

THE DEVELOPMENT OF CONTACT BEHAVIOR IN BOTTLENOSE DOLPHIN CALVES (*Tursiops truncatus*)

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INTRODUCTION

Tactile interactions undoubtedly represent a complex phenomenon which involves signal exchange among animals.

Touch signals can be varied in many ways to increase their information content, including how produced, where touched, and the intensity of contact (Herman & Tougel, 1990).

Extensive contact with pectorals, flukes or trunks during affiliative relationships is common among dolphins.

In particular, the mother-calf unit seems to benefit from tactile interactions as a factor for surviving and growth of the calf, giving evidence of establishment and maintenance of strong social bonding between the pair, which may be in part developed and maintained through touch.

Until recently, however, these interactions were rarely analytically quantified.

The aim of this study is to investigate the development of tactile interactions as social behavior between mother and calf, both quantitatively and qualitatively.

Contacts shown during nursing, sexual or aggressive behavior were not included in this analysis.

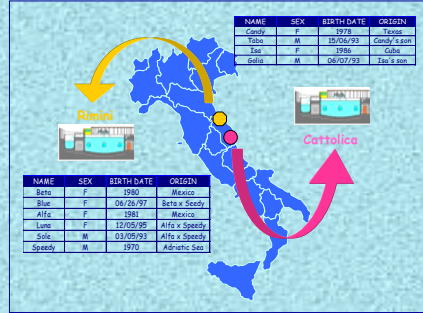


FIG. 1 - SUBJECTS AND ENVIRONMENTS. The three calves (TABO, GOLIA and BLUE) are hosted in two different Delphinaria. Details about the colonies composition are shown.

METHODS

Subjects of the study were three bottlenose dolphin calves: two males (TABO & GOLIA) born in 1993 of the Cortolica Delphinarium and one female (BLUE) born in 1997 at the Rimini Delphinarium (FIG. 1).

In order to quantify tactile interactions with their own mothers, calves were constantly observed from birth to 52 weeks of age. Systematic diurnal "focal animal" (Altmann, 1974) sessions, lasting 30 minutes, were carried out, according to a decreasing schedule (from week 1 to week 26: 8 sessions/twice a week; from week 27 to week 52: 8 sessions/once a week). A total number of 936 hours – equally shared out between the calves – were recorded by means of a video camera.

A specific ethogram was first set up and then used for observations. Seven displays related to touches were selected from the catalogue and then analyzed. Total and hourly frequency for all these behavioral categories was first scored and then studied using Observer 3.0 software. The indication of the calves state as recipient or a giver, and the part of the body involved in the tactile interaction (FIG. 2), were also measured.

All data was finally analyzed by χ^2 test for independent samples.



FIG. 2 - ANATOMICAL REGIONS. In order to group data in a limited number of cases, the animal's body was divided into seven anatomical regions.

TAB. 1 - TACTILE INTERACTIONS

Seven tactile displays – not related to aggressive, sexual or nursing touches – were selected from a general ethogram for *Tursiops truncatus* consisting of 70 behavioral categories (Tizzi, 1995).

DEFINITION	REFERENCE
contact	Any behavior which involved physical contact between two animals; an interaction began when one dolphin touched the other and continued until they moved greater than one body length apart (Nelson & Lien, 1994)
rubbing	Strenuous action in which one dolphin swimming at a fast pace advanced upon another and rubbed part of his body vigorously against his vigorous contact of the tow bodies along their length (Tavog & Essopjan, 1957)
beak genital propulsion	One dolphin uses its snout to nudge the genital area of another dolphin who is lying stationary on its side (Shane, 1990)
bonding	Actor dolphin rest its pectoral on the flank of another, behind the other's pec and below or just posterior to his dorsal fin (von Streit & von Fersen, 1995)
push	Pushing with the beak, the side or ventral part another animal (Pilleri, 1986)
clasp	Taking a calf between flippers (von Streit & von Fersen, 1995)
hold down	Dolphin holds another down on bottom (Hering, 1995)

RESULTS AND DISCUSSION

Affiliative contacts and rubbing acts were the most frequently exchanged behaviors among the mother-calf pairs during the whole study (FIG. 3).

Both appeared to be highly reciprocal and intentional by mothers and calves to be assured, even comforted, of the presence of the other. However, given interactions resulted slightly higher than the received ones for all the calves (FIGs. 4b and 5b).

Some monthly variations of both given and received touches were found between the animals (the female BLUE always showed higher values than the two males, particularly during the first two months for contacts and the last two months for rubbings), providing evidence of possible environmental influence and sex-related differences (FIGs. 4a and 5a).

The analysis for identifying which part of the animals' body was mainly involved in both given and received touches (FIGs. 6 and 7) revealed little differences between calves. In fact, head and pectoral fins were used as major "giver" body portions as well as belly and side were applied like "the best recipient parts for both contacts and rubbings". All these anatomical regions have many free-nerve endings which seem to determine a relevant broad-ranging cutaneous sensitivity and may function as tactile receptors in these animals.

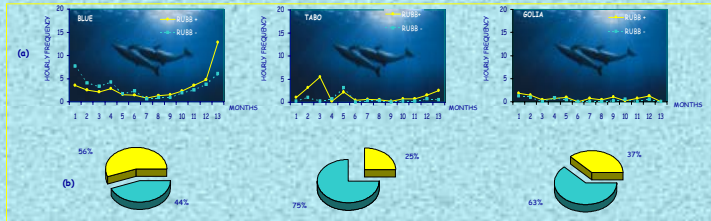


FIG. 4 - GIVEN (RUBB-) AND RECEIVED (RUBB-) RUBBINGS

(a) Hourly frequency per month. BLUE, the female BLUE resulted more active than the two males TABO and GOLIA, showing higher frequency of rubbing behavior during each month of the study. However, this difference between the calves was not statistically significant for both given ($\chi^2 = 23.43$; $df = 24$; $p = 0.4946$) and received ($\chi^2 = 18.67$; $df = 24$; $p = 0.2666$) interactions. The monthly trend showed a quite low profile for GOLIA, slightly higher for TABO during the first three months and more evident for BLUE, who reached higher values during the last two months of the study period. This last observation suggested a relation with the presence of other animals in addition to mother-calf pairs in Rimini's Aquarium. In fact, the increasing of given rubbing acts during that period was possibly related to the fact that BLUE was the recipient of sexual approaches made by the sub-adult male (SOLE). In this respect, she seemed to look for a more protected situation through active vigorous touches with her mother.

(b) Total frequency. The calves showed some differences in the distribution of given and received rubbings. In fact, the female BLUE received a higher number of received acts (56%) when compared with the two males, which displayed a similar frequency mainly represented by rubbi-. This situation was probably due to the more complex social context of Rimini's Delphinarium, in which the other animals may play a role in the reinforcing mother-calf bond through vigorous interactions like rubbings particularly during the first period of the calf's life.



FIG. 6 - CALF'S ANATOMICAL REGIONS GIVING INTERACTIONS

The external ring shows rubbing acts whereas the internal one displays contact behaviors. It is clear that the two males TABO and GOLIA mainly used HEAD, PEC FINS and BELLY for giving tactile interactions. The female BLUE was similar to the others, providing relevant values for PEC FINS, HEAD and BACK.

CONCLUSIONS

Where and how dolphins anatomically touch each other, as well as the level of intensity with which they contact each other, may depend on the kind of exchanged signals. However, examining the types and amount of action patterns animals participate in, can provide information on the developmental use of certain signals according to different behavioral contexts. In this respect, the development of a correct mother-calf relationship seems to be strongly related to the evolution of specific touch signals as an important component of their communication system. This first study, although preliminary and with a limited sample size, allowed us to quantify in a very detailed manner this behavior, suggesting interesting items for further investigations.

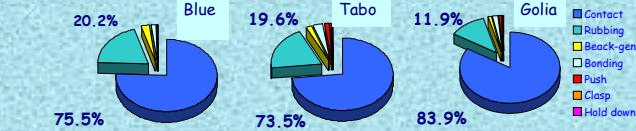


FIG. 3 - TOTAL FREQUENCY OF THE TACTILE INTERACTIONS

Contact and Rubbing were the most frequent interactions seen (about 95% of the total) during the study year, whereas the others were observed for the first two months only.

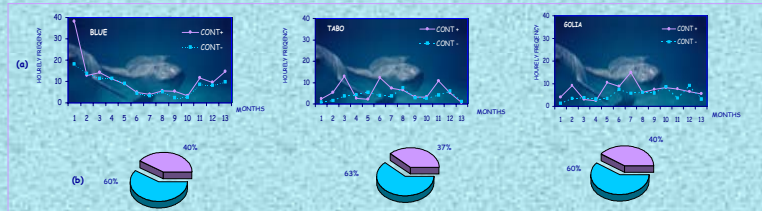


FIG. 5 - GIVEN (CONT-) AND RECEIVED (CONT-) CONTACT

(a) Hourly frequency per month. BLUE, the female hosted in the Rimini's Aquarium, resulted more active than the two males TABO and GOLIA in Cortolica, showing higher frequency of contact behavior during each month of the study. This difference between the calves was statistically significant for both given ($\chi^2 = 89.28$; $df = 24$; $p < 0.0001$) and received ($\chi^2 = 54.45$; $df = 24$; $p = 0.0004$) interactions. The monthly trend of TABO and GOLIA showed a similar profile, whereas BLUE reached higher values during the first two months. This observation seems to reflect the need for the calf to actively stay with the mother in order to have increased protection and care, considering the presence of other animals in the same environment.

(b) Total frequency. No differences in the distribution of given and received contacts were found between the calves. In fact, given (cont+) and received (cont-) acts represented 60% and 40% respectively of the total budget for each animal.

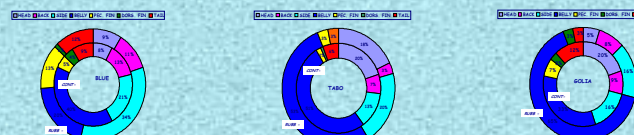


FIG. 7 - CALF'S ANATOMICAL REGIONS RECEIVING INTERACTIONS

The external ring shows rubbing acts whereas the internal one displays contact behaviors. All three subjects of this study mainly received touches on BELLY, but an interesting difference between the calves was discovered by this analysis: in fact, the dams of GOLIA and BLUE touched their own calf not only on BELLY but on the SIDE, whereas TABO's mother preferred the HEAD region. This particular observation is possibly due to the primiparity of GOLIA's and BLUE's mothers which seemed to commonly privilege the echelon formation while swimming, promoting touches with their pectoral fins on the calves' side.

ACKNOWLEDGMENTS

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