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SKELETON ANALYSIS OF THE *CRANII REGION* IN THE CASE OF DOLPHINS *(Tursiops trucantus*) STRANDED ON SENGGIGI BEACH WEST LOMBOK REGENCY

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Abstrak

Cetacea adalah sekelompok mamalia laut yang sepenuhnya beradaptasi dengan kehidupan air termasuk paus dan lumba-lumba. Lumba-lumba termasuk dalam kelompok hewan laut yang dikenal sebagai cetacea yang telah berevolusi sepenuhnya untuk hidup di air. Di perairan Indonesia, hampir semua spesies cetacea telah diklasifikasikan sebagai biota yang dilindungi. Banyak kematian cetacea telah dikaitkan dengan polusi air dan aktivitas seismik bawah laut. Lumba-lumba hidung botol (genus Tursiop) adalah salah satu spesies cetacea yang paling banyak dipelajari karena penyebarannya yang luas di perairan tropis dan sedang serta perilaku ramah manusia. Pada penelitian ini menunjukkan bahwa hasil ukuran tulang Tursiops .truncatus pada bagian Cranii yang ditemukan di Pantai Senggigi berbeda dengan hasil ukuran tulang Cranii Tursiops truncatus yang ditemukan di Korea Pulau Jeju. Dalam tinjauan literatur yang ditulis tentang tulang belulang spesies Tursiops truncatus dari Korea, Pulau Jeju. Setiap bagian Os Cranii pada Tursiop truncatus yang terdapat pada Pulau Jeju, Korea memiliki ukuran yang sangat berbeda dengan Tursiop truncatus yang terdapat pada Pantai Senggigi, yang dapat disimpulkan bahwa ukuran Os Cranii pada Tursiops truncatus yang terdapat pada Pulau Jeju, Korea memiliki ukuran yang lebih besar dibandingkan dengan ukuran Tursiops truncatus yang terdapat pada Pantai Senggigi, Kabupaten Lombok Barat. Sebuah studi tentang analisis isotop stabil pada mamalia laut di lepas pantai barat laut Afrika dan ceruk trofik yang unik mengatakan tulang mamalia tidak hanya mencerminkan perbedaan tingkat trofik tetapi juga pergeseran tempat mencari makan.

***Kata kunci**: Tursiops truncatus, senggigi, morfometri, cranii.*

Abstract

Cetaceans are a group of marine mammals fully adapted to aquatic life including whales and dolphins. Dolphins belong to a group of marine animals known as Cetaceans that have evolved completely to live in water. In Indonesian waters, almost all cetacean species have been classified as protected biota. Many cetacean deaths have been linked to water pollution and underwater seismic activity. The bottlenose dolphin (genus Tursiop) is one of the most studied cetacean species due to its wide distribution in tropical and temperate waters and its friendly behavior towards humans. This research shows that the results of the size of the Tursiops truncatus bones in the Cranii section found on Senggigi Beach are different from the results of the size of the Cranii bones of Tursiops truncatus found on Korea's Jeju Island. In a review of literature written about the bones of the Tursiops truncatus species from Korea, Jeju Island. Each part of the Os Cranii on Tursiop truncatus found on Jeju Island, Korea has a very different size from the Tursiop truncatus found on Senggigi Beach which can be concluded that the size of the Os Cranii on Tursiops truncatus found on Jeju Island, Korea has the same size. larger than the size of Tursiops truncatus found on Senggigi Beach, West Lombok Regency. The cause of differences in bone size could be due to diet and habitat. A study on stable isotope analysis of marine mammals off the coast of Northwest Africa and unique trophic niches says mammalian bones reflect not only differences in trophic level but also shifts in foraging areas.

Key words: Tursiops truncatus, senggigi, morphometry, cranii.

1. INTRODUCTION

Cetaceans is a group of marine mammals fully adapted to aquatic life including whales and dolphins. Dolphins belong to a group of marine animals known as *Cetaceans* which has fully evolved to live in water. In Indonesian waters, almost all species *Cetaceans* has been classified as a protected biota. Many cetacean deaths have been attributed to water pollution and underwater seismic activity. Many *Cetaceans* stranding along Indonesia's coastline was one reaction *Cetaceans* which is immediately visible if there is interference. It is likely that something similar happened to *Cetaceans* the dead washed up on Senggigi Beach in June 2022 (Harahap *et al*., 2021).

Cetaceans It is famous for having many modifications to its skeleton, including telescopic modifications of its skull which are used to create space for melons as well as to improve its hydrodynamics and asymmetry. Skull *Cetaceans* undergoes a lengthening process called *Telescopic* which gives morphological characteristics to the facial bones and *cranium* (Cozzi *et al*., 2010). Skull *Cetaceans* is an important part of *Cetaceans* Because the skull is a place that can protect the brain. Skull *Cetaceans* It also has a function to place organs such as eyes and melons which play an important role for *Cetaceans*. Melon is a lump on the head *Cetaceans* which serves to emit sound waves that cannot be heard by humans (Rommel *et al*., 2009).

Bottlenose dolphins (*Tursiop trucantus*) is a species of dolphin that is found in tropical waters. Bottlenose dolphins are categorized as protected animals, so their maintenance must be carried out by conservation institutions with maintenance that meets the principles of animal welfare and health *(*Elmanaviean &; Seta, 2023*)*. Bottlenose dolphin *(T. truncatus*) is one of the species *Cetaceans* the most studied for its wide distribution in tropical and temperate waters and human-friendly behavior *(*Kim *et al*., 2010).

At *Os Cranii* exist *Os Mandibular* which has a forward elongated shape that serves to break water currents and as a place to attach its lower teeth. *Os Pre Maxilla* has the same function as *Os Mandibular* as a place of attachment to his upper teeth and to catch his prey however, *Cetaceans* has teeth just to catch its prey and instantly swallow without chewing (Huggenberger, n.d.*)*. *Os Nassal* as a respiratory tract *Cetaceans* when it comes to the surface of the sea to take a breath. *Os Tympanoperiotic* which serves as a hearing instrument needed for underwater sound perception *(*Cozzi *et al.,* 2016*)*.

Some of the bone parts are completely inlaid with soil, brittle and difficult to identify (Buckley *et al.,* 2014). Based on size data *Skeleton* Regional Dolphins *Cranii* from different countries. Most data is only from other species and lack of size data *Skeleton* of species (*T.truncatus*) especially in Indonesia. Then it is necessary to conduct an analysis *skeleton T.truncatus* to know the characteristics of this species. Therefore, the purpose of this study is to analyze *Skeleton* making it easier to determine the character and age of the specification *T.truncatus* bottlenose dolphins stranded on Kila Beach Senggigi, West Lombok.

Size research *Skeleton* Region *Cranii* species (*T.truncatus*) bottlenose dolphins are rarely practiced especially in Indonesia. With little research on the species, it is difficult for veterinarians and researchers to determine the characteristics of stranded dolphins. One of the obstacles for rescuers *cetaceans* What is stranded in the field is the difficulty of identifying the type (Yusmalinda *et al.,* 2017).

2. MATERIALS AND METHODS

2.1 Second-Level Heading

The tools used in this study are, mobile phone camera, box, scissors, ruler, pencil, glove, mask, cloth, and meter measuring instrument (Domínguez-Rodrigo *et al,* 2010). The ingredients used in this study were gasoline, formalin 10%, hydrogen peroxide 30%, and alcohol 70%. (Tefera, 2011).

2.2 Sample Observation

The carcass of *a T. truncatus* dolphin was found washed up on Ampenan beach, Mataram City. To avoid the smell of carrion, the carcass was transported to Senggigi beach in West Lombok for burial. Removal is carried out four months after burial. To avoid pathogenic microorganisms present in bone or meat carcasses, picking is done manually using a hoe or shovel and latec gloves. After almost the entire flesh rotted, only small remnants stuck to the bones. The smell of carrion is still piercing people's noses. The rest of the bone is cleaned using a brush (Avila et al., 2015).

2.3 Sample Preparation

A solution of H2O2 (hydrogen peroxide) 3%, alcohol 70%, and water are used to clean the meat. Cleaned bones Soaking for three days using 5 liters of gasoline and 10% formalin. After soaking the bones are sun-dried From the meat dried in the sun to dry. A clear flash plitur coating was used for finishing this sample (Tefera, 2011). Then reconstruct the dolphin skeleton as mentioned in the literature review.

2.4 Measurement and Analysis of Cranii samples

Bone samples were measured using a small meter based on a review of the literature we obtained. The tape measure is the main tool needed in the field to obtain length and thickness measurements. Measurements on Os cranii were made on 1, condylobasal length. 2, Pulpit length. 3, The width of the pulpit at the base. 4, The width of the pulpit is 60 mm from the base. 5, The width of the pulpit in the center. 6, Wide premaxillaries in the center of the pulpit. 7, The width of the pulpit with a length of 3/4. 8, The distance from the end of the pulpit to the external nares. 9, The distance from the end of the pulpit to the internal nares. 10, The largest preorbital width. 11, The largest postorbital width. 12, The smallest supraorbital width. 13, The largest width of the external nares. 14, The largest width traverses the zygomatic squamosal process. 15, The width of the largest premaxillaries. 16, Largest parietal width. 17, The greatest length of the left posttemporal fossa. 18, The largest width of the left posttemporal fossa. 19, Left orbit length. 20, Left lacrimal antorbital process length. 21, The largest width of the internal nares. 22, The largest length of the left pterygoid. 23, Long upper left tooth row. 24, Long row of lower left teeth. 25, The greatest length of the left ramus. 26, The height of the largest left ramus. 27, Length of left mandibular fossa (Kim *et al*., 2010).

3. RESULTS AND DISCUSSION

Observations of the skeleton dolphin (*T. truncatus*) of the *Cranii* region at the West Nusa Tenggara Museum. Based on observations and measurements, there are changes in bone size that differ between skeletons on Senggigi beach and other literature reviews.

Figure 1. Measurement of the cranii region of Tursiops truncates found on Senggigi Beach.

Table 1. T. truncatus regio skeleton measurement results *cranii* found on Jeju Island of Korea, South Africa, and China in units of mm (Kim *et al*., 2010) and T. truncatus regio skeleton measurement results *cranii* found on Senggigi Beach West Lombok in mm units.

NO	SKULL	KOREAN JEJU ISLAND	SOUTH AFRICA	CHINA	SENGGIGI BEACH
		SIZE mm	SIZE mm	SIZE mm	SIZE mm
1	CONDYLOBYLE LENGTH	473.1	473.0	485.0	410
2	MIMBAR LENGTH	270.1	271.9	282.0	210
3	BAR WIDTH	103.98	112.3	115.8	70.0
4	MIMBAR LENGTH 60mm FROM BASE	70.07	-	-	50.0
5	THE WIDTH OF THE PULPIT IN THE CENTER	58.91	64.9	64.2	40.0
6	PRMAXILARIS WIDTH IN THE CENTER OF THE PULPIT	30.38	-	-	30.0
7	THE WIDTH OF THE PULPIT WITH A LENGTH OF 3/4	44.42	48.8	50.3	20.0

8	THE DISTANCE OF THE END OF THE PULPIT TO THE EXTERNAL NARES	319.45	316.9	328.5	250.0
9	DISTANCE FROM PULPIT TO INTERNAL NARES	314.1	-	-	240.0
10	LARGEST PREORBITAL WIDTH	194.89	203.4	201.9	150.0
11	GREATEST POSTORBITAL WIDTH	217.29	230.2	223.4	190.0
12	SMALLEST SUPRAORBITAL WIDTH	196.8	207.3	199.5	140.0
13	THE GREATEST WIDTH OF THE EXTERNAL NARES	56.52	54.4	58.7	40.0
14	LARGEST WIDTH ACROSS ZYGOMATIC SQUAMOSAL	218.66	229.6	230.6	140.0
15	THE LARGEST WIDTH OF PREMAXILLARIS	81.55	83.4	86.2	50.0
16	LARGEST PARIETAL WIDTH	186.04	-	-	110.0
17	THE GREATEST LENGTH OF THE LEFT POSTTEMPORAL FOSSA	102.31	-	-	50.0
18	GREATEST WIDTH OF LEFT POSTTEMPORAL FOSSA	75.77	-	-	30.0
19	LEFT ORBITAL LENGTH	59.45	-	-	50.0
20	LENGTH OF THE LEFT LACRIMAL ANTORBITAL PROCESSUS	43.66	44.8	46.1	30.0
21	THE GREATEST WIDTH OF THE INTERNAL NARES	52.46	-	-	40.0
22	THE GREATEST LENGTH OF THE LEFT PTERYGOID	61.52	-	-	30.0
23	UPPER TOOTH ROW LENGTH	236.3	224.8	236.9	180.0
24	BOTTOM TOOTH ROW LENGTH	234.15	226.9	243.9	200.0
25	THE GREATEST LENGTH OF THE LEFT RAMUS	400.25	399.6	416.0	310.0
26	THE HEIGHT OF THE LARGEST LEFT RAMUS	81.42	83.2	82.6	40.0
27	MANDIBULAR FOSSA LENGTH	141.27	-	-	80.0

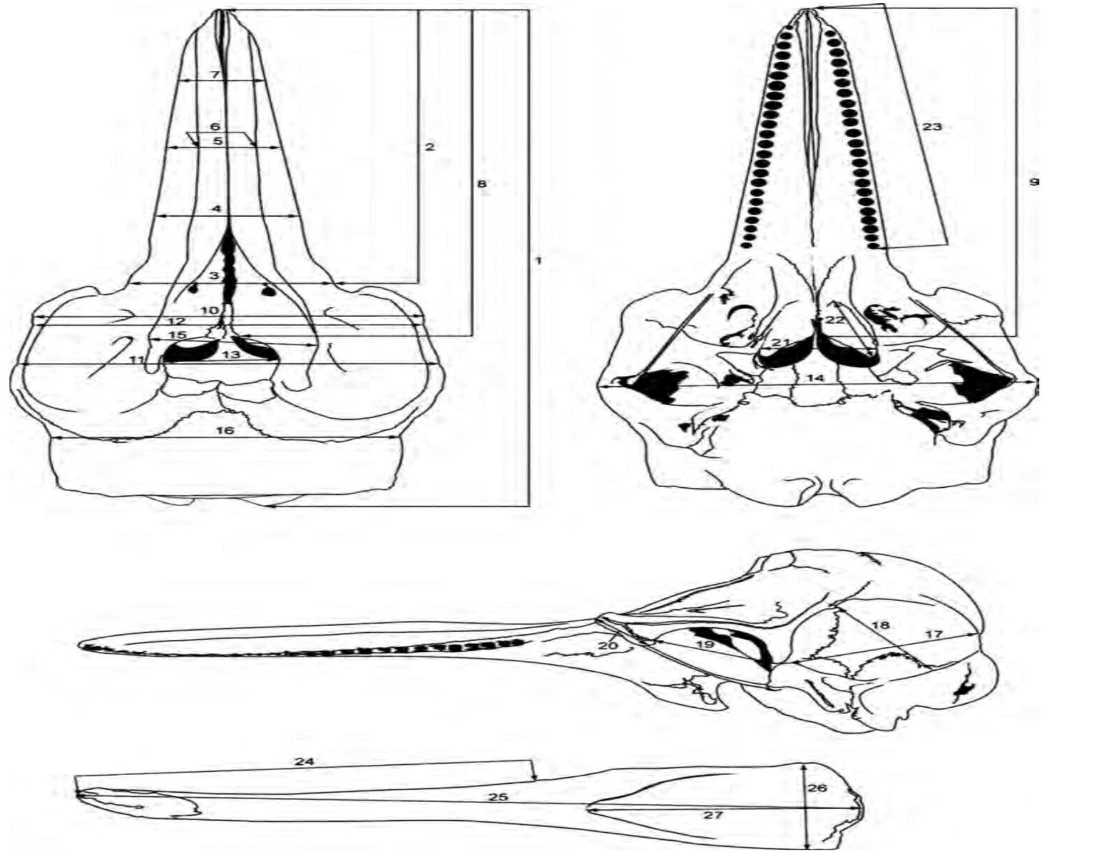

Figure 2. Measurement of Tursiops truncatus.1, condylobasal length. 2, Pulpit length. 3, The width of the pulpit at the base. 4, The width of the pulpit is 60 mm from the base. 5, The width of the pulpit in the center. 6, Wide premaxillaries in the center of the pulpit. 7, The width of the pulpit with a length of 3/4. 8, The distance from the end of the pulpit to the external nares. 9, The distance from the end of the pulpit to the internal nares. 10, The largest preorbital width. 11, The largest postorbital width. 12, The smallest supraorbital width. 13, The largest width of the external nares. 14, The largest width traverses the zygomatic squamosal process. 15, The width of the largest premaxillaries. 16, Largest parietal width. 17, The greatest length of the left posttemporal fossa. 18, The largest width of the left posttemporal fossa. 19, Left orbit length. 20, Left lacrimal antorbital process length. 21, The largest width of the internal nares. 22, The largest length of the left pterygoid. 23, Long upper left tooth row. 24, Long row of lower left teeth. 25, The greatest length of the left ramus. 26, The height of the largest left ramus. 27, Length of left mandibular fossa (Kim *et al*., 2010).

The results of some of the measurements above show that the results of bone size *T.truncatus* in the section *Cranii* The results found on Senggigi Beach are different from the results of Cranii bone size from Tursiops truncatus found in Korea Jeju Island, South Africa, China. In a literature review written about the bones of the species *Tursiops truncatus* from Korea Jeju Island, South Africa, China measurement results *Cranii* on condylobasal length in Korea Jeju Island 473.11mm, South Africa 473.00mm, China 485.00mm, 410.00mm on T.truncatus found on Senggigi Beach which shows smaller size compared to the size on Tursiops truncatus in three countries, on the size of the pulpit length on Jeju Island 270.1mm, in South Africa 271.9mm, in China 282.00mm, while the size on T. truncatus found on Senggigi Beach measuring 210.00mm which shows the size The length of the pulpit in China is more Length compared to Korea, South Africa and Senggigi Beach, In the results of measuring the width of the pulpit on Jeju Island 103.98mm, the measurement of the width of the pulpit in South Africa 112.3mm, the measurement of the width of the pulpit in China 115.8mm, showing a difference in size of 70.00mm on T. truncatus found on Senggigi Beach which means the width of the pulpit on Senggigi Island is smaller than Jeju Island, South Africa, and China, the measurement results on the length of the pulpit at 60mm from the pedestal on Jeju Island 70.07mm, the measurement results in South Africa are unknown and in China are also unknown, while the size on T. truncatus found on Senggigi Beach is 50.00mm (Woo et al., 2010).

In the size of the width of the pulpit in the middle, on Jeju Island measuring 58.91mm, the measurement of the width of the pulpit in the middle, in South Africa measuring 64.9mm, the measurement of the width of the pulpit in the middle, in China measuring 64.2mm, while T. truncatus in Senggigi Beach measuring 40.00mm which shows the size of the width of the pulpit in the middle is smaller than the size in South Africa, China and Jeju Island, in the size of the width of the premaxillaris in the middle of the pulpit, on Jeju Island 30.38mm, the measurement of the width of the premaxillaris in the middle of the pulpit in South Africa and China is unknown, showing differences in T. truncatus found on Senggigi Beach measuring 30.00mm which is smaller compared to the measurement results in Jeju Island, on the measurement of the width of the pulpit at a length of 3/4 on Jeju Island which is 44.42mm, the measurement of pulpit width at a length of 3/4 in South Africa 48.8mm and in China measuring 50.3mm while T. truncatus found on Senggigi Beach measuring 20.00mm which shows the size on Senggigi Beach is smaller than South Africa, Jeju Island and China, on the size of the distance of the pulpit tip to the external nares on Jeju Island 319.45mm, the measurement of the distance of the pulpit tip to external nares in South Africa 316.9mm, The measurement results in China are 328.5mm, while the size on T. truncatus on Senggigi Beach is 250.00mm, on the size of the distance from the pulpit to the internal nares on Jeju Island is 314.1mm, the measurement results of the distance from the pulpit to the internal nares in South Africa and China are unknown, while on T. truncatus found on Senggigi Beach measuring 240.00mm shows a smaller size difference compared to Jeju Island, in the results of the largest preorbital width measurement, on Jeju Island 194.89mm, the largest preorbital width measurement in South Africa 203.4mm, the largest preorbital width measurement, in China measuring 201.9mm, has a difference in size results on T. truncatus on Senggigi Beach measuring 150.00mm which shows the largest preorbital width in Senggigi Beach is smaller than the measurement results in South Africa, China and Jeju Island, in the results of the largest postorbital width measurement, on Jeju Island 217.29mm, the results of postorbital width measurements, in South Africa measuring 230.2mm, the results of postorbital width measurements in China 223.4mm, while the measurement results on T. truncatus on Senggigi Beach 190.00mm which means the size of the postorbital width on Senggigi Beach is smaller, on the results of the smallest supraorbital width measurement, on Jeju Island 196.8mm, The smallest supra-orbital width measurement, in South Africa 207.3mm, the smallest supra-orbital width measurement, in China 199.5mm, shows a difference in T. truncatus found on Senggigi Beach 140.00mm (Kim *et al.*, 2010).

In the results of the largest width measurement of external nares, on Jeju Island 56.52mm, the largest width measurement result of external nares, in South Africa 54.4mm, the largest width measurement result of external nares, in China 58.7mm, has a size difference in T. truncatus found on Senggigi Beach which is 40.00mm which shows the largest width of external nares on Senggigi Beach is smaller than China, Jeju Island and South Africa, in the largest width measurement results across zygomatic squamosal, on Jeju Island 218.66mm, measurement results in South Africa 229.6mm, measurement results in China 230.6mm, while the measurement results on T. truncatus found on Senggigi Beach measuring 140.00mm which showed a smaller size, on the largest premaxillaris width measurement, on Jeju Island 81.55mm, the largest premaxillaris width measurement in South Africa 83.4mm, the measurement of the width of the premaxillaris in China 86.2mm, and in T. truncatus in this study measuring 50.00mm which shows its size is smaller than the measurement results in Jeju Island, South Africa and China, in the largest parietal measurement results, on Jeju Island 186.04mm, the largest parietal measurement results, in South Africa and China are unknown, while the measurement results on T. truncatus on Senggigi Beach 110.00mm which shows the size on Jeju Island is larger, on the results of the largest length measurement of the left posttemporal fossa, on Jeju Island which is 102.31mm, the results of the largest length of the left posttemporal fossa, in South Africa and China are unknown, while the measurement results on T. truncatus on Senggigi Beach 50mm which means the size on Senggigi Beach is smaller than Jeju Island, in the results of the measurement of the largest width of the left posttemporal fossa, on Jeju Island measuring 75.77mm, the results of the largest width measurement of the left posttemporal fossa, in South Africa and China are unknown, showing the difference in measurement results on T. truncatus on Senggigi Beach 30.00mm which shows the size on Senggigi Beach is smaller than Jeju Island, the measurement results of the left orbital length, on Jeju Island 59.45mm, The measurement results of the length of the left orbital, in South Africa and China are unknown, while the measurement results in this study are 50mm, the measurement results of the length of the left lacrimal antorbital process, on Jeju Island 43.66mm, the measurement results of the length of the left lacrimal antorbital process in South Africa 44.8mm, the measurement results of the length of the left lacrimal antorbital process in China 46.1mm, while the measurement results on T. truncatus on Senggigi Beach measure 30.00mm, The largest width measurement result from internal nares, on Jeju Island measuring 52.46mm, the largest width measurement result from internal nares, in South Africa and China is unknown, while the measurement result of T. truncatus on Senggigi Beach is 40mm (Woo *et al.*, 2010).

The results of the largest length measurement of the left pterygoid, on Jeju Island 61.52mm, the measurement result of the largest length of the left pterygoid, in South Africa and China is not kethaui, while the measurement results on T. truncatus found on Senggigi Beach measuring 30.00mm, the measurement result of the length of the upper tooth row, in Jeju Island 236.3mm, the measurement result of the length of the upper tooth row, in South Africa 224.8mm, measurement results The length of the upper tooth row in China is 236.9, while in the measurement of T. truncatus on Senggigi Beach is 180.00mm, the measurement results of the length of the lower tooth row, on Jeju Island measuring 234.15mm, the measurement results of the length of the lower tooth row, in South

Africa is 226.9mm, the measurement results The length of the bottom tooth row, in China is 243.9mm, but in the measurement results The length of the lower tooth row of T. truncatus on Senggigi Beach is 200.00mm, the measurement of the largest left ramus length, in Jeju Island 400.25mm, the measurement result on the largest left ramus climber, in South Africa 399.6mm, the measurement result of the largest left ramus length, in China 416.00mm, while the size on T.truncatus on Senggigi Beach measuring 310.00mm, the measurement result on the largest left ramus height, on Jeju Island 81.42mm, the largest left ramus height measurement result, in South Africa 83.2mm, while the measurement results on T. truncatus on Senggigi Beach 40.00mm, the results of measuring the length of the mandibular fossa, on Jeju Island 141.27mm, the measurement results of the length of the mandibular fossa, in South Africa and China are unknown and the measurement results on T. truncatus on Senggigi Beach 80.00mm which shows a smaller size difference compared to Jeju Island (Kim *et al.*, 2010).

A study of stable isotope analyses in marine mammals off the coast of northwest Africa and unique trophic niches says mammalian bones reflect not only differences in trophic levels but also shifts in foraging grounds. In marine ecosystems, coastal marine mammals are thought to have lower nitrogen values than their oceanic counterparts or those in the ocean because macrophytes show lower nitrogen values. Higher nitrogen and carbon values in the sub-tropical east Atlantic as a consequence of oxidicity in the area morphotypes of short- and long-beaked dolphins, individuals from the Northeast Atlantic display lower nitrogen values reflecting dissimilarity in diet and variation in local isotope baseline lines. Traffic behavior of common dolphin populations around the world was well analyzed and revealed substantial differences, most likely reflecting the adaptive strategies of the genus and differences in ecosystem structure. Aside from that, bone is a tissue of choice with a low turnover rate, which reflects the animal's diet over several years (Morais, 2015).

Aside from food, habitat and heavy metal causes, bone differences can also be caused by environmental factors during burial in the sand or the position of the bones on the sand. All bones generally have a similar color to the white shells that make up the coast, making detection of small bones more difficult. Some smaller skeletal elements may also get buried faster. In addition, smaller skeletal elements can be destroyed more quickly by physical processes such as abrasion by wind-driven grains of sand and/or peeling due to drying and intense UV radiation in these sunny, hot regions. Bones with a lower surface area to volume ratio or higher density can survive for a longer time, refracting bone groups toward larger, denser bones (Liebig *et al.*, 2003).

Aside from food and habitat, bone differences can also be caused by heavy metals. A study on the toxicity of kidney heavy metals and bone tissue in adult South Australian bottlenose dolphins stated Some dolphins showed evidence of toxicity and explained the cause of the abnormalities. An increase in metallothionein (MT) leads to kidney damage and loss of bone density and complexity. MT induced by metal toxins forms large metal-MT complexes that cause damage to kidney structures. This leads to leakage of calcium, phosphate, and protein from the kidneys, inhibits bone remodeling and causes loss of bone density (bone mineral density) and complexity (bone histomorphometry) (Lavery *et al.*, 2009).

4. CONCLUSION

The results of some of the measurements above show that the results of bone size *Tursiops .truncatus* in the section *Cranii* The results found on Senggigi Beach are different from the Cranii bone size results of Tursiops truncatus found in Korea, Jeju Island, South Africa and China. In a literature review written about the bones of the species *Tursiops truncatus* from Korea Jeju Island. Each part of Os Cranii on Tursiop truncatus found on Jeju Island Korea, South Africa and China has a very different size from Tursiop truncatus found on Senggigi Beach which can be concluded that the size of Os Cranii on Tursiops truncatus found in China is larger than South Africa and Jeju Island Korea. While the size of Tursiops truncatus on Senggigi Beach has a smaller size compared to the size of Tursiops truncatus found in China, South Africa and Jeju Island. In a study of stable isotope analyses in marine mammals off the coast of northwest Africa and unique trophic niches said mammalian bones reflect not only differences in trophic levels but also shifts in foraging grounds (Morais, 2015).

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