PRE AND POST PARTUM WHISTLE PRODUCTION OF A BOTTLENOSE DOLPHIN (*TURSIOPS TRUNCATUS*) MOTHER-CALF DYAD

AUDRA AMES

Department of Psychology, University of Southern Mississippi,
Hattiesburg, MS, USA
audra.ames@eagles.usm.edu

SARA WIELANDT, DIANNE CAMERON

Six Flags: Discovery Kingdom
Vallejo, California, USA
sWielandt@sftp.com, dCameron@sftp.com

STAN KUCZAJ

Department of Psychology, University of Southern Mississippi,
Hattiesburg, MS, USA
s.kuczaj@usm.edu

Vocal learning has been defined as the process by which an individual modifies its vocal repertoire as a result of the sound environment (Marler, 1976a; McCowan & Reiss, 1997). Vocal learning has been found in a number of species, including the Atlantic bottlenose dolphin (*Tursiops truncatus*)(see review: Janik & Slater, 1997). Dolphins mimic sounds heard in their sound environment, and modify their vocal repertoire based on this mimicry. Much of the research on vocal learning in bottlenose dolphins has focused on whistle development in dolphin calves (Fripp et al., 2005; McCowan & Reiss 1995; Morisaka, Shinohara, & Taki, 1995; Tyack & Sayigh, 1997). In particular, this literature focuses on the sounds calves may select as part of their signature whistles and has suggested that a calf's signature whistle is strongly influenced by the sounds it hears, especially those sounds produced by conspecifics (Bojanowski, Veit, & Todt, 2000; Fripp et al., 2005; McCowan & Reiss, 1995; Sayigh, Tyack, Wells, & Scott, 1990; Sayigh, Tyack, Wells, Scott, & Irvine, 1995). Few studies have addressed the ontogeny of whistle development during a calf's early life (McCowan & Reiss, 1995; Morisaka et al., 1995). Studies that have attempted to discuss the early development of calf acoustic repertoires, rarely address the roles of adult dolphin signature whistles in this development. For example, bottlenose dolphin mothers increase their signature whistle rates surrounding the birth of their calf (Fripp & Tyack, 2008; Gnone & Moriconi, 2010; Mello & Amundin, 2005), and it has been suggested that this increase could serve as a model for dolphin calves in the development of their own signature whistle (Fripp & Tyack, 2008).

Our findings suggest that this may not be the case, and that increased signature whistle rates in bottlenose dolphin mothers must exist for an alternate reason. In this study, we investigate a calf's developing whistle repertoire as a function of the adult whistles it hears. The signature whistles of a group of five adult bottlenose dolphin females in managed care were recorded from a four-month period (two months prior to and two months after the birth of a calf to one of the group members). We gathered video recordings with hydrophone input, which allowed us to observe sound in the environment as it was simultaneously produced with behavior. As has been previously reported for other pregnant dolphins, the mother dolphin exhibited a significant increase ($p<.05$) in whistle production before the birth of the calf. The mother also produced whistles at an additional significant rate ($p<.05$) following the birth of the calf, but this rate decreased over time, consistent with findings from similar studies (Fripp & Tyack, 2008; Gnone & Moriconi, 2010). The remaining four adult females produced whistles at relatively low levels pre-partum, showing an increase in whistle rates as the mother dolphin gradually decreased her vocal production over the first two months of the calf's life. These findings are more supportive of additional hypotheses regarding this phenomenon (e.g., imprinting; Mann & Smuts, 1998; Fripp & Tyack, 2008), not with whistle modeling. We used a discriminate analysis to determine which signature whistles present in the calf's environment, if any, existed in her early repertoire. Parameters from whistles identified as belonging to the calf or as a match to an adult signature contour, were extracted from the data using sound analysis software (RavenPro 1.5). These parameters included the beginning, end, minimum, maximum and delta frequencies of the whistle, along with the whistle duration and inflection points. We did not find that the calf developed a predominant whistle type in the early months of her life, but instead used each of the adults' signature whistles in addition to several whistles that were dissimilar to the adults' signature sounds through the course of the study. Based on our findings, it does not appear that repeated exposure to a sound guarantees that sound's use by the calf. The adult contours most commonly mimicked by the calf were that of a female who produced moderate levels of her signature whistle during the course of the study. This is consistent with findings that suggest a calf may select their signature whistle based on sounds that are not over abundant in their environment (Bojanowski et al., 2000; Fripp et al., 2005). The selection process for sounds that calves include in their vocal repertoire is still largely unknown, but studies that add to the dearth of information regarding this developmental process may help us piece together how dolphins develop their communication system.

Keywords: dolphin communication, vocal learning, signature whistle

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