BREATHING AND DIVING IN *TURSIOPS*

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Summary.

From data, published by VERWEY (1975), it is concluded that in *Tursiops truncatus* there exists a relationship between the number of respirations and the duration of the subsequent dive.

Introduction.

In VERWEY's paper on dolphins and porpoises (1975, p. 28 et seq. and DRAL, 1976) attention is given to the question whether the series of breaths which alternate with long dives for food seeking are related to the preceding or the following long dive. RIDGWAY c.s. (1969) believed that a bottle-nose dolphin that had been trained to dive to greater depths, from the lowering of the deep-diving device and its echo-location, knew beforehand to what depth it was expected to go. That would result in greater numbers of respirations prior to deeper (longer) dives. VERWEY thought that RIDGWAY's interpretation might be wrong, and he assumed that increased breathing did not precede, but did follow the deep dives and in principle removed the oxygen debt that had resulted from that dive. VERWEY's second argument not to follow RIDGWAY c.s. in their belief was that the increase in the quantity of oxygen taken down must be of quite secundary importance when compared with the quantity used when an oxygen debt results.

Material.

The data in discussion are taken from VERWEY's paper (1975) and are summarized as follows.
On march 14th, 1937 a group of 15 - 20 bottlenose dolphins *(Tursiops truncatus)* was observed. By virtue of its white tail one specimen could eassily be followed and notes were made of the number of surfacings (breathings) and of the duration of the dives which alternated with the series of breathings :

number of breathings :	8	7	6	5	5	6	4	7	8	1	3	1	7	5	
duration of dive*)		160	118	190	144	115	196	114	140	180	79	87	85	220	120

*) The duration was measured by steadily counting. Each count was probably somewhat more than one second.

One should be aware that the considerations, exposed in the next paragraph, are based on only this one series of observations.

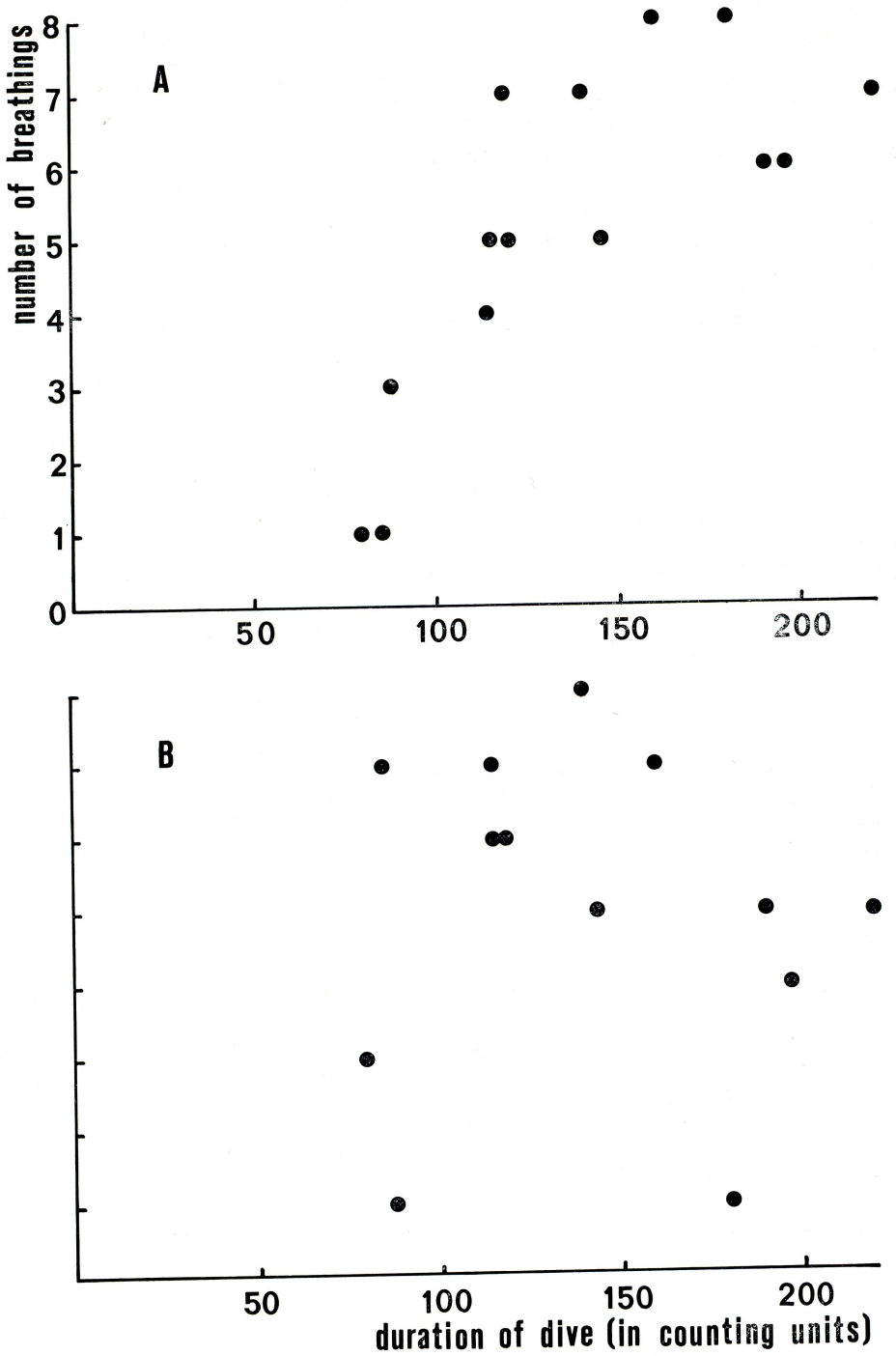

Fig. 1. Relation between number of breathings and duration of dives in **Tursiops truncatus.** In A the duration of the dive is plotted against the number of breathings **before** that dive, in B against that number **after** the dive.

Discussion.

When reviewing VERWEY's paper DRAL found that the series of breathings and the durations of dives appear to be reasonably correlated (r = 0.75) if each number of breathings is related to the *subsequent* dive (Fig. 1A), while no correlation exists between the number of breathings and the duration of *preceding* dives (Fig. 1B). This would mean that the dolphins, before going down for a long dive, "ventilate" their lungs in relation to the duration of the dive to *come* and that it would not be a question of removing an oxygen debt caused by a preceding dive. We are tempted to suppose, then, that our animal "planned" a dive of certain duration and, like RIDGWAY's animal, deliberately prepared its oxygen stock in accordance. - A second possibility could be that the animal took its breaths quite unintentionally, to remain submerged for as long as the (arbitrary) number of respirations had created the possibility. The correlation, on which both suppositions are based, may eventually be spoiled by variants, like the expenditure of energy and the depth of breathing (according to KARANDEEVA c.s. (1973) the volume of breathed air may vary up to a factor 2.5). The data, diagrammed in Fig. 1, must have a great freedom to shift to either side. That the correlation is not fully obscured by that may be felt as a surprise. It is even not beyond reason to suppose that the apparant correlation is a product of chance.

To us it is hard to accept that by chance a reasonably systematic collection of figures could be created. We prefer to consider our data as indicative for an interesting physiological and ethological process. More insight depends on the availability of more data, which are not difficult to collect for persons having the opportunity to observe dolphins in their natural behaviour.

These notes may serve to stimulate.

References.

DRAL, A. D. G., 1976. Review of a paper on dolphins and porpoises by Dr J. VERWEY. Aq. Mammals, 4 (1) : 10-13.

KARANDEEVA, O. G., S. K. MATISHEVA and V. M. SHAPUNOV, 1973. Features of external respiration in the Delphinidae. *In :* K. K. CHAPSKII and V. E. SOKOLOV (eds.) : Morphology and ecology of marine mammals, p. 196-206. John Wiley & Sons, New York and Toronto.

RIDGWAY, S. H., B. L. SCRONCE and J. KANWISHER, 1969. Respiration and deep diving in the bottlenose porpoise. Science 166 : 1651-1654.

VERWEY, J., 1975. The cetaceans *Phocoena phocoena* and *Tursiops truncatus* in the Marsdiep area (Dutch Waddensea) in the years 1931-1973. Neth. Inst. for Sea Research, Publicaties en Verslagen, No. 1975 - 17a/b 153 pp. + 6 Figs.

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