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1	Immunomodulatory Activity of Black Jinten Oil (<i>Nigella sativa</i>) as Macrophage Activator for <i>Salmonella typhimurium</i> Infected Rat	2020
2	Screening the Reproductive Tract of Dairy Cattle for Pathogenic Micros	2019
3	Human Chorionic Gonadotropin (hCG) from Urine of Pregnant Women to Manipulate in vivo Ovulation and Pregnancy of Madura Cows	2019
4	Anti Early Embryonic Protein (EEP) for Pregnancy Test by Microtiter Strip in Dairy Cows	2019
5	The Effect of Feeding High Level of Protein on Reproductive Performance of Bali Starling.	2019
6	Antisperm Antibody in Repeat Breeder Friesian Holstein Cows at KPSP Setia Kawan Nongkojajar, Tutur District, Pasuruan, Indonesia.	2019
7	Diagnosis of Single and Twin Pregnancy, and Early Embryo Mortality Through Progesterone Level Test on Local Does.	2019
8	Improvement of Pregnancy Rate in Bali Cows with the Combination of Equine Chorionic Gonadotropine (eCG) from Local Pregnant Mare with PGF _{2α} .	2019
9	Progesterone Profile of Dairy Cows which Experienced the Failure of Pregnancy to Artificial Insemination (AI).	2019
10	Effect of Heat Shock Protein (HSP) in Post Thaw Baluran Bull Semen	2018
11	Potency of Mycotoxin Binders on MDA Level, Expressions of Caspase 9 and Caspase 3 in The Uterus of Mice Exposed to Zearalenone	2017



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12	Polymorphism of Growth Hormone Gene in The Artificial Insemination Result of Madura Cattle with Limousin Semen as a Reference for Genetic Selection	2018
13	Implementation of fotogrametry techniques as body mass estimation of indo-pacific bottle nose dolphin (Tursiops aduncus) in bali dolphin lodge	2020
14	Uji Sensitivitas Kebuntingan Sapi Perah Menggunakan Pregnancy Specific Protein B (PSPB) Microtiter Strip dan Progesteron sebagai Gold Standard	2007
15	Estimation of Equine Chorionic Gonadotropin (eCG) concentrate in the Blood Sera of Pregnant Mare	2014
16	Efek Pemberian L-Arginin Terhadap Gambaran Histologi Jumlah Spermatisit Primer pada Mencit (Mus musculus) Setelah Terpapar Suhu Panas	2019
17	Anti Prolactine Overcomes Heat Stress on Laying Hen.	2008
18	Unnatural Forced Moulting in The Laying Hen as Cause of Zoonosis from Salmonella Enteritidis	2009
19	Case Study: Dystocia on Beef Cattle in Kunir Regency of Lumajang District, East Java, Indonesia in 2015 and 2016	2017
20	Teratogenic Effect of Congenital Toxoplasmosis in Chicken Embryo	2017

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Surabaya, 3 April 2023

Wakil Dekan III,

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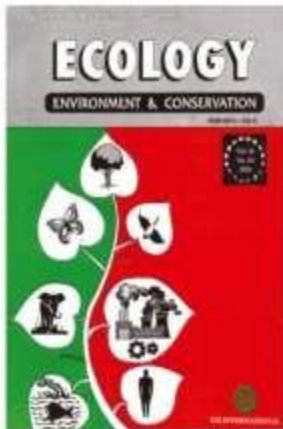
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[Contents](#)

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AVIFAUNA COMPOSITION OF TWO NATURAL AND ARTIFICIAL WETLANDS IN JIJEL REGION OF NORTH-EASTERN ALGERIA (THE BENI HAROUN DAM AND REDJLA MARSH)

Chabou Sarra, Khammar Hichem, Hadjab Ramzi and Saheb Menouar

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POSITIONING OF ENVIRONMENTAL EDUCATION IN LIFE SCIENCES (GRADE 12)

Sikhulile Bonginkosi Msezane

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RESOURCE-SAVING RESTORATION TECHNOLOGIES OF THE DEGRADED IRRIGATED LANDS IN SOUTHEASTERN KAZAKHSTAN

Tastanbek Atakulov, Sagynbay Kaldybaev, Kenzhe Erzhanova and Ashirali Smanov

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IMPORTANCE OF ALDER FORESTS FOR BIRDS IN THE NORTH-EAST OF ALGERIA: COMPOSITION AND STRUCTURE OF BREEDING BIRDS STANDS AND THE EFFECT OF

ECOLOGY, ENVIRONMENT AND CONSERVATION

VOL. 26 (November Suppl. Issue) : 2020

CONTENTS

- S1–S5 Preliminary study of dengue virus serotype on *Aedes* mosquitoes in endemic area, Surabaya, Indonesia, January 2020
—Aulia Azzahra, Lucky Vera Oktavia, Muhammad Fariz Naviyanto, Shifa Fauziyah, Teguh Hari Sucipto, Dwi Winarni, Sri Puji Astutik Wahyuningsih, Siti Churrotin, Ilham Harlan Amarullah and Soegeng Soegijanto
- S6–S11 Remote sensing and GIS based assessment of groundwater potential zones in AMU campus using AHP approach
—S. Said and M. Anees
- S12–S17 Population-level of *Nannochloropsis* sp. as an enrichment diet for marine rotifer *Brachionus rotundiformis* in mass culture tanks
—Putu Angga Wiradana, Mayadita Dwi Sani, Raden Joko Kuncoroningrat Susilo, Arif Nur Muhammad Ansori, Ni Nyoman Sri Septiani, Deny Suhernawan Yusup and Agoes Soegianto
- S18–S22 Experimental study on behaviour of fiber reinforced concrete and fly ash for rigid Pavements
—Jayant Virat and Humaib Nasir
- S23–S28 Availability of ecological resources in power plant Tanjung Tiram Village, South Konawe, Indonesia
—Ferasari Ferasari, La Sara, La Rianda and La Onu La Ola
- S29–S35 Faunal diversity of Kitchen Gardens of Sikkim
—Aranya Jha, Sangeeta Jha and Ajeya Jha
- S36–S40 *Oreochromis mossambicus* accumulates lead without showing growth inhibition
—Sumah Yulaipi, Aunurohim, Arif Luqman, Dewi Hidayati and Agoes Soegianto
- S41–S48 Heavy metal concentration of Chandigarh urban soils due to urbanization in a changing environment: An ecological assessment
—Viney Kumar, Rupinder Kaur and A. N. Singh
- S49–S54 Effect of addition of onion (*Allium cepa* L.) extract in ringer's diluent on spermatozoa quality of *Gallus domesticus* at room temperature
—Sakinato Mazidda, Suyadi and Dyah Hikmawati
- S55–S60 Fish diversity of River Bhagirathi Upstream to Tehri Dam Reservoir, Uttarakhand (India)
—M.S. Rawat, Dhyal Singh and O.P. Gusain
- S61–S64 Size structure and gonad maturity of red snapper *Lutjanus malabaricus* in Pinrang waters, Makassar Strait, South Sulawesi, Indonesia
—Nuraeni L. Rapi, Mesalina Tri Hidayani, Murwantoko, Djumanto and Agoes Soegianto
- S65–S69 A review analysis on environmental factors influencing morphology and behaviour of estuarine Mollusc
—Arundhati Ganguly, Banani Mandal, Arunava Mukherjee and Susanta Kumar Chakraborty
- S70–S78 The influence of ozone exposure on organoleptic and chlorophyll levels of curly lettuce (*Lactuca sativa* L.)
—Suryani Dyah Astuti, Hery Purnobasuki, Miratul Khasanah, Siti Khoiriyatul, Nurul Fitriyah, Deny Arifianto and Fadli Ama
- S79–S83 Growth and nutrient uptake of indian mustard [*Brassica juncea* (L.) Czern and Coss.] genotypes as influenced by nitrogen and sulphur fertilization under irrigated condition
—Harsita Nayak, J. S. Bohra and Shiv Poojan Yadav

- S84–S90 Biofouling colonization on cubic artificial reefs in Pantai Damas, Trenggalek, Indonesia
—Andik Isdianto, Oktiyas Muzaky Luthfi, Shafa Thasya Thaeraniza and Agoes Soegianto
- S91–S97 A study on web asymmetry and prey capture in *Argiope pulchella* Thorell, 1881 (Araneae: Araneidae)
—Sangeeta Das, Jatin Kalita and Nilutpal Mahanta
- S98–S103 The effectiveness of solenoid magnetic fields to reduce precipitation levels of CaCO₃ in hard water
—Fadli Ama, Suryani D. Astuti, Tri A. Prijo, Qod'nu Rahmawati, Yunus Susilo and Rahma A. Puspitasari
- S104–S108 Nutrition-based benefits of Kitchen Gardens: An investigation of gender differences
—Ananya Jha, Sangeeta Jha, Shenga Sherap, Rajlakshmi Mallik and Ajeya Jha
- S109–S113 Potency of phosphate solubilizing mold from rhizosphere soil in Mangrove Center Tuban, Indonesia
—Tini Surtiningsih, Arina Putri Ramadhani, Dinda Rahmi Anindi, Ni'matuzahroh, Tri Nurhariyati and Fatimah
- S114–S122 Investigating local community's perception on tourism development in protected areas: A study on Sunderbans Tiger Reserve, India
—Ananya Ghosh, Pankaj Kumar Tyagi and Pawan Gupta
- S123–S126 Phytochemical in the methanol extract of *Piper sarmentosum*
—Junairiah, Tri Nurhariyati, and Nabilah Istighfari Zuraidassanaaz
- S127–S134 Analysis of water quality status in Bordoibam Bilmukh wetland ecosystem of Assam, India
—Jayanta Sonowal, Kaustubh Rakshit and Debojit Baruah
- S135–S139 Utilization of bagasse and sawdust as bio-based insulation on the walls of the ship's accommodation ceiling
—Tristiandinda Permata, D. Hikmawati, Aurista Miftahatul Ilmah and Jailani
- S140–S144 Prediction of temperature data for Ghataprabha Sub-basin using change factor method
—Bharath A., Preethi S., Manjunatha M., Ranjitha B. Tangadagi and Shankara
- S145–S155 Mapping of land potentially for maize plant in Madura Island-Indonesia using remote sensing data and geographic information systems (GIS)
—Suhartono, Agoes Soegianto and Achmad Amzeri
- S156–S161 Biototoxicity analysis of different doses of *Beauveria bassiana* (Balsamo) Vuillemin against Nymph of *Odontotermes obesus* (R.)
—Anjana Intodia, Arti Prasad and Bharati Veerwal
- S162–S165 The effect of cooking methods to the existence of *Bacillus* sp. spores in beef
—Adityas Putri Pamartha, Mochammad Lazuardi, Nenny Harijani, Agnes Theresia Soelih Estoepongastie, Didik Handijatno, Martia Rani Tacharina and Dadik Raharjo
- S166–S169 Effectiveness of planned teaching programme about 'E-waste management' among Jr. College going students
—Rutuja M. Ghorpade, Nandkumar R. Kakade, Tukaram B. Zagade, Anagha V. Katti and Sneha S. Mahindrakar
- S170–S173 Isolation and identification of fungal infections causing death in leopard gecko's (*Eublepharis macularius*) eggs
—Erwin Nugroho Indhi, Koesnoto Supranianondo, Sri Chusniati, Djoko Legowo, Suryanie Sarudji, Martia Rani Tacharina and Didik Handijatno
- S174–S181 Assessment of elemental Carbon, Nitrogen, Hydrogen and Sulphur in alluvial sediments of River Yamuna in Delhi region
—Vivek Chopra and Jai Gopal Sharma

- S182–S187 Antifugal potency againsts *Candida albicans* (ATCC 10231) and its activity as biosurfactant of WNA 4.1.13 fermented growth of sediment from mangrove Wonorejo Surabaya Indonesia
—C. Rahayuningsih, S. Chusniati, D. Handijatno, L. Maslachah, S. Sarudji and Rahmi Sugihartuti
- S188–S196 A review on impact of coal mining on soil properties and reclamation by organic amendments
—Poonam Poonia, Ram Prasad Choudhary and Sangita Parihar
- S197–S201 Characterization of *Aeromonas hydrophila* bacteria on dumbo catfish (*Clarias gariepinus*) from Bungo Jambi Province, Indonesia
—A. Indrawati, T. Wulandari, F. H. Pasaribu and A. B. Rifai
- S202–S209 *Moringa oleifera* : A potent immune booster in the catastrophe of Covid -19
—Madhumita Bhattacharjee
- S210–S214 Identification of worms in the digestive tract of water monitor lizards through gastrointestinal surgery
—A. N. Faradis, Mufasirin, S. Mulyati, Kusnoto, I. S. Yudaniayanti and E. Suprihati
- S215–S220 GCMS analysis of Phyto Components of the musky smelling *Dendrobium moschatum*
—Dipika Rajput and L.R. Saikia
- S221–S224 Correlation between muara grouper fish weight (*Epinephelus coioides*) with *Anisakis* worm infection level in Mayangan Indonesia
—T. D. Setyaningrum, S. Koesdarto, T. R. Yustinasari, Kusnoto, M. Yunus and E. B. Aksono
- S225–S230 Effect of nitrogen and zinc levels on growth and yield of Basmati rice
—Nirmal Joshi, Shiv Prakash Singh, Tikendra Kumar Yadav and Uppu Sai Sravan
- S231–S237 Isolation of *Actinomycetes* from mangrove sediments at Ujung Pangkah, Gresik, Indonesia
—A. R. Hidayatullah, R. Sugihartuti, D. Handijatno, S. Chusniati, L. Maslachah and S. Sarudji
- S238–S244 Development, environmental impact and green growth: India
—Dheeraj Verma, Vartika Singh, Prodyut Bhattacharya and Jagdish Kishwan
- S245–S247 Description of breeding management Timor deer (*Cervus timorensis*) in Merauke, Papua Province, Indonesia
—K. R. Ismail, Ismudiono, I. N. Triana, P. Srianto, M. Hariadi and S. Utama
- S248–S251 Microgreens: Exciting new food for 21st Century
—Shashank Sharma, Priyanka Dhingra and Sameer Koranne
- S252–S254 Acanthocephala worm detection in cavity body of frog (*Fejervarva cancrivora*) in Surabaya, Indonesia
—S. L. Rahmatika, S. Koesdarto, E. P. Hestianah, E. D. Poetranto, L. T. Suwanti and Kusnoto
- S255–S260 Assessment of spatio- temporal changes in current Jhum cultivation of *Thysanolaena maxima* in Mawthai village of Umsning Tehsil in Meghalaya
—Raymond Wahlang and S. S. Chaturvedi
- S261–S264 Antibiotic resistance profile of *Escherichia coli* isolates collected from cloaca swabs on laying hens in Udanawu Sub-District, Blitar District, Indonesia
—Freshinta Jellia Wibisono, Bambang Sumiarto, Tri Untari, Mustofa Helmi Effendi, Dian Ayu Permatasari and Adriana Mutamsari Witaningrum
- S265–S266 Determination of oil and grease present in the Hussain Sagarlake, Hyderabad, Telangana, India
—Anitha and S. Kedarini
- S267–S270 Isolation and identification of *Lactobacillus* sp. bacteria in asian palm civet (*Paradoxurus hermaphroditus*) feces
—Dinda Jelita Jauharah, Sri Chusniati, Mohammad Anam Al Arif, Wiwiek Tyasningsih, Suryanie Sarudji, Agnes Theresia and Soelih Estoepangestie

-
- S271–S275 Assessment of water quality index for Shivnath river in Durg, Chhattisgarh State, India
—*Sukhpreet Kaur Bhatia and Sumita Nair*
- S276–S280 The effectiveness of antibacterial essential oil of cinnamon (*Cinnamomum burmannii*) on *Staphylococcus aureus*
—*M. L. Hakim, S. Susilowati, M. H. Effendi, W. Tyasningsih, R. Sugihartuti, S. Chusniati and A. M. Witaningrum*
- S281–S285 The impact of consumer's engagement in Pro-environment activities on the preference for green food products
—*Deepika Jindoliya and Gagandeep Nagra*
- S286–S290 Cone maturation timing and seed germination in *Pinus roxburghii* (Serg.) in the central Himalayan region of Uttarakhand, India
—*Amit Mittal, Nandan Singh, Ashish Tewari and Shruti Shah*
- S291–S294 Total plate count of beef meat at traditional markets in south of Surabaya, Indonesia
—*Z. Aminullah, W. P. Lokapirnasari, N. Harijani*, M. H. Effendi, Budiarto and W. Tyasningsih*
- S295–S299 Behaviour of concrete Brick and flyash Brick on infilled frame under cyclic loading
—*K. Senthil, S. Rupali, Ajay Pratap, A. Thakur and A. P. Singh*
- S300–S306 Sero-prevalence and hematological investigation of *Bovine brucellosis* under extreme ecological conditions
—*Aamir Shehzad, Awais Masud, Tabassam Fatima, S. Bibi and Fedik Abdul Rantam*
- S307–S313 Life forms classification and biological spectrum in natural and human impacted ecosystems of Senapati district, Manipur, India
—*Ng Niirou and Asha Gupta*
- S314–S320 Distribution of gastrointestinal parasite in beef cattle through feces examination at Gunung Tabur Sub-District, Berau Regency, Indonesia
—*Rosyida Dwi Rahmawati, Nunuk Dyah Retno Lastuti, Mustofa Helmi Effendi, Setiawan Koesdarto, Soeharsono and Muhammad Yunus*
- S321–S326 Decolorisation of Textile Dyes using Immobilised PPO from Tomato Peel and Pulp
—*Sr. Sandra Horta, Agnel Arul John and S. Parijatham Kanchana*
- S327–S332 The biosurfactant activity of supernatant fermentation broth isolates bacterial origin of Surabaya's Wonorejo mangrove sediment and its potential as an antifungal against *candida albicans* ATCC 10231
—*Bima Widya Pramudianto, Suryanie Sarudji, Rahmi Sugihartuti, Didik Handijanto, Wiwiek Tyasningsih and Eduardus Bimo Aksono*
- S333–S336 Zooplankton diversity in Amaravathi Dam Tirupur District, Tamilnadu, India
—*A. Krishnamoorthi and K. Moorthikumar*
- S337–S342 Implementation of fotogrametry techniques as body mass estimation of Indo-pacific bottle nose dolphin (*Tursiops aduncus*) in Bali dolphin lodge
—*Muhammad Adifian Latif, Amar Ma'ruf, Erma Safitri, Yeni Dhamayanti, Soeharsono and Boedi Setiawan*
- S343–S344 Iron removal of water by using different parts of *Musa paradisiaca*
—*K. S. Beenakumari*
- S345–S350 Trace element contamination in fruits and vegetables grown in low nutrient availability soil environment by using inductively coupled plasma mass spectrometry
—*N. Swathi, P. Padmavathi and N.V.S. Venugopal*
- S351–S356 Biopigments and Rubisco expression under Heavy metal stress in *Spirulina platensis*
—*Ameesh Dev Singh and Gajendra Pal Singh*

- S357–S359 Systematic survey on population of *Gyps himalayensis* in Hirpora Wildlife Sanctuary, Jammu and Kashmir, India
—Hameem Mushtaq Wani, Mustahson F. Fazili, Samina A. Charoo and Riyaz Ahmad
- S360–S368 Experimental study of biomedical waste incinerator using input-output method: A case study of biomedical waste incinerator at Etmadpur, Agra, India
—Sandeep Kumar Verma, N.B. Singh, C.N. Tripathi and P.K. Sharma
- S369–S377 Quantifying and mapping sediment retention ecosystem services in a mountain landscape of Southern Western Ghats, India
—Shiju Chacko, C. Ravichandran, Jikku Kurian and S.M. Vairave
- S378–S381 Wastewater characterization of grossly polluted textile industries located at main stem of River Ganga in Uttar Pradesh, India
—Ajit Kumar Vidyarthi, Pankaj Kumar, Surindra Negi and Vipin Kumar
- S382–S386 Performance analysis of existing sewage treatment plants in Prayagraj, Uttar Pradesh
—Ajit Kumar Vidyarthi and Raj Kishore Singh
- S387–S392 Floristic cortege of the genre *Lavatera* a Malvaceae for the two species: *Lavatera maritima* and *L. flava* in the region of sabra (Tlemcen, Western of Algeria)
—Ghalem Sarra, Hassani Faiçal, Bensouna Amel, Khatir Hadj and Aouadj Sid Ahmed
- S393–S396 Surface water quality and pollution load in river Kali-east: A tributary of river Ganga, India
—Ajit Kumar Vidyarthi, Vivek Rana, Garima Dublish, Prabhat Ranjan and Mrinal Kanti Biswas
- S397–S407 Assessment of water quality of Choyyia Nadi (River) Catchment area in Bijnor District, Uttar Pradesh, India
—Matta Gagan, Rajput Ayush, Rajput Akshay, Kumar, Pawan, Kumar, Avinash, Nayak, Anjali, Kumar Ajendra, Dhingra, Gulshan K., Chauhan Avnish, Chadha, Sanjeev Kumar and Wats, Meenu
- S408–S414 Flowering pattern and floral architecture of Wild and cultivated varieties of Jamun (*Syzygium cumini* L.) for pollination and productivity
—Eswarappa, G. and Somashekar, R.K.
- S415–S422 The rate of absorption of carbon dioxide and moisture content in Linggua (*Pterocarpus Indicus* Willd.) for climate change management
—Gun Mardiatmoko, Jacob Kailola, Radios Simanjuntak and Agustinus Kastanya
- S423–S427 Ecological significance of plant life forms of an urban green space of Purulia Region, West Bengal, India
—Rimi Roy, Manideepa Bhattacharya, Barsha Baral and Deblina Das Modak
- S428–S433 A study of the risk of ground water pollution by shallow septic tank system in Aligarh, India
—Sohail Ayub, Md. Meraj Faisal and Pushpendra Kumar Sharma
- S434–S438 Preliminary analysis of fungal macroflora in Madras Christian College vegetation and ecological aspects
—Mirfath Jahan, Jeya Rathi J., Kumar M. and Santhosh S.
- S439–S443 Biodecolorization of reactive red HE7B and reactive orange 3R through Indigenous bacterial isolate *Microbacterium oryzae* strain JC8 isolated from textile effluent
—Ravi Kant Rahi and Varsha Gupta

Implementation of fotogrametry techniques as body mass estimation of Indo-pacific bottle nose dolphin (*Tursiops aduncus*) in Bali dolphin lodge

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ABSTRACT

This study was aimed to estimate the body mass of Indo-Pacific bottlenose dolphins through photogrammetric techniques. Dolphins are animal listed in Appendix 2 according to Convention on International Trade in Endangered of Wild Fauna and Flora (CITES), which must be considered for its sustainability. Poor management of dolphins will causes stress. Morphometrics measurements need to be done to see the body condition of the dolphin. The data used are Indo-Pacific bottlenose dolphins that are captured in the Bali sea under professionally managed care. Dolphins are photographed with lateral and ventral position. Photographs result will be measured at a lateral position with lateral lengths, L1, L2, L3, and L4. Measurement at the ventral position are ventral lengths, D1, D2, D3, and D4. The measurement data obtained by reading with ImageJ then calibrated and analyzed with simple linear regression. From the results of regression analysis of dolphins weighted in the lateral position with L2 has a value ($R^2 = 0.984$) and lateral position with D2 ($R^2 = 0.958$).

Key words: Fotogrametry techniques, Body mass estimation, Indo-pacific bottle, *Tursiops aduncus*

Introduction

Indonesia is a country that has vast marine wealth. Indonesia's sea area according to the Ministry of Maritime Affairs and Fisherie is around 3.25 million km² and 2.5 million km² Exclusive Economic Zone (EEZ). Indonesian marine waters have a rich marine life of more than 2,200 species of reef fish and are crossed by a variety of species, including sea turtles and mammals (Estradivari, 2017). The ordo of marine mammals consists of three orders, i.e. Cetaceans, Carnivores and Sirenians. The Cetacean ordo is one of the marine mammals that crosses Indonesian marine waters. The Cetacean order has 33 species, and 17 species including family Delphinidae

(Mustika, 2015; Mira, 2013). The waters of the Bali island in particular, there were 16 species of Cetacean ordos that crossed (Mustika, 2015).

The Indo-Pacific bottlenose dolphin (*Tursiops aduncus*) according to the Convention on International Trade in Endangered of Wild Fauna and Flora (CITES) is included in the Appendix II category. Animals belonging to the category Appendix II are animals that are not threatened with extinction, but are threatened with extinction if traded without a clear rule. Cetacean conservation which aims to protect and maintain the stability of the cetacean population, especially the Indo-Pacific bottle nose dolphins (*Tursiops aduncus*), needs to be of more concern. Specifically in the body condition

and stress level management of Indo-Pacific bottlenose dolphins (*Tursiops aduncus*) for their survival (Read, 1993).

Knowledge about the size and body condition of cetaceans can be used to determine nutritional status in individuals (Cornick, 2016). Body measurements and health monitoring in the overall Atlantic Nose Dolphins (*Tursiops truncatus*) population as a reference for evaluating the health condition of the body in the wild (Hart, 2013). Opportunities to measure regularly from Indo-Pacific bottlenose dolphins (*Tursiops aduncus*) are rare.

Predictive tools for estimating body size and growth patterns have been developed. Growth patterns and body size reference ranges for body conditions can be used to evaluate and compare entire populations (Read, 1993; McFee, 2012). Conducted morphometric measurements to estimate the weight of the Atlantic Bottlenose Dolphin (*Tursiops truncatus*) (Lauderdale, 2019). Morphometric measurements were carried out on wild sea animals and captive animals. Wild sea animals are measured on the health assessment of capturing and releasing wild animals, while animals that are captive using a trainer handled, show results that can be used to predict body weight with $R^2 = 0.937$. This value has a meaning of 0.937 or 93.7% influenced by body length, and body circumference, while 7.3% is the result of a reduction of the total percentage of accuracy of the estimated weight of 100%. The value of 7.3% is explained by other causes.

Photogrammetry is a technique that involves measuring morphometry through photography techniques. This technique is appropriate to reduce any threat to animals because it does not require excessive handling of animals (Krause, 2017). Photogrammetry can be used to estimate the mass and volume of wildlife, such as pinnipeds (Beltran, 2018). The dorsal fin of Hector's dolphins (*Cephalorhynchus hectori*) by photogrammetric techniques (Webster, 2010). The dorsal fin length of the Hector dolphin (*Cephalorhynchus hectori*) is accurate enough to measure the surface area of dorsal fin when compared with the height of the dorsal fin Hector dolphin (*Cephalorhynchus hectori*). The prediction of the weight of the Indo-Pacific bottlenose dolphin (*Tursiops aduncus*) through photogrammetric techniques there is no research data. This is the reason for estimating the weight of Indo-Pacific bottle nose dolphins (*Tursiops aduncus*) using body measurements of the Indo-Pacific bottle nose dol-

phins (*Tursiops aduncus*) through photogrammetric techniques.

Materials and Methods

The research material used was seven Indo-Pacific bottlenose dolphins (*Tursiops aduncus*). The equipment used in this study includes measuring tape, remote shutter, stationery, monopod and Canon 50D camera with EF-S lens 10-18mm f / 4,5-5,6 IS STM.

Indo-Pacific animals are bottlenose dolphins (*Tursiops aduncus*), five males and two females. Animals are in a cage in the middle of the sea. Handling of animals is carried out by trainers who are on site, so it is easier to do the process of taking photos. Handling is done in seawater using a special whistle.

The process of taking pictures is done on a cage using a 50D canon camera, remote shutter and wide cannon lens EF-S lens 10-18 mm f / 4,5-5,6 IS STM along with a monopod. Shooting was done 50 times with a distance of 2.5 meters from animals and a 1.5 meter long monopod. Animals are fully photographed lateral and ventral positions of the anterior and posterior parts. The picture is taken with an auto focus method that is centered on animals

This study was analyzed by the method of reading data from photos in the form of pixels with Image-J and then converted to cm based on the calibration results. Weight estimation was analyzed using paired sample t tests, multiple linear regression in SPSS version 25.

Results and Discussion

Measurement and calibration of the body circumference and length

The measurement of the body circumference is done with 8 positions, as shown in Figure 1 on the left side are L1, L2, L3, L4 in lateral position on the right side in ventral position are D1, D2, D3, D4. The measurement results in the pixels form which then calibrated with a measuring tape measured the number of pixels. Repetition was done in 10 times for each position. Figure 1 showed that there were different site of body circumference measurement by the number of the position. The lateral position resulting the letter marks such as A, B, D, E, F, G, H, I, J and T marks. The ventral position resulting the

letter marks such as A, C, J, K, L, M, N, O, P, Q, R, S and T marks. Remarks A is end of rostrum, B is the point parallel to dorsal fin, C is pectoral fin sinister, D is cranial dorsal fin, E is ventral point perpendicular to D, F is apex dorsal fin, G is ventral point perpendicular to F, H is caudal dorsal fin, I is ventral point perpendicular to H, J is median notch, K is cranial pectoral fin sinister, L is cranial pectoral fin dexter, M is caudal pectoral fin sinister, N is caudal pectoral fin dexter, O is pectoral fin dexter, R is genital organs, P is cranial sinister point, Q is cranial dexter point, S is anus and T is flukes (tail).

The results of the calibration of the indo-pacific bottle nose dolphin thoracic circumference (*Tursiops aduncus*) are presented in Tables 1 and 2. The cali-

bration results need to be multiplied 2 to fulfill the third table. The calibration results need to be multiplied twice to fulfill the third table. The multiplication results are presented in Table 3. Calibration results for indo-pacific bottle nose dolphins (*Tursiops aduncus*) are presented in Table 4.

Multiple linear regression equations

The equation of multiple regression lines results from multiple linear regression analysis. Beta coefficient shows the relationship between the independent variable and the dependent variable. Beta coefficients are used to make linear regression equations. Weight estimation can be done with a large R^2 value. The greater the value of R^2 , the stronger the

Table 1. The result of callibration in lateral length data of indo-pacific bottle nose dolphin (*Tursiops aduncus*)

Name	Mean of Lateral Length Pixel	Lateral Length Calibration	Mean of Ventral Pixel Length	Ventral Length Calibration
Apollo	3810.61±173.35	277.13±13	3690.81±214.23	268.10±15.56
Ardhan	2880.22±191.12	209.22±13.88	3075.98±80.07	223.44±5.82
Jasmin	3026.00±77.56	219.81±5.63	2917.67±23.38	211.94±1.70
Marco	3171.87±88.70	230.40±6.44	3192.73±73.14	231.92±5.31
Rig	3220.79±121.44	233.96±8.82	2946.11±130.81	214.00±9.50
Rose	3270.45±55.32	237.59±4.02	3337.00±65.40	242.42±4.75
Triton	3436.76±115.12	249.64±8.36	3400.10±43.51	246.98±3.16

Table 2. The result of callibration in ventral circumference data of indo-pacific bottle nose dolphin (*Tursiops aduncus*)

Name	Pixel D1	Calibration D1	Pixel D2	Calibration D2	Pixel D3	Calibration D3	Pixel D4	Calibration D4
Apollo	377.60±32.45	27.43±2.36	443.74±31.75	32.23±2.81	393.67±27.50	28.60±2.00	946.87±59	68.78±6.45
Ardhan	337.60±22	24.52±1.83	380.93±20.47	27.67±1.49	322.53±14.40	23.43±1.05	908.07±29.35	65.96±2.13
Jasmin	370.92±20.86	26.94±1.52	433.00±13.35	31.45±0.97	339.83±6.50	24.69±0.47	902.87±33.10	65.58±2.40
Marco	339.73±14.33	24.68±1.04	405.03±17.09	29.42±1.24	354.13±7.30	25.72±0.53	880.67±18.53	63.97±1.35
Rig	309.61±16.29	22.49±1.18	383.86±19.48	27.88±1.42	317.75±13.69	23.08±0.99	633.47±31.83	46.01±2.31
Rose	332.23±3.52	24.13±0.26	4460.60±13.94	32.44±1.01	304.10±11.62	22.09±0.84	782.07±37.17	56.81±2.70
Triton	351.78±6.51	25.55±0.47	457.73±9.89	33.25±0.72	365.33±10.72	26.54±0.78	797.80±29.95	57.59±2.18

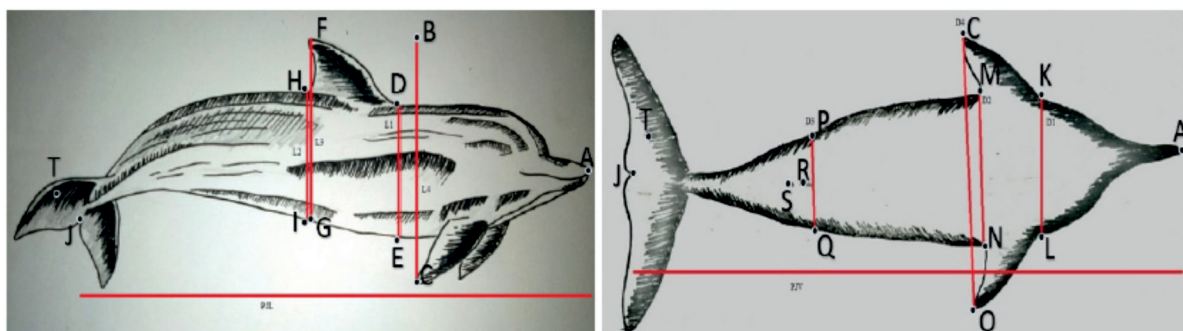


Fig. 1. Site of measurement of the indo-pacific bottle nose dolphin (*Tursiops aduncus*) in lateral view on the left side and in ventral view on the right side (Personal documentation, 2019)

regression model's ability is obtained or the stronger it is to estimate dolphin weight (*Tursiops aduncus*). The results of the regression analysis and the value of R² are presented in Table 5.

The results of multiple linear regression analysis have a large R² value above 80%. Lateral length measurements with chest circumferences L1, L2, L3, L4, D1, D2, D3 and D4 have R² values of more than 90%. Measurement of ventral length with chest cir-

cumferences L1, L2, L3, L4, D1, D2, D3 and D4 have R² values of more than 80%. The value of R² is not much different from the value of R² measurements using a measuring tape, which is equal to 0.933 or 93% (Lauderdale, 2019).

The regression equation with the largest R² value is owned by PJLL2 (R² = 0.984) with the equation $bb = 113,932 + 0.593PJL - 0.257L2$ and PJLD2 (R² = 0.958) with the bb equation = $112.788 + 0.551 PJL -$

Table 3. The result of callibration in ventral circumference data after multiplied twice of indo-pacific bottle nose dolphin (*Tursiops aduncus*)

Name	Pixel L1	Calibration L1	Pixel L2	Calibration L2	Pixel L3	Calibration L3	Pixel L4	Calibration L4
Apollo	720.93±46.82	52.37±3.40	700.80±47.84	50.91±3.47	1030.8±74.88	74.88±5.16	10383.6±169.29	100.5±12.30
Ardhan	528.63±51.49	28.40±3.74	520.67±45.60	37.82±3.31	790.67±90.49	57.43±6.57	1054.5±27.69	76.60±2.01
Jasmin	686.82±16.18	49.89±1.18	683.20±22.54	49.63±1.64	916.50±26.53	66.57±1.96	1048.8±59.40	76.18±4.31
Marco	632.60±22.98	45.95±1.67	601.43±22.05	43.69±1.60	931.73±36.82	67.68±2.67	1182.80±47.26	85.92±3.43
Rig	549.53±16.44	39.85±1.19	551.53±22.57	40.06±1.64	803.93±26.97	58.40±1.96	947.00±23.21	68.79±1.69
Rose	596.10±26.41	43.30±1.92	569.76±18.06	41.39±1.31	818.87±28.05	59.48±2.04	966.70±39.58	70.22±2.88
Triton	630.10±24.65	45.77±1.79	611.13±22.54	44.39±1.64	898.60±32.02	65.27±2.33	1146.8±20.57	83.30±1.49

Table 4. The result of double multiplication in body circumference measurements of indo-pacific bottle nose dolphin (*Tursiops aduncus*)

Name	L1(cm)	L2(cm)	L3(cm)	L4(cm)	D1(cm)	D2(cm)	D3(cm)	D4(cm)
Apollo	104.74	101.81	149.75	201.01	54.86	64.47	57.19	137.56
Ardhan	76.80	75.64	114.87	153.20	49.05	55.34	46.86	131.92
Jasmin	99.78	99.25	133.15	152.37	53.89	62.91	49.37	131.17
Marco	91.90	87.38	135.36	171.84	49.36	58.84	51.45	127.94
Rig	79.69	80.13	116.79	137.58	44.98	55.77	46.16	92.03
Rose	86.60	82.77	118.96	140.44	48.27	64.88	44.18	113.62
Triton	91.54	88.78	130.55	166.61	51.11	66.50	53.08	115.90

Table 5. The result of multiple linear regression analysis of indo-pacific bottle nose dolphin (*Tursiops aduncus*)

Information	Score R ²	Multiple Regression Equations
PJLL1	0.979	$bb = 112.133 + 0.594PJL - 0.234L1$
PJLL2	0.984	$bb = 113.932 + 0.593PJL - 0.257L2$
PJLL3	0.965	$bb = 111.414 + 0.582PJL - 0.136L3$
PJLL4	0.955	$bb = 107.007 + 0.519PJL + 0.011L4$
PJLD1	0.964	$bb = 120.009 + 0.551PJL - 0.375D1$
PJLD2	0.958	$bb = 112.788 + 0.551 PJL - 0.188D2$
PJLD3	0.954	$bb = 107.267 + 0.530PJL - 0.022D3$
PJLD4	0.955	$bb = 109.322 + 0.528PJL - 0.022D4$
PJVL1	0.819	$bb = 106.002 + 0.524PJL + 0.034L1$
PJVL2	0.822	$bb = 103.722 + 0.517PJL + 0.079L2$
PJVL3	0.823	$bb = 103.858 + 0.500PJL + 0.083L3$
PJVL4	0.819	$bb = 107.597 + 0.518PJL + 0.018L4$
PJVD1	0.833	$bb = 121.884 + 0.570PJL - 0.471D1$
PJVD2	0.820	$bb = 110.86 + 0.549PJL - 0.113D2$
PJVD3	0.835	$bb = 100.335 + 0.466PJL + 0.445D3$
PJVD4	0.904	$bb = 120.472 + 0.598PJL - 0.236D4$

0.188D2. The average estimation results, if the values of PES, L2 and D2 are included in the equation are 231.01 and 231.73; while the average body weight is 231.71.

The body weight PJLL2 equation has a difference of 0.7. The results of paired analysis of the t test sample has 0.981 can be interpreted as not having a significant difference. The average PJLD2 equation with an average body weight has a difference of 0.2. The results of paired analysis of the t test sample has 0.982 can be interpreted as not having a significant difference. The results of equation analysis with paired sample t tests are presented in Table 6. The best statistical estimation formula that can be accepted with good results with the largest R² value for multiple regression analysis is PJLL2 with R² value 98.4%; this is in accordance with the position which is mostly done by bottlenose dolphins (*Tursiops sp.*) in the wild are mostly found in lateral measurement positions. Lateral position is the normal position of bottlenose dolphins (*Tursiops sp.*) (Kreb, 2005). The position of bottlenose dolphins (*Tursiops sp.*) Appears to be ventral only for animals that have done well in training (Lauderdale, 2019).

Conclusion

Photogrammetric photo techniques can be used as an alternative way to estimate the weight of the Indo-Pacific bottlenose dolphin (*Tursiops aduncus*) without having to come into direct contact with the

dolphin. Weight estimation can be done using lateral length measurements with measurements of chest circumference L2 (PJLL2), $BW = 113,932 + 0.593PJL - 0.257L2$ ($R^2 = 0.984$) and lateral length with measurement of chest circumference D2 (PJLD2), $BW = 112.788 + 0.551PJL - 0.188D2$ ($R^2 = 0.958$).

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References

- Beltran, R.S., Ruscher-Hill, B., Kirkham, A.L. and Burns, J.M. 2018. An evaluation of three-dimensional photogrammetric and morphometric techniques for estimating volume and mass in Weddell seals *Leptonychotes weddellii*. *PloS one*. 13(1) : e0189865.
- Cornick, L.A., Quakenbush, L.T., Norman, S.A., Pasi, C., Maslyk, P., Burek, K.A., Goertz, C.E. and Hobbs, R.C. 2016. Seasonal and developmental differences in blubber stores of beluga whales in Bristol Bay, Alaska using high-resolution ultrasound. *Journal of Mammalogy*. 97(4) : 1238-1248.
- Estradivari, H. and CN N, F., F., Yusuf, M. and Santiadji, V. 2017. Water Conservation Area: Intelligent Investments for marine biodiversity protection and building Indonesian fisheries. WWF, Jakarta. Indonesia. [Text in Indonesian].
- Hart, L.B., Wells, R.S. and Schwacke, L.H. 2013. Reference

Table 6. The result of analysis on body weight estimation. conventional weight with paired sample t test of indo-pacific bottle nose dolphin (*Torsioops aduncus*)

Information	Estimated Weight (Kg)	Conventional Weight (Kg)	Paired sample t test Results
PJLL1	231.68±11.66	231.71± 11.79	0.959
PJLL2	231.73±11.69	231.71± 11.79	0.981
PJLL3	231.74±11.58	231.71± 11.79	0.974
PJLL4	231.66±11.51	231.71± 11.79	0.953
PJLD1	231.64±11.56	231.71± 11.79	0.930
PJLD2	231.73±11.53	231.71± 11.79	0.982
PJLD3	231.66±11.51	231.71± 11.79	0.956
PJLD4	231.66±11.51	231.71± 11.79	0.961
PJVL1	231.74±10.67	231.71± 11.79	0.988
PJVL2	231.71±10.69	231.71± 11.79	0.998
PJVL3	231.58±10.68	231.71± 11.79	0.945
PJVL4	231.76±10.67	231.71± 11.79	0.983
PJVD1	231.68±10.75	231.71± 11.79	0.984
PJVD2	232.47±10.67	231.71± 11.79	0.703
PJVD3	231.57±10.76	231.71± 11.79	0.940
PJVD4	231.81±11.22	231.71± 11.79	0.947

- ranges for body condition in wild bottlenose dolphins *Tursiops truncatus*. *Aquatic Biology*. 18(1) : 63-68.
- Krause, D.J., Hinke, J.T., Perryman, W.L., Goebel, M.E. and LeRoi, D.J. 2017. An accurate and adaptable photogrammetric approach for estimating the mass and body condition of pinnipeds using an unmanned aerial system. *PloS one*. 12(11) : p.e0187465.
- Kreb, D. 2005. Cetacean diversity and habitat preferences in tropical waters of East Kalimantan, Indonesia. *The Raffles Bulletin of Zoology*. 53(1) : 149-155.
- Lauderdale, L.K., Messinger, C., Wells, R.S., Mitchell, K.A., Messinger, D., Stacey, R. and Miller, L.J. 2019. Advancing the use of morphometric data for estimating and managing common bottlenose dolphin (*Tursiops truncatus*) mass. *Marine Mammal Science*. 35(3) : 875-892.
- McFee, W.E., Adams, J.D., Fair, P.A. and Bossart, G.D. 2012. Age Distribution and Growth of Two Bottlenose Dolphin (*Tursiops truncatus*) Populations from Capture-Release Studies in the Southeastern United States. *Aquatic Mammals*. 38(1).
- Mira, S. 2013. Introduction of Indonesian marine mammals. Directorate of Area and Fish Conservation, Directorate General of Coastal and Small Islands, Ministry of Marine and Fisheries of Indonesia. Jakarta. [Text in Indonesian].
- Mustika, P.L.K., Birtles, A., Everingham, Y. and Marsh, H. 2015. Evaluating the potential disturbance from dolphin watching in Lovina, north Bali, Indonesia. *Marine Mammal Science*. 31(2) : 808-817.
- Read, A.J., Wells, R.S., Hohn, A.A. and Scott, M.D., 1993. Patterns of growth in wild bottlenose dolphins, *Tursiops truncatus*. *Journal of Zoology*. 231(1) : 107-123.
- Webster, T., Dawson, S. and Sooten, E. 2010. A simple laser photogrammetry technique for measuring Hector's dolphins (*Cephalorhynchus hectori*) in the field. *Marine Mammal Science*. 26 (2) : 296-308.
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