

Basic Science for Sustainable Marine Development

PROCEEDING

INTERNATIONAL SEMINAR 2015

Ambon, 3-4 June 2015

Organized by
Faculty of Mathematics and Natural Sciences
Pattimura University



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1st International Seminar of Basic Science, FMIPA Unpatti - Ambon
June, 3rd – 4th 2015

ISBN : 978-602-97522-2-9

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October 2015

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Welcoming Address by The Organizing Committee

The honorable, the rector of Pattimura University

The honorable, the vice rector of academic affair, Pattimura University

The honorable, the vice rector of administration and financial affair, Pattimura University

The honorable, the vice rector of planning, cooperation and information affair, Pattimura University

The honorable, all the deans in Pattimura University

The honorable, the key note speakers and other guests.

We have to thank The Almighty God for the blessings that allow this International seminar can be held today. This is the first seminar about MIPA Science in which the Faculty of MIPA Pattimura University becomes the host. The seminar under the title Basic Science for Sustainable Marine Development will be carried out on 3 June 2015 at Rectorate Building, the second floor. There are 250 participants from lecturers, research institute, students, and also there are 34 papers will be presented.

This International seminar is supported by the amazing people who always give financial as well as moral supports. My special thanks refer to the rector of Pattimura University, Prof. Dr. Thomas Pentury, M.Si, and the Dean of MIPA Faculty, Prof. Dr. Pieter Kakissina, M. Si. I also would like to express my deepest gratitude to Dr. Kotaro Ichikawa, the director of CSEAS Kyoto University, Prof. Bohari M. Yamin, University of Kebangsaan Malaysia, Prof. Dr. Budi Nurani Ruchjana (Prisident of Indonesian Mathematical Society/Indo-MS), Dr. Ir. A. Syailatua, M.Sc (Director of LIPI Ambon), and Hendry Ishak Elim, PhD as the key note speakers. We expect that this international seminar can give valuable information and contribution especially in developing basic science for sustainable marine development in the future.

Last but not least, we realize that as human we have weaknesses in holding this seminar, but personally I believe that there are pearls behind this seminar. Thank you very much.

Chairman

Dr. Netty Siahaya, M.Si.

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Opening Remarks By Dean of Mathematic and Natural Science Faculty

I express my deepest gratitude to The Almighty God for every single blessing He provides us especially in the process of holding the seminar until publishing the proceeding of International Seminar in celebrating the 17th anniversary of MIPA Faculty, Pattimura University. The theme of the anniversary is under the title Basic Science for Sustainable Marine Development. The reason of choosing this theme is that Maluku is one of five areas in Techno Park Marine in Indonesia. Furthermore, it is expected that this development can be means where the process of innovation, it is the conversion of science and technology into economic value can be worthwhile for public welfare especially coastal communities.

Having the second big variety of biological resources in the world, Indonesia is rich of its marine flora and fauna. These potential resources can be treated as high value products that demand by international market. Basic science of MIPA plays important role in developing the management of sustainable marine biological resources.

The scientific articles in this proceeding are the results of research and they are analyzed scientifically. It is expected that this proceeding can be valuable information in terms of developing science and technology for public welfare, especially people in Maluku.

My special thanks refer to all researchers and reviewers for your brilliant ideas in completing and publishing this proceeding. I also would like to express my gratefulness to the dies committee-anniversary of MIPA Faculty for your creativity and hard working in finishing this proceeding, God Bless you all.

Dean of Mathematic and Natural Science Faculty

Prof. Dr. Pieter Kakisina, M.Si.

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Studies on Habitat Use and Vocal Activities of Dugongs by Using Acoustical Analysis

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ABSTRACT

Dugongs, *Dugong dugon*, are one of the marine endangered species ranging from tropical to sub-tropical waters. Distribution pattern and habitat use of dugongs are key factors for space based conservation. Previous studies on passive acoustic monitoring of vocalizing dugongs in Thailand revealed that there was an area especially for acoustic socialization. Identifying and examining habitat use of the vocal hotspot provides deeper insight into the dugong behavior and thus contributes to effective conservation.

Keywords: Dugongs, acoustic

Peaceful co-existence in coastal areas between the human activities such as coastal fisheries and conservation of endangered animals such as dugongs (*Dugong dugon*) is an important matter to be solved for sustainable development of marine resources. Dugongs are herbivorous marine mammal that range throughout tropical to subtropical region (Marsh et al., 2002). They are listed as vulnerable to extinction in the IUCN Red List and the concerns for their extinction are rising day by day.



Fig. 1. A dugong in Thailand

We established a new observational method for the dugongs and accumulated behavioral information of the dugongs in Talibong Island, Thailand. Acoustical characteristics of the dugong calls were described to apply passive acoustical monitoring method (Ichikawa et al., 2006). Dominant frequency of dugong calls ranged from 3-8 kHz, and the duration of the calls was classified roughly in chirps (50-300 ms) and trills (over 300 ms). Vocalization

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intervals were classified in two patterns: 0-5 s and about 20 s between each call. These results suggested that the acoustical analyses on the dugong calls will be a powerful method to locate the vocalizing dugongs.

Automatic underwater sound monitoring systems for dugongs recorded total of 3.453 calls during the 164 h of recording. Autocorrelation of the call rate indicated an attendance cycle of about 24 h, and the most frequent vocalizations were observed from 0300 to 0600 h. Calculated bearings of the sound sources, i.e., dugongs, were used as an indicator to track the relative numbers of dugongs during the monitoring periods to indicate that there were more dugongs in spring tide than in neap tide (Ichikawa et al., 2006).

A playback experiment was conducted to investigate dugongs' call-back behavior. The population in Talibong Island was exposed to 4 different playback stimuli, including a recorded wild dugong's chirp, two kinds of synthesized sound and no sound as a control. Wild dugongs vocalized more frequently after the playback of dugong chirps (2.8 calls/min) than those of constant-frequency (0.55 calls/min) and control (0.2 calls/min) (Fig. 2). Ratio of the dugong chirps among all of the call type during the playback was higher than other non-experimental period. Dugongs were localized on 52 occasions within 25 m range from the playback source. Repeated vocalization of higher-frequency calls has large redundancy and SNR that could enhance the conspecific recognition in the water (Ichikawa et al., 2011).

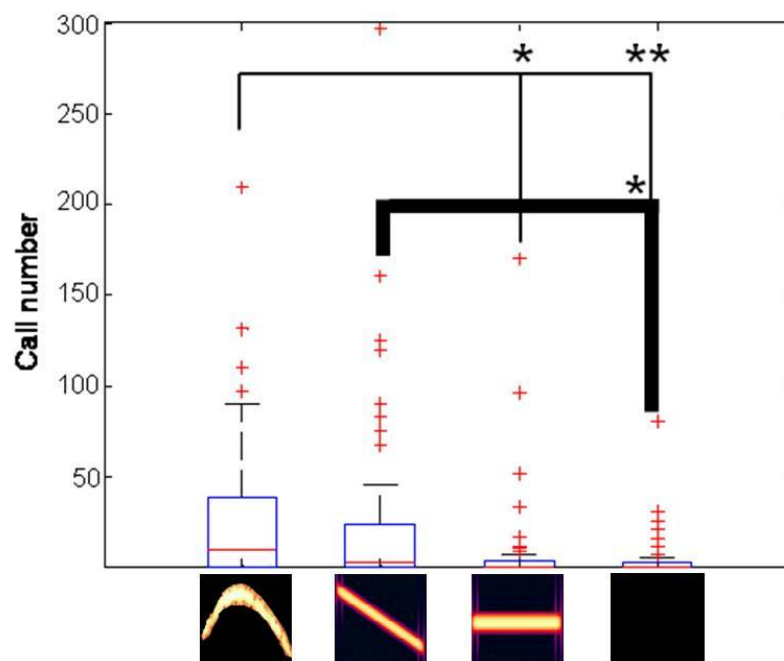


Fig. 2. Number of total call back from dugongs after playbacks of 4 different stimuli

Distribution patterns of vocalising dugongs, solitary and cow-calf pairs of dugongs were described by using aerial surveys, ship-based visual surveys and towed acoustic surveys. Total of 31 hours and 24 minutes of aerial surveys over southern Thai waters were conducted to observe distribution of the dugongs in 2006, 2008 and 2010. We also conducted towed acoustic surveys to observe the distribution of vocalising dugongs. Total of 473 adult dugongs and 122 calves and 223 vocalizations were found. The distribution of vocalising dugongs was clumped with the range of about 1 km². Groups with cow-calf pairs (9 animals on average) were also clumped. Their distribution range was about 3 km² and did not overlap that of vocalising dugongs. Average number of individuals in groups without cow-calf

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pairs was about 1, indicating that the most of the group members were solitary. They distributed widely throughout the focal area with the distribution range of about 41 km² (Fig. 3) (Ichikawa et al., 2012).

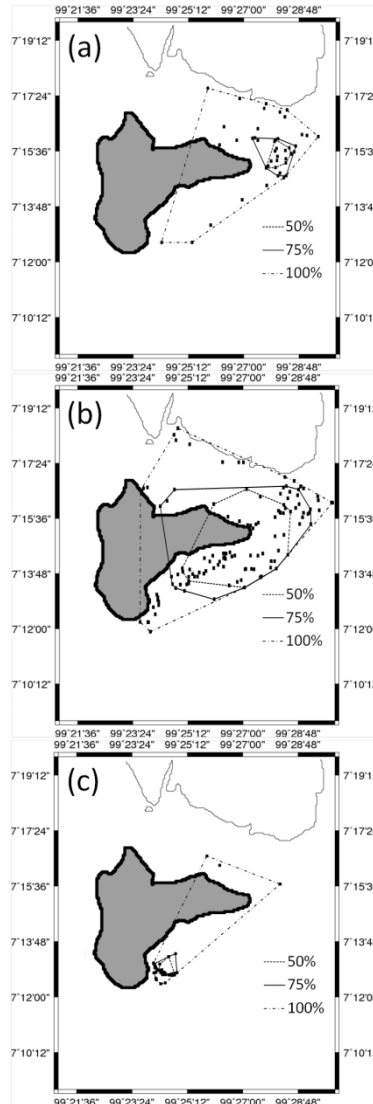


Fig. 3. Distribution patterns of (a) calving herds, (b) non-calving herds, (c) vocalizing dugongs.

The distribution of calving herds and vocalizing dugongs were clumped off Talibong Island while the non-calving herds (most of them were solitary) ranged randomly throughout the focal area. The distribution range (75% minimum convex polygon) of the vocalizing dugongs was mainly used by non-calving herds.

This study provided behavioral ecology of the dugongs and suggested a conceptual framework for the series of processes of determining protection plans.

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