

Sumberdaya hayati laut Sulawesi dan Eksplorasi Potensi Molekuler Mikroba Laut



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Wallacea Line in https://en.wikipedia.org/wiki/Wallacea#/media/File:Indonesia_Wallacea.svg

13 Desember 2022



Webinar Diseminasi Riset APIK Indonesia Network
(Jaringan Ahli Perubahan Iklim dan Kehutanan Indonesia)



As the world's fourth most populous nation, Indonesia depends highly upon protein from the ocean to feed its population.



As Indonesia protects more marine areas, top priority is management: experts

by Basten Gokkon on 14 October 2022



<https://news.mongabay.com/list/business>

- *The Indonesian government has pledged to secure **10% of the country's territorial waters towards biodiversity protection and sustainable use by the end of this decade, and triple the size by 2045.***
- *The move is part of the country's contribution to the global **"30 by 30" conservation goal, which aims to protect 30% of the world's seas and lands by 2030.***

Indonesia Invites G20 Countries to Support Coral Reef Restoration

- The Indonesian government invites G20 countries to jointly carry out coral reef restoration in Indonesia. it is needed **improve coral health conditions in Indonesian seas.**
- "The Ministry of Marine Affairs and Fisheries (KKP) and the Ministry of Environment and Forestry (KLHK) of the Republic of Indonesia: Conservation areas have been proven to protect coastal areas on small islands and create sustainable environmental management.
- **Awareness on the importance of coral reefs had started since 1998** with the existence of The Coral Reef Rehabilitation and Management Program (**Coremap**) with a total investment of more than **170.77 million US dollars.**

Coral Reef in Indonesia

- Etymologically, the term coral reefs refers to coral (the collection of animals from Scleratina order) and reef (sedimentary rocks in the ocean).

Coral reefs are divided into 2:

•**The soft type** is the coral reef that grows along the coast line. This type of coral does not form reefs, and they flourish very well because they get enough sun rays.

•**The hard type** is corals that form calcium stones on seabeds. This type of corals is very fragile to climate changes. This is the main framer of coral reef ecosystem in the sea.

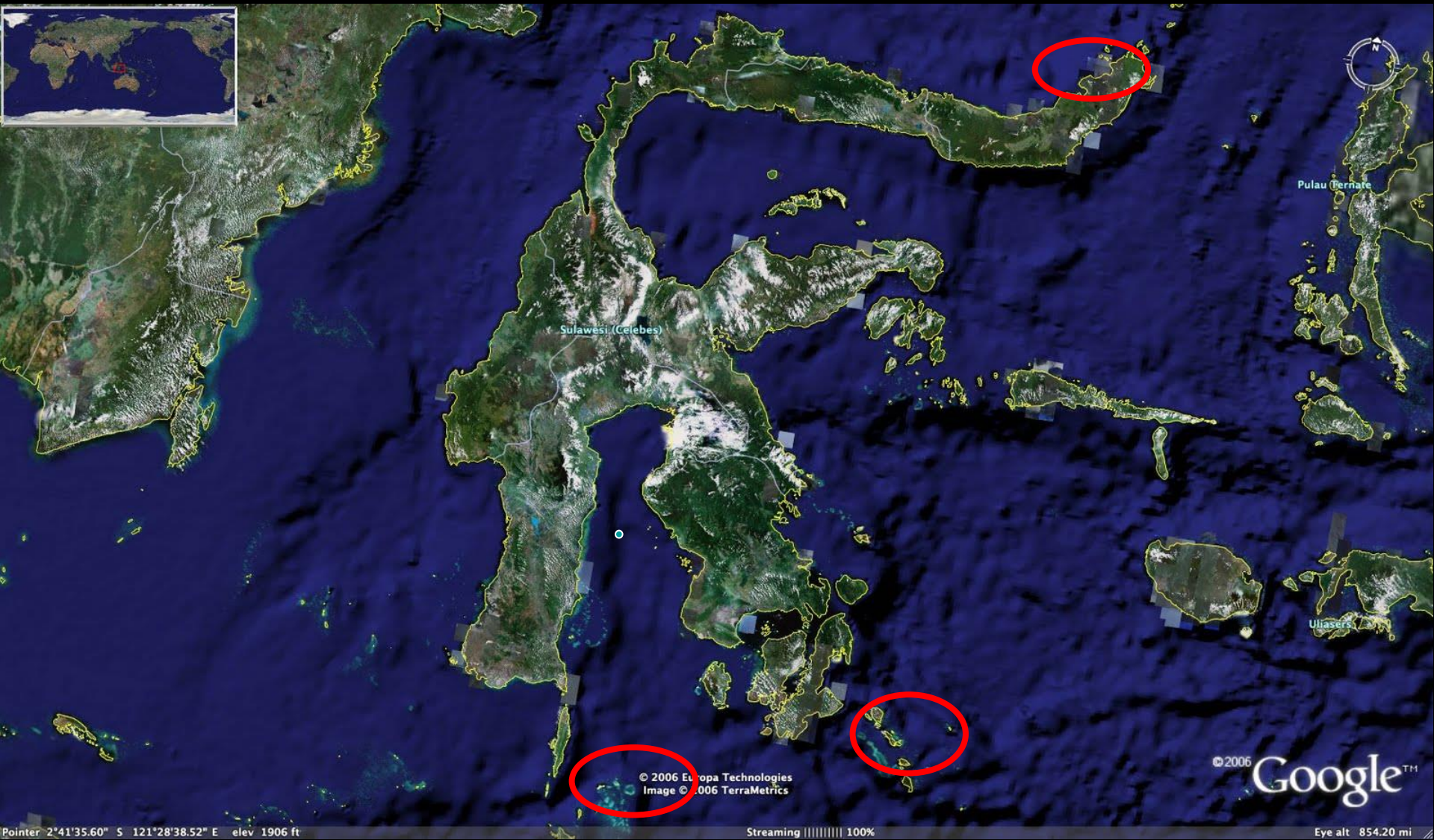


Restoring
Optimism
Rebuilding
Confidence

<https://factsofindonesia.com/popular-coral-reefs-in-indonesia>

It is estimated that the total area of world's coral reefs are **284.300 km²**, and **Indonesia has 18% (85.200 km²) of the area**. This is due to the fact that Indonesia is the biggest maritime country in the world, with the marine area of **93.000 km²**. Indonesian coral reef also has the highest biodiversity in the world, with more than **2500 species of fish, 590 species of stone corals, 2500 species of mollusks, and 1500 species of crustaceans**

Coral Reef in Suawesi



© 2006 Europa Technologies
Image © 2006 TerraMetrics

© 2006 Google™

Pointer 2°41'35.60" S 121°28'38.52" E elev 1906 ft

Streaming ||||| 100%

Eye alt 854.20 mi

Taman Laut Wakatobi

This is the name of a national park located in Wakatobi regency, Southeast Sulawesi Province. This national park is a heaven and the center of the world's coral reefs .

This marine park is popular globally especially after **Wallacea Expedition** done by England which stated that this area is rich with coral species. The underwater topography is beautiful and colorful, there are **more than 112 coral live here.**



Takabonerate Sea Park

- This marine park is located in South Sulawesi, considered as the **third largest atoll** region in the world after Kwajifein in Marshall island and Suvadiva in Maldives.



Atolls here is formed as the result of volcanic eruptions which submerged 2.000 meters below the sea level.

The atoll is forming a round reef like coral reefs which is the habitat of various marine plants, nudi fish, cuttlefish, barracuda, pari, and bump head fish in the depth of one meter.

Taman Laut Bunaken

Bunaken is an 8.08 km² island which is located in Manado Bay, exactly in the northern part of Sulawesi island.

This national park represents Indonesian tropical water ecosystems which composed of mangrove ecosystems, seagrass beds, coral reefs, and land or coastal ecosystems.

There are about **91 species of fish** found in this national park. The fish such as fish gusumi horse (*Hippocampus horse*), white oci (*Seriola rivoliana*), yellow tail lolosi (*Lutjanus kasmira*), goropa (*Ephinephelus spilotoceps* and *Pseudanthias hypselosoma*), ila trunk (*Scolopsis bilineatus*), etc. This national park has **390 species of coral reefs** consists of **algae, seaweed, marine mammals, reptiles, birds, mollusks, and mangroves.**



Keragaman Sumberdaya Hayati Laut: Eksplorasi dan Eksploitasi



Potensi Molekuler Laut

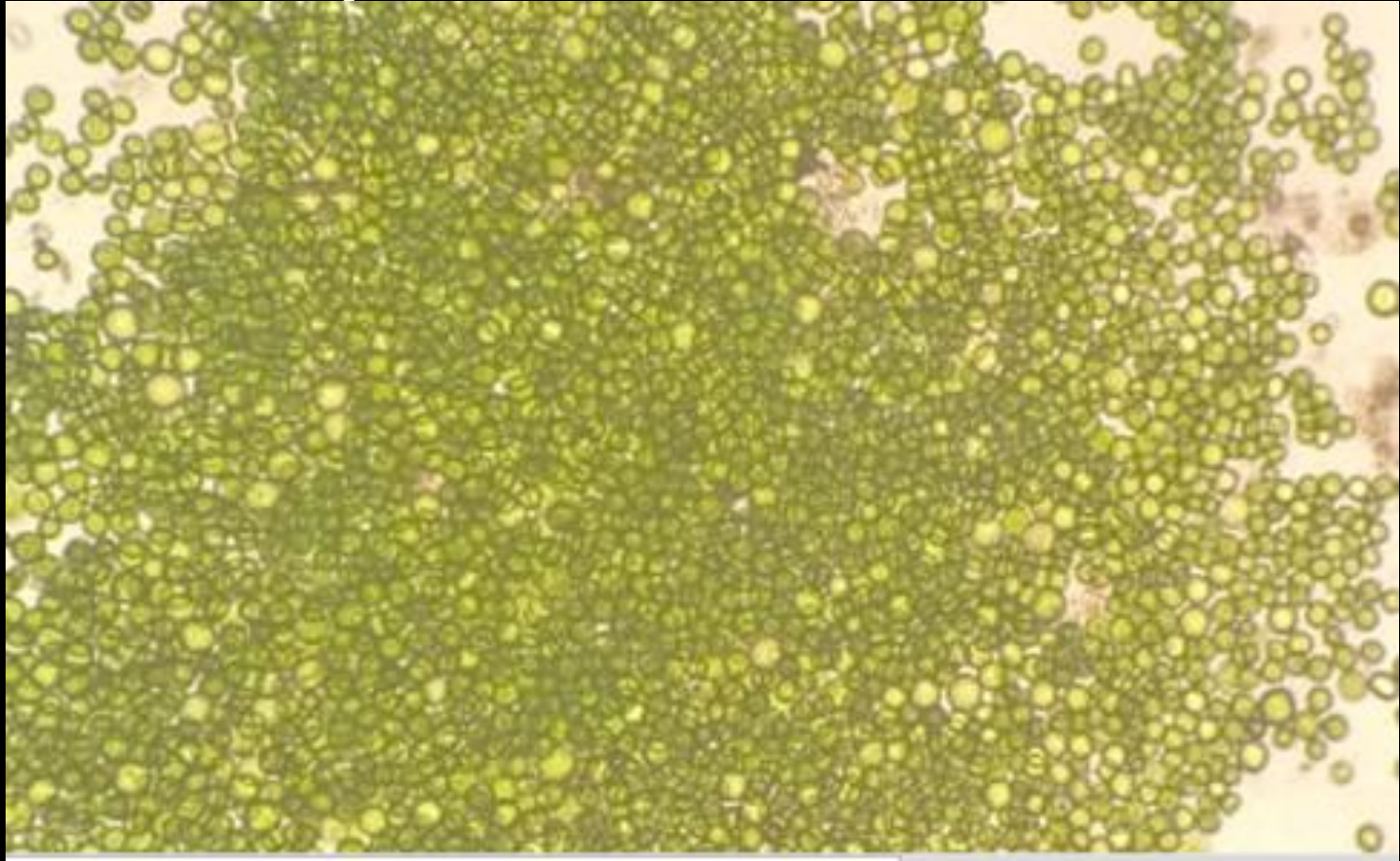


Biomaterial: substans bioaktif, racun, pigmen, enzim, biopolimer, bioadesif, biokomposit

Analisis in vitro dan in silico: anti virus dan anti kangker

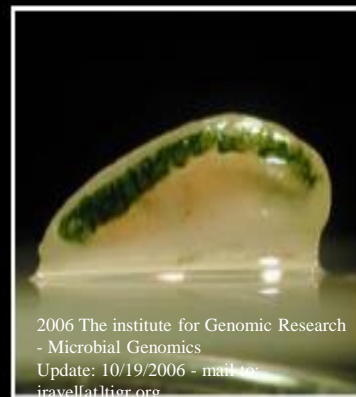
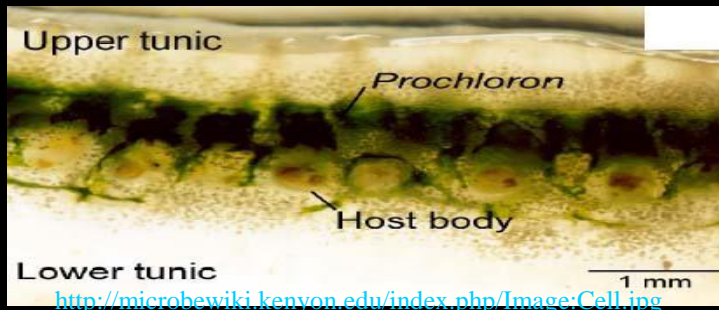
**Using *Prochloron* sp. as a Model to
Characterize Potentials Genes of
Ascidian Symbionts**

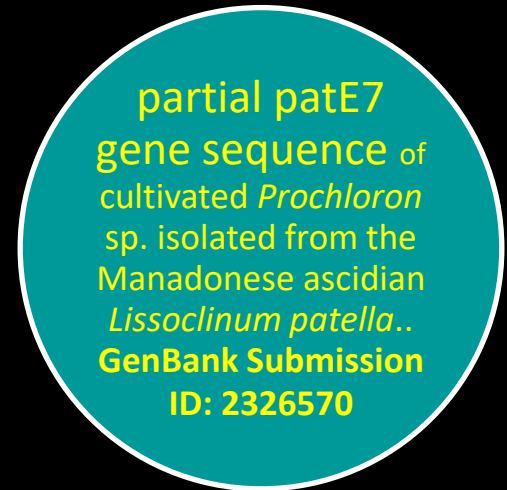
Obyek Riset sejak 2006: Photosynthetic microbial cells



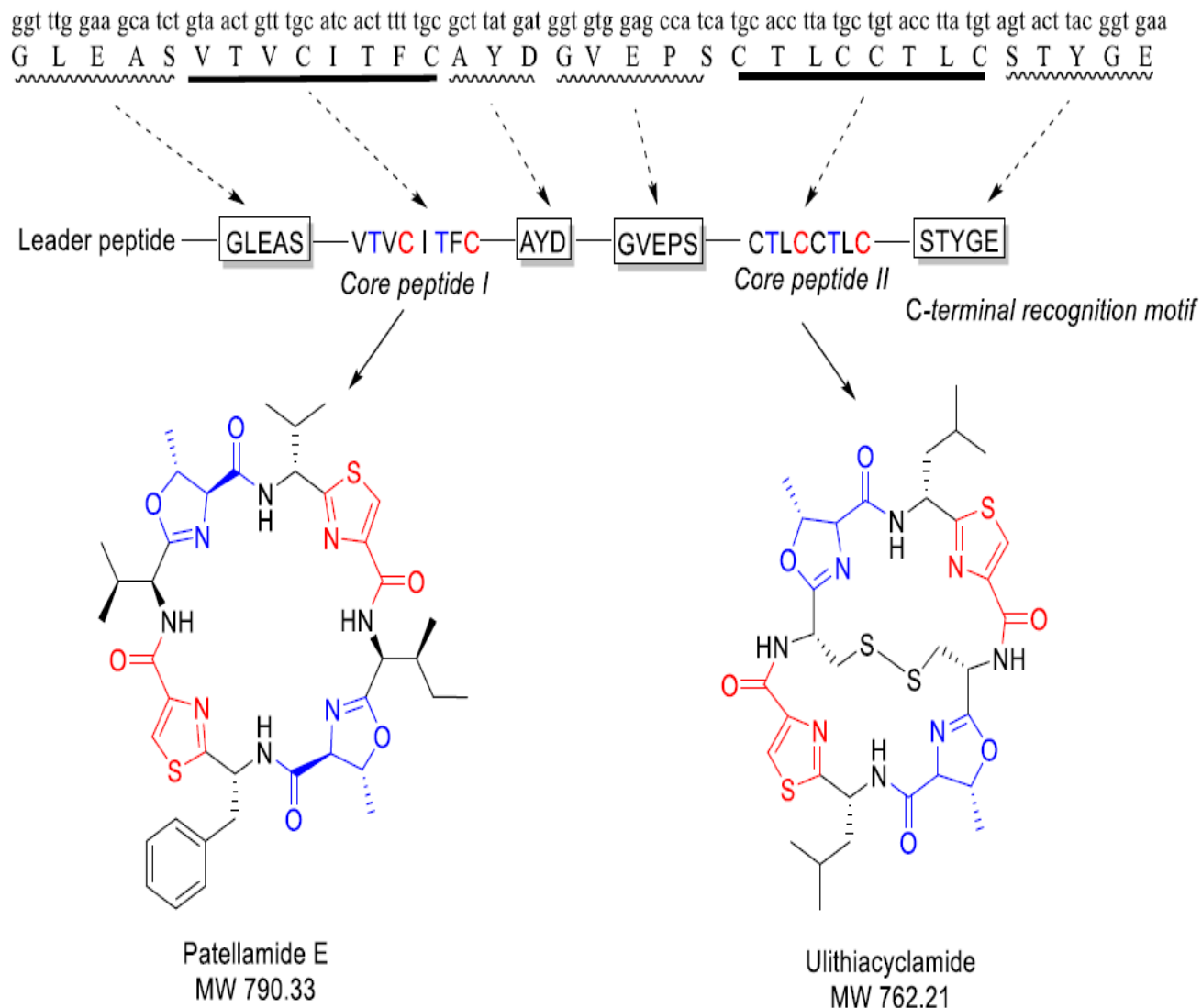
Prochloron-ascidian symbiosis

- The microbe can reside on a sea cucumber (Cheng and Lewin, 1984) or in a sponge (Parry, 1985). There are more than 20 species of ascidians that may have *Prochloron* cells on their surfaces (Kott, 1984), sometimes associated with cyanophytes, indicating that the **phycobiont is not specific** (in symbiosis jargon it could be said that the symbiosis is “**non-obligate**”).






- DNA from cultivated *Prochloron* cells was prepared
- Gene coding for petE precursor was PCR-amplified from the isolated genomic DNA using the certain primer pair combinations





Ascidian-associated photosymbionts from Manado, Indonesia: secondary metabolites, bioactivity simulation, and biosynthetic insight

Inneke F. M. Rumengan¹  • Vera I. Y. Roring² • Jabal R. Haedar^{3,4} • Mayse S. Siby¹ • Aldian H. Luntungan⁵ • Beivy J. Kolondam⁶ • Agustinus R. Uria^{3,7} • Toshiyuki Wakimoto^{3,7}

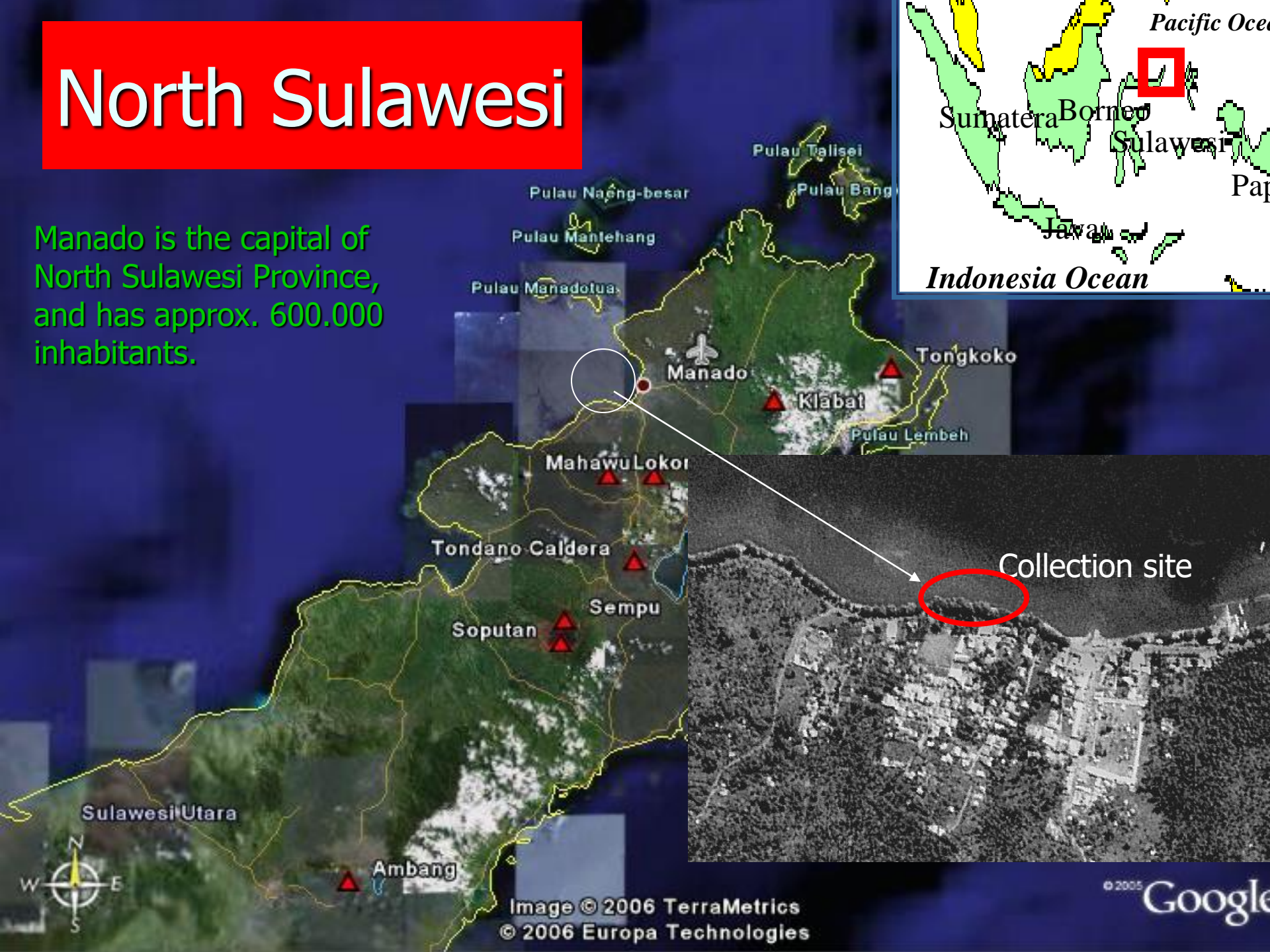
Received: 10 June 2020 / Accepted: 17 March 2021 / Published online: 22 April 2021
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Abstract

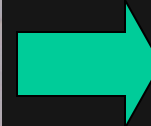
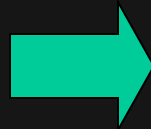
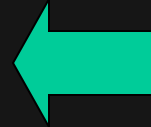
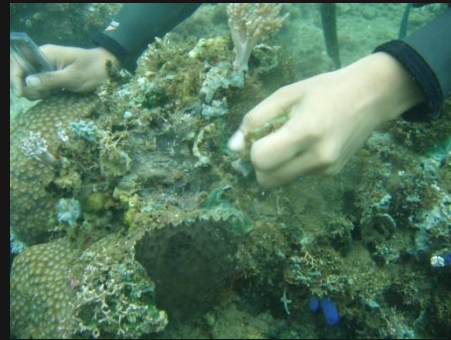
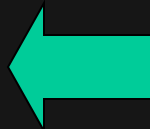
This research work aimed at investigating the chemistry and biosynthetic potential of ascidian-associated symbionts that originated from Manado Bay, North Sulawesi. We initially enriched the symbiotic cells associated with the Manadonese ascidian *Lissoclinum patella*. Subsequently we identified the presence of *Prochloron didemni* in both unenriched and salt-enriched samples by examining the 16S rRNA gene and the chlorophyll A oxygenase (CAO) gene. Investigation of the secondary metabolites by HPLC, LCMS/MS, and NMR showed the presence of ulithiacyclamide along with patellamide E in the unenriched symbiotic cells. Interestingly, ulithiacyclamide was detected in the enriched cells from the same Ascidian specimen. Molecular docking showed the high binding affinity of both compounds to estrogen receptor beta (ER- β) protein. This is a subtype of the nuclear receptor superfamily expressed abnormally in ovarian cancer cells. Furthermore, we isolated a *patE* gene variant encoding for a precursor with patellamide E (VTVCITFC) and ulithiacyclamide (CTLCCCTL) core peptides from the enriched cells. This represents a new core peptide combination. The outcome of this work provides a basis for producing useful

North Sulawesi

Manado is the capital of North Sulawesi Province, and has approx. 600.000 inhabitants.



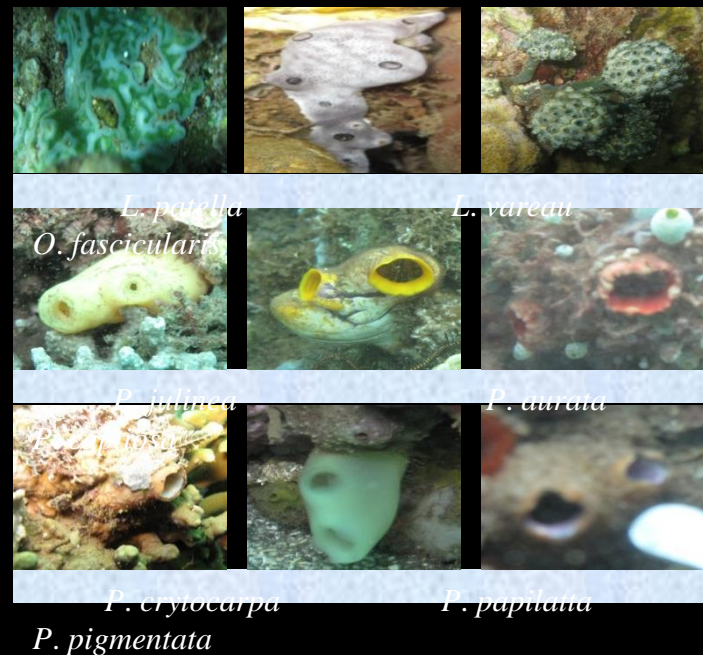
Field collection



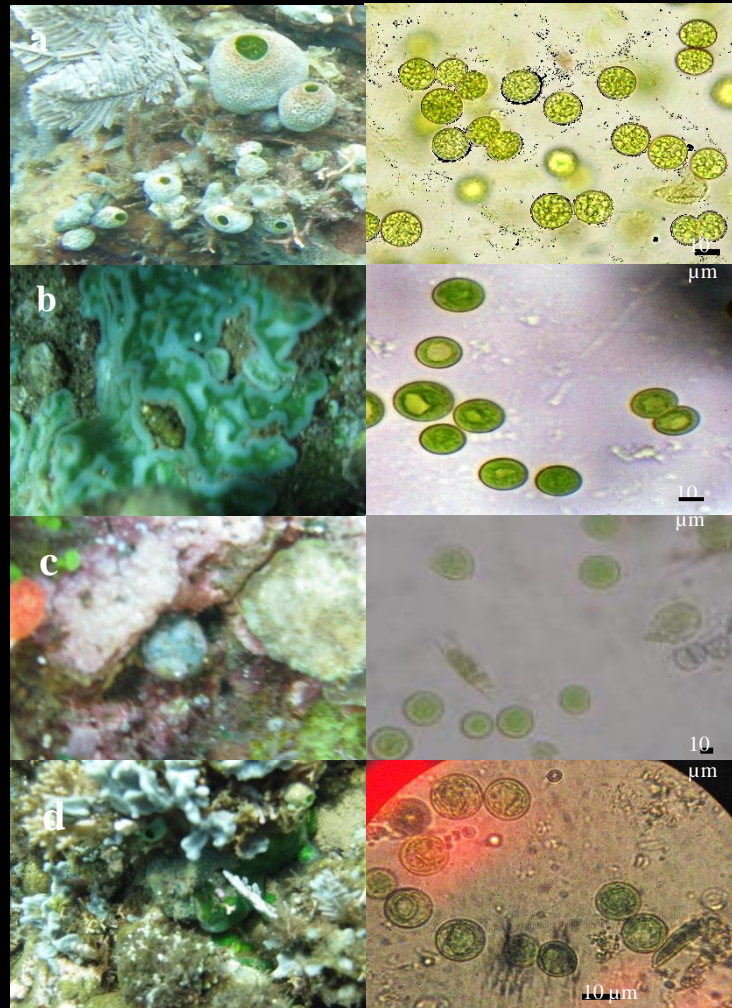
**BIOECOLOGICAL STUDIES
OF *Prochloron*
ASSOCIATED WITH
ASCIDIAN AT MANADO
BAY, NORTH SULAWESI**

- **Jenis-jenis Biota Ascidiacea yang ada di Perairan Pantai Malalayang 2010**

Berdasarkan hasil survei di lapangan dengan melakukan penyelaman bebas (free dive) yang dimulai dari kedalaman 1 – 20 m, biota ascidia yang terdapat di perairan Malalayang terdiri dari 28 jenis Ascidiacea.



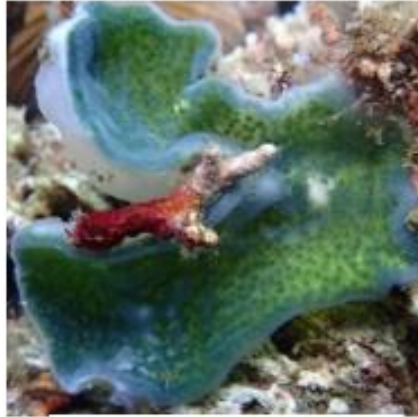
- **Ascidian species associated with microbial symbionts including *Prochloron* sp.**



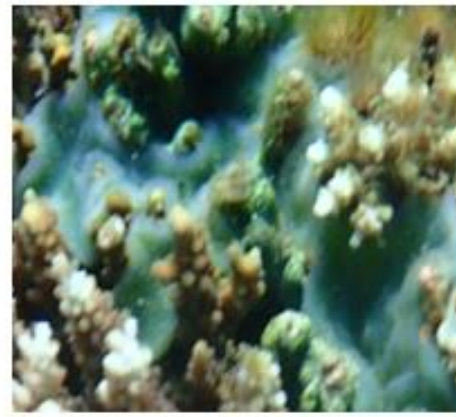
Existing ascidian species in 2019



Trididemnum cyclops



Lissoclinum bistratum



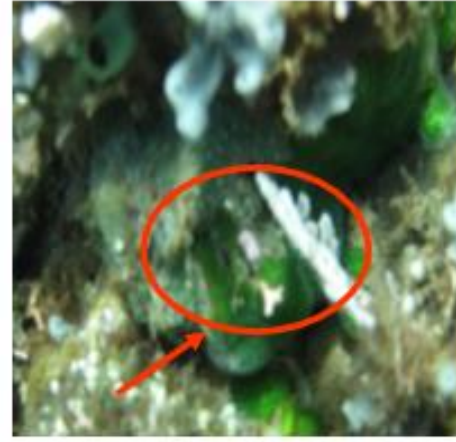
Lissoclinum patella



Didemnum molle



Diplosoma virens



Didemnum viridis

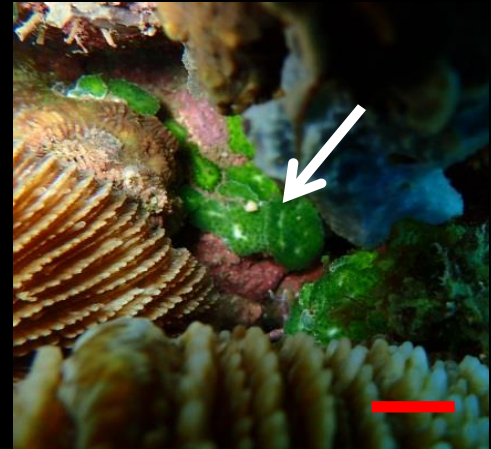
Existing ascidian species in 2020



Didemnum molle



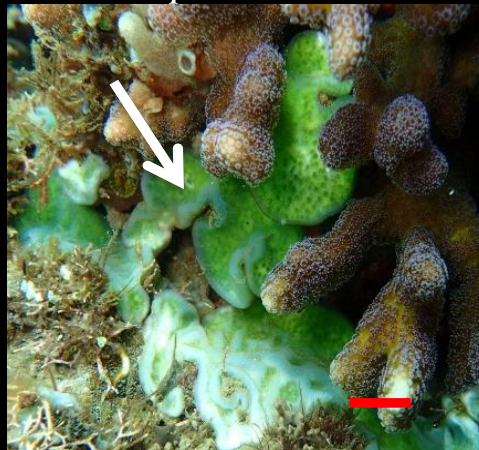
Diplosoma simile



Lissoclinum bistratum



Diplosoma virens



Lissoclinum patella



Atriolum robustum

Malalayang Beach Walk Manado Bay



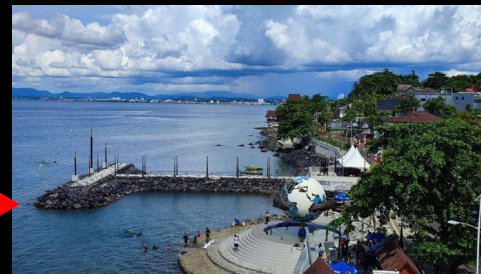
Depan lokasi penelitian
kami sejak 2006 ...



LOKASI PENGAMBILAN SAMPEL



Di Perairan Malayang Dua Beach Walk
Teluk Manado Kecamatan Malayang



TANGGAL
29 Oktober 2022

JAM
09:40 WITA

TITIK KOORDINAT
1°27'39,4"LU dan 124°47'32,0"BT



1°27'39" N and 124°17'31" E.



PRAKTEK KERJA LAPANG

Identifikasi Jenis-jenis Ascidia Di Perairan Malalayang Dua Beach Walk Teluk Manado Sulawesi Utara

Oleh:

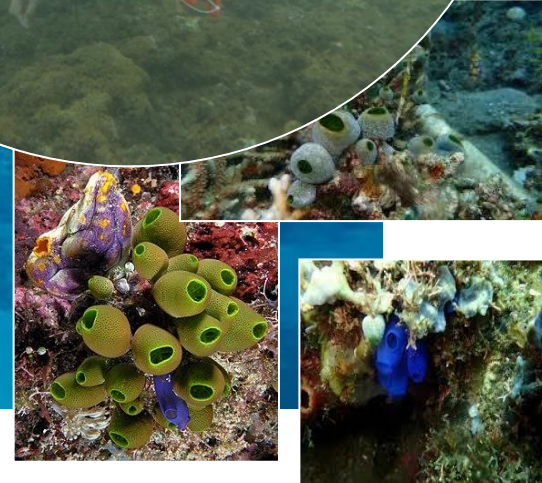
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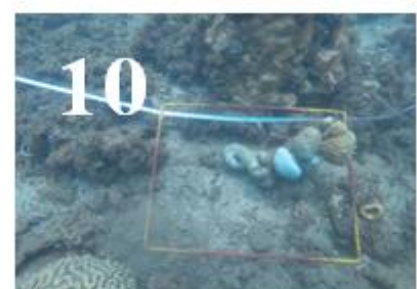
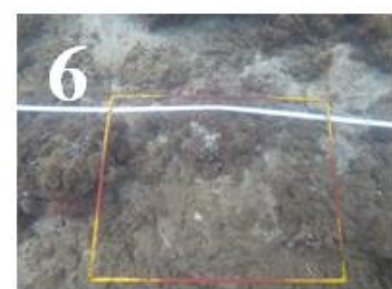
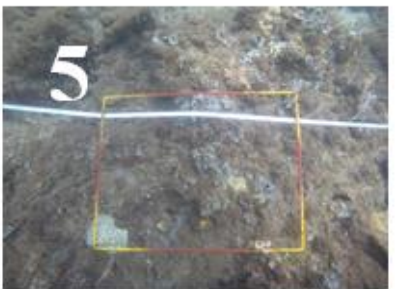
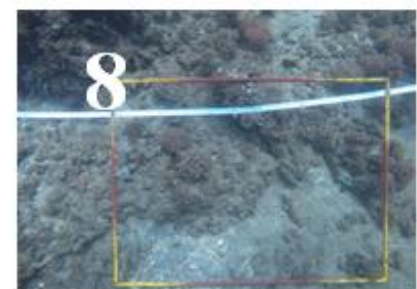
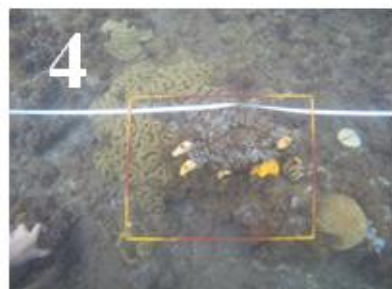
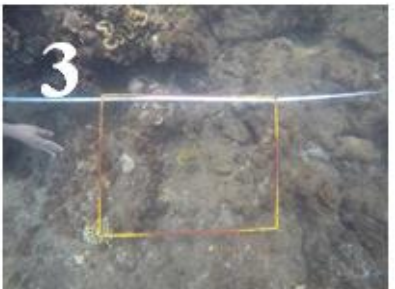
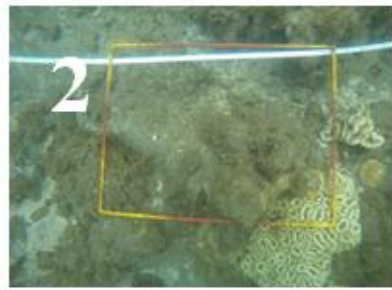
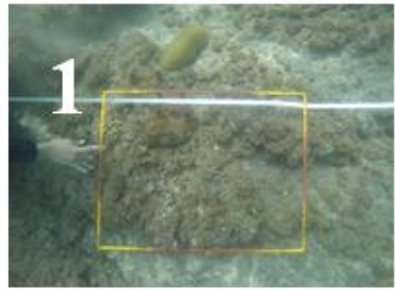
Manado, 29 Oktober 2022

Dosen Pembimbing

Prof. Dr. Inneke F.M Rumengan, MSc, Ph.D



Oktober 2022



Kondisi sekarang ladang koral termasuk ascidia diselimuti sedimen halus, kolom air di atasnya keruh, keindahan biota laut memudar, termasuk mikroba simbion yang dulunya nampak hijau tidak terlihat. Tinggal beberapa spesies Ascidia yang bisa dikenal. Bandingkan yang berikut



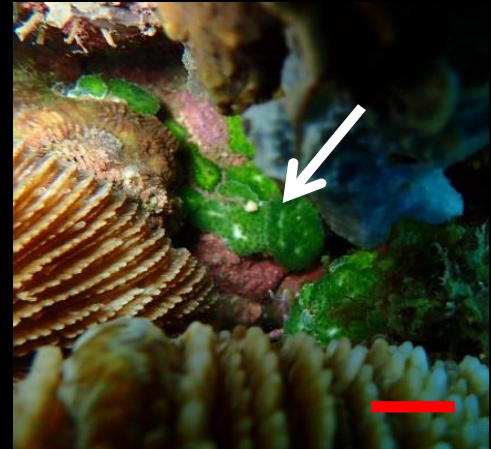
Existing ascidian species in 2020



Didemnum molle



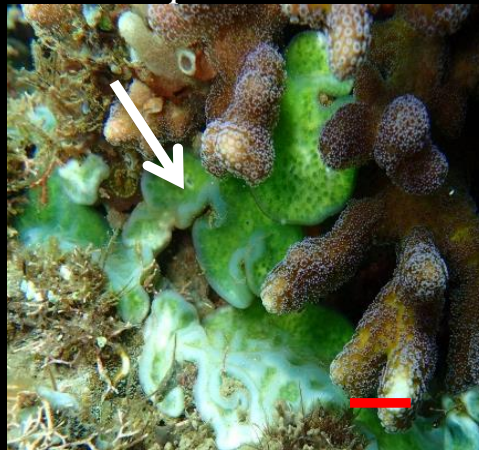
Diplosoma simile



Lissoclinum bistratum



Diplosoma virens



Lissoclinum patella



Atriolum robustum



**Bagaimana dengan
potensi molekuler
yang terkandung
pada biota laut ??**

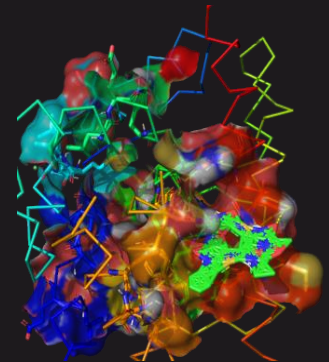


The peptides that are synthesized by ribosomal biosynthetic pathways in marine photosynthetic microbes, such as patellamides and ulithicyclamides are well-known as bioactive compounds.

Potent drugs

MOLECULAR DOCKING

Prof.Dr.Ir.Inneke F.M.Rumengan,M.Si





MOLECULAR DOCKING STUDIES ON SOME PEPTIDES PRODUCED BY MARINE PHOTOSYNTHETIC MICROBES AS POTENT DRUGS FOR CANCER AND COVID-19 TREATMENTS

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**International Webinar on Coastal and Deep Sea Natural Resources
@ Faculty of Fisheries and Marine Science, Sam Ratulangi University
20 November 2020**

Penutup

- Kekayaan sumberdaya hayati laut membutuhkan keseriusan pengelolaan pihak berwenang, karena merupakan aset berharga untuk keberlanjutan generasi mendatang
- Dalam berbagai program pengembangan wilayah pesisir, seperti misalnya Malalayang Beach Walk melibatkan pendapat para ahli terkait resiko yang mungkin diakibatkan ke depan;
- Potensi molekuler yang terkandung dalam biota laut jika dieksplorasi dan dieksploitasi dengan penerapan bioteknologi yang ramah lingkungan dapat dikembangkan sebagai agen pengendali virus, anti kanker dan sebagainya

Acknowledgments

We thank to the Directorate of Research and Community Services, Indonesian Ministry of Research, Technology and Higher Education for financial support in 2018-2020 with a research scheme of basic priority/excellent university research (PDUPT).



TERIMA KASIH