Egyptian Journal of Aquatic Biology & Fisheries
Zoology Department, Faculty of Science,
Ain Shams University, Cairo, Egypt.
ISSN 1110 – 6131
Vol. 24(1): 667 – 695 (2020)
www.ejabf.journals.ekb.eg

First record of Bryde's whale (*Balaenoptera brydei*, Olsen, 1913) in the southeastern Mediterranean Sea, Alexandria, Egypt

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ARTICLE INFO

Article History:
Received: Feb. 16, 2020
Accepted: March 4, 2020
Online: March 9, 2020

Keywords:
Bryde's whale,
Balaenoptera brydei
Deviation,
Migration,
Plankton,
Whale suicide.

ABSTRACT

The deviation of whales towards the beaches is one of the known phenomena around the world but it is one of the few and rare phenomena in the southeastern Mediterranean off Egypt, so the occurrence of this phenomenon requires detailed studies to find out the type of delinquent whale as well as the reasons for its attraction towards the shore of the Mediterranean Sea.

In the current study, several methods were used to determine the type of delinquent whale, such as 1) morphometric measurements, 2) the characterization of the phenotype, 3) the analysis of mtDNA, and 4) analyzing the biochemical content of whale samples to try to determine its health condition. Furthermore, the physical, chemical and productive properties of water area have been studied. The species of the whale was identified as *Balaenoptera brydei* and the results showed that whale mortality due to hunger or drift was excluded due to its high protein content, which reinforced the assumption of the tendency of the whale in question to commit suicide to lose its natural environment and peers. In general, the presence of whales in the southeastern Mediterranean off the Egyptian coast is a phenomenon that needs further studies due to it is increased in recent decades.

INTRODUCTION

Among large baleen whales, Bryde’s whales are the least known species (**Kato, 2002**). In Bryde’s whales, calving and breeding occur year-round (**Jefferson *et al.*, 2008**). Bryde’s whales have two migration movement patterns, shorter seasonal movement (**Jefferson *et al.*, 2008**) and longer migration like that from (25° N) tropical Pacific to the eastern Japanese coast (34° N) (**Kishiro, 1996**). Bryde’s whales received little attention for the past decades; they not considered an endangered or threatened species and not regarded a strategic stock by Marine Mammal Protection Act (**Carretta *et al*., 2007; Jefferson *et al*., 2008**).

The number of Bryde’s species and taxonomy is still having some questions (**Kato, 2002**). Many authors and organizations such as The International Whaling Commission use *Balaenoptera edeni* in nomenclature all Bryde’s whales. Although it is widely professed that there are possibly two species included, till now, the homeomorphisms of the type specimens haven't been resolved, therefore many authors use the name *B. edeni* for all Bryde’s whales as a prompt approach (**Jefferson *et al*., 2008**), on the other hand, others use *Balaenoptera brydei/edeni* to get out this conflict (**Smultea *et al*., 2012**).

Bryde's whales consist of two species of rorqual and possibly three. The larger and common form is Bryde's whales *"Balaenoptera brydei*, Olsen, 1913" founds worldwide in tropical and warm temperate waters, and the Indo-Pacific smaller form Eden's or Sittang whale *"B. edeni*, Anderson, 1879". Morphological similarities between Bryde's and Eden's whales has led to confusions over species identification despite numerous anatomical differences. Other methods are used to distinguish between the two putative types, such as sample size, geographical distribution, and inshore/offshore predilection. In general, the taxonomy is poorly described despite both species are genetically distinct **(Perrin and Brownell, 2007; Reilly *et al*., 2008; Martenstyn 2013a, b; Kershaw *et al*., 2013)**.

The largest measured by **Olsen (1913)** was a 14.95 m (49.0 ft) female caught off Durban in November 1912, while the longest of each sex measured by **Best (1977)** at the Donkergat whaling station in Saldanha Bay, South Africa, was a 15.51 m (50.9 ft) female caught in October 1962 and a 14.56 m (47.8 ft) male caught in April 1963; both were the offshore form**.**

Bryde's whales feed on a wide variety of fish, planktonic crustaceans, and cephalopods. In the western North Pacific, Bryde's whales caught by Japanese scientific whaling vessels (2000–2007) mainly fed on Japanese anchovy (*Engraulis japonicus*, 52%) and various species of euphausiid (36%, including *Euphausia similis*, *E. gibboides*, *Thysanoessa gregaria*, and *Nematoscelis difficilis*), as well as oceanic lightfish (*Vinciguerria nimbaria*, nearly 3%), and mackerels (*Scomber* spp., less than 2%). The prey differed by location and season. In coastal areas, euphausiids dominated the diet, comprising 89 and 75% of the diet in May and June, respectively. Further offshore, Japanese anchovy was the dominant species, accounting for nearly 100% of the diet in late summer **(Tamura *et al*., 2009).**

Based on the stomach contents of Bryde's whales caught by Japanese pelagic whaling expeditions in the North Pacific in the 1970s, the majority were found to feed on euphausiids (nearly 89%), whereas only about 11% fed on fish **(Nemoto and Kawamura, 1977)**, such as sardines and herrings (**Gallardo *et al*., 1983; Siciliano *et al*., 2004**). They can also feed on euphausids, copepods, cephalopods and pelagic crabs (**Omura, 1962; Kawamura, 1977; Best، 2001; Kato and Perrin, 2009**). Additionally, previous studies suggest that the whales feed on small fishes (mainly *Sardinella brasiliensis*) in coastal waters, generally showing interspecific feeding association with seabirds and large fishes (**Siciliano *et al*., 2004**). **Best (2001)** studied the feeding differences in preys consumed by offshore and inshore forms of Bryde’s whales taken off South Africa. According to this author, the inshore form shows a high preference for small pelagic fishes (genera *Engraulis*, *Trachurus* and *Sardinops*), while the offshore form prefers euphausiids (*Euphausia lucens* and *E. recurva*) and in low-frequency mesopelagic fish (*Maurolicus* and *Lestidium*).

B. brydei occurs in the Atlantic, Pacific, and Indian Oceans between the 40th parallels of latitude, preferring highly productive, tropical, subtropical, and warm, temperate waters of 16-22 °C. In the North Pacific, they occur as far North as Honshu to the west and Southern California in the East, with vagrants reported as far North as Washington in the United States. A resident population is found in the Gulf of California and they occur throughout the Eastern Tropical Pacific, including Peru and Ecuador (**Reilly *et al.*, 2008**).

In the North Atlantic, they have been recorded as far north as Cape Hatteras. They occur in the Gulf of Mexico and throughout the wider Caribbean-two specimens from Aruba were found through mtDNA analysis to be firmly placed within *B. brydei* and to form a clade with a specimen from Madeira and individuals of the offshore form of South Africa, but do not occur in the Mediterranean Sea (**Steiner *et al.*, 2007).**

Bryde's whale is listed on Appendix II of the Convention on the Conservation of Migratory Species of Wild Animals. It is listed on Appendix II as it has an unfavourable conservation status or would benefit significantly from international co-operation organized by tailored agreements **(Appendix II Archived, 11 June 2011).** In addition, Bryde's whale is covered by the Memorandum of Understanding for the Conservation of Cetaceans and Their Habitats in the Pacific Islands Region (Pacific Cetaceans MOU). **(Tønnessen and Arne, 1982).**

The present study aimed to identify the species of the dead whale found on Egypt's Alexandria Mediterranean shore and try to add more clarification on the cause of the whale death by studing the environmental conditions surrounding the area to clarify whether the cause of the death due to drift, hunger or a case of collective suicide.

MATERIALS AND METHODS

Bryde’s whale body was found dead at Azur Hotel beach (31.2001° N, 29.9187° E) on the coast of Mediterranean Sea, Alexandria, Egypt **(Fig. 1)**.

1. Morphometric characters:

Many photos have been captured using Nikon D3200 Camera Kit with 18.55mm lens for body and fins (Dorsal, pectoral and caudal fin) of the whale to be processed by Image J V1.46r software to calculate the morphometric measures. Each morphometric feature for the body and fins has been measured three times in three separate sessions and the average has been calculated to eliminate the error as could as possible.

Morphometric measurements

To study morphometric and morphology, **Marshall and Barone (2016)** method was consulted to perform the following measurements:

Fig. 1. A map showing the location of observing the whale specimens.

a. Body Measurements

Total length (TL): Length from the tip of snout to the end of the caudal fin.

Fork length (FL): Length from the tip of snout to the fork of the caudal fin**.**

Body depth (BD): The greatest depth of the body.

Head length (HL): Length from the tip of the snout to the last gill slits opening.

Eye diameter (ED): Horizontal diameter of the eye.

Spiracle Dimeter (SD): Horizontal diameter of the Spiracle.

Caudal fin Length: The distance from one tip of the left caudal lobe to the other.

b. Dorsal Fin Measurements

Dorsal fin anterior Margin (Dors. E): The distance between the dorsal fin origin and the fin tip.

Dorsal fin Width (Dors. F): The distance from the fin origin to the end of the free rear tip.

Dorsal fin upper posterior margin (Dors. H_1): The distance between the tip of the fin and the deepest point of the concave curve of the posterior margin.

Dorsal fin lower Posterior margin (Dors. H_2): The distance between the deepest point of the concave curve of the posterior margin to the posterior end of the dorsal fin.

Dorsal fin posterior margin (Dors. I): The distance between the fin tip and the posterior tip of the free rear tip.

Dorsal fin angle (Dors. J°): The angle between the direct fin height (K) and the mid-fin base (1⁄2 B).

Dorsal fin height (direct) (Dors. K): Distance from the mid-fin base (F) to the tip of the fin.

Dorsal fin height: Perpendicular distance from the fin baseline (F) to the tip of the fin.

Dorsal fin height (absolute) (Dors. L): Perpendicular distance from the fin baseline (B) to the tip of the fin.

Dorsal fin anterior margin height (Dors. Ah): The greatest distance (perpendicular) between line E and the anterior margin of the fin, anterior to line E.

Dorsal fin posterior margin depth (Dors. Bh): The greatest distance (perpendicular) between line I and the posterior margin of the fin, anterior to the line I.

Upper posterior margin convex depth (Dors. Dh): The greatest distance (perpendicular) between the line H and the posterior margin of the fin, posterior to line H.

Dorsal fin upper posterior Margin concave depth (Dors. Eh): The greatest distance (perpendicular) between the line H and the posterior margin of the fin, anterior to line H.

c. Pectoral Fin Measurements

Pectoral fin anterior Margin (Pect. E): The distance between the Pectoral fin origin and the fin tip.

Pectoral fin total Width (Pect. F): The distance from the fin origin to the end of the free rear tip.

Pectoral fin upper posterior margin (Pect. H1): The distance between the tip of the fin and the deepest point of the concave curve of the posterior margin.

Pectoral fin lower Posterior margin (Pect. H2): The distance between the deepest point of the concave curve of the posterior margin to the posterior end of the dorsal fin**.**

Pectoral fin posterior margin (Pect. I): The distance between the fin tip and the posterior tip of the free rear tip.

Pectoral fin angle (Pect. J°): The angle between the direct fin height (K) and the mid-fin base (1⁄2 B).

Pectoral fin height (direct) (Pect. K): Distance from the mid-fin base (F) to the tip of the fin.

Pectoral fin height (absolute) (Pect. L): Perpendicular distance from the fin baseline (F) to the tip of the fin.

Pectoral fin anterior margin height (Pect. Ah): The greatest distance (perpendicular) between line E and the anterior margin of the fin, anterior to line E.

Pectoral fin upper posterior margin convex depth (Pect. Dh): The greatest distance (perpendicular) between the line H and the posterior margin of the fin, posterior to line H.

Pectoral fin upper posterior Margin concave depth (Pect. Eh): The greatest distance (perpendicular) between the line H and the posterior margin of the fin, anterior to line H.

d. Caudal Fin Measurements

Right caudal lobe (LA): Distance from the right caudal fin origin to the right tip.

Left caudal lobe base (LD): Distance from the caudal fin left origin to the deepest point of the caudal fork.

Right caudal lobe base (RD): Distance from the caudal fin right origin to the deepest point of the caudal fork.

Left Post-ventral Margin (LP): The distance from the tip of the left caudal lobe to point before the inner caudal fork.

Right Post-ventral Margin (RP): The distance from the tip of the right caudal lobe to point before the inner caudal fork.

Left Inner fork (LIF): The left space of the inner fork.

Right inner fork (RIF): The right space of the inner fork.

2. Biochemical analysis:

A known weight of the target organs muscles was kept under the freezing condition at 4 ^{0}C until the biochemical analysis.

a. Tissue preparation

For determination of the total proteins, total lipids and total carbohydrates, a known weight of each organ was homogenized in saline solution by using the electric homogenizer, for 2 min. The homogenate specimens were centrifuged at 4000 rpm. for 15 min. at 2 ^{0}C in a refrigerator centrifuge. The supernatant solution was used directly or stored at 4 ^{0}C until the using for biochemical analysis.

b. Determination of the total proteins

Total protein content in the muscles was determined according to **Doumas** method **(Doumas *et al.*, 1981)** using a kit of Vitro Scient Company. This method depends on a violet colour resulted from reactions of protein with cupric ions in alkaline medium, then measure the absorbance for the standard and the samples against working biuret reagent at wavelength 550 nm.

Calculation:

Total protein (g/100 ml) = A_s / A_{st} X n

Where:

A_s= Absorbance of the samples.

A_{st}= Absorbance for the standard solution.

n= Concentration of standard = 6

c. *Determination of the total lipids*

Total lipids content in the muscles were determined according to the method of **Kaplan (1984)**, using a kit of Reactivos GPL Company. Lipids were hydrolyzed by sulfuric acid, then treated with the phospho-vanillin mixture to produce a sulphophosphovanillin complex of rose concentration which was measured photometrically for the standard and the samples against blank at wavelength 525 nm.

Calculation:

Total lipids (mg/100ml) = $A_s / A_{st} \times n$

Where:

A_s= Absorbance of the samples.

A_{st}= Absorbance of the standard solution.

n= Concentration of standard solution = 750

d. *Determination of the total carbohydrates*

Total carbohydrates content in muscles were determined according to the method of **Singh and Sinha (1977)** as follows:

Calculation:

Total carbohydrates (mg/100ml) = $A_s / A_{st} \times n$

Where:

A_s= Absorbance of the samples.

A_{st}= Absorbance of the standard solution.

n= Concentration of standard solution= 0.05

3. DNA analysis:

a. *Tissues preparation for DNA Analysis*

Tissue sample obtained from the caudal fin of the investigated sample which found dead on the shore of the Mediterranean Sea at Alexandria Egypt.

b. *DNA extraction*

DNA was extracted from 0.05 g of caudal fin muscle using the protocol of **Sambrook *et al.* (1989)**.

c. *mtDNA analysis*

Sequencing analysis of around 300 bp control region of mtDNA (Br51) was conducted using the primers MT4 (**A´rnason *et al.*, 1993**) and P2 (5´-GAAGAGGGATCCCTGCCAAGCGG- 3´; **Hori *et al.*** unpublished). PCR amplification followed the manufacturer’s instructions for the use of Ex Taq DNA polymerase. After an initial denaturation step at 95ºC for 5 min, the PCR profile consisted of 30 cycles of 30 s at 94ºC, 30 s at 50ºC, and 30 s at 72ºC, followed by a final extension step of 10 min at 72ºC. PCR products were then cycle sequenced with the same primers using the

AmpliTaq FS Sequencing Kit (Perkin–Elmer). PCR profile for the cycle sequence was 25 cycles of 10 s at 96ºC, 20 s at 56ºC, 4 min at 60ºC. After purification, the cycle-sequenced products were directly sequenced. Observed sequences were aligned using SEQUENCE NAVIGATOR (Applied Biosystems).

4. Ecological measurements:

Hydrographic and some chemical parameters (Temperature, Salinity, pH, dissolved oxygen and ammonia fixation) measured in-situ. Water temperature and pH were measured directly in the field using a standard Schmidt thermometer and a portable digital pH-meter (Orion Research, model 210), respectively. Salinity was determined using a Beckman Induction Salinometer (model RS-7C). The classical Winkler method, modified by **Grasshoff *et al.* (1983)** was used for determination of dissolved oxygen (DO). The method used for the determination of chemical oxygen demand (COD) was described by **Fujimori *et al.* (2001)**. The biological oxygen demand (BOD) determination was carried out in seawater samples following the procedure described by APHA (1985), while it was filtered before analyzing NO2-N, NO3-N and SiO4 and kept under deep freeze until their analysis in the laboratory. The determination of nitrite and nitrate described by **Grasshoff (1976)**, while ammonia (NH4-N) and dissolved silicate compound is based on the method described by **Koroleff (1983)**. Chlorophyll-a was measured according to the method described by **Strickland and Parsons (1972)**. The measurements of dissolved nutrient salts (NO_2-N, NO_3-N, NH_4-N, SiO_4) and Chlorophyll-a, as well as total nitrogen and total phosphorus, were performed using a Shimadzu double beam spectrophotometer UV- 150-02. Ion exchange techniques have been the most commonly applied methods in determining the labiality of heavy metals in water samples (Chelex-100 ion exchange) (**Van Veen *et al.*, 2002; Gardner and Van Veen, 2004**). The concentration of these metals in the final acidic extracts was measured using a GBC-932 Ver. 1.1 atomic absorption spectrophotometer in the flame mode.

Validation and quality control method

For heavy metals analysis; all reagents used were of analytical grade, Milli-Q water was used throughout the study, the glassware used was soaked in detergent, rinsed with water, soaked in 15% nitric acid for five days, rinsed with Milli-Q water and kept in the oven at 110°C till need. Seawater samples were collected in previously acid-washed polyethylene bottles. The method of validation and quality control samples were done by using reference material (NASS-5, National Research of Council of Canada). The accuracy ranged from 90 to 110%, while precision agreed within 10%. The detection limits calculated by four determinations (in duplicate) in one batch of synthetic seawater. These limits (expressed in microgram metal per liter) 0.045 for Fe, 0.009 for Zn0.03 for Cu, and 0.007 for Pb.

5. Zooplankton estimation:

Zooplankton samples collected from 5 stations represented the following habitats: St 1&2 (Coastal zone with depth 10-50 m), St 3&4 (Shelf zone with depth between 50 and 100 m) and offshore station St 5 has a depth more than 200 m, 3 samples collected from each station through a vertical haul for the upper 50m water depth and this carried out using standard plankton net of 25µm meshes. The vertical haul is made by lowering the net to the desired depth and hauled slowly upwards. The sample collected is from the water column transversed by the net. The samples taken with closing nets are analysed to study zooplankton abundance at different depths. The volume of the water filtered is normally expressed in cubic meters. It is calculated as follows:

The volume is V = A * d

Where A = Mouth area of the net and d = Depth of haul.

All the species in the sample were preserved in 5% neutralized formalin solution, Sample concentrated to 100ml which examined under a binocular microscope to identify all the species in the sample. We took subsample to the counting chamber to count the species; this operation repeated three times, the obtained average count was expressed in terms of individual.m-3. The identification of zooplankton species carried out by consulting the following references: Giesbrecht (1892), Sars (1918), Jorgensen (1924), Rose (1933), Sewell (1948), Tregouboff and Rose (1957), Edmondson (1959), Newell (1963, 1979), Gonzalez and Bowman (1965), Williamson (1967), Marshall (1969), Boltovskoy (1999), and Conway *et al.* (2003).

RESULTS

Taxonomy

Kingdom: Animalia – Animal, animaux, animals

Subkingdom: Bilateria

Infrakingdom: Deuterostomia

Phylum: Chordata – cordés, cordado, chordates

Subphylum: Vertebrata – vertebrado, vertébrés, vertebrates

Infraphylum: Gnathostomata

Superclass: Tetrapoda

Class: Mammalia (Linnaeus, 1758) – mammifères, mamífero, mammals

Subclass: Theria (Parker and Haswell, 1897)

Infraclass: Eutheria (Gill, 1872)

Order: Cetacea (Brisson, 1762)

Suborder: Mysticeti (Flower, 1864) – baleen whales

Family: laenopteridae (Gray, 1864) – rorquals

Genus: *Balaenoptera* (Lacépède, 1804) – rorquals, finback whales, baleen whales

Species: *Balaenoptera Bryde*

Morphometric and morphological features

The specimen of *Balaenoptera Bryde* whale was a male which measured 12.33 m **(Fig. 2)**, the specimen was found dead on the shore of Mediterranean Sea, Alexandria, Egypt on the first of January 2018. Body, dorsal fin, pectoral fin and caudal fin morphometric measurements (Table 1) obtained using Image j software V1.46.

Diagnostic feature: Dark smoky grey dorsally, white ventrally; straight rostrum with three longitudinal ridges; auxiliary ridges appear as depressions to the tip of the rostrum; dark grey lower jaws.

The ratios of those measurements represented in **(Table 1)** revealed that the fork length represents 82.73% of total body length while the body depth, head length and caudal fin length occupying 34.47, 18.73 and 16.06% respectively. In the same manner, eye diameter, as well as spiracle diameter, was represented 2.60 and 2.16%, respectively, of head length.

Fig. 2. Head of *Balaenoptera bryde* whale, which was found dead on the shore of Mediterranean Sea, Alexandria, Egypt on 1/1/2018.

Protein, carbohydrate and lipid content:

Muscle tissue obtained from 3 different parts from the caudal fin of *Balaenoptera brydei* and analyzed for their protein, carbohydrate and lipids content to reveal the health state of the specimen which revealed that the sample was at good health condition with protein, carbohydrate and lipids content average 3.55, 0.845 and 0.877 (g /100 g wet wt.) respectively as showed in **(Table 3)**.

Table 1. Morphometric measurements of the *Balaenoptera brydei* which was found dead on the shore of the Mediterranean Sea, Alexandria, Egypt on 1/Jan./2018. All measurements are given in meters

Measurements	Cm	Measurements	Cm
Total length (TL)	1233	**Left caudal lobe base (LD)**	97
Fork length (FL)	1020	**Right caudal lobe (LA)**	104
Head length (HL)	231	**Left Post-ventral margin (LP)**	30
Body depth (BD)	425	**Right Post-ventral margin (RP)**	28
Eye diameter (ED)	7.75	**Left caudal lobe base (LD)**	91
Spiracle Dimeter (SD)	10	**Right caudal lobe base (RD)**	98
Caudal fin Length (Caud. L)	198	**Left Inner fork (LIF)**	7.5
Dorsal fin anterior Margin (Dors. E)	80	**Right inner fork (RIF)**	7.1
Dorsal fin Width (Dors. F)	45	**Pectoral fin anterior margin (Pect. E)**	132.01
Dorsal fin upper posterior margin (Dors. H_1)	60.17	**Pectoral fin total Width (Pect. F)**	42
Dorsal fin lower Posterior margin (Dors. H_2)	18.87	**Pectoral fin upper posterior margin (Pect. H1)**	54.57
Dorsal fin posterior margin (Dors. I)	72.14	**Pectoral fin lower Posterior margin (Pect. H2)**	45.1
Dorsal fin height (direct) (Dors. K)	72.84	**Pectoral fin posterior margin (Pect. I)**	96.15
Dorsal fin height (absolute) (Dors. L)	71.86	**Pectoral fin height (direct) (Pect. K)**	113.47
Dorsal fin anterior margin height (Dors. Ah)	12.18	**Pectoral fin height (absolute) (Pect. L)**	66.34
Upper posterior margin convex depth (Dors. Dh)	7.07	**Pectoral fin anterior margin height (Pect. Ah)**	11.9
Dorsal fin upper posterior Margin concave depth (Dors. Eh)	2.27	**Pectoral fin upper posterior margin convex depth (Pect. Dh)**	1.92
Dorsal fin posterior margin depth (Dors. Bh)	13.33	**Pectoral fin upper posterior Margin concave depth (Pect. Eh)**	11.47
Dorsal fin angle (Dors. J°)	79.65	**Pectoral fin angle (Pect. J°)**	31.53

Table 2. Ratios represented by morphometric measurements of the *Balaenoptera edeni*, which was found dead on the shore of mediterranean sea, Alexandria, Egypt on 1/1/2018. All measurements are given in meters

Ratios	%	Ratios	%
FL/ TL	82.73	**LA/RA**	93.27
BD/TL	34.47	**LP/RP**	107.1
HL/TL	18.73	**LD/RD**	92.86
Caud. L/ TL	16.06	**LIF/RIF**	105.6
ED/HL	2.60	**Pect. L/ Pect. F**	158
SD/HL	2.16	**Pect. L/ Pect. E**	50.25
Dors. L/ Dors. F	159.7	**Pect. Ah/ Pect. E**	9.01
Dors. L/ Dors. E	89.83	**Pect. L/ Pect. K**	58.46
Dors. Ah/ Dors. E	15.23	**Pect. H2/ Pect. H_1**	82.65
Dors. L/ Dors. K	98.65	**Pect. Dh/ Pect. H_1**	3.52
Dors. Bh/ Dors. I	18.48	**Pect. Eh/ Pect. H_1**	21.02
Dors. H2/ Dors. H_1	31.36		
Dors. Dh/ Dors. H_1	11.75		
Dors. Eh/ Dors. H_1	3.77		

Table 3. Total protein, carbohydrate and lipid (g /100 g wet wt.) in the muscle of caudal fin of *Balaenoptera brydei* whale

Chemical composition	Muscle	
Total Protein	Range	3.4-3.65
	Average ± SD	3.55±0.13
Total Carbohydrate	Range	0.84-0.92
	Average ± SD	0.845±0.007
Total Lipid	Range	0.87-0.88
	Average ± SD	0.877±0.005

mt DNA

Analysis of *m*tDNA sequence clearly revealed that the tissue DNA sample belonging to *Balaenoptera brydei* Species. Based on 299 bp (Br51) mtDNA control region sequences. The evolutionary history was inferred using the Neighbor-Joining method **(Saitou and Nei, 1987)**. The optimal tree with the sum of branch length = 0.02416040 is shown. The percentage of replicate trees in which the associated taxa clustered together in the bootstrap test (1000 replicates) are shown next to the branches **(Felsenstein, 1985).** The tree is drawn to scale, with branch lengths in the same units as those of the evolutionary distances used to infer the phylogenetic tree. The evolutionary distances were computed using the Tamura 3-parameter method **(Tamura, 1992)** and are in the units of the number of base substitutions per site. The analysis involved 4 nucleotide sequences. Codon positions included were 1st+2nd+3rd+Noncoding. All positions containing gaps and missing data were eliminated. There was a total of 593 positions in the final dataset. Evolutionary analyses were conducted in MEGA6 **(Tamura *et al.*, 2013) (Fig. 3)**. The estimates of evolutionary divergence between sequences based on the number of base substitutions per site from between sequences has been obtained.

(Fig. 3) shows phylogenetic relationships among 3 DNA sequence, one from this work and two belonging to *Balaenoptera Bryde* species and one mtDNA sequence for *Balaenoptera physalus* as an outgroup from close species. The tree shows the clustering of tow clades corresponding to 2 haplotypes belonging to 2 types of baleen whales one is *Balaenoptera brydei* and the other **is** *Balaenoptera physalus*. Within the 299 bp length sequences (Total number of sites (excluding sites with gaps / missing data): 298. Variable (polymorphic) sites: 14 (2.36 %). Haplotype diversity (h) and nucleotide diversity (Per site) (π) were 0.500 and 0.01180, respectively. Nucleotide composition was clearly biased towards A–T. The mean values of T, C, A and G within the sequence data are 25.5, 21.8, 33.3 and 19.4%, respectively. all clades including individuals belonging to the same species had almost near 100% value with 1000 bootstrap.

Generally, we reported a high level of congruence between current established taxonomic boundaries and the aggregation of DNA barcode sequences in NJ tree's branches, for investigated species.

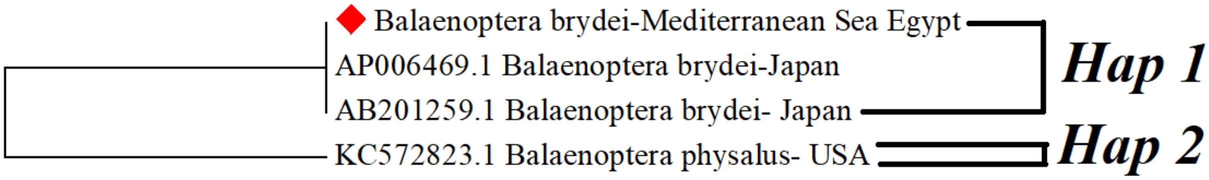

Fig. 3. Molecular Phylogenetic analysis using neighbor joining

Environmental conditions

The water temperatures ranged from 20.50 to 21°C (Table 1), while hydrogen ion concentration (pH) of the different stations was slightly alkaline and ranged from 7.91 ±0.01 to 7.99±0.01. The salinity of the water was around 37 PSU. While the concentration of dissolved oxygen was ranged from 6.05 ±0.07 mg/l at station 1 and 6.30±0.28 mg/l at station 5. The chemical oxygen demand (COD) was between 3.40±0.21 mg/l detected at station 5 and 3.55 ±0.07 mg/l at station 3. The variation of the biological oxygen demand (BOD) was not clear between different stations its average values ranged between 2.35±0.07 to 2.52 ±0.11 mg/l **(Table 4)**. The average values of NH_4 fluctuated between 0.49±0.08 mg/l at station 5 and 0.58 ±0.04 at station 3, NO_2 and NO_3 showed the same trend of NH_4 variations (Table 1). fluctuated between 0.28±0.21 in station 3 and 1.04±0.14 mg/l at station 5. Chlorophyll-a concentration (Chl-a) is considered as a good indicator of the phytoplankton biomass, it exhibited lower value at station 4 (0.15±0.02 mg/l), while the highest value (0.21±0.03 mg/l) was recorded at station 5 (Table 1). Generally, station 5 that lies away from the coastline was showed the optima environmental conditions among the studied stations.

Table 4. Average and standard deviation of Physico-chemical characteristics of the study area of the Mediterranean Sea

Parameters	**Stations**				
	St. 1	**St. 2**	**St. 3**	**St. 4**	**St. 5**
Temperature (°C)	20.50 ±0.71	21.00 ±1.41	20.50 ±0.71	20.00±0.00	21.00±0.00
pH values	7.95 ±0.07	7.91 ±0.01	7.97 ±0.05	7.99±0.01	7.96±0.06
Salinity (‰)	37.00 ±0.00	37.25 ±0.35	37.00 ±0.00	36.50 ±0.71	37.05±0.07
DO (mg/l)	6.05 ±0.07	6.10 ±0.14	6.15 ±0.07	6.18±0.04	6.30±0.28
COD (mg/l)	3.46 ±0.07	3.46 ±0.01	3.55 ±0.07	3.46±0.21	3.40±0.21
BOD (mg/l)	2.45 ±0.07	2.52 ±0.11	2.48 ±0.07	2.35±0.07	2.40±0.21
NH_4 (mg/l)	0.57 ±0.03	0.55 ±0.04	0.58 ±0.04	0.51±0.02	0.49±0.08
NO_2 (mg/l)	0.05 ±0.00	0.04 ±0.01	0.05 ±0.01	0.05±0.02	0.03±0.01
NO_3 (mg/l)	0.88 ±0.02	0.89 ±0.01	0.85 ±0.01	0.78±0.03	0.81±0.06
SiO_4 (mg/l)	0.65 ±0.55	1.00 ±0.08	0.28 ±0.21	0.66±0.62	1.04±0.14
Chl-a (mg/l)	0.19 ±0.02	0.19 ±0.05	0.17 ±0.05	0.15±0.02	0.21±0.03

Heavy metal distributions

The average values of iron (Fe) concentration in the study area are shown in Table 2, it was ranged from 16.05±6.33 µgl^{-1} at station 5 to 10.51±4.93 µgl^{-1} at station 3, while the copper profile concentration is ranged from 0.75 to 2.94 µgl^{-1}. The results revealed wide variation in the distribution of Zn concentrations, it varied between 12.46 and 26.85 µgl^{-1}. While lead (Pb) concentrations generally ranged between 2.05 and 2.52 µgl^{-1} **(Table 5)**.

Table (5): Average and standard deviation of the measured heavy metals in the study area.

Parameters	**Stations**				
	St. 1	**St. 2**	**St.** 3	**St.** 4	**St.** 5
Iron, Fe (µgl^{-1})	13.41±4.81	14.63±9.84	10.51±4.93	14.45±2.04	16.05±6.33
Copper, Cu (µgl^{-1})	2.88±1.38	2.45±0.29	0.75±0.50	2.94±1.49	2.42±0.11
Zinc, Zn (µgl^{-1})	25.90±2.66	12.46±6.89	19.34±9.45	26.85±2.62	13.46±1.59
Lead, Pb (µgl^{-1})	2.52±0.11	2.05±0.64	2.46±0.11	2.44±0.16	2.16±0.40

Zooplankton community

During the present study there were 231 different forms of zooplankton organisms recorded from 5 stations perpendicular on the coastline from the point where the whale was encountered; with an average count was 13460 individuals/m^3. The recorded fauna was belonging to several groups; the most dominant were Tintinnida and Copepoda which represented by 88 and 78 species, respectively, in addition to the copepod nauplius larvae and the immature stages. On the other hand, there were 17 forms of Appendicularia. While Cnidaria expressed by 6 species of Siphonophora and 5 Hydromedusa, meanwhile it noticed the presence of 5 Ostracoda species. Chordata expressed by fish eggs, fish larvae and 4 Thaliacea. Cladocera and Mollusca represented by 4 species for each. Three Euphausiids species were recorded in addition to their larvae. However, there were 3 species belonging to each of Chaetognatha, Amphipoda and Annelida and 2 Decapoda, whilst Cirripedia, Echinodermata, Isopoda, Mysida and Nematoda were each represented by one species **(Table 6)**.

Copepoda was the most abundant group with average counts of 9277 individuals/m^3 which represented 68.9% of total zooplankton abundance followed by Tintinneda which estimated by 2001 individuals/m^3 and 14.86%. There was a total average of 741 individuals/m^3 annelids and 5.51%. While Appendicularia ranked in the fourth position with total average counts 571 individuals/m^3 represented 4.24% of total zooplankton. On the other side, the remaining groups formed collectively 871 individuals/m^3 and 6.47% of total zooplankton abundance **(Fig. 4)**.

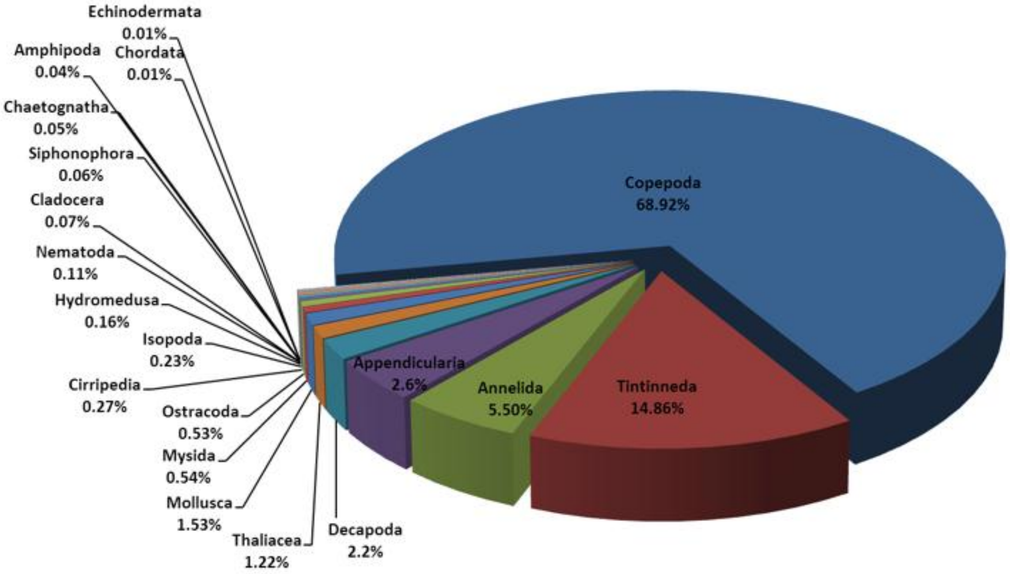

Fig. 4. The percentage of different recorded zooplankton groups in the present study

Ten copepods considered the most dominant and formed collectively 52% of the adult copepod species, they were *Oithona nana*, *Euterpina acutifrons*, *Paracalanus parvus*, *Microsetella norvegica*, *Subeucalanus subcrassus*, *Acartia (Acartia) negligens*, *A. clausi*, *Clausocalanus furcatus* and *O. plumifera* with average species count was 154 individuals/m^3, while copepod nauplius larvae and the immature forms represented 68% of total copepod counts with 6308 individuals/m^3. The most dominant tintinneds were *Codonellopsis morchella*, *Eutintinnus lusus-undae*, *Dadayiella ganymedes*, *Undella hyaline*, *Steenstrupiella steenstrupii*, *Tintinnopsis radix*, *Amphorides amphora*, *Amphorellopsis tetragona*, *Epiplocylis blanda*, *Eutintinnus fraknoii* and *Leprotintinnus nordgvisti* with 51% of total tintinneds count and average density was 92 individuals/m^3. The highest density was observed in the inshore area but sustained the lowest number of species. In contrast, the offshore sites had the lowest population density and the highest species diversity with the presence of a large number of oceanic forms (**Fig. 5**).

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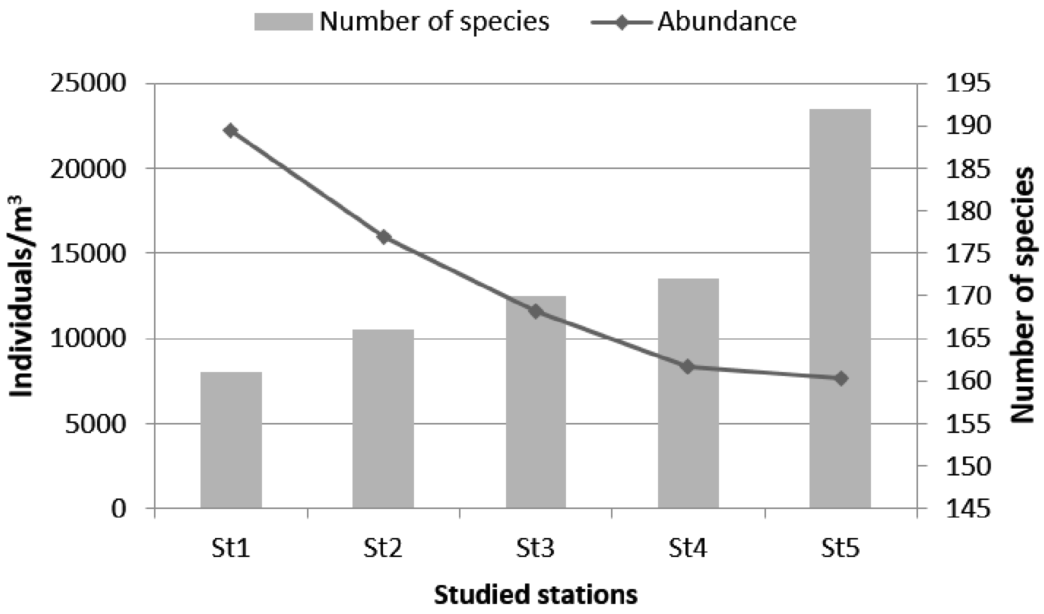

Fig. 5. Relation between zooplankton species abundance and their diversity at the studied sites

Table 6. Checklist of the recorded zooplankton species during the present study

Copepoda

Acartia (Acartia) negligens Dana, 1849
Acartia (Acartiura) clausi Giesbrecht, 1889
Acartia (Acartiura) longiremis (Lilljeborg, 1853)
Acartia (Acanthacartia) fossae Gurney, 1927
Acartia latisetosa (Krichagin, 1873)
Acrocalanus gibber Giesbrecht, 1888
Acrocalanus gracilis Giesbrecht, 1888
Agetus typicus Krøyer, 1849
Calanopia elliptica (Dana, 1849)
Calanus helgolandicus (Claus, 1863)
Calocalanus aculeatus Shmeleva, 1987
Calocalanus contractus Farran, 1926
Calocalanus pavo (Dana, 1852)
Calocalanus styliremis Giesbrecht, 1888
Candacia simplex (Giesbrecht, 1889)
Candacia truncata (Dana, 1849)
Candacia varicans (Giesbrecht, 1893)
Centropages elongatus Giesbrecht, 1896
Centropages kroyeri Giesbrecht, 1893
Centropages orsinii Giesbrecht, 1889
Centropages violaceus (Claus, 1863)
Clausocalanus arcuicornis (Dana, 1849)
Clausocalanus furcatus (Brady, 1883)
Clausocalanus pergens Farran, 1926
Calocalanus styliremis Giesbrecht, 1888
Corycaeus (Onchocorycaeus) agilis Dana, 1849
Corycaeus speciosus Dana, 1849
Cosmocalanus darwinii (Lubbock, 1860)
Ctenocalanus vanus Giesbrecht, 1888
Oithona fallax Farran, 1913
Oithona nana Giesbrecht, 1893
Oithona oculata Farran, 1913
Oithona plumifera Baird, 1843
Oithona robusta Giesbrecht, 1891
Oithona setigera Dana, 1852
Oithona similis Claus, 1866
Oithona tenuis Rosendorn, 1917
Oncaea lacinia Heron, English & Damkaer, 1984
Oncaea media Giesbrecht, 1891
Oncaea mediterranea (Claus, 1863)
Oncaea venusta Philippi, 1843
Paracalanus parvus (Claus, 1863)
Phaenna spinifera Claus, 1863
Pleuromamma gracilis Claus, 1863
Scolecithrix danae (Lubbock, 1856)
Subeucalanus crassus (Giesbrecht, 1888)
Subeucalanus monachus (Giesbrecht, 1888)
Subeucalanus subcrassus (Giesbrecht, 1888)
Temora discaudata Giesbrecht, 1889
Temora stylifera (Dana, 1849)
Triconia conifera (Giesbrecht, 1891)
Triconia minuta (Giesbrecht, 1893)
Triconia similis (Sars G.O., 1918)
Nubilius larvae
copepodiet stages

Tintinneda

Acanthostomella minutissima Kofoid & Campbell, 1929
Amphorella intumescens Jörgensen, 1924
Amphorellopsis tetragona (Jörgensen, 1924) Kofoid &

Dioithona rigida Giesbrecht, 1896
Euaetideus giesbrechti (Cleve, 1904)
Eucalanus attenuatus (Dana, 1849)
Euchaeta marina (Prestandrea, 1833)
Euterpina acutifrons (Dana, 1847)
Farranula carinata (Giesbrecht, 1891)
Farranula concinna (Dana, 1849)
Farranula curta (Farran, 1911)
Farranula gracilis (Dana, 1849)
Farranula rostrata (Claus, 1863)
Goniopsyllus rostratus Brady, 1883
Haloptilus longicornis (Claus, 1863)
Heterorhabdus papilliger (Claus, 1863)
Ischnocalanus plumulosus (Claus, 1863)
Isias clavipes Boeck, 1865
Macrosetella gracilis (Dana, 1847)
Mecynocera clausi Thompson I.C., 1888
Microsetella norvegica (Boeck, 1865)
Microsetella rosea (Dana, 1847)
Monstrilla sp. Dana, 1849
Nannocalanus minor (Claus, 1863)
Neocalanus gracilis (Dana, 1852)
Neocalanus robustior (Giesbrecht, 1888)
Neocalanus tenuicornis (Dana, 1849)
Nitokra lacustris (Shmankevich, 1875)

Campbell, 1929
Amphorides amphora (Claparède & Lachmann, 1858)
Amphorides quadrilineata (Claparède & Lachmann, 1858)
Codonaria cistellula (Fol, 1884) Kofoid & Campbell, 1929
Codonella galea Haeckel, 1873
Codonella nationalis Brandt, 1906
Codonella perforate Entz Sr., 1884
Codonellopsis ecaudata (Brandt, 1906)
Codonellopsis americana Kofoid & Campbell, 1929
Codonellopsis contracta Kofoid & Campbell, 1929
Codonellopsis morchella (Cleve, 1900) Jörgensen, 1924
Codonellopsis orthoceras (Haeckel) Jörgensen, 1924
Codonellopsis ostenfeldi (Schmidt, 1902) Kofoid & Campbell, 1929
Coxliella ampla (Jörgensen) Brandt, 1907
Coxliella laciniosa (Brandt, 1906) Brandt, 1907
Coxliella longa Kofoid & Campbell, 1929
Cyttarocylis brandti Kofoid & Campbell, 1929
Cyttarocylis cassis (Haeckel) Fol, 1881
Cyttarocylis magna (Brandt, 1906) Kofoid and Campbell, 1929
Dadayiella ganymedes (Entz, 1884) Kofoid & Campbell, 1929
Dictyocysta mitra Haeckel, 1873
Dictyocysta obtusa Jörgensen, 1924
Dictyocysta speciosa Jörgensen, 1924

Epiplocylis atlantica Kofoid and Campbell, 1929
Epiplocylis blanda (Jörgensen, 1924) Kofoid & Campbell, 1939
Epiplocylis undella (Ostenfeld and Schmidt) Balech, 1962
Eutintinnus eleggans (Jörgensen) Kofoid & Campbell, 1939
Eutintinnus fraknoii (Daday, 1887) Kofoid and Campbell, 1939
Eutintinnus latus (Jörgensen) Kofoid and Campbell, 1939
Eutintinnus lusus-undae (Entz) Kofoid and Campbell, 1939
Eutintinnus macilentus (Jörgensen) Kofoid and Campbell, 1939
Eutintinnus pinguis (Kofoid & Campbell, 1929) Kofoid & Campbell, 1939
Eutintinnus tubulosus (Ostenfeld) Kofoid and Campbell, 1939
Eutintinnus sp.
Favella azorica (Cleve) Jörgensen, 1924
Favella campanula (Schmidt, 1902) Jörgensen, 1924
Favella ehrenbergii (Claparède & Laachmann, 1858(
Favella panamensis Kofoid & Campbell, 1929
Helicostomella edentata (Fauré-Fremiet, 1924)
Helicostomella subulata (Ehrenberg, 1833) Jörgensen, 1924
Leprotintinnus nordqvistii (Brandt, 1906) Kofoid & Campbell, 1929
Leprotintinnus simplex Schmidt, 1902
Metacylis annulifera (Ostenfeld & Schmidt) Kofoid & Campbell, 1929
Metacylis mediterranea (Mereschkowsky) Jörgensen, 1924
Parundella caudata (Ostenfeld, 1899) Jörgensen,

Steenstrupiella steenstrupii (Claparède & Lachmann, 1858) Kofoid & Campbell, 1929 Kofoid and Campbell, 1929
Tintinnopsis nana Lohmann, 1908
Tintinnopsis aperta Brandt, 1906
Tintinnopsis beroidea Stein, 1867
Tintinnopsis buetschlii Daday, 1887
Tintinnopsis cylindrica Daday, 1887
Tintinnopsis elongata Daday, 1887
Tintinnopsis lindeni Daday, 1887
Tintinnopsis lobiancoi Daday, 1887
Tintinnopsis nudicauda (corniger) (Paulmier, 1997
Tintinnopsis platensis Lebwohl, 1914
Tintinnopsis radix (Imhof, 1886) Brandt, 1907
Tintinnopsis strigosa A. Meunier, 1919
Tintinnopsis sp.
Undella clevei Jörgensen, 1924
Undella hadai Balech, 1962
Undella hemisphaerica Laackmann, 1910
Undella hyalina Daday, 1887
Undella ostenfeldi Kofoid & Campbell, 1929
Xystonella lohmanni(Brandt) Kofoid and Campbell, 1929
Xystonella longicauda (Brandt, 1906) Laackmann, 1911
Xystonellopsis anthropomorpha Paulmier, 1972
Xystonellopsis brandti (Laackmann) Jörgensen, 1924

Appendicularia

Appendicularia sicula Fol, 1874
Oikopleura (Vexillaria) albicans (Leuckart, 1853)
Oikopleura (Vexillaria) cophocerca (Gegenbaur, 1855)
Oikopleura (Vexillaria) dioica Fol, 1872
Oikopleura (Coecaria) fusiformis Fol, 1872
Oikopleura (Coecaria) longicauda (Vogt, 1854)
Oikopleura (Coecaria) gracilis Lohmann, 1896
Oikopleura (Vexillaria) parva Lohmann, 1896
Fritillaria aequatorialis Lohmann, 1896
Fritillaria borealis Lohmann, 1896
Fritillaria formica Fol, 1872

Proplectella acuta Jörgensen, 1924
Proplectella angustior (Jörgensen, 1924) Kofoid and Campbell, 1929
Proplectella claparedei (Entz, 1908)
Proplectella ellipsoida Kofoid & Campbell, 1929
Proplectella globosa Kofoid & Campbell, 1929
Proplectella ostenfeldi Kofoid & Campbell, 1929
Proplectella ovata Jörgensen, 1924
Proplectella pentagona (Jörgensen, 1924) Kofoid and Campbell, 1929
Rhabdonella amor (Cleve) Brandt, 1906
Rhabdonella conica Kofoid and Campbell, 1929
Rhabdonella elegans Jörgensen, 1924
Rhabdonella hebe (Cleve) Brandt, 1907
Rhabdonella spiralis ((Fol, 1881)) Kofoid and Campbell, 1929
Salpingella acuminata (Claparède and Lachmann, 1858) Jorgensen, 1924
Salpingella attenuate Kofoid & Campbell, 1929
Salpingella decurtata Jörgensen, 1924
Salpingella gracilis Kofoid & Campbell, 1929
Steenstrupiella gracilis (Jörgensen, 1924) Kofoid & Campbell, 1929

Fritillaria haplostoma Fol, 1872
Fritillaria borealis intermedia Lohmann, 1905
Fritillaria megachile Fol, 1872
Fritillaria pellucida (Busch, 1851)
Folia gracilis Lohmann, 1892
Stegosoma magnum (Langerhans, 1880)

Chaetognatha

Sagitta friderici Ritter-Záhony, 1911
Sagitta serratodentata Krohn, 1853
Sagitta enflata Grassi, 1881

Amphipoda

Hyperia latissima Bovallius, 1889
Parathemisto oblivia (Krøyer)
Gammarus marinus Leach, 1815

Decapoda

Lucifer typus H. Milne Edwards, 1837
Zoea of Decapoda

Mysida

Mysis relicta Lovén, 1862

Chordata

Thaliacea

Doliolum denticulatum Quoy & Gaimard, 1834
Salpa fusiformis Cuvier, 1804
Salpa maxima Forskål, 1775
Thalia democratica (Forskål, 1775)

Fish eggs
Fish larvae

Cladocera

Evadne spinifera P.E. Müller, 1867
Evadne tergestina Claus, 1864
Penilia avirostris Dana, 1849
Podon polyphemoides (Leuckart, 1859)

Cnidaria

1- Hydromedusa

Aglaura hemistoma Péron & Lesueur, 1810
Obelia spp. Péron & Lesueur, 1810
Phialidium hemisphaericum (Linnaeus, 1767)
Solmundella bitentaculata (Quoy & Gaimard, 1833)
Liriope tetraphylla (Chamisso & Eysenhardt, 1821)

Euphausiids

Euphuasis sp.
Meganyctyphanes norvigica
Thysonoess gregaria
Euphausiaces larvae

2- Siphonophora

Eudoxoides spiralis (Bigelow, 1911)
Chelophyes appendiculata (Eschscholtz, 1829)
Lensia conoidea (Keferstein & Ehlers, 1860)
Lensia subtilis (Chun, 1886)
Lensia subtilis (Chun, 1886)
Muggiaea kochii (Will, 1844)

Echinodermata

Ophiothrix fragilis (Abildgaard in O.F. Müller, 1789)

Ostracoda

Cypridina (Vargula) mediterranea (Costa, 1845)
Conchaecia haddoni (Brady & Norman, 1896)
Conchaecia curta (Lubbock, 1860)
Conchoecia obtusata (Sars, 1866)
Philomedes globosus (Lilljeborg, 1853) Sars, 1869

Annelida

Polychaete larvae
Polychaete spionid larvae
Polychaete species

Isopoda

Isopod species

Cirripedia

Larvae of cirripeds

Nematoda

Free living nematodes

DISCUSSION

The morphometric measurements could contribute to ongoing animal biology and taxonomic studies **(Hussey *et al.,* 2009** and **Başusta and Başusta, 2015).** Our specimen was male measured at 12.33 m, which agreed with **(Evans, 1987)** who mentioned that, at physical maturity, the coastal form off South Africa averages 13.1 m (43 ft) for males and 13.7 m for females, while the South Africa offshore form averages 13.7 and 14.4 m. The coastal form near Japan is slightly smaller, with adult males averaging 12.9 m (42 ft). At sexual maturity, males average 11.9 m. meaning that our specimen is an adult male.

The dorsal fin height measures reached 72.84 cm which slightly agreed with **(Best, 1977)** who reported that the Bryde's whales have an upright, falcate dorsal fin is up to 46.25 cm in height.

The caudal fin muscle of *Balaenoptera brydei* has high protein content in comparison to lipid and carbohydrate content which agreed with **(O'Hara *et al.,* 2004)** who mentioned that, the skeletal muscle of bowhead whale is a poor (<5%) source of fat, dietary fiber, and carbohydrate but provides approximately 45% of needed protein.

According to **Notarbartolo di Sciara (2001)**, there are fourteen whale species have been recorded in the Mediterranean; Cuvier’s beaked whale *Ziphius cavirostris* G. Cuvier 1823, fin whale *Balaenoptera physalus* (Linnaeus 1758), long-finned pilot whale *Globicephala melas* (Traill 1809), sperm whale *Physeter macrocephalus* (*P. catodon*) Linnaeus 1758, Blainville’s beaked whale *Mesoplodon densirostris* (Blainville 1817), dwarf sperm whale *Kogia sima* (Owen 1866), false killer whale *Pseudorca crassidens* (Owen 1846), humpback whale *Megaptera novaeangliae* (Borowski 1781), killer whale *Orcinus orca* (Linnaeus 1758), minke whale *Balaenoptera acutorostrata* Lacépède 1804, North Atlantic right whale *Eubalaena glacialis* (Müller 1776), northern bottlenose whale *Hyperoodon ampullatus* (Forster, 1770), sei whale *Balaenoptera borealis* Lesson 1828 and Sowerby’s beaked whale *Mesoplodon biden*s (Sowerby 1804). They have been reported from scattered areas along the Mediterranean Sea such as off Algeria, Egypt, France, Greece, Israel, Italy, Malta, Morocco, Spain, Tunisia, Turkey, and through the Strait of Gibraltar. Among them, the only first four species have been well-known throughout the Mediterranean Sea (fin whale, sperm whale, Cuvier’s beaked whale, and long-finned pilot whale). All other species encountered occasionally, instantiated by vagabond individuals of the Red Sea and North Atlantic populations (**Notarbartolo di Sciara, 2001**) with no known Mediterranean population. For the last decades, we noticed that the number of invading species is known to grow with time may be due to several reasons include climate changes, global warming, and food lack.

Studies conducted in the recent decade have interested the taxonomic status of Bryde’s whales and discriminating different forms and species **(Wada & Numachi, 1991; Best, 1977, Best, 2001; Wada *et al.,* 2003, Sasaki *et al.,* 2006; Hussey *et al.,* 2009, Kato & Perrin, 2009)**. Nevertheless, as a particular deduction has not been attained yet on the taxonomic status or management based on different species or forms of the many regions such as western South Atlantic specimens **(Committee on Taxonomy, 2011)**.

In South Africa, **Best (1977)** specified two allopatric shapes of Bryde's whales being known as offshore and inshore whales. The offshore form is found in water over 50 miles off the coast, and perform a latitudinal winter migration to the equatorial regions. In contrary, the inshore form limited to the first 20 miles of the coastal region and found year-round. Both forms have differences in distribution, seasonality, food type, possibly breeding behaviour, life history, scarring, body size, and baleen shape (**Best, 2001**).

The morphometric measurements could assist in continuing zoological taxonomic and biology studies **(Hussey *et al.*, 2009** and **Başusta and Başusta, 2015)**. Some author used the baleen measurements description of **Best (1977)** for classification of offshore Bryde's whale specimen such as **Zerbini *et al.* (1997)**, where the length-width ratio of the baleen plate does not exceed 2.24 in offshore ecotypes but in inshore ecotypes, it is more than 2.25. Our specimen was adult male measured 12.33m which agreed with **Evans (1987)** who noted that, at physical maturity, the South Africa coastal and offshore males of Bryde's whales average 13.1m and 13.7m respectively, while females are 13.7m and 14.4m, whereas near Japan the adult coastal forms are somewhat smaller averaging 12.9m, with length of 11.9m at first sexual maturity. The dorsal fin height measures 72.84cm which slightly agreed with **Best (1977)** who mentioned that the Bryde's whales have an upright, falcate dorsal fin that is up to 46.25cm in height.

Classical taxonomy relies primarily on morphological characteristics to elucidate the phylogenetic relations among organisms. Recently, the molecular approach based on comparing nucleotide sequences of RNA and DNA open a new era in phylogenetic analysis. Both the classical morphology-based methods and molecular taxonomy methods are of importance as the basic bio-molecular framework of all organisms are similar, and morphology of an organism is actually the manifestations of its genome and transcriptome profiles. A combination of the morphological based methods and molecular analysis-based methods thus strengthens the exercise of the determination of phylogenetic relationships of organisms to a great extent **(Patwardhan *et al.*, 2014)**. The present results, based on sequencing analysis of the 299 bp control region of mtDNA (Br51) which was conducted using the primers MT4. The phylogenetic relationships derived from the present molecular data indicated that the investigated sample is *Balaenoptera brydei.*

It is challenging to differentiate *Balaenoptera brydei* (Bryde's whales) in the wild from *B. borealis* (sei whales), but the difficulty is slightly-low when distinguishing them from *B. physalus* (fin whales), given the unnoticeable variations in external morphology (physical characteristics), including colouration, body shape and morphometric (**Cummings, 1985; Jefferson *et al.*, 2008; Smultea *et al.*, 2010**). According to **Williamson (1975**) Sei whale (*Balaenoptera borealis*) was not discriminated from Bryde's whales pre 1967. Our specimen was misidentified as *B. physalus* (fin whale) by **Farrag *et al.* (2019a)** depending only on the previous record for fin whale from the Egyptian Mediterranean coast in 1963 as well as the fact that fin whale is a common species for the Mediterranean, the author didn't use any scientific key for whale identification. A lot of historical sightings have not discriminated between sei and Bryde's whales (as well as fin whales in many cases) (**Jefferson *et al.*, 2008**). Bryde's whale confirmation requires a clear view of some characteristics such as lateral longitudinal paired ridges, the shape of the dorsal fin, and balaenopterid central longitudinal ridge (one on each side) (**Omura, 1959, Omura, 1966; Cummings, 1985; Jefferson *et al.*, 2008**). While a single prominent central rostrum ridge characterizes all other balaenopterids, other rorqual whales occasionally emerge auxiliary rostrum ridges that are greatly-reduced (**Jefferson *et al.*, 2008**). Almost this type of whale tends to approach the shore during the winter as recorded by **Kerosky *et al.* (2011)** at inshore of California. This is likely a phenomenon related to climate change and ocean temperatures warming that influence the food distribution and availability as mentioned by (**Learmonth *et al.*, 2006; Kerosky *et al.*, 2011**) for Bryde's whales. The movement closer to the shore may be a behaviour for these whales after long travel as reported by **Smultea *et al.* (2012)** where Bryde's whales off California moves north offshore and then return closer to the shore. Or it may be an occasional case.

The e studied area showed high zooplankton richness as well as high standing crop which indicate that it was rich in nutritional values as it known about the Southeastern Mediterranean **(Zakaria *et al.*, 2007; Aboul Ezz *et al.*, 2014; Abou Zaid *et al.*, 2014; Abo-Taleb, 2010, Abo-Taleb *et al.*, 2016a,b; Abo-Taleb *et al.*, 2018; Ashour *et al.*, 2019; Farrag *et al.*, 2019b; Dorgham, 1997; Gharib, 1998; Dorgham *et al.* 2004; Dorgham, 2011; Abo-Taleb *et al.*, 2015).** Bryde's whales are commonly observed in areas rich in primary productivity (**Croll *et al.*, 2005 and Biggs *et al.*, 2017**), they tend to invade areas of extraordinarily high productivity **(Jefferson *et al.*, 2008)**. Bryde's whales as suggested are opportunistic feeders nourishing upon variety of pelagic fishes species, schooling of small fishes, planktonic crustaceans, euphausiids, cephalopods, copepods and pelagic crabs (**Omura, 1962; Kawamura, 1977; Best، 2001; Tamura, *et al.*, 2009; Kato & Perrin, 2009**), while other researches indicate that Bryde's whales feed mainly (89%) on planktonic euphausiids as a general **(Nemoto and Kawamura, 1977)** or even during a special time of the year (May and June) as mentioned by **Tamura *et al.* (2009)**. **Gallardo *et al.* (1983); Davis *et al.* (2002); Jefferson *et al.* (2008)** noted that Bryde's whales appear to have to favour for habitats with an expectable biological abundance, and this may explain current whale's attraction toward the study area.

The current protein estimate of the samples from the studied whale was high, as well as the high zooplankton density (13460 individuals/m^3) and the high diversity (231 species) in the area where this whale was recorded, strongly rejects the possibility of starvation. In addition, this whale was still alive when detected. On the other hand, the present whale was encountered during winter, it is known that during winter most of Bryde's whales are stranded (**De moura and siciliano, 2012**), especially males than females. There was a significant destination (53.6%) in stranding of sexually mature males (more than 11.12 m) this may be as a result of the influences of severe environmental condition such as strong wind ocean currents would play an significant role in heightening the encounter average of whales ashore, particularly during winter when the currents and winds can force the whale landward (**de moura and siciliano, 2012** It is not expected that the whale drifted towards the shore, which led to the obstruction of its movement and death, as the area in which it was found is characterized by gentle waves movement, and there are no strong and violent winds that help to drift the whale towards the shore and its death. In addition, the nature of the shore's slope in the study area prevents such an assumption. It is worth noting that the whale was detected in open water of the Mediterranean Sea in front of the Egyptian Coast (without identification) before founding it on the beach, and since this species is not previously recorded in the Egyptian Mediterranean coast in particular or in the Mediterranean as a whole, it is likely that this whale has lost its way and missed contact with its peers, which prompted it to commit suicide, a phenomenon previously recorded and known about whales, which is most likely in the case of studied whale.

Along the study area, there are passive fishery activities which can promote a negative impact on the whales, principally in coastal waters. In addition, the study area is responsible for more than 80% of the national oil and petroleum produced and the presence of important large harbours which are associated with the intensive movements of large ships that elevate the risk of whale collision.

B. brydei occurs in the Atlantic, Pacific, and Indian Oceans between the 40th parallels of latitude, preferring highly productive, tropical, subtropical, and warm, temperate waters of 16-22 °C. In the North Pacific, they occur as far North as Honshu to the west and Southern California in the east, with vagrants reported as far north as Washington in the United States. A resident population is found in the Gulf of California and they occur throughout the Eastern Tropical Pacific, including Peru and Ecuador (**Reilly *et al.*, 2008**).

In the North Atlantic, they have been recorded as far north as Cape Hatteras. They occur in the Gulf of Mexico and throughout the wider Caribbean-two specimens from Aruba were found through mtDNA analysis to be firmly placed within *B. brydei* and to form a clade with a specimen from Madeira and individuals of the offshore form of South Africa, but do not occur in the Mediterranean Sea (**Steiner *et al.*, 2007**).

Bryde's whales are common along the southwestern Atlantic Ocean at southeastern Brazilian coast (**De moura and siciliano, 2012**). Worldwide, Bryde's whales are considered as 'data deficient' by the IUCN Red List (**Reilly *et al.*, 2008**) and it has been included in Appendix I of the Convention on International Trade in Endangered Species (**CITES, 2011**), and in Appendix II of the Convention on the Conservation of Migratory Species of Wild Animals (**CMS, 2009**).

Our study showed that, the caudal fin muscle has high protein content in comparison to lipid and carbohydrate content as mentioned by **O'Hara *et al.* (2004)** who showed that, the skeletal muscle of bowhead whale is a poor (<5%) source of fat, dietary fiber, and carbohydrate but provides approximately 45% of needed protein.

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ARABIC SUMMARY

التسجل الأول لحوت برايد (*Balaenoptera brydei*, Olsen, 1913) في جنوب شرق البحر الأبيض المتوسط ، الإسكندرية ، مصر

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٢. المعهد القومى لعلوم البحار والمصايد- الأسكندرية- مصر.
٣. المعهد القومى لعلوم البحار والمصايد- الغردقة- مصر.

يعد انحراف الحيتان نحو الشواطئ أحد الظواهر المعروفة في جميع أنحاء العالم ، ولكنها واحدة من الظواهر القليلة والنادرة في جنوب شرق البحر المتوسط خاصةً قبالة السواحل المصرية ، لذلك فإن حدوث هذه الظاهرة يتطلب دراسات دقيقة متأنية ومفصلة لمعرفة نوع الحوت الجانح وتحديد أسباب انجذابها نحو تلك المنطقة من البحر المتوسط ، وكذلك دافع جنوحها إلى الشاطئ.

في الدراسة الحالية ، تم استخدام عدة طرق لتحديد نوع الحوت ، مثل القياسات المورفومترية المفصلة وكذلك توصيف النمط الظاهري بالإضافة إلى تحليل الحمض الريبوزى النووي النقال. وهذا بالإضافة إلى تحليل المحتوى البيوكيميائي لعينات من الحوت الجانح لمحاولة تحديد حالتها الصحية قبل الجنوح إلى الشاطئ مباشرةً. من ناحية أخرى ، تمت دراسة الخصائص الفيزيائية والكيميائية والإنتاجية للمياه في المنطقة من البحر المتوسط التى تم رصد الحوت بها.

بعد دراسة متأنية تم التعرف على نوع الحوت وهو بالينوبترا برايدي (*Balaenoptera brydei*) لتصحيح ما تم تعريفه مسبقا وأثبتت نتائج الدراسة استبعاد احتمالية الجنوح والوفاه بسبب الجوع أو الانجراف حيث أكد ذلك نتائج الدراسات البيئية بالإضافة إلى المحتوى العالي من البروتين بالعينات المأخوذة من الحوت ، مما عزز افتراض ميل الحوت المعني بالدراسة إلى الإنتحار لتغيير بيئته الطبيعية وفقدان أقرانه.

وبصفة عامة فإن ظاهرة رصد تواجد الحيتان في جنوب شرق البحر الأبيض المتوسط قبالة الساحل المصري قد تزايدت فى العقود الأخيرة مما يجعلها ظاهرة تحتاج إلى مزيد من الدراسات على نطاق واسع.