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Evolution of Sex
Midterm Paper

Why do Male Bottlenose Dolphins Engage in Socio-Sexual Behavior?

Bottlenose dolphins (*Tursiops truncatus)* are a cetacean of a moderate weight and size. Individuals can be 9 to 13 feet long, and weigh from 500 to 1,440 pounds (1). They reach sexual maturity when they grow to be about 7.2 to 8.5 feet long, or at 5 to 12 years of age (10). Dolphins live in fission-fusion societies, where social bonds between individuals develop, change, and fuse constantly (7). They are able to form these complex relationships in part because they have large, sophisticated brains with highly folded cerebral cortexes, not dissimilar to humans (2). Although the basic "family unit" in cetacean society is between mother and calf (10), male bottlenose dolphins form strong alliances that usually consist of two to three males (8), but may include as many as 14 individuals (9). Male dolphins engage in same sex relationships within these groups (9). Why do males form alliances, and why do males engage in socio-sexual behavior within these alliances?

One of the only obvious differences between males and females is that females have two mammary slits near their genital opening, to dispense milk (APPENDIX A). It can be very difficult to tell the difference between a male and a female while dolphins are engaged in sex. Even with these difficulties, scientists are able to gather information about socio-sexual behaviors of dolphins. Male bottlenose dolphins engage in many different socio-sexual behaviors, including mounting, goosing (beak to genital slit contact), push-ups (one dolphin pushes the genital slit of another up with it's head), and petting (fin to genital slit contact, APPENDIX B) (8). One study showed that mounting accounted for 66.5% of all socio-sexual behavior between bottlenose dolphins (8). Although socio-sexual behavior occurs with males and females, males only, or females only, interactions between males were the most common events, even more common than male-female socio-sexual interactions (APPENDIX C). In fact, when females engaged in socio-sexual behaviors, it was most often with their calf (8). Male sessions also tend to last longer than other displays of socio-sexual behavior (8); sex usually only lasts 2-10 seconds in the first place (10). Young male calves were found to be the most likely actors or recipients in socio-sexual behavior (8). This paper will focus on male socio-sexual interactions of all kinds, not involving females.

Many hypotheses can be formed to explain why dolphins engage in alliance forming and socio-sexual behavior. The two questions, although most likely interconnected, would require distinction in order to be researched and studied accurately. Tables A and B provide this distinction between both questions, but also may relate to each other in certain ways. Table A asks, "Why do male bottlenose dolphins form alliances?", while Table B asks "Why do male bottlenose dolphins engage in socio-sexual behavior?". Upon researching one question, scientists could find an answer to the other. For example, results could prove that socio-sexual behavior occurs mainly to help form male alliances. Another possibility is that males form alliances in order to perpetuate socio-sexual behaviors. It seems likely that the reason male dolphins engage in socio-sexual behavior is dependant on why they form alliances, and appears to be more related to alliances than other dolphin behaviors. In any case, in order to understand socio-sexual behavior, we must understand male alliances, and vice versa.

Male alliances among bottlenose dolphins may develop so that males have more access to mating opportunities with females (6). Research has shown that male dolphins do not have significant access to females unless they are part of an alliance (8). Females tend to stay away from males, especially females with calves (5). It has been suggested that females occupy different habitats and segregate from males because they have different "activity budgets"; they catch fish more easily in shallow waters (5), which helps them to produce more of their rich milk. Since calves suckle for one and a half to two years (2), and the female reproductive cycle takes about two to three years (10), making milk is a constant process for females. Females also might keep to themselves to avoid male violence, which could influence females to be more violent, or put their calves at risk (5). They could even be trying to avoid bull sharks, which live in the deeper waters males occupy (5). In any case, females are not around. Males in alliances of two to three members have been found to be an efficient team, and members work together to use force against females to increase their chances of mating with them (5). They may need to "prove" that they are the best choice for a mate, or they may eliminate female choice and force copulation (10).

Another suggested hypothesis would be that male alliances are more successful hunters than non-allied males (6). This hypothesis could be as simple as suggesting that dolphins need food, but it would also make sense for females to select mates that are better hunters. If being a good hunter has a genetic basis, they would ensure that their calf would be passed on some sort of a "good hunting" gene.

Alliances may also help to prevent violence and infanticide amongst male dolphins (6). As previously mentioned, male dolphins may use force to copulate. Males may employ biting, hitting females with their tails, jerking their heads, or body slams (5). Maybe some levels of aggression in males are helpful towards spreading genes, but alliances may help manage this aggression so that it does not become harmful to the males goal. If aggression in a group of male dolphins got out of hand, they could be hurting their own best interests. Killing infants so that your own calf survives may not be as much of an advantage to bottlenose dolphins as it is in other species where infanticide is frequent. Maybe male dolphins are simply bad at determining which infants to kill. It is possible that alliances aid in this feat.

Socio-sexual behavior amongst male dolphins is extremely frequent. One hypothesis is that these behaviors may occur to establish dominance hierarchies (8). It may be important for males to be in a dominant position (in their alliance or otherwise) if females are looking to select dominant males. There is evidence of dominance amongst males; dominant males have been found trying to keep young males away from females (2).

Another possibility is that socio-sexual behavior aids in the formation of male alliances, and alliances, not socio-sexual behavior, aid in male reproduction success. Calves and juvenile male dolphins are frequent participants in socio-sexual behavior (8), which could be an indicator that these behaviors help them to form their alliances early on, increasing their chances at reproductive success.

Socio-sexual behavior may simply be good practice for adult sexual behavior (8). Since females often segregate themselves from other dolphins (as previously mentioned), and mating with females can prove difficult (5), males may need all the practice that they can get. This hypothesis could prove unlikely if males are found to engage in different behaviors with males than females.

It is possible that when males engage in socio-sexual behavior, their group stability is increased. It may be a way to prevent conflict; bonobos engage in same sex behaviors for the

same reason (8). One study showed that males are more aggressive towards males that they spend less time with (6). In addition, the closer a male dolphin group is, the less violent they are with *other* groups (6). It appears that socio-sexual behavior may lower levels of violence across all boards, not just within alliances.

Maybe male bottlenose dolphins are highly sexual because high sexual responsiveness, not socio-sexual behavior, has been selected for over time. In other words, this is a "result of selection for another trait" (4). Homosexual behavior occurs in Japanese macaques for this very reason (4).

My own contributing hypothesis is that socio-sexual behavior amongst male dolphins is a form of cultural communication. Cultural communication would be defined as "the transmission of learned behavior" (3). Dolphins are one of the only species that have a form of culture, consisting of mainly language and sound (3). Furthermore, their level of cognitive sophistication is impressive. No other animal has proved that they are able to imitate behaviors as well as bottlenose dolphins except for humans (3). Dolphins even have a level of self-awareness, and can recognize themselves in a mirror (3). This hypothesis is similar to the dominance hypothesis, in that certain bodily positions have meaning and significance, but is distinct in that the communications that occur would have more complex and alternative meanings. Maybe their behaviors are a type of sign language that can evolve and change over time. This hypothesis is different from the others in that it suggests that socio-sexual behavior could be passed on from learning as opposed to inherited traits. Male dolphins would compete to be included in the "best group", and parental genes would not determine their success.

In order to test these hypotheses, three categories need to be investigated. The first category is the male-female relationship between dolphins. If females have a choice in whom they mate with, how do they choose? Is it based on alliances? If so, what about alliances makes females pursue males? Is it their hunting abilities, their levels of aggression, their status in the dominance hierarchy, or who has the most practice at sex? Or, do females not have a choice of whom they mate with? Are they forced to copulate with many males in an alliance? Another possibility is that females must choose one male within the alliance that has pursued them. The male female relationship would mainly be tested by extensive observation. Some genetic testing could prove useful in determining which males were successful at reproducing.

If alliances prove to be the main means of reproduction among bottlenose dolphins, further information would be needed about these alliances, and a test would be crucial. How do males in alliances behave? Are they competitive or cooperative? Do males help each other hunt, or are they more focused on establishing who is dominant and who is not? How do these alliances spend their time, compared to solitary males? Do they reconcile fights with sex, or do they practice mounting before perusing a female? Do these socio-sexual behaviors manifest in other ways? Once again, intense observation would be necessary in determining why male alliances occur in bottlenose dolphin populations, and how these alliances affect, or are affected by, socio-sexual behavior.

The last test that would be preformed would be about the offspring of dolphins. Are the traits present in their parents that have proved to be helpful to reproduction, whatever those traits may be, present in their calves? Do male offspring of alliance-males form alliances of their own in the future? Are their alliances similar to their father's, or different? Genetic testing could be helpful if it was extensive enough. Do offspring carry alliance-forming genes, or do they learn this behavior? Do they carry practicing genes? Reconciliation genes? If their parent was high ranking in the "pecking order", are the offspring also high ranking, or does the parent's ranking

have no affect on the offspring? Are there males who engage in socio-sexual behavior less often than others? How do the genetics of those individuals compare? Do offspring seem to be more influenced by their genes or by their environment? Do they offspring instinctually know when to engage in socio-sexual behavior, or does it seem to be a learned behavior?

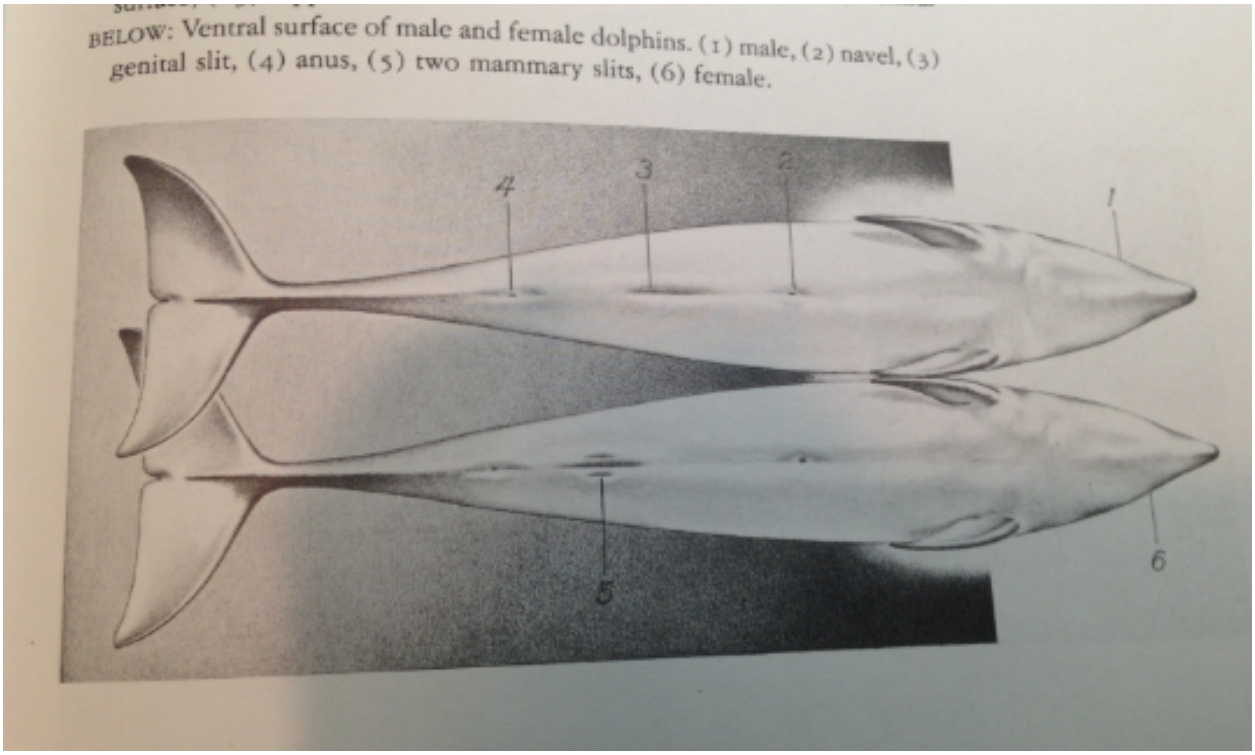
Depending on which behaviors are present, the reasons male bottlenose dolphins form alliances and engage in socio-sexual behavior would become clear. It is important to note that many of these hypotheses could prove true at the same time. Male alliances and male socio-sexual behavior could have a multi-purpose role in dolphin society. Based on my research, no one hypothesis stands out as most likely; rather, it seems that a combination of multiple hypothesis could explain why male dolphins form alliances and engage in socio-sexual behavior. Additional extensive research would provide much insight about the many functions male alliances and male socio-sexual behaviors serve in bottlenose dolphin society.

TABLE A: Why do male bottlenose dolphins form alliances?

Hypotheses	Prediction	Prediction	Prediction
	Female-Male Relationship	Male Alliances	Offspring
A1. Males in alliances have more access to females (6)	Males in alliances will have less restriction when mating	Will compete for access to females	May possess an 'alliance gene' and form their own alliances in the future
A2. Alliances are better at hunting (6)	Females will choose males in alliances to ensure that their sons are good hunters	Help individuals catch more food than solitary males	Will be alliance-hunters and catch more food
A3. Alliances help prevent violence and infanticide (6)	New mothers will associate with males in alliances more than solitary males	Have individuals that are less violent than solitary males	Will possibly be born into safer environments (not guaranteed)

TABLE B: Why do male bottlenose dolphins engage in socio-sexual behavior?

Hypotheses	Prediction	Prediction	Prediction
	Male Alliances	Female-Male Relationship	Offspring
B1. To establish dominance hierarchies (8)	Will have higher ranking and lower ranking individuals	Females select males that are higher-ranking	May have a greater chance of becoming higher-ranking in the future
B2. To aid in the formation of male alliances (8)	Males who engage in socio-sexual behavior together will form stronger alliances	Males that are more closely bonded will have more access to females	May form alliances in the future
B3. Socio-sexual behavior amongst males is good practice for adult sexual behavior (8)	Male socio-sexual behavior will be unaffected by male alliances	Females will choose males with more sexual experience.	May possess a practicing gene, or learn about how to practice from parents
B4. Socio-sexual behavior enhances group stability and prevents conflict (8)	Males will engage in socio-sexual behavior within alliances to reconcile	Females will avoid violence and choose males in alliances with less conflict	May possess a reconciliation gene
B5. Males are highly sexual as a result of selection for sexual responsiveness (4)	Male socio-sexual behavior will be unaffected by male alliances	Males will have frequent sex with females	May possess a high sexual responsiveness gene
B6. Socio-sexual behavior is a form of cultural communication for male dolphins	The increased communication will result in stronger alliances	Males that are more closely bonded will have more access to females	May learn this form of communication within their lifetime



APPENDIX A. Diagram of male and female dolphin anatomy.
From *Whales, Dolphins and Porpoises, an Illustrated Encyclopedia Survey by International Experts* (10).

APPENDIX B. Pectoral fin petting of the genital area. From *Homosexual Behaviour in Animals, an Evolutionary Perspective (8).*

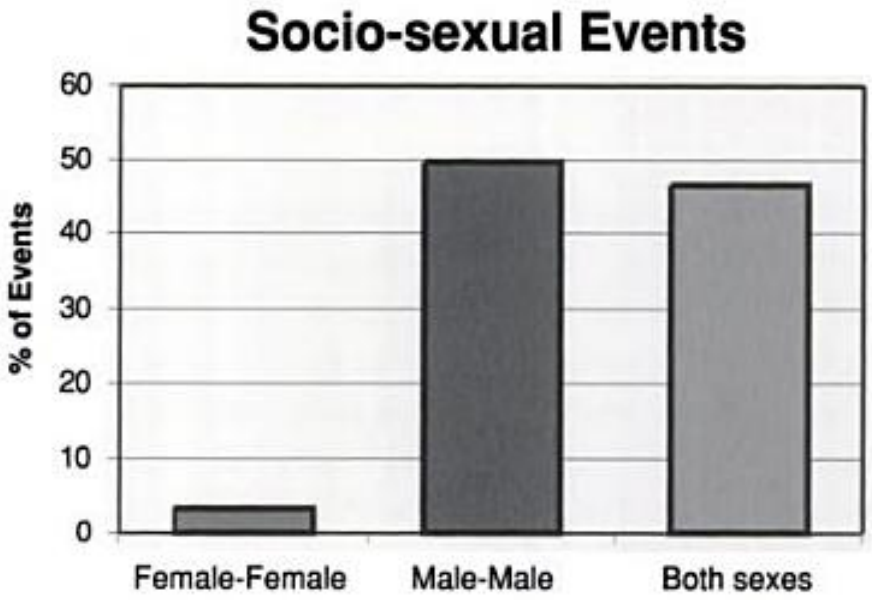


Figure 4.2. Proportion of socio-sexual events (n = 1597) that were homosexual or bisexual.

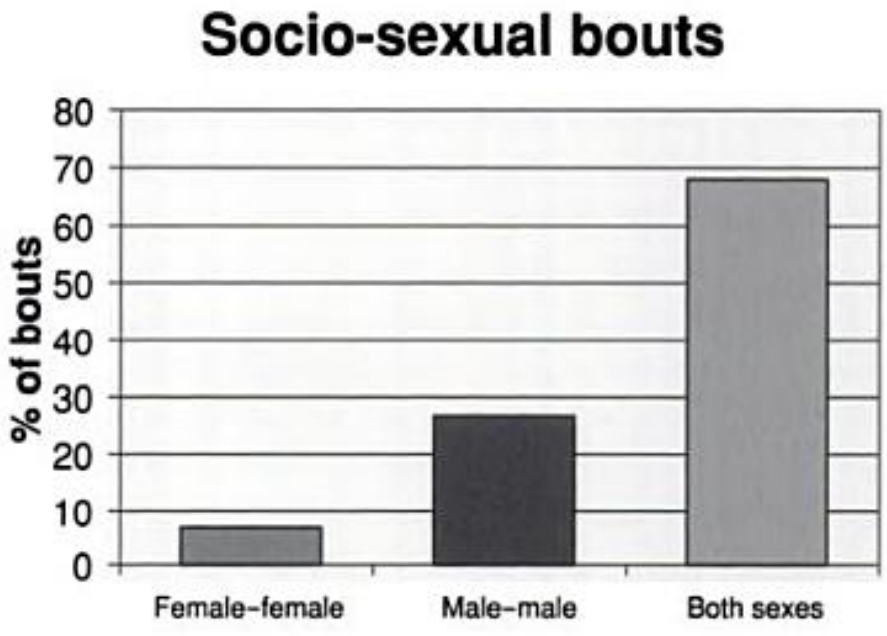


Figure 4.3. Proportion of bouts that were exclusively female, exclusively male or bisexual. Bout = events clustered within 5 min intervals (n = 245).

APPENDIX C. Percentage of socio-Sexual events and bouts among Indian Ocean bottlenose dolphins. From *Homosexual Behaviour in Animals, an Evolutionary Perspective (8)*.

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