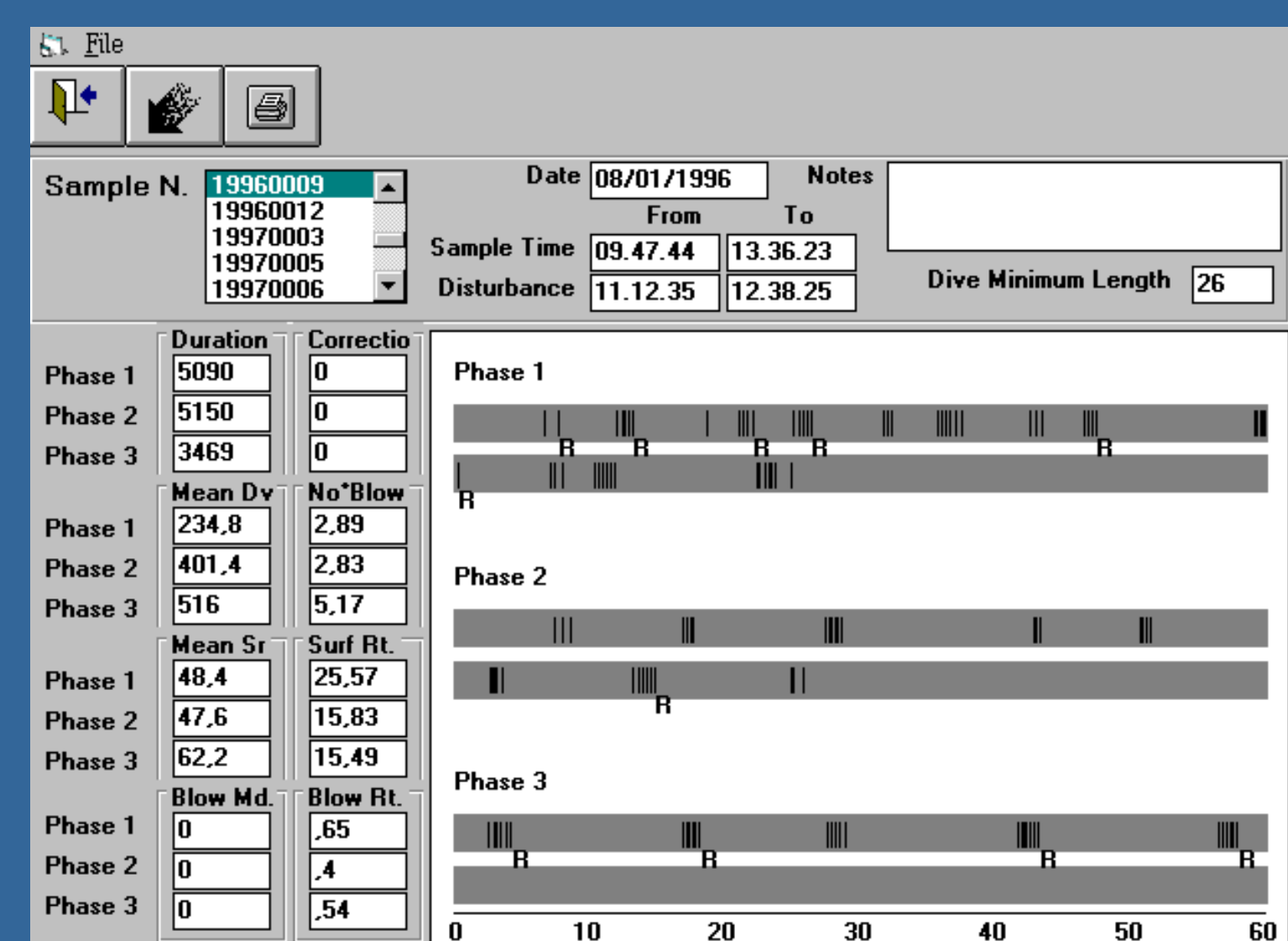
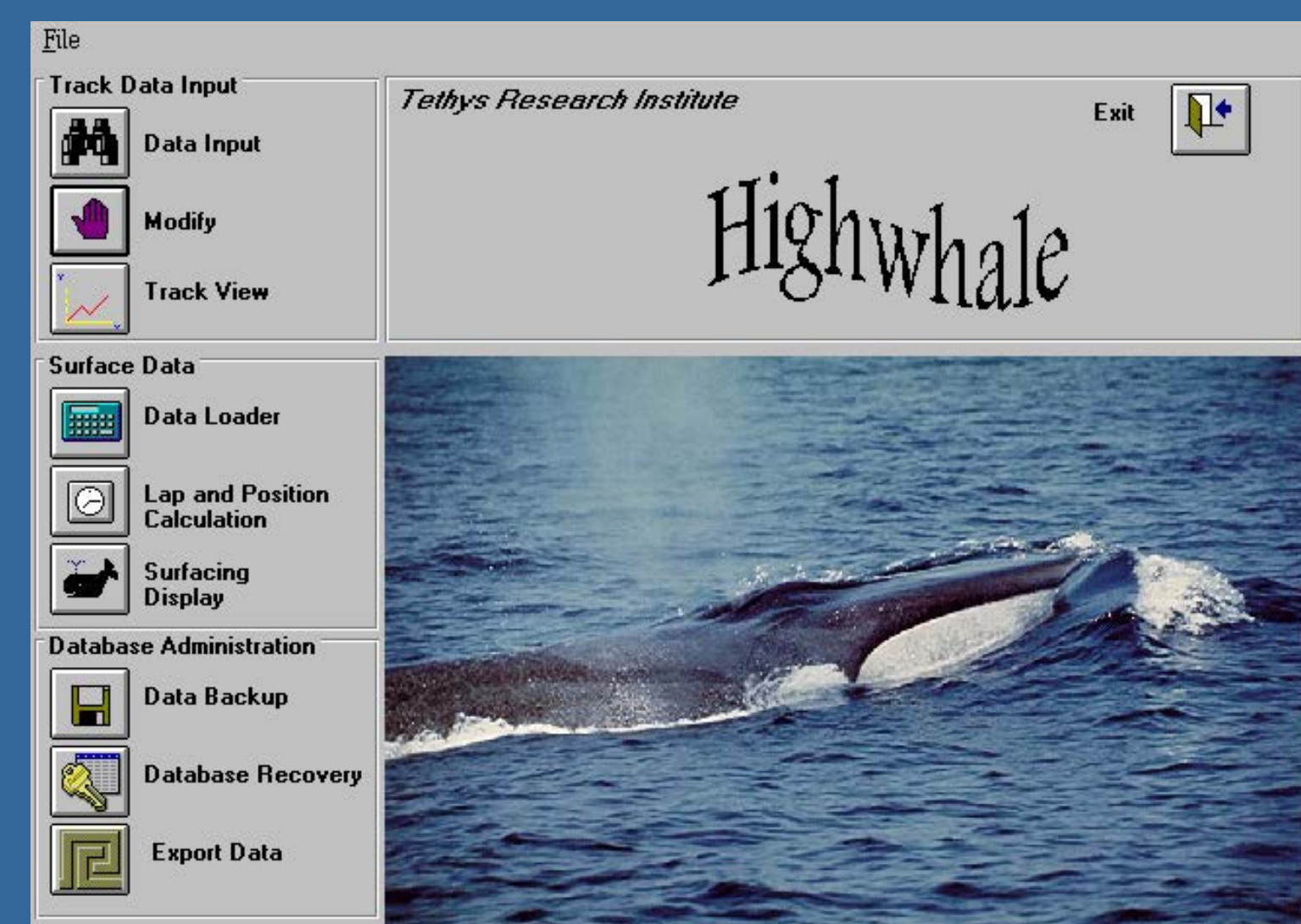




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PASSIVE TRACKING AND TIMING OF RESPIRATION AS A METHODOLOGY TO DETERMINE REACTIONS OF MEDITERRANEAN FIN WHALES IN RESPONSE TO DIFFERENT SOURCES OF POSSIBLE DISTURBANCE

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Nineteen individual fin whales (*Balaenoptera physalus*) were studied in their Ligurian Sea feeding grounds between 1995 and 2000 to describe and measure short-term responses to a) close approaches by a fast-moving inflatable craft and b) anthropogenic noise sources.

MATERIALS AND METHODS

Passive tracking was performed with a technique based on the simultaneous determination of

- 1) position of the observation vessel,
 - 2) distance between the target animal and the observation vessel,
 - 3) azimuth of the target animal with respect to the observation vessel.
- Target animals were tracked by means of a Leica Vector laser range-finder (1500 DAES 7x42 class 1) connected to a portable PC with dedicated software (HighWhale), which combined tracking data with synchronously-timed surfacing intervals (Fig. 1).

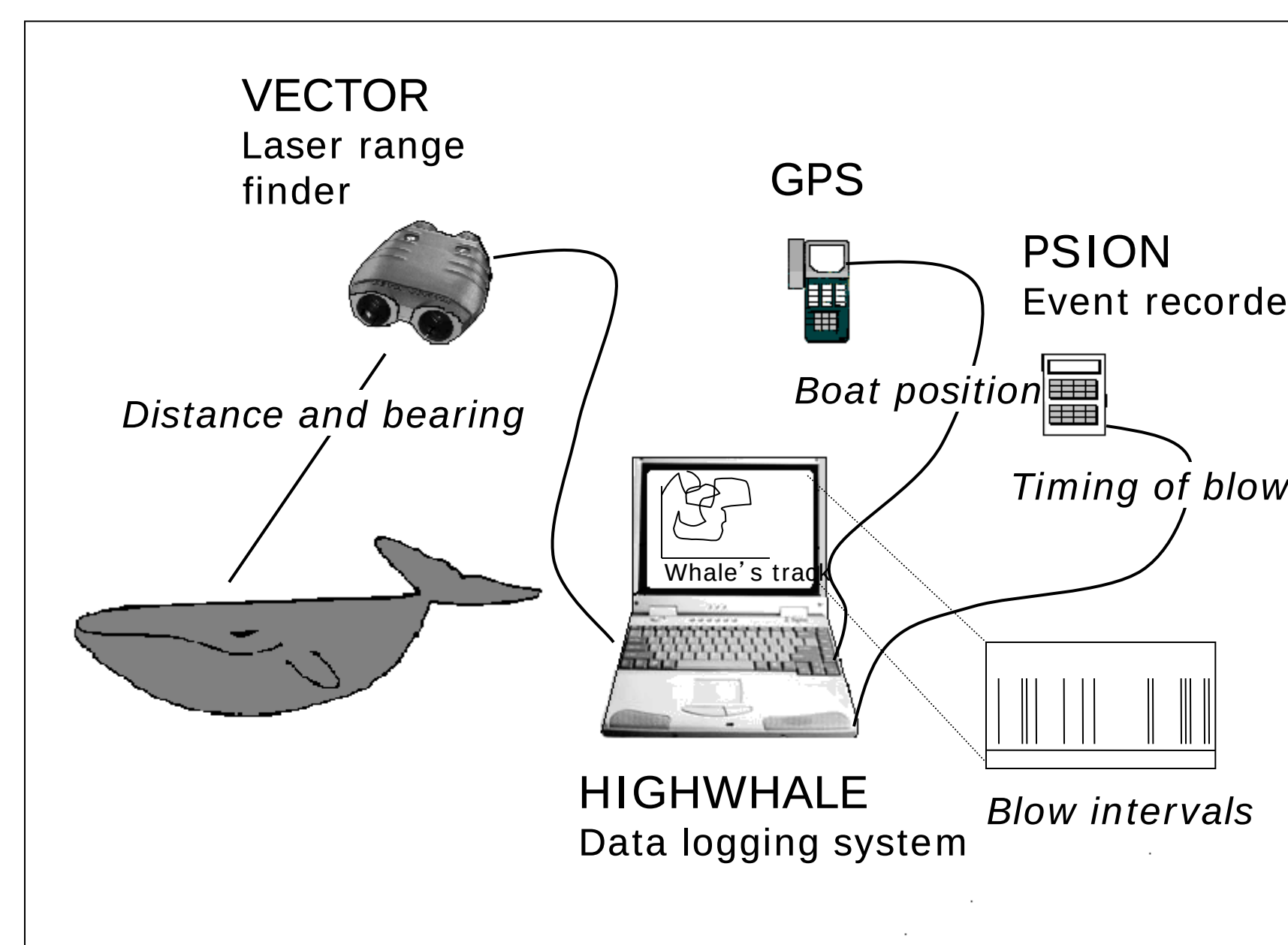


Fig. 1

RESULTS AND DISCUSSION

APPROACHING BY A SMALL INFLATABLE
Two distinctive swimming-surfacing patterns were observed: one supposedly related to feeding and one to travelling (Fig. 2 A, B). “Feeding” whales reacted to disturbance by changing their behaviour into travelling. During the disturbance phase swimming and respiratory parameters (mean-of-the-sample values) changed between the 3 experimental phases (Tab. 1; ANOVA, repeated measures, $n = 18$, $P < 0.05$, *post hoc* comparisons significant for pre-approach vs approach, and pre-approach vs post-approach phases).

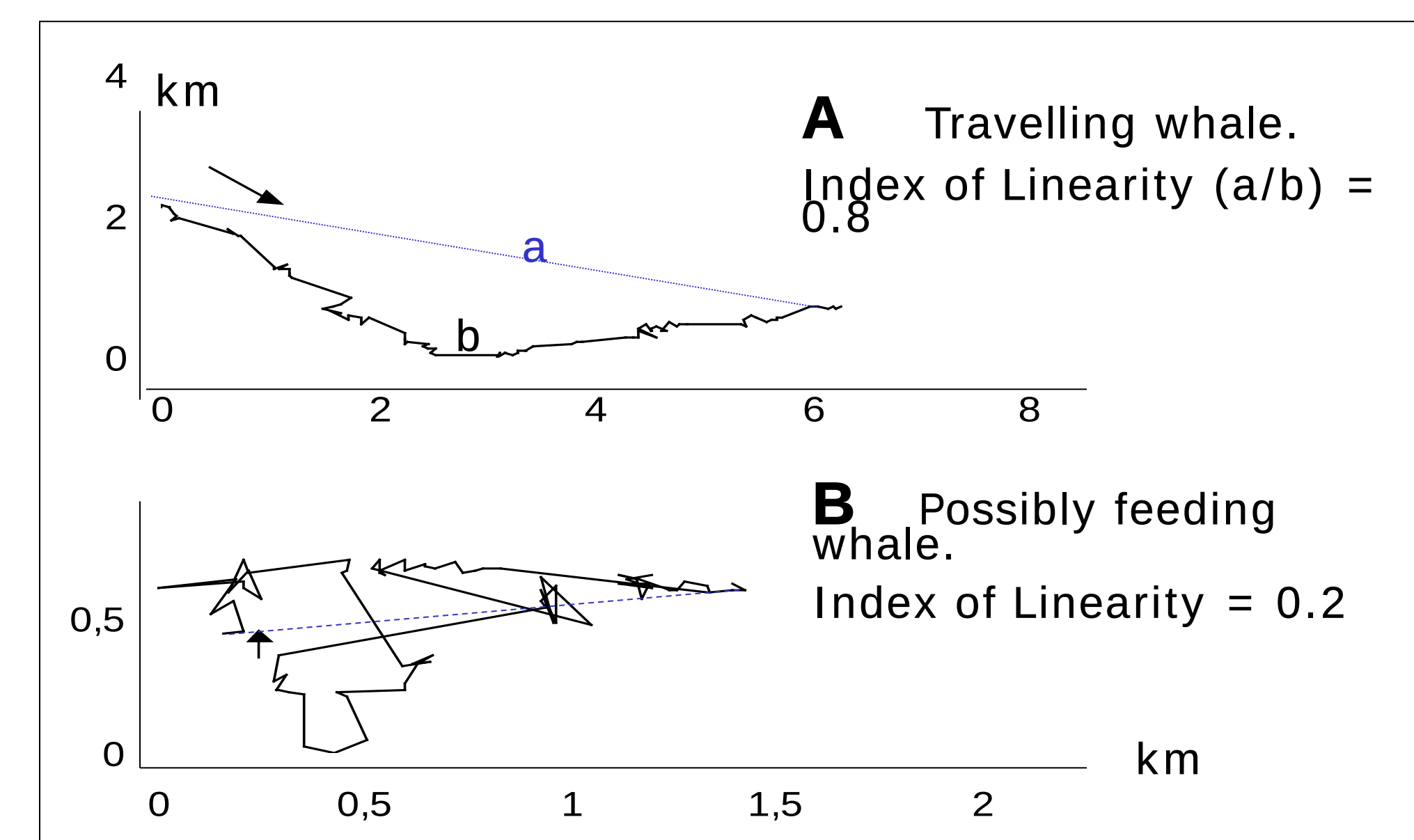


Fig 2

		Pre-approach phase	Approach phase	Post-approach phase
		mean ($\pm$ SD)	mean ($\pm$ SD)	mean ($\pm$ SD)
Index of linearity	$p < 0.05$	0.5 ($\pm$ 0.3)	0.65 ($\pm$ 0.2)	0.70 ($\pm$ 0.2)
Velocity (m/sec)	$p < 0.05$	1.3 ($\pm$ 0.5)	1.6 ($\pm$ 0.6)	1.6 ($\pm$ 0.6)
Dive time (sec)	ns	227.5 ($\pm$ 133.3)	215.1 ($\pm$ 89.4)	253.1 ($\pm$ 127.8)
Surface time (sec)	$p < 0.05$	90.0 ($\pm$ 34.6)	56.4 ($\pm$ 17.2)	75.2 ($\pm$ 29.6)

Tab. 1

Independently from behavioural patterns, two kinds of avoidance reactions were simultaneously performed by the whales: travelling at increased speed (+23%) and reduction of the time spent at the surface (-37.3%). After the disturbance ceased, the surfacing activity never completely reverted to pre-disturbance conditions, based on 1 hour of post-exposure control. Supposed feeding behaviour appeared to be disrupted.

ANTHROPOGENIC NOISE SOURCES

In a preliminary test, conducted in collaboration with Saclant Undersea Research Centre, the same technique was employed to evaluate fin whale reactions to acoustical potential disturbances represented by low-power, low-frequency sonar transmissions (1-8 kHz, SL 160-180 dB) and concurrent background noise. During a test performed on two associated fin whales, differences were measured between pre-exposure and post-exposure phases in velocity (increasing by 27%), and mean dive time (increasing by 129 %).

CONCLUSIONS

This method of passive tracking represents a useful tool to assess fin whale reactions to different kinds of human-caused interference. Concerning sonar noise, more samples will be needed to compare the possible reaction with the response to known causes of disturbance.

ACKNOWLEDGEMENTS

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