
6. General discussion

Although therapy with dolphins has been practised for more than twenty years, there is still no scientific publication concerning the subject of the behavior of the animals within the framework of such therapy (Curtis 2000). This is all the more remarkable in that the utilization of non-domesticated animals has often been criticized in the past (Iannuzzi and Rowan 1991). The present work is thus the first attempt to describe the behavior of the animals during DAT. The objective was to observe self-motivated behavior. For this reason, an enclosure was sought in which DAT takes place with untrained animals. It was considered especially important that the animals could move freely during interaction with humans and that their behavior was not manipulated by their being fed with fish.

As described above, many positive publications on the success of DAT lead to the conclusion that therapy with dolphins is especially successful. One reason for this success could be the hypothetical impact of dolphin ultrasound on human tissue, as described by Cole (1996) and Birch (1997). That gives rise to the question, "**Can dolphins heal by ultrasound?**" (page: 10). On the basis of theoretical considerations and calculations, it was possible to verify that, in specific circumstances, dolphin ultrasound can have an effect on biological tissue. It could therefore be demonstrated that the intensity of the ultrasound from dolphins is strong enough; and that, by virtue of residential therapy over several weeks, a regular repeated application of ultrasound was guaranteed. However, according to prior experience of the application of ultrasound the duration of individual therapeutic treatments is of decisive significance. A patient must be in a predetermined situation in relation to the dolphin during the therapy. This leads to the following hypothesis being put forward:

- One or more dolphins exhibits a behavior that results in patients' exposure to ultrasound in doses comparable to those in medical treatments.

As described above, only one dolphin showed a particular preference towards patients. It spent an average of ninety seconds near the patient. For approximately 50% of this time, its head was directed towards the patient. Only in this position is it

possible for a patient to be exposed to ultrasound in the required intensity. The remaining 45 seconds were divided amongst five or six patients. On average, the individual patients each received less than ten seconds of “ultrasound therapy”. This is not sufficient to produce any recognizable effect. Of course, the possibility that the dolphins have some previously unrecognized effect cannot be ruled out. It must, however, be emphasized that the effects of ultrasound have been the subject of intensive research in recent decades and such an unrecognized effect is extremely unlikely. The hypothesis must, on this basis, be rejected. Nor can the hypothesis of Cole (1996) and Birch (1997) be confirmed. To the contrary, as a result of the observations made, the hypothesis must be regarded as extremely improbable.

As described in the beginning, because of technical difficulties it was not possible to measure ultrasound directly. Unfortunately, our method could only be implemented during the final weeks of the residential program in Florida. It was therefore not possible to obtain a sufficiently representative dataset. The publication "**Sound source location by phase differences of signals**" (page: 24) describes a method which facilitates assigning a specific signal to a specific dolphin. In the past, this problem could not be solved satisfactorily. It was therefore impossible, for example, to analyze overlapping signals from moving animals in close proximity to one another. The hydrophones had also to be kept a long way apart in order to determine direction (Janik 2000). There was thus no method which allowed the assignment of signals to socially interacting individuals. The method as presented allows for the employment of a small array of hydrophones which can easily be attached to an underwater video camera. By calculating the horizontal and vertical angles it is possible to determine the sender of a signal in video footage. Acoustic communication from dolphins can thus be observed in context.

In the article "**Behavior of dolphins *Tursiops truncatus* towards adults and children during swim-with-dolphin programs and towards children with disabilities during therapy sessions.**" (page: 34) the following hypothesis was put forward:

- Dolphins can distinguish between different types of humans.

It was further investigated whether dolphins behave differently towards various categories of humans. The statements here touch upon the contact and distance behavior of the animals towards humans. The results showed both general and individual behavior. All dolphins maintained a greater distance from adults than from younger swimmers (children and disabled children). In consideration of the parameter “speed difference”, it becomes clear that almost all dolphins behaved differently towards the various categories of humans. They must therefore have the ability to distinguish between the different groups. It could be demonstrated that some animals prefer patients and others prefer children. Especially noticeable was the behavior of Sarah. She distinguished herself from the other animals by her especially lengthy periods of contact with patients. This special behavior is closely related to a great number of observations in which dolphins helped and assisted each other and members of other species, e.g., humans (Brown & Norris 1956; Norris & Prescott 1961; Essapian 1962; Gilmore 1962; Caldwell et al. 1963; Caldwell & Caldwell 1964; Caldwell & Caldwell 1966; Norris 1974; Pilleri 1984; Norris & Dohl 1988). Sarah’s observed behavior provoked renewed discussion of Connor and Norris’ (1982) hypothesis that dolphins can be motivated by a broad concept of distress and some kind of emotional response to individuals of another species. This poses the question whether this helpful behavior may influence the success of the therapy. In any case, this self-motivated behavior can easily be reinforced by the trainers and is a possible explanation for the often impressive interactions that have taken place in DAT.

Having thoroughly considered and discussed the behavior of dolphins towards different categories of humans, the previous articles, **"Impact of different kinds of humans in Swim-With-The-Dolphin-Programs"** (page: 51) look at the effect of the various categories of people on the dolphins. To this end, the following hypotheses have been constructed:

- Different kinds of swimmers such as adults, children or disabled children have a different impact on the social structure of the interacting group of dolphins at "Dolphins Plus".
- Dolphins are attracted by humans at "Dolphin Reef".

The aim of this work was to investigate the interaction between dolphins and humans along with the possibility that they affect one another.

In contrast to the claim by “Dolphins Plus”, that the dolphins enjoy swimming with humans, it was possible to verify that the animals were attempting to evade humans. Furthermore, the intensification of a subgroup, generally uncoordinated behavior, increases in speed, depth of diving and frequency of breathing, all imply that the animals were under stress during the presence of humans. Contrary to earlier investigations, no aggressive behavior was observed. Our results make it clear, however, that the animals were subject to a certain strain. It is shown here that adult swimmers had the strongest influence on the dolphins. Because of the surprising results of the investigation at “Dolphins Plus”, a further study was conducted at “Dolphin Reef”. It is also claimed there that the dolphins try to come close to humans. It could be shown that humans at “Dolphin Reef” did in fact serve as an attractor for dolphins. It was thus observed, that the animals more frequently went to the area in which people enter and leave the water. Furthermore, it could be verified that groups of people swimming around served as attractors for the dolphins. These findings led to a critical appraisal of the conditions of captivity in the two enclosures. “Dolphin Reef” is essentially different from “Dolphins Plus” in terms of the following conditions: “Dolphin Reef” is substantially larger, the dolphins have the possibility to leave the enclosure at any time, there is an area in which no swimmers are allowed and the swimming groups are accompanied by staff. The conditions of captivity are thus extremely different and very probably have a measurable influence on the behavior of the dolphins. However, the establishment of an area where the presence of humans is prohibited and to which dolphins can retreat is advised by the Final Environmental Statement on the Use of Marine Mammals in Swim-With-The-Dolphin-Programs (NMFS 1990); all facilities should therefore include such an area. For this reason, it is recommended here that the conditions at "Dolphin Reef" be adopted and that the recommendations of the NMFS (NMFS 1990), should be followed.

DAT is a growth market worldwide and it is very probable that an ever-increasing number of dolphinariums will follow this trend. In contrast to natural water enclosures, therapy in dolphinariums is bound up with the risk of mutual transfer of illnesses and parasites (Geraci & Ridgway 1991). This risk can only be minimized by

an increase in chlorine concentration levels. Unfortunately, however, increasing the chlorine concentration has a negative influence on the health of dolphins. Even if therapy with dolphins, in some form, were to promise a special cure, this can certainly not be a justification for keeping the animals in an unhealthy living environment. Additionally, neither here nor in any other works to date, can any advantage of DAT over other animal therapies be demonstrated. In contrast, there exists a serious criticism that some of the positive studies about the DAT used flawed data resulting in flawed conclusions (Marino and Lilienfeld 1998). This accusation carried extra weight because, in therapy with dolphins, research and commerce are often closely intertwined. This poses the much-discussed question (Iannuzzi & Rowan 1991), whether therapy with dolphins should be conducted at all. However, our observations have shown that more DAT can reduce the stress of the animals in the swim-with-dolphins programs.

Comparative analysis of therapy with different animals should be the subject of further research. It would also be interesting to answer the question: What motivates a dolphin like Sarah to help disabled children? In order to obtain indications of especially effective interaction contexts, further physiological measurements should be obtained from the human participants.

A clearer definition of conditions under which therapy with dolphins may take place is necessary in order to exclude the possibility of endangering the animals in dolphinariums.