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Behavior comparison between bottlenose dolphin (*Tursiops* spp.) living in Bali Exotic Marine Park captivity and Lovina Beach, Bali

Perbandingan tingkah laku lumba-lumba hidung botol (*Tursiops* spp.) di penangkaran Bali Exotic Marine Park dan Pantai Lovina, Bali

David Keane Wijaya, I Wayan Nuarsa, Gede Surya Indrawan*

Marine Science Study Program, Faculty of Marine and Fisheries, Udayana University
Jl. Raya Kampus Unud, Jimbaran, Badung, Bali – Indonesia 80361
**Email: suryaindrawan@unud.ac.id*

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ABSTRACT

The bottlenose dolphin is a species often used in the entertainment industry worldwide. They are the most commonly encountered type of dolphin in aquariums and water parks, where they are featured in shows. This research aims to determine the behavioural differences of *Tursiops* spp. living in their natural habitat versus in captivity to improve and enhance the quality of life for these animals in captivity. Data collection for this study involved a direct observation method of dolphins at Bali Exotic Marine Park (BEMP) and Lovina Beach for four weeks at each location, with a descriptive analysis of the findings. The results indicate that bottlenose dolphins (*Tursiops* spp.) living in their natural habitat exhibit behaviours typical of wild dolphins and do not show signs of stress, demonstrating well-being with non-repetitive and varied behaviour patterns according to their natural activities. In contrast, bottlenose dolphins (*Tursiops* spp.) in captivity display behaviours similar to those in the wild but also exhibit abnormal behaviours, including signs of stress such as the occurrence of Repetitive Abnormal Behaviour three times (0.3%), as well as other repetitive behaviours like surface displays, side breaching, chuffing, and sexual behaviours. These behaviours may be attributed to a lack of social interaction with other dolphins, disturbances from humans, and limitations in the captive environment.

Keywords: Bali Exotic Marine Park, Behavior, Bottlenose Dolphin, Lovina, Tursiops *spp.*

INTISARI

Lumba-lumba hidung botol merupakan spesies yang sering digunakan dalam industri pertunjukkan di seluruh dunia. Mereka merupakan jenis lumba- lumba yang paling sering ditemui di akuarium dan taman air, yang dimana mereka digunakan untuk atraksi. Tujuan dari penelitian ini adalah untuk megetahui perbedaan tingkah laku *Tursiops* spp. yang hidup di habitat alami dan di penangkaran agar dapat memperbaiki dan meningkatkan kualitas hidup hewan di penangkaran. Pengambilan data dalam penelitian ini menggunakan metode observasi langsung terhadap lumba-lumba di Bali Exotic Marine Park (BEMP) dan Pantai Lovina selama 4 minggu untuk masing-masing lokasi yang dianalisis secara deskriptif. Hasil penelitian menunjukkan bahwa lumba-lumba hidung botol (*Tursiops* spp.) yang hidup di habitat alami menunjukkan perilaku yang umum diamati pada lumba-lumba liar dan tidak memperlihatkan tanda-tanda stres serta menunjukkan kesejahteraan dengan pola perilaku yang tidak repetitif dan bervariasi sesuai dengan aktivitas alamiah mereka. Sebaliknya, lumba-lumba hidung botol (*Tursiops* spp.) di penangkaran memperlihatkan perilaku yang mirip dengan lumba-lumba di habitat alami, namun tetap menunjukkan perilaku yang tidak normal yakni terlihat tanda-tanda stres seperti Perilaku Abnormal Berulang (PAB) sebanyak 3 kali (0,3%) dan menunjukkan tingkah laku repetitif lainnya seperti tampilan permukaan, pelanggaran samping, menenggak, dan perilaku seksual.

Perilaku-perilaku ini dapat diindikasikan oleh kurangnya interaksi sosial dengan lumba-lumba lain, terdapat gangguan dari manusia, serta keterbatasan lingkungan hidup di penangkaran.

Kata kunci: Bali Exotic Marine Park, Lovina, Lumba-lumba Hidung Botol, Tingkah Laku Tursiops *spp.*

INTRODUCTION

Dolphins are marine mammals closely related to whales and porpoises. There are over 40 known dolphin species worldwide, living in both oceans and rivers. The habitat of the bottlenose dolphin (*Tursiops* spp.) is in warm waters around the globe and can be found in almost all waters except the Arctic and Southern Oceans. Dolphins are highly intelligent animals with complex social structures. They are important predators in marine ecosystems, playing a key role in regulating fish populations and other marine species. Dolphins are also a major tourist attraction, contributing to the economy of many coastal communities (Salmah, 2018).

Bottlenose dolphins (*Tursiops* spp.) is a species that inhabit various coastal areas with warm temperatures and is the most well-known type of dolphin. Bottlenose dolphins have large, strong bodies and relatively long snouts. There are two types of bottlenose dolphins: *Tursiops truncatus*, which is typically found in coastal areas, and *Tursiops aduncus*, which is commonly found in deeper marine waters. The morphology difference between *T. aduncus* and *T. truncatus* can be seen in their skull structure, with *T. aduncus* has a more pointed forehead and a longer beak than *T. truncatus*. These two species also have different geographic distributions, where *T. aduncus* is found in the Indian and western Pacific Oceans, while *T. truncatus* is found in the Atlantic, eastern Pacific, and Indo-Pacific regions. However, there is evidence of interbreeding between these species, especially in areas where their ranges overlap (Hale et al., 2000).

Bottlenose dolphins exhibit a remarkable tendency and ability to learn various movement patterns and imitate sounds. Moreover, these patterns are displayed spontaneously, practiced, and developed, both in the presence and absence of the original stimuli, seemingly without reinforcement beyond the performance of the activity itself. Dolphins have also been observed mimicking human divers during maintenance operations, demonstrating simple tool-using behavior. These instances of observational learning have been noted in both captivity and free conditions, indicating their natural occurrence. The ability to imitate in dolphins is important in assessing animal intelligence and may serve in mate selection, strengthening social bonds, and enhancing group cohesiveness (Galhardo et al., 1996).

Bottlenose dolphins is a species frequently used in performance industries worldwide. They are the most commonly seen species in aquariums and marine parks, where they are used for attractions and swim-with-the-dolphin programs (Patterson, 2013). Bottlenose dolphins (*Tursiops* spp.) kept in captivity are still used for entertainment and therapy in some of countries. It is known that these animals must adapt to changes in their physical and social environments due to the design of the enclosures where they live, changes in food presentation, and shifts in their social structure (Ugaz, 2013). Bottlenose dolphins are non-aggressive animals, making them easy and safe to enjoy in performances. They are very active at the surface and often follow the waves generated by moving ships. Bottlenose dolphins are often seen alongside recreational boats and coastal fisheries. According to Andrimida (2021), bottlenose dolphins are typically found in groups of less than 20 individuals. According to Fazioli et al. (2006), in

coastal waters of the Gulf of Mexico, the composition and size of bottlenose dolphin groups change throughout the day.

This research was conducted at Lovina Beach, Bali and Bali Exotic Marine Park (BEMP) captivity. Lovina is famous for its dolphin tourism, where visitors can watch dolphins directly in the open sea. The natural dolphin attraction is a unique draw for both local and international tourists. Dolphins are protected by law under Indonesian Government Regulation (*Peraturan Menteri Lingkungan Hidup dan Kehutanan*) No. P.106 of 2018 concerning the Conservation of Plant and Animal Species.

The purpose of this research is to examine behavioral differences between bottlenose dolphins living in two distinct habitats: captivity and the wild. A similar study by Sulthanah et al. (2024) investigated bottlenose dolphin behavior in Umah Lumba, Bali; however, the difference lies in the location and research subjects. This study is essential for gathering insights into bottlenose dolphin behavior in Bali, as no previous research has focused on the populations in Lovina and Bali Exotic Marine Park (BEMP). According to Westerlaken et al. (2022), frequent dolphin-watching activities in Lovina may negatively impact the local dolphin population and pose a risk to the village's tourism revenue. Meanwhile, the bottlenose dolphins at BEMP were initially captured illegally by other attraction facilities before being seized by authorities and placed in a conservation setting.

MATERIALS AND METHOD

Time and location of research

This research was conducted at two locations: the coordinates -8.7238137, 115.2164186 at Bali Exotic Marine Park, located in Tanjung Benoa, Pedungan District, Denpasar City, Bali Province, and the coordinates -8.1606434, 115.0239701 at Lovina Beach, located in Anturan Village, Buleleng Regency, Bali Province (Figure 1), during December 2023 – January 2024. Data collection at each location is expected to represent *Tursiops* spp., which live in different habitats, and the choice of location was based on considerations, namely the high occurrence rate of dolphins in Lovina Beach waters and the fact that Bali Exotic Marine Park serves as a dolphin conservation site.

Materials and tools

The tools used in this research include a Pixel mobile phone camera, binoculars 10x42, paper and writing utensils, an ASUS laptop, the identification book Cetacean Identification Cards for Indian Ocean Fisheries by Braulik (2018), and Microsoft Excel.

Methods

The method used in this research involved direct observation of dolphins in both captivity and the wild, conducted over four weeks for each location. The dolphins were observed continuously, with each occurrence of a behavior from the ethogram (Table 1) being recorded. Observations of dolphins in the waters off Lovina Beach were carried out weekly over four weeks, with data collection occurring once a week from 06:00 to 09:00, both from the boat and in the water through snorkeling. This time frame was chosen because it is when dolphins are most commonly found near the shore while hunting for food. Observations of dolphins at Bali Exotic Marine Park (BEMP) were also conducted weekly over four weeks. A total of nine dolphins, including eight males and one female, were observed. Observations took place from 08:00 to 11:00 to maintain consistency

with the observation times at Lovina. Each individual was observed once a week, with one or two individuals observed per day.

Data analysis

The data processing includes analyzing the occurrence frequency of dolphin behaviors. Observation results were entered into Microsoft Excel, where they were then analyzed descriptively. The observational data were presented in the form of diagrams and divided into two categories: the percentage of bottlenose dolphin behavior at Bali Exotic Marine Park (BEMP) and the percentage of bottlenose dolphin behavior at Lovina Beach.

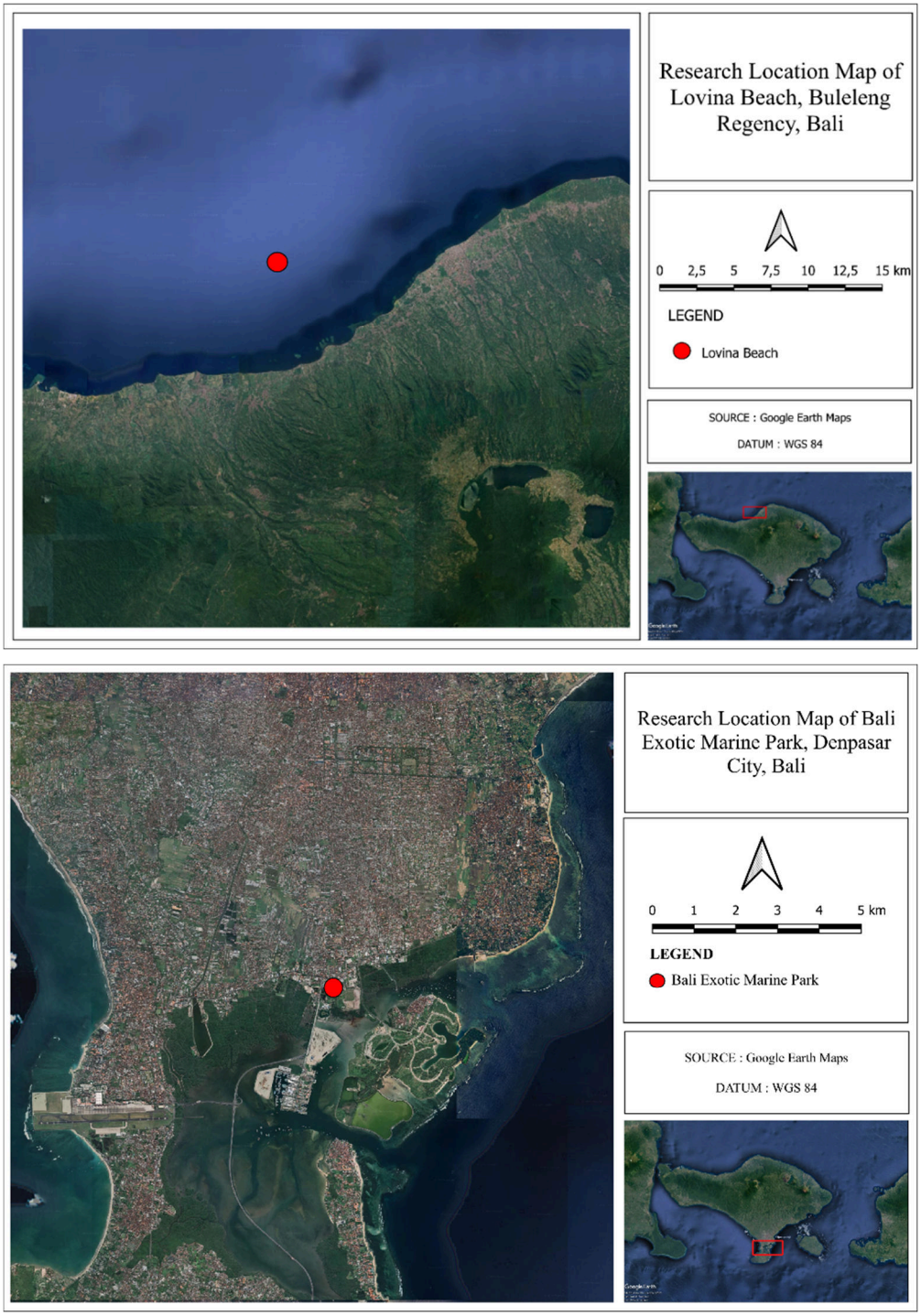


Figure 1. Location of Research's Map

Table 1. Dolphin's Behavior Ethogram (Clegg, 2020)

No	Behavior	Definition
1.	Resting behavior (RB)	The dolphin is not moving either at the water's surface or at the bottom of the pool, with its eyes half-closed or fully closed and no head orientation movement.
2.	Slow swimming (SS)	The dolphin's eyes are generally open, its head may be oriented towards its own kind, and it may change position around other dolphins if synchronised, with a speed generally <2 m/s.
3.	Medium swimming (MS)	The dolphin's eyes are generally open, it is alert to stimuli, and its speed is approximately 2-4 m/s.
4.	Fast swimming (FS)	The dolphin's head moves up and down, its eyes are open, and its speed is around 4 m/s.
5.	Social play (SP)	The dolphin engages in behaviors including rubbing, nudging, chasing, attempting to bite, pushing, and jumping with other dolphins, all of which are softer and at lower speeds (<4 m/s) compared to agonistic interactions. There may be some high-speed chasing or pushing, but these instances are brief and not highly aggressive.
6.	Object play (OP)	The dolphin exhibits playful behavior (e.g., nudging, rubbing, biting, pushing, jumping) involving objects/bubbles/parts of the environment, which can be done alone or in groups.
7.	Chest Rubbing (CR)	The dolphin moves its pectoral fins back and forth to rub against other dolphins in a non-sexual manner (i.e., not focusing on genitalia).
8.	Synchronized swimming (SCS)	The dolphin swims within a body length of another dolphin, showing parallel movement and body alignment, with pauses of only a few seconds between movements.
9.	Biting (B)	The dolphin bites or rakes (or attempts to do so) other dolphins. At high speeds, this is usually aggressive behaviour, but it may be playful at low speeds, especially among young males. *Note: Rake marks are scratch marks left by the teeth of dominant whales and dolphins as they scrape the skin of less aggressive animals.*
10.	Jaw clap (JC)	The dolphin moves with its mouth open and forcibly closes its jaws; it may also open and close its jaws rapidly, often making loud popping or slapping sounds.
11.	Sexual behavior (SXB)	dolphin performs genital-to-genital contact, with or without full penetration, with both dolphins generally aligned on the same axis; or, it performs genital-to-non-genital contact, where it positions parts of its body (e.g., fins, rostrum) in contact with the genitalia of the same sex, or projects its genitalia onto the body of the same sex.
12.	Side breach (SB)	The dolphin intentionally leaps out of the water and lands on its side, usually making a loud "slap" sound.
13.	Tail slap (TS)	The dolphin raises its tail and slaps the water's surface with it, often repeating this several times, either slapping with the top or bottom of its tail.
14.	Surfacing (S)	The dolphin raises its head out of the water while its eyes are directed to the side of the pool, above the surface. It may raise its head while swimming forward or float still while looking up. The dolphin might be observing a stimulus (object, person) or anticipating an upcoming stimulus.
15.	Repetitive abnormal behavior (RAB)	The dolphin performs a repetitive behavior that does not change and appears to have no function, such as biting a fence (if unchanged), throwing water, chewing stones, or swimming in circles (if using a specific part of the pool in a repeated, unchanging path).
16.	Chuffing (C)	The dolphin forcibly blows air from its blowhole, producing a loud hissing or "blowing" sound.

RESULTS

Species and *Tursiops* spp. behavior observation results

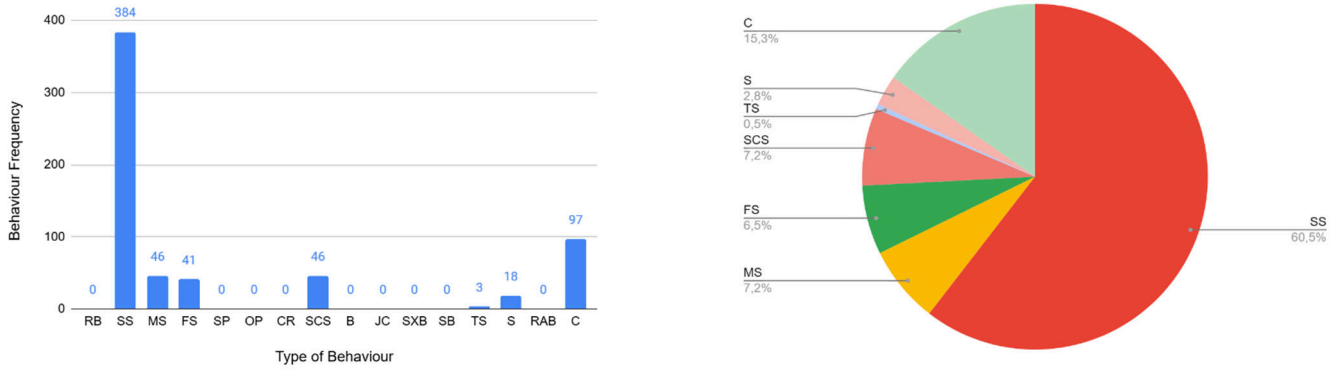
The research found two species of the genus *Tursiops* in the waters of Lovina Beach: *Tursiops truncatus* (Common Bottlenose Dolphin) and *Tursiops aduncus* (Indo-Pacific Bottlenose Dolphin). In the Bali Exotic Marine Park, only one species of bottlenose dolphin was present: *Tursiops aduncus* (Indo-Pacific Bottlenose Dolphin). The types of behavior and the frequency of dolphin behavior from the two locations are listed in (Table 2).

Table 2. *Tursiops* spp. behavior occurrences

Behavior	*T. truncatus* (Lovina) (times)	*T. aduncus* (Lovina) (times)	*T. aduncus* (BEMP) (times)
Travelling			
Slow swimming (SS)	384	74	386
Medium swimming (MS)	46	15	41
Fast swimming (FS)	41	21	6
Socializing			
Social play (SP)	-	5	36
Object play (OP)	-	1	5
Side breach (SB)	-	2	39
Chest Rubbing (CR)	-	-	1
Synchronized swimming (SCS)	46	14	49
Sexual behavior (SXB)	-	3	15
Aggressive behavior			
Biting (B)	-	8	-
Jaw clap (JC)	-	-	8
Tail slap (TS)	3	6	12
Milling			
Resting behavior (RB)	-	-	272
Surfacing (S)	18	5	98
Repetitive abnormal behavior (RAB)	-	-	3
Chuffing (C)	97	21	63

Tursiops truncatus observation result in Lovina

Based on observations conducted in Lovina, the behavior of wild *Tursiops truncatus* with the highest frequency was Slow swimming (SS), with 384 occurrences (Figure 3a), representing 60.5% of the total frequency. Other observed behaviors in wild *Tursiops truncatus* included Medium swimming (MS) at 7.2%, Fast swimming (FS) at 6.5%, Synchronized swimming (SCS) at 7.2%, Tail slapping (TS) at 0.5%, Surfacing (S) at 2.8%, and Chuffing (C) at 15.3%, as shown in (Figure 3b).

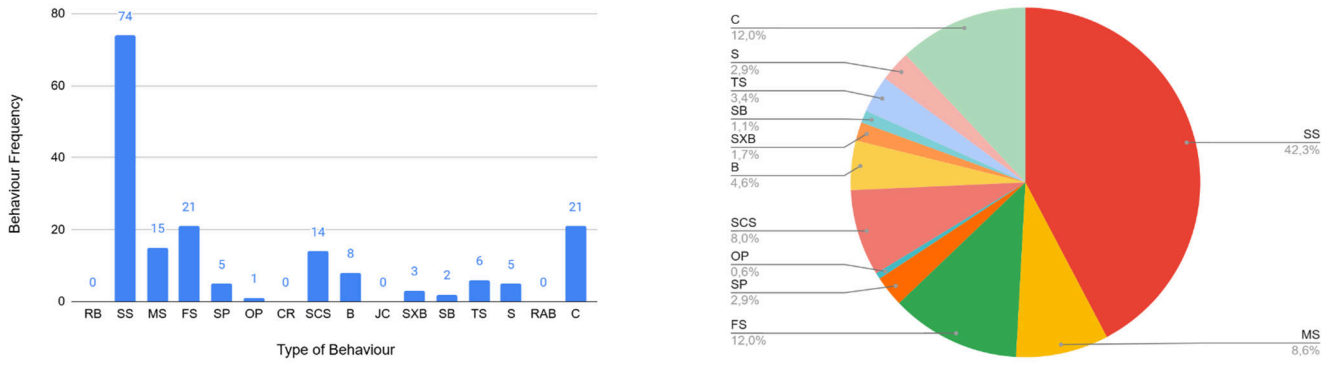


(a) (b)

Figure 3. Lovina's *Tursiops truncatus* behavior frequency (a), behavior percentage (b)

Tursiops aduncus observation result in Lovina

Based on observations conducted in Lovina, the wild behavior with the highest frequency was Slow Swimming (SS) with a frequency of 74 occurrences (Figure 4a), accounting for 42.3% of the total frequency. Other behaviors observed in the wild included Medium swimming (MS) at 8.6%, Fast swimming (FS) at 12.0%, Social play (SP) at 2.9%, Object play (OP) at 0.6%, Synchronized swimming (SCS) at 8%, Biting (B) at 4.6%, Sexual behavior (SXB) at 1.7%, Side breach (SB) at 1.1%, Tail slap (TS) at 3.4%, Surfacing (S) at 2.9%, and Chuffing (C) at 12%, as shown in (Figure 4b).

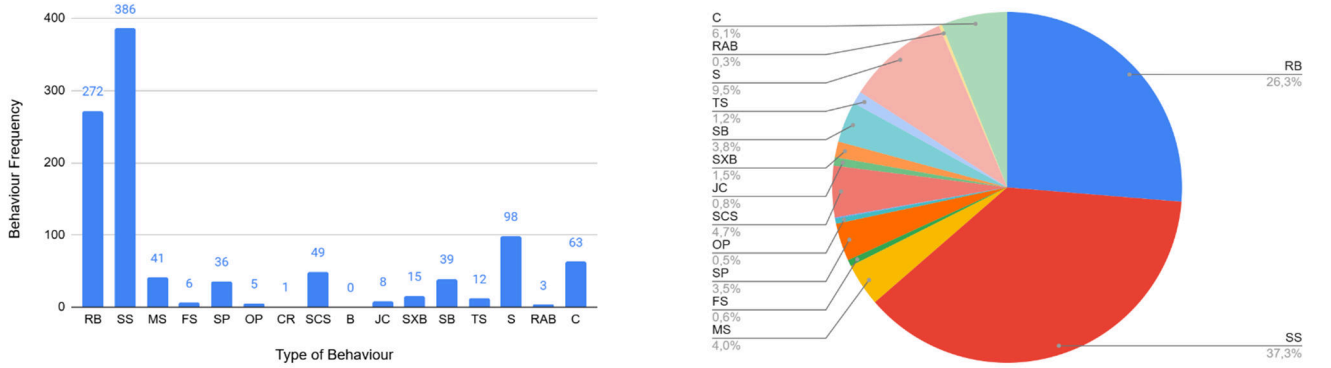


(a) (b)

Figure 4. Lovina's *Tursiops aduncus* behavior frequency (a), behavior percentage (b)

Tursiops aduncus observation result in Bali Exotic Marine Park (BEMP)

Based on observations conducted at Bali Exotic Marine Park, the behavior with the highest frequency in captivity was Slow swimming (SS) with a frequency of 386 occurrences, accounting for 37.3% of the total frequency, and Resting behavior (RB) with a frequency of 272 occurrences (Figure 5a), accounting for 26.3% of the total frequency. Other behaviors observed in the wild included Medium swimming (MS) at 4.0%, Fast swimming (FS) at 0.6%, Social play (SP) at 3.5%, Object play (OP) at 0.5%, Chest rubbing (CR) at 0.1%, Synchronized swimming (SCS) at 4.7%, Sexual behavior (SXB) at 1.5%, Side breach (SB) at 3.8%, Tail slap (TS) at 1.2%, Surfacing (S) at 9.5%, Repetitive Abnormal Behavior (RAB) at 0.3%, and Chuffing (C) at 6.1%, as shown in (Figure 5b).



(a) (b)

Figure 5. BEMP's *Tursiops aduncus* behavior frequency (a), behavior percentage (b)

DISCUSSION

Lovina's *Tursiops* spp. behavior

Based on the observations, the behavior of *Tursiops truncatus* in Lovina showed fewer behavioral variations compared to *Tursiops aduncus* in Lovina. This may be due to the limited frequency of field data collection. The behavior of *T. aduncus* in Lovina exhibits similar variations to *T. aduncus* in captivity but with different frequencies. Notably, the number of individuals in Lovina varied from 5 to 20 dolphins per pod, though it was unclear whether repeated sightings involved the same pod. *T. aduncus* in Lovina displays typical wild dolphin behavior. This also demonstrates that even though the same species live in different environments, they still exhibit similar behaviors. Despite being geographically separated, with significant differences in environmental conditions, habitats, and prey species, *T. truncatus* and *T. aduncus* seem to share a similar basic social structure (Hawkins & Gartside, 2008). This is supported by Wang et al. (2000), who stated that the behaviors of both species, *T. aduncus* and *T. truncatus*, are similar, suggesting that there may be behavioral differences that have not yet been studied. Further research is needed to determine whether behavioral observations can contribute to species identification.

Bali Exotic Marine Park's Tursiops aduncus behavior

The behavior of *T. aduncus* at BEMP show similar variations to those of *T. aduncus* in Lovina. However, there were differences in the behavior of *T. aduncus* in captivity, which displays repetitive abnormal behaviors indicating signs of stress, higher frequencies of sexual behavior, below-average swimming speeds, and so on. By meeting criteria such as having a large water volume suitable for the number and size of animals; providing adequate shelter areas that are off-limits to humans; ensuring controlled and supervised human-dolphin interactions; and allowing dolphins the freedom to choose whether or not to interact with humans, captive dolphins often behave similarly to wild dolphins, both social and solitary (Perelberg et al., 2010).

Slow, medium, & fast swimming behavior

Based on observations, bottlenose dolphins at Bali Exotic Marine Park and Lovina Beach were mostly seen swimming at speeds below 2.0 m/s. Moderate and fast swimming frequencies were more commonly observed in wild bottlenose dolphins. This may be due to the lower metabolism of dolphins in captivity and the vast size of the wild dolphins' habitat compared to the highly restricted environment of captivity. The swimming speed of bottlenose dolphins is influenced by body size, and the average swimming speed specific to size also increases significantly with age. The ability to reach a certain swimming speed clearly depends on the animal's metabolic capacity. The higher the dolphin's metabolic rate, the faster they swim (Noren et al., 2006). Swimming speed and duration are closely related. High-speed swimming generally lasts only a few seconds, while low-speed swimming can be sustained for longer periods. The average swimming speed of bottlenose dolphins (excluding fast swimming) is 1.7 m/s, which is the average travel speed of wild bottlenose dolphins (Yazdi, 1999). However, it has been acknowledged that trained dolphins may lack the appropriate motivation to swim at their maximum potential and may not be in the same athletic condition as wild dolphins. Swimming near the water's surface can limit maximum speed due to increased resistance from energy loss in wave production (Rohr et al., 2002).

Social play behavior

Based on the data obtained, bottlenose dolphins at Bali Exotic Marine Park exhibit a higher frequency of social play behavior compared to bottlenose dolphins in Lovina. This could indicate that the dolphins in captivity experience a high-quality environment and well-being. The age and type of playmates in an animal's social group have important implications for their development. Additionally, the importance of peers as play partners can have a significant impact on social groups in zoological facilities. Animals in zoos do not face the same environmental pressures as their wild counterparts (e.g., avoiding predators, foraging), giving them more time to engage in alternative behaviors, such as play. Play behavior is reported to decrease in animals that are sick or stressed, making playfulness a potential indicator of an animal's health and well-being (Mackey et al, 2014).

Object play behavior

Based on the observations, object play was rarely seen in bottlenose dolphins at Bali Exotic Marine Park and in Lovina. This may be due to the lack of available toys for the dolphins in captivity and the fact that wild dolphins may not often engage in object play, possibly because data collection occurred during times when dolphins were hunting for food. Play is an important activity for dolphins, providing opportunities to practice various behaviors such as predation and reproduction. A clear linear relationship between a dolphin's age and the number of interactions with objects suggests that age is a major factor contributing to individual variation in object use. Younger dolphins spend more time interacting with objects than older ones. Adolescent dolphins are at a stage of life where they are highly curious and more likely to experiment and express various behaviors with objects (Kuczaj & Eskelinen, 2014).

Chest rubbing behavior

Based on the data collection, both dolphins in Lovina and at Bali Exotic Marine Park rarely, if ever, displayed this behavior. This is likely due to the timing of data collection for wild dolphins and the absence of mother-calf pairs in captivity. Chest rubbing is a social behavior where one dolphin touches another with its pectoral fin (flipper), and both dolphins actively move the contacting body parts back and forth (Sakai et al., 2006). This behavior is thought to be similar to social grooming and social preening in terrestrial animals, serving both hygiene and social functions. Rubbing F–B (Flipper-Body) and self-rubbing have maintenance and grooming functions, helping to remove old skin and generally represent a form of parental care from mother to offspring (Sakai et al., 2022).

Synchronized swimming behavior

The data collected for the study only counting the instances of synchronous swimming and not surface occurrences. According to the observations, *Tursiops truncatus* exhibited a constant number each week, whereas *Tursiops aduncus* in the wild and in captivity showed high numbers in the first and second weeks but fewer in the third and fourth weeks. This suggests that dolphins at Bali Exotic Marine Park and Lovina have a well-structured social group. Synchronous swimming occurs when two or more animals perform the same behavior at the same time and in close proximity, and is a common phenomenon observed across various Cetacea species. Synchronous swimming is often seen as a behavior important for maintaining individual cohesion within a group and enhancing

foraging success. The average rate of synchronous swimming at the surface is reported to be between 2.6-2.9 surface occurrences per minute, or 156-172 surface occurrences per hour (Kawabata, 2023).

Side breach behavior

Tursiops aduncus at Bali Exotic Marine Park was observed to exhibit side breach behavior with a higher frequency compared to bottlenose dolphins in Lovina. This may be due to the external disturbances experienced by the dolphins in captivity, leading them to perform side breaches repetitively. Side breaches in dolphins are more commonly displayed in the context of foraging. Such behavior, which can be categorized as percussive, might be used by dolphins to herd prey together. Breaching in dolphins is described as part of the foraging tactics of bottlenose dolphins, including side breaches which are believed to produce the greatest percussive effect in the water, thus disturbing fish schools (Tardin et al., 2014). Dolphins can be easily disturbed by the presence of humans, especially if approached too closely, too quickly, or too noisily for either short or long durations. Repetitive or frequent side breaches at the surface are one of the sudden changes indicating disturbance (NOAA, 2024). Side breaches serve as a form of communication or social interaction among dolphins. These behaviors can be used to attract attention, convey information, or coordinate group activities. However, research on dolphin breaching is still limited, so the repetitive side breach behavior in *Tursiops aduncus* in captivity has not yet been thoroughly analyzed (Lusseau, 2006).

Sexual behavior

Tursiops aduncus at Bali Exotic Marine Park exhibited sexual behavior with a higher frequency compared to bottlenose dolphins in the wild. Captive bottlenose dolphins tend to be more sexually active, particularly in same-sex interactions, compared to those in Lovina. This may be due to the fact that in a captive environment, individuals are often in close proximity to one another and may have limited environmental stimuli, leading to more frequent same-sex sexual behavior among males than in the wild. Factors such as social dynamics within the captive group and lack of access to females could contribute to this. Although not scientifically proven, several hypotheses exist regarding the purpose of these same-sex interactions, including dominance assertion, tension reduction, reconciliation, practice for future mating, and formation of social bonds related to key factors (Acosta, 2015).

Biting behavior

Based on the data collected, biting behavior was only observed in dolphins at Lovina. This may be due to wild dolphins moving in groups with various age and sex compositions, making it more likely to be seen only in wild dolphins. In dolphins, threat bites and jaw slaps are considered agonistic/aggressive signals and are also observed in disciplinary interactions between mothers and their calves or among individuals. Discipline in Cetacea involves one individual punishing another to stop undesirable behavior and/or maintain order. Aggressive contact behaviors such as biting are considered highly effective forms of discipline, although they are dangerous and risky due to the potential for serious injury or even death in young or juvenile dolphins (Frick, 2018).

Jaw clap behavior

Based on the observations, this behavior was only seen in bottlenose dolphins at Bali Exotic Marine Park. This is likely due to disputes or issues among individuals in captivity, which have not been observed in wild bottlenose dolphins. Jaw clapping is used as an index of aggression in interactions because there is a significant increase in jaw clapping behavior when situations become more aggressive or tense. Jaw slapping is also observed in disciplinary exchanges between individuals. Discipline in Cetacea involves one individual punishing another to stop undesirable behavior and/or maintain order (Frick, 2018).

Tail slap behavior

Based on the data collected, the frequency of tail slapping behavior in captivity is observed to be higher than in the wild, indicating that captive dolphins may experience discomfort or displeasure. This could be due to issues within the group or external disturbances from the environment. This behavior is identified as occurring when dolphins are at the water's surface and slap their flukes against the water, producing a sound or signal. Bottlenose dolphins use tail slapping to display aggressive behavior or to signal discomfort or displeasure with something (Herzing, 2015).

Resting behavior

Resting behavior is only observed in bottlenose dolphins in captivity because data collection for wild bottlenose dolphins was conducted during hunting hours, and wild bottlenose dolphins only exhibit resting behavior below the sea surface. As a result, resting behavior in bottlenose dolphins (*Tursiops* spp.) in Lovina was not observed. Indo-Pacific bottlenose dolphins (*Tursiops aduncus*) in captivity spend part of their time engaging in resting behavior. Resting behavior at the water's surface has never been observed in wild bottlenose dolphins, as resting behavior at the surface is considered exclusive or has only been seen in bottlenose dolphins in captivity (Gnone et al., 2001). According to Sekiguchi & Kohshima (2003), research on resting behavior in captive bottlenose dolphins shows a flexible aspect of rest and sleep in these dolphins. They exhibit three types of behavior related to rest at different depths and often engage in this behavior at various times throughout the day, even during the most active periods. These bottlenose dolphins can flexibly adjust the type and amount of resting behavior according to the situation.

Surfacing behavior

Based on the data collected, the frequency of surfacing behavior exhibited by bottlenose dolphins at Bali Exotic Marine Park is significantly higher compared to bottlenose dolphins in Lovina. This is likely because captive dolphins are often exposed to interactions with humans, including trainers and visitors, while wild bottlenose dolphins have minimal human interaction. Surfacing behavior is observed in wild dolphins and is used as a means of gathering information. Captive bottlenose dolphins have also been shown to display anticipatory behavior (in this case, surfacing) in response to expecting food (Clegg et al., 2018; Papale et al., 2011).

Repetitive abnormal behavior

Tursiops aduncus at Bali Exotic Marine Park was observed to display several instances of Repetitive Abnormal Behavior (RAB), which were not seen in bottlenose dolphins in Lovina. Repetitive Abnormal Behavior is often broadly

associated with factors such as personality and anticipatory behavior and is linked to poor animal welfare and living conditions (Baumgratner et al., 2024). This suggests that life in an artificial environment may induce stress that affects their well-being. Changes in the behavior of captive dolphins are generally influenced not by attractions and similar sessions but by the presence of trainers (even for short durations), disturbances both inside and outside the pool, and even the pool itself can impact behavioral changes. This indicates that dolphins are highly attentive to events occurring outside the pool and show a mix of vigilance and anticipation (Brando et al., 2019).

Chuffing behavior

Based on the observations, bottlenose dolphins both in the wild and in captivity show relatively high instances of *chuffing*, especially in the wild. This may be due to the presence of many boats approaching the wild dolphins while they are foraging for food. In captive dolphins, it is likely caused by a combination of respiratory irritation from the pool water and human disturbances both from outside and within the pool. Chuffing is a behaviour typically expressed when dolphins experience disturbance. This behaviour is analysed as an indicator of respiratory irritation, similar to coughing or sneezing in humans, which is a physiological response to irritation by particles in the respiratory tract (Fire et al., 2020). Wild dolphins can be easily disturbed by the presence of humans and boats, especially if approached too closely, too quickly, or too noisily for either short or long durations. Repetitive or frequent *chuffing* at the surface is one of the sudden changes indicating such external disturbances (NOAA, 2024).

CONCLUSION

Bottlenose dolphins (*Tursiops* spp.) living in their natural habitat exhibit behavior typical of wild dolphins. They do not show signs of stress and demonstrate well-being with non-repetitive, varied patterns of behavior that align with their natural activities. In their natural environment, these dolphins engage in a range of complex social behaviors, such as playing, foraging, and communicating with group members. In captivity, *Tursiops* spp. display behavior similar to wild dolphins, but they still exhibit abnormal behaviors. They show signs of stress, such as Repetitive Abnormal Behavior (RAB), and demonstrate other repetitive behaviors including surfacing, side breaches, chuffing, and sexual behavior. These behaviors may be indicated by a lack of social interaction with other dolphins, external disturbances from outside the pool, and limitations of the captive environment.

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