

Do Bottlenose Dolphins (*Tursiops truncatus*) Have Distinct and Stable Personalities?

Lauren E. Highfill and Stan A. Kuczaj II

*Department of Psychology, University of Southern Mississippi, 118 College Drive, #5025, Hattiesburg, MS 39406, USA;
E-mail: Lauren.Highfill@usm.edu*

Abstract

Psychologists have long been interested in the role of individual differences in the behavior of many species, particularly consistent differences that might reflect temperament or personality. Only recently has animal personality become an important and credible topic of research, however. In an effort to add to the literature on animal personality, the possibility of consistent personality characteristics was explored for a previously unstudied species, the bottlenose dolphin (*Tursiops truncatus*). Dolphin personality was assessed using a measure that evaluated possible personality characteristics. The measure consisted of a list of adjectives and descriptions commonly associated with dolphin behaviors (e.g., “curious: appears to be interested in new situations or objects”). Judges rated each animal on each description using a seven-point rating scale. The stability of individual dolphin personality characteristics was assessed by comparing results from judgments of individual dolphin personalities collected prior to Hurricane Katrina with those collected approximately 15 months later. In the interval between these two ratings, the dolphins’ home at MarineLife Oceanarium was destroyed, and the dolphins were subsequently relocated to a facility in the Bahamas. The second set of judgments was made by individuals in the Bahamas who had no experience with the dolphins prior to Hurricane Katrina and no information about the results of the earlier dolphin personality assessments. The results support the notions that dolphins demonstrate different personalities and that these personalities are relatively stable over time and across situations.

Key Words: animal personality, behavior, temperament, individual differences, bottlenose dolphin, *Tursiops truncatus*

Introduction

The study of animal personality pales in comparison to the study of human personality (Gosling, 2001).

Studies of animal personality are limited because of the subjects’ lack of language, which excludes the use of methods such as self-reports, life-stories, attitude reports, and identity reports (Mather, 1998). In addition, the terms “personality” and “temperament” are distinguished in human personality research but not in animal personality research. Temperament in humans is defined as “the early appearing tendencies that interact with environmental influences to serve as the biological foundation for personality” (Vazire & Gosling, 2004, p. 818). Because temperament in humans appears in infants, it does not depend on language or developed cognitive skills, and it is assessed without relying on the subject’s communication skills. In this way, the study of temperament in human infants is similar to the study of personality in animals (Mather, 1998) and may be one reason why the words “personality” and “temperament” are often used interchangeably in the animal personality literature. In addition, animal researchers may have used the word “temperament” to avoid sounding anthropomorphic (Gosling, 2001). In this paper, the term “personality” will be used to refer to an individual dolphin’s distinguishing patterns of behavior that remain consistent over time and across situations (Pervin & John, 1997).

To study personality in any species, it is necessary to create a method that assesses individual differences in behavior. Unfortunately, the literature on animal personality has not always employed consistent terminology. Different studies on animal personality explored behavioral dimensions that may have similar qualities but nonetheless were used to describe different personalities. For example, Forkman et al. (1995) discussed the personality trait of “exploration” in piglets, whereas Gosling (2001) used the term “curiosity” in his study of a group of hyenas. Do “exploration” and “curiosity” express similar behavioral dimensions? Or do the two terms describe different sorts of behaviors that can be described similarly by human speakers of English? Consistency of terminology within research on animal personality is needed to allow meaningful within- and across-species comparisons.

One possible solution is to devise an animal personality measure that is based on measures used in the study and assessment of human personality. In human psychology, the Five Factor Model is a descriptive model of personality (Goldberg, 1990). The model includes five broad factors or dimensions of personality: (1) Openness to Experience, (2) Conscientiousness, (3) Extroversion, (4) Agreeableness, and (5) Neuroticism (Goldberg, 1993). Each factor consists of more specific traits. For example, the factor Openness to Experience is characterized by a sense of adventure, unusual ideas, imagination, and curiosity. The factor Conscientiousness is characterized by a tendency to show self-discipline, demonstrate planned behaviors, and aim for achievement. The factor Extroversion is characterized by energy, surgency, and the tendency to seek stimulation. The factor Agreeableness is characterized by a tendency to be cooperative rather than antagonistic towards others. The final factor Neuroticism is characterized by a tendency to experience unpleasant emotions easily such as anger or anxiety. In a cross-species review, Gosling & John (1999) retrospectively applied the Five Factors of human personality to previously published studies of animal personality. The authors chose the Five Factor Model because it is "the most widely accepted and complete map of personality structure" (p. 69). They were able to apply four of the Five Factor dimensions (Openness to Experience, Extroversion, Agreeableness, and Neuroticism) to 12 species: chimpanzees (*Pan troglodytes*), gorillas (*Gorilla gorilla*), rhesus monkeys (*Macaca mulatta*), vervet monkeys (*Cercopithecus aethiops*), hyenas (*Crocuta crocuta*), dogs (*Canis familiaris*), cats (*Felis catus*), donkeys (*Equus asinus*), pigs (*Sus scrofa*), rats (*Rattus rattus*), guppies (*Poecilia reticulata*), and octopi (*Octopus rubescens*). The factor of Conscientiousness only formed a separate dimension for chimpanzees. Other studies have directly used a modified version of the Five Factor Model to assess personality in nonhuman species and experienced similar success (e.g., chimpanzees [King & Figueredo, 1997]; horses [Morris et al., 2002]; and pets such as dogs, cats, ferrets, horses, rabbits, and hedgehogs [Gosling & Bonnenburg, 1998]). A potential problem with using human personality traits with nonhuman animals is that important domains of animal personality might not be captured by the adjectives associated with the Five Factor Model (Gosling & Bonnenburg, 1998). Furthermore, some Five Factor traits are more human-oriented and difficult to apply to nonhuman animals (e.g., "disorganized"). An alternative method is to use species-specific personality scales (e.g., Gold & Maple, 1994; Gosling, 1998); however, as described above, this

severely limits cross-species comparisons. The limitations of using an established human scale are outweighed by the benefits of being able to compare across species, including humans to nonhuman animals (Gosling & Bonnenburg, 1998).

Animal personality has been studied in a wide range of species (see Gosling, 2001, for review). The possibility of personality differences in bottlenose dolphins (*Tursiops truncatus*) has not been subjected to scientific study, however. Therefore, the current study contributes to the emerging field of animal personality by examining this underrepresented species. Some research with dolphins has indicated consistent individual differences during feeding, swimming, and mothering behaviors. For example, Hill et al. (in press) suggested that dolphin mothers exhibit consistent individual differences in parenting styles. In this study, the behavior of eight mother-calf pairs of captive bottlenose dolphins was observed. The results suggested three main maternal styles, ranging from "permissive" to "restrictive." Although the relationship of dolphin personality and dolphin maternal style was not examined in our study, it is possible that individual maternal styles are related to personality differences. It is also possible that maternal style may affect the development of a calf's personality, but the extent to which this is the case has not been determined.

Another example suggesting that dolphins maintain consistent individual differences concerns the feeding behavior of two groups of bottlenose dolphins near the coast of Florida (Gazda et al., 2005). Both groups of dolphins used a specialized technique to obtain their prey. Within each group, one animal would herd fish toward other group members using fluke slaps. For both groups, there was one individual (a different individual in each group) that consistently played the role of the "driver." Although it is not clear if personality affects decisions about which dolphins play specific roles during cooperative foraging, the behavioral differences that have been observed are consistent with the notion of dolphin personality.

In another study, group movements and positional leadership in a resident population of bottlenose dolphins near the Florida Keys were examined (Lewis et al., 2005). The study used focal-follows and photo-identification to determine which dolphins maintained the lead (most forward position) and which dolphins initiated movement within the group. A small number of individuals within the group controlled the group's movement and direction changes. Moreover, a direction change was always initiated by animals in the most forward position. Again, these individual differences may be related to personality types, particularly in terms of those characteristics that enable an individual to lead a group or to follow a leader.

It is possible that dolphins exhibit consistent individual differences in other behavioral domains as well. Dolphins are extremely social animals and live within a social hierarchy where some animals take on more dominant roles while others take on more submissive positions. The existence of different social roles creates many occasions for consistent individual behavioral differences to manifest themselves as do dolphins' problem-solving strategies and exploratory behaviors (e.g., Herman et al., 1993; Connor et al., 2001; Xitco et al., 2004; Delfour & Marten, 2005; Kuczaj & Walker, 2006; Kuczaj & Yeater, 2006). For example, a high ranking dolphin maintains dominance over another by biting, chasing, and fluke-slapping. Consequently, a lower ranking dolphin can either choose to fight back or swim away (Herman, 1980). A dolphin's consistent choice to fight or flee could reflect a certain personality type. Furthermore, dolphins establish strong social bonds by associating with other animals (Wells, 1991). Male dolphins often form a pair bond that lasts a lifetime. The formation of a pair bond may depend on the compatibility of each dolphin's personality. For example, within some pair bonds, one of the males always sires the calves, while the other male never does (Connor et al., 2000). The male which always sires the calves may have a more dominant and bolder personality. If so, he might be more compatible with another male that has a less dominant personality.

Much of dolphin activity consists of social behaviors (Shane et al., 1986). Dolphins playfully chase one another, exhibit affiliation through gentle rubbing, and use objects to seek interaction. Cooperative play behaviors have been observed among rough-toothed dolphins (*Steno bredanensis*) (Kuczaj & Highfill, 2005). Social interactions between different dolphin species can also occur. Herzog and colleagues (2003) observed aggressive behaviors between Atlantic spotted dolphins (*Stenella frontalis*) and bottlenose dolphins. Bottlenose dolphins have been observed aiding ill or injured group members by vocalizing or physically supporting the animal at the surface so it can breathe (Siebenalen & Caldwell, 1956). Bottlenose dolphins have even been seen attending to dead dolphin bodies (Dudzinski et al., 2003). This broad behavioral repertoire implies that dolphin behavior is far from stereotypical, thus creating many opportunities for consistent individual differences.

The above examples of dolphin behavior demonstrated that all dolphins are not the same, and they support the possibility that individual differences among dolphins might reflect the dolphins' individual personalities. This possibility was examined by asking human judges who were

familiar with a group of dolphins to rate individual dolphins on a number of behavioral characteristics, which yielded a personality profile for each animal. Next, the stability of these profiles was assessed by asking a different group of human judges to rate the same dolphins approximately 15 months later. In between the times of the two ratings, the dolphins' home was destroyed by Hurricane Katrina and, in time, the dolphins were relocated to a different facility in the Bahamas.

Materials and Methods

Assessment 1

A bottlenose dolphin personality measure was created to evaluate the ability of human raters to accurately assess the personality of individual dolphins. This personality measure described 30 behavioral dimensions and was a modified version of the Five Factor Model used in human personality research such that each of the 30 behavioral dimensions corresponded with a factor from the Five Factor Model (Goldberg, 1990). For example, an adjective representing the factor Conscientiousness was "careful, cautious: animal exhibits caution in its actions" (p. 1225). All terms were operationally defined to reduce confusion or variability during the assessments. The rating instrument contained 30 adjectives—six for each dimension (see Table 1). Each adjective was scored on a seven-point rating scale, ranging from (1) "very accurate description" to (7) "very inaccurate description." All negatively written trait descriptions were reversed scored, so that 1 would remain the most accurate description for that factor. To account for all the raters, a mean score was calculated for each subject on each adjective and within all of the five dimensions.

Subjects consisted of 16 bottlenose dolphins (12 females and four males). These dolphins were housed in three pools at MarineLife Oceanarium in Gulfport, Mississippi. All dolphins were housed in social groups ranging between three and seven animals. The ages of the animals ranged from 1.5 y to over 40 y (see Table 2). The personality assessments were completed by judges who had a minimum of one year's experience with each dolphin that they rated. The judges consisted of graduate students and MarineLife Oceanarium trainers. Each of the students had observed the dolphins they rated for at least 2 h weekly over the course of at least one year. During the observations, the students used 2 min or 5 min scan samples to record behavioral ethograms. The trainers had interacted with the dolphins at least three times per day during training sessions for a minimum of one year. For all assessments, three or more judges rated the animals with which they were most familiar.

Table 1. Adjectives and definitions used for dolphin personality measure based on the human Five Factor Model

Factor I: Openness to Experience	Factor II: Conscientiousness	Factor III: Extroversion	Factor IV: Agreeableness	Factor V: Neuroticism
(+) Creative, imaginative: Approaches situations and addresses problems in novel, creative ways (e.g., finds various ways to play with a toy).	(+) Careful, cautious: Animal exhibits care in its actions.	(+) Assertive: Self-assured, not easily intimidated.	(+) Friendly, gentle: Friendly, amicable, and congenial toward other animals and humans. Responds to others in an easy, kind manner. Not hostile. Not antagonistic.	(+) Jealous: Resentful or envious of another dolphin.
(+) Intelligent: Animal appears to learn easily. Quick to understand.	(+) Alert, vigilant: Ready, attentive, watchful; appears to pay attention to surroundings.	(+) Playful: Engages in play behavior.	(+) Obedient, cooperative: Obeys; cooperates with instructions. Not defiant.	(+) Aggressive: Threatens or causes harm; high frequency of raking, biting, or hitting other animals and/or humans.
(+) Curious: Appears to be interested in new situations or objects.	(+) Diligent, attentive: Animal monitors its actions and exhibits a willingness to please.	(+) Active, energetic: Moves around a lot. Locomotion can include swimming, leaping, beaching, etc. Not lethargic.	(+) Affiliative, companionable: Agreeable and sociable. Appears to like the company of others. Seeks out social contact with another animal or person.	(+) Temperamental: Displays frequent mood swings.
(--) Not exploratory or inquisitive: Does not seek out or investigate novel situations or objects.	(--) Lazy: Resistant to work or exertion.	(--) Timid: Hesitant, apprehensive, tentative.	(--) Inflexible, incontinent: Stubborn or headstrong. Not willing to adapt or change.	(--) Relaxed, calm: Assured or at ease. Not tense or highly sensitive.
(--) Unoriginal, conforming: Not inventive or original; does not produce new and unusual actions.	(--) Undependable, unreliable: Not easily relied or depended on. Not a "go-to" animal.	(--) Quiet, not vocal: Does not vocalize often.	(--) Demanding: Requires much effort or attention from other dolphins and/or humans.	(--) Comfortable, complacent: Self-satisfied, content; appears free from anxiety.
(--) Simple: Engages in routine behaviors. Does not have a complex behavioral repertoire.	(--) Inconsistent, variable: Not consistent or predictable.	(--) Unexcitable: Not readily roused into action; relatively unresponsive to stimuli.	(--) Selfish: Self-centered or concerned chiefly with itself and its needs.	(--) Tolerant and easy-going: Inclined to be relaxed and tolerant.

Furthermore, all raters were directed to complete their assessments independently and were asked to not discuss their choices or the personality characteristics for the duration of the study.

Assessment 2

To establish that individual personalities exist for any species, it must be demonstrated that the pattern of behaviors is consistent over time and across situations (Pervin & John, 1997). Originally, the authors had planned to reassess the dolphin personalities by having the same raters complete the assessments after one year; however, at the end of

August 2005, MarineLife Oceanarium in Gulfport, Mississippi, was destroyed by Hurricane Katrina. For eight dolphins, this occurred while they were in one of the pools, and they were able to escape into the Mississippi Sound. These dolphins struggled to survive in the waters of the Mississippi Sound and were subsequently rescued and relocated to hotel swimming pools and later to temporary pools provided by the U.S. Navy. Fortunately, no dolphins were severely injured physically during the storm. Other dolphins at MarineLife Oceanarium had been relocated to various oceanaria in preparation for the storm. Ultimately, 15 of the 16 dolphins

Table 2. Information concerning the 16 study animals originally housed at MarineLife Oceanarium

Subject	Age (y)	Gender	Born in human care: (H); wild born: (W)	Familial relationships	No. of raters' assessments: 1st/2nd
A	~1.5	F	W	N/A	4/0
B	4	M	H	Mother: O Half-sibling: H	4/3
C	6	M	H	Mother: M	4/3
D	6	M	H	Mother: N Half-sibling: F	4/3
E	7	F	H	Mother: K	7/3
F	9	M	H	Mother: N Half-sibling: D	3/3
G	9	F	H	Mother: Deceased	3/3
H	17	F	H	Mother: O Half-sibling: B	6/3
I	~20	F	W	N/A	4/3
J	20	F	H	N/A	5/3
K	~20	F	W	Mother of E	3/3
L	~31	F	W	N/A	3/3
M	~20	F	W	Mother of C	3/3
N	~31	F	W	Mother of D & F	4/3
O	~31	F	W	Mother of B & H	5/3
P	~40	F	W	N/A	7/3

were relocated to a facility at Atlantis Resort in the Bahamas. Unfortunately, the 16th dolphin that had been relocated to another oceanarium prior to the storm passed away before the relocation to the Bahamas occurred. The surviving dolphins' experiences during and after the storm provided the unique opportunity to retest the dolphins' personality over time and across situations, following a period in which much had changed in the dolphins' lives.

Fifteen of the 16 previously rated bottlenose dolphins (11 females and 4 males) were housed in a large, open ocean pool at Atlantis Resort, Bahamas. Approximately 14 mo after Hurricane Katrina and approximately 9 mo after the dolphins had been housed at Atlantis, the trainers at Atlantis used the same personality assessment to rate the dolphins that had been used in MarineLife Oceanarium by different raters. None of the raters had been in contact with the dolphins or trainers prior to Hurricane Katrina. Due to the circumstances of relocation, the new trainers had no contact with the previous trainers. As a result, there were no discussions about the dolphins' personality characteristics between new and previous trainers. Furthermore, none of the raters had been involved in the first personality assessment or seen the results of Assessment 1. Ratings were obtained from three trainers for each dolphin. Assessments were completed independently, and raters were asked to not discuss their choices or

the personality characteristics for the duration of the study.

Next, the results of the two personality measures were compared for each of the 15 dolphins that were rated in both Assessment 1 and Assessment 2. Test-retest reliabilities were computed using Spearman's rho correlations.

Results

Assessment 1

Since each dolphin was rated by three or more judges (range: three to seven raters), concordance between raters was measured using Kendall's Coefficients (range 0.41 to 0.86). Comparisons were statistically significant ($p < 0.05$) for each of the 16 dolphins, indicating agreement among judges within each subject. When the raters disagreed on the seven-point rating scale, the average discrepancy was 1.21 ($SD = 0.38$), suggesting that even when the raters disagreed they were relatively close in their assessments of a dolphin's behavioral tendencies. Furthermore, the different raters did not consistently disagree on particular traits, demonstrating that individual raters did not assess any particular trait in a unique fashion. To illustrate the different dolphin personalities, a personality profile was created for each subject. Overall, the results of Assessment 1 supported the hypothesis that dolphins possess distinct individual personalities.

Assessment 2

Since each dolphin was rated by three judges, concordance between raters was measured using Kendall's W. The Kendall's Coefficients (range 0.53 to 0.79) were statistically significant ($p < 0.05$) for each of the 15 dolphins, indicating agreement among judges within each subject. When there was disagreement among the raters on the seven-point rating scale, the average discrepancy was 1.31 (SD = 0.27). Once again, the different raters did not consistently disagree on particular traits. As was the case in Assessment 1, with a different set of raters, even when the raters disagreed, they produced similar ratings of individual dolphin's behavioral tendencies.

Consistency of Personality over Time and Across Situations

Kendall's Coefficients of concordance were computed for all the raters from both Assessment 1 and Assessment 2 for each dolphin. The Kendall's Coefficients ranged from 0.23 to 0.50, each of which was statistically significant ($p < 0.05$) for each of the 15 dolphins. This indicated overall agreement among judges for each subject that they rated. It is worth noting that these coefficients are based on raters producing identical scores on the seven-point scale for each of the items. Given that raters rarely differed by more than one point on the scale for an item, the raters were even more consistent than this conservative analysis suggests.

The ratings for 12 of the 15 dolphins that were rated in both Assessment 1 and Assessment 2 exhibited significant positive correlations, demonstrating that ratings were more likely to be consistent than inconsistent despite the time lapse, change in circumstances, and different raters ($p < 0.05$, binomial test). These results suggested that individual differences in dolphin behavioral patterns are stable over time and across situations, at least insofar as human judgments of these patterns are concerned (see Tables 3 & 4).

Personality profiles were created for each of the 15 dolphins to illustrate the similarities and differences between the ratings from each assessment (see Figures 1 & 2 for examples). Each of the factors in the Five Factor Model was also examined for consistency over time and across situations. Spearman's rho correlations were also computed for each of these factors. The results indicated significant positive correlations for each factor for the ratings from Assessments 1 and 2 (Figure 3). Overall, these results provide strong support for stability across time and situations in the individual personality characteristics for dolphins.

Table 3. Test-retest reliabilities for Assessment 1 and Assessment 2 ratings for each dolphin

Dolphin	df	r	p
B	29	.652	0.01
C	29	.309	0.10
D	29	.673	0.01
E	29	.843	0.01
F	29	.293	0.12
G	29	.161	0.40
H	29	.776	0.01
I	29	.416	0.02
J	29	.734	0.01
K	29	.829	0.01
L	29	.756	0.01
M	29	.592	0.01
N	29	.506	0.01
O	29	.515	0.01
P	29	.602	0.01

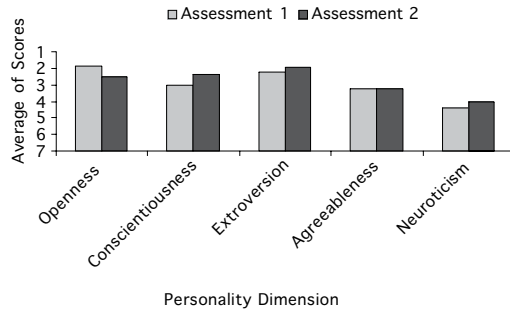


Figure 1. Dolphin B: An example of a "stable" personality profile

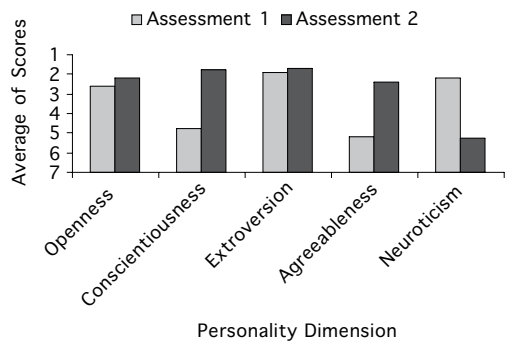


Figure 2. Dolphin G: An example of an "unstable" personality profile

Table 4. The means for each of the Five Factors (O = Openness, C = Conscientiousness, E = Extroversion, A = Agreeableness, N = Neuroticism) for each of the 15 dolphins during Assessments 1 and 2

Dolphin	Assessment	O	C	E	A	N
B	1	1.88	3.00	2.22	3.24	4.42
	2	2.50	2.39	1.94	3.22	4.00
C	1	2.00	3.57	2.13	4.10	3.43
	2	3.89	4.39	3.67	4.45	3.16
D	1	2.21	2.89	2.21	3.63	4.29
	2	2.44	2.11	2.61	2.61	5.83
E	1	2.55	2.80	2.17	3.70	4.02
	2	1.67	2.17	1.83	3.56	4.11
F	1	1.94	2.75	2.33	3.86	3.94
	2	2.11	1.94	4.00	2.89	5.94
G	1	2.61	4.78	1.89	5.19	2.17
	2	2.50	1.78	1.67	2.39	5.06
H	1	2.87	2.62	2.97	3.75	5.18
	2	3.50	2.00	3.17	3.06	5.78
I	1	4.47	3.00	4.08	2.57	5.67
	2	2.94	1.94	2.72	3.06	5.56
J	1	2.22	2.17	2.47	2.89	4.90
	2	1.67	1.50	1.78	3.28	5.33
K	1	3.17	2.72	2.56	3.36	5.06
	2	2.45	2.00	1.56	2.89	5.06
L	1	2.36	2.33	2.22	3.36	4.94
	2	2.06	2.28	1.94	2.61	6.22
M	1	3.56	2.53	2.89	2.67	5.11
	2	2.56	2.83	2.39	3.84	5.06
N	1	2.03	2.42	2.29	3.18	4.75
	2	3.19	2.22	2.94	2.61	5.81
O	1	3.67	2.37	2.54	3.14	5.33
	2	2.22	2.56	2.00	4.39	4.33
P	1	3.62	2.62	3.12	3.45	4.98
	2	3.22	2.33	3.61	2.56	5.89

Discussion

Pervin & John (1997) defined personality as an individual's distinguishing pattern of behavior which remains consistent over time and across situations. This definition has two key components:

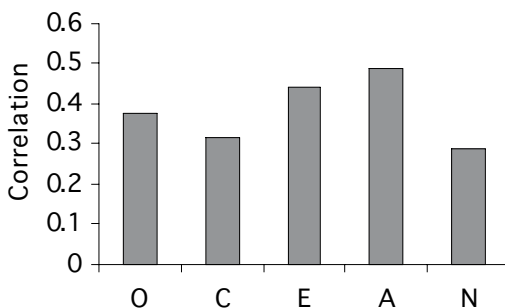


Figure 3. Spearman's correlations for each factor (all significant at the 0.01 level)

(1) an individual's distinguishing pattern of behavior and (2) consistency over time and across situations. To address the first component, a measure was created to assess possible differences in dolphin personality. Inter-rater scores were reliable. The descriptive statistics also indicated that different personalities existed for this group of dolphins. If dolphins shared the same personality type, they should rate similarly on each of the factors. This was not the case, however. The personality profiles that were found for each dolphin were distinct, indicating personality differences among the dolphins. But were these individual differences between dolphins stable over time and across situations? The unfortunate circumstances that surrounded the impact of Hurricane Katrina on the Mississippi Gulf Coast provided a unique opportunity to assess the stability of dolphin personality. The dolphins in this study were all displaced by the hurricane, and eight of them were actually in the oceanarium when it was destroyed.

They survived and were rescued approximately 3 wks later. All 16 of the dolphins experienced significant changes in the interval between the two sets of ratings. They were moved multiple times, which resulted in a variety of separations and reunions; were temporarily housed in small pools; and finally were moved to a facility in the Bahamas. After they had been in the Bahamas approximately 9 mo, trainers at the facility rated each of the 15 surviving dolphins. Despite the fact that these raters had no knowledge of the results from the first set of ratings and no prior experience with these animals, the ratings for 12 of the 15 animals were remarkably similar. These results suggest that dolphin personality is stable, even after drastic changes in social and physical environments.

These results support the findings of previous studies which have demonstrated that personality traits for nonhuman animals can remain consistent over time and across situations (e.g., Suomi et al., 1996; Capitanio, 1999; Carere et al., 2005). In one such study, longitudinal behavioral observations were made for rhesus monkeys (*Macaca mulatta*) from the age of 6 until 20 (Suomi et al., 1996). The results indicated that each monkey maintained their distinctive personalities throughout their adult years. Most of the previous work demonstrating stability in individual behavioral differences has been limited to elapses in time while the subjects' physical and social environments remained fairly stable. The dolphins examined in this study endured changes in both their physical and social environments while experiencing an elapse in time. The fact that the majority of these dolphins' personality profiles remained stable through all of these changes provides strong support for the notion that individual differences among dolphins reflect stable personalities.

It is not always the case that personality-related traits are consistent over time and/or across situations, however (e.g., Coleman & Wilson, 1998; Visser et al., 2001; Dingemanse & de Goede, 2004). In one such study, Coleman & Wilson (1998) found that pumpkinseed sunfish (*Lepomis gibbosus*) do not consistently exhibit shy or bold behaviors across different contexts. For example, a sunfish may demonstrate bold-type behaviors towards the threat of a meterstick but shy away from a predator. Another study found that personality characteristics of great tits (*Parus major*) were dependent on whether they occurred during a social or nonsocial context (van Oers, Klunder, & Drent, 2005). For example, after being mildly startled at a feeding table, females were slower to return within a social context. The personality profiles for three of the 15 dolphins—Dolphin C (a 6-y-old male), Dolphin F (a 9-y-old male), and Dolphin G (an 8-y-old female)—were not entirely

consistent from Assessment 1 to Assessment 2. It is not clear why these three dolphins' personality profiles changed, but this result demonstrates that dolphins may differ in the stability of their personalities as well as in the type of personality. Determining the factors that influence the stability of dolphin personality is necessary to increase our understanding of personality development in dolphins. We suspect that a myriad of factors may interact in this regard, including age, social rank, reproductive activity, and gender.

The ultimate goal of studying personality in nonhuman animals is to relate personality characteristics to observed behavior. Examining individual differences enables animal caretakers to better understand and predict the behavior of animals (Vazire & Gosling, 2004). The study of animal personality research has both practical and theoretical benefits. In applied settings, zoo administrators could use information about the personalities of animals in their care to design individualized plans for environmental enrichment and other animal welfare considerations. Furthermore, knowledge of personality types can aid in animal management techniques such as breeding and reintroduction programs. In a recently published chapter, King (2007) stated, "Failure to include subjective personality measures as a fundamental component of animal behavior studies would be roughly analogous to studying animal behavior exclusively by automatic data recording while scrupulously excluding direct visual observation" (p. 49). We agree with King's statement and plan to continue our investigations of dolphin personality by assessing the personality of other groups of dolphins with our measure and attempting to relate personality profiles obtained via ratings with an individual animal's behaviors. The available data support the notion that dolphins have distinct personalities, and the data also suggest that many of these individual differences are stable over time and across situations. Determining the factors that influence the ontogeny of dolphin personality and its stability is an important next step as is the ability to relate dolphin personality to dolphin behavior. Although it is clear that not all dolphins are the same, it is also clear that there is much more to learn about dolphin personality.

Acknowledgments

We thank the graduate students in the Marine Mammal Behavior and Cognition Laboratory at the University of Southern Mississippi, the trainers at MarineLife Oceanarium, and the trainers at Atlantis for their thoughtful ratings of the dolphins.

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