

Program

2nd AcroporaNET Symposium (Amsterdam, December 1st 2017)

- 10:00–10:30 **Arrival at venue with coffee, tea etc.**
- 10:30–10:45 **Opening**
Petra Visser, Mark Vermeij (University of Amsterdam, Carmabi Foundation)
- 10:45–11:00 **Introduction and overview AcroporaNET**
Johan Stapel (Caribbean Netherlands Science Institute, St. Eustatius)
- 11:00–11:15 **Possibility to ask questions about AcroporaNET and marine tropical research in general**
- 11:15–11:30 **3D reconstruction as a monitoring strategy for coral reef restoration of *Acropora palmata* on Bonaire**
Julia Huisman (University of Oxford, United Kingdom)
With thousands of Acropora corals out-planted on Caribbean reefs annually, reef restoration practitioners are in need of monitoring tools to optimise restoration approaches. Recent advances in structure from motion (SfM) imaging techniques along with affordable underwater cameras, led to increasing interest in using three-dimensional (3D) reconstruction as a tool for reef monitoring. This study investigates the use of 3D reconstruction as a monitoring tool for Acropora palmata transplants. It aims to determine whether 3D reconstruction of individual elkhorn corals provide reliable information on growth and health over time and between observers. The study also aims to discern the effect of direct sunlight on 3D reconstruction and measurements. Measurement error between observers ranged from 9.4% to 6.0%, depending on the metric. Direct sunlight was found to have a significant adverse effect on model reconstruction and measurement error. This study suggests that 3D reconstruction is a viable monitoring tool for Acropora palmata, enabling reliable measurements of various ecological metrics.
- 11:30–11:45 **Impacts of megaherbivores on expansion of invasive seagrass in the Caribbean**
Marjolijn Christianen (University of Groningen)
Co-authors: Fee O.H. Smulders, Sabine Engel, Mabel Nava, Sue Willis, Per J. Palsbøll, J. Arie Vonk, Leontine E. Becking
*Our knowledge on the functional role of large herbivores is rapidly expanding, however the impact of grazing on non-native species expansion is still unknown. Since its introduction in 2002, the seagrass species *Halophila stipulacea* has rapidly expanded across the Eastern Caribbean, forming dense meadows, also in green turtle (*Chelonia mydas*) foraging areas. We investigate the changes in seagrass occurrence and the impacts of grazing by green turtles on non-native seagrass expansion in Lac Bay (Bonaire, Caribbean Netherlands).*

*In 6 years *H. stipulacea* underwent a significant expansion, invading 20 of 49 fixed monitoring locations in Lac Bay from 2011-2017, increasing from 6% to 20% total occurrence. During the same period, native seagrass *Thalassia testudinum* occurrence decreased by 20%. Green turtle grazing behavior appeared to be affected by the introduced seagrass. Field observations, together with time-lapse satellite images over the four last decades, showed initiation of new cropping patches (65 ha) in areas that had previously (1970-2010) been ungrazed shallow-depth *T. testudinum* meadows. Green turtles deployed with Fastloc-GPS transmitters confirmed high site fidelity to these patches that were located along the sharp border of grazed and ungrazed native seagrass patches. In addition, cafeteria experiments indicated selective grazing by green turtles on native species. In parallel, native seagrass species had significantly higher nutritional values compared to the invasive species. Finally, in exclosure-experiments, introduced seagrass expanded more rapidly in grazed canopies compared to ungrazed canopies. Combined, our results showed that *H. stipulacea* can rapidly colonize, and replace native seagrasses in the Caribbean. We conclude that green turtle grazing may modify the rate and spatial extent of this invasive species' expansion, due to grazing preferences, and increased space for settlement. We propose a conceptual framework that aims to explain expansion of this invasive species and the cost to native species.*

11:45–12:00 **Benthic cyanobacterial mats on coral reefs**

Petra Visser (University of Amsterdam)

Benthic cyanobacterial mats are a growing concern on coral reefs. They grow on sand, and over corals and macroalgae. Most mats are observed in the relatively shallow coral reefs, but along the coast of Bonaire also huge areas with benthic cyanobacterial mats were observed at depths of 50-90 meters. Emerging evidence strongly indicates that cyanobacterial mats are becoming increasingly prevalent on reefs worldwide. Despite the increasing abundance on reefs, hardly anything is known about the composition of these mats. To unravel the bacterial composition, we sampled morphologically different cyanobacterial mats on the coral reefs of Curaçao and analysed the samples using Illumina sequencing of the 16S DNA sequence. The results showed that cyanobacterial mats consisted of a high variety of bacterial groups, including pathogenic bacterial families. We have also tested the toxicity of several mats using standard toxicity assays with shrimps since cyanobacteria are known to produce a variety of toxins. Indeed the majority of the mats were very toxic which will most likely have adverse effects on neighbouring corals and organisms grazing on mats.

12:00–12:15 **Ecological communities in future ocean conditions**

Christiaan De Leeuw (Wageningen University & Research)

Co-authors: Agustin Capriati, Diede L. Maas¹ Leontine E. Becking

Oceans are being fundamentally altered by global climate change. In particular, sea surface temperatures are increasing, threatening especially vulnerable ecosystems like tropical coral reefs. Yet, the impact of increasing temperatures on the structure and function of ecological communities is still largely unknown.

Here, we investigate the effect of temperature on the structure of ecological communities. We compare 17 marine lakes in Papua, Indonesia, which are of similar ages and sizes, but vary in temperature and in degree of connection to the open sea. These lakes represent multiple independent replicates of community assembly. Temperatures are stable throughout the year within lakes, and range from 30°C (similar to the surrounding sea) to 42 °C. The communities in marine lakes range from being very similar to the reef flat (coral dominated, high diversity) to algal dominated and species poor. Using replicated photo transects, we assessed abundance and distribution of functional groups for each lake (e.g. sponges, corals, cyanobacteria). We found significant differences in diversity of functional groups between marine lakes. In extreme environments (>35°C), diversity of functional groups was lower. However, in the majority of lakes (30-34 °C) the diversity of functional groups is largely unexplained by temperature. Hence, stochastic processes such as neutral dispersal limitation and priority effects likely play an important role. Since the environmental conditions in marine lakes resemble predictions for future oceans, our results will aid in understanding the response of marine communities to climate change.

12:15–12:30 **Saba Bank communities and why hurricanes and lionfish are a blessing**

Erik Meesters (Wageningen University Marine Research)

The Saba Bank is by far the largest coral reef of the Dutch Caribbean and the largest Nature Park of the Kingdom of the Netherlands. Research on the Saba Bank is challenging at best and impossible much of the time. I'll give an overview of some of the research results of the last years.

12:30–12:45 **An experimental approach to studying staghorn coral (*Acropora cervicornis*) genetic diversity and transcriptomic response to nursery environments in the Dutch Caribbean**

Pam Engelberts (University of Amsterdam)

*Acropora cervicornis has suffered widespread declines in coral cover throughout the Caribbean. To counteract this decline, the Restoration of Ecosystem Services and Coral reef Quality project (RESCQ) has set up various coral nurseries in the Dutch Caribbean. Following the observation that corals in nurseries calcify faster than their wild counterparts, we propose an experimental setup employing RNA-seq technology and qPCR quantification to analyse the transcriptome of wild and nursery *A. cervicornis* colonies to investigate the effect of the nursery environment on gene expression as well as the potential impact on coral resilience. An RNA-seq protocol tailored for use on *A. cervicornis* can be used to elucidate differentially expressed genes and to examine genetic diversity and possible consequences for *Acropora* adaptive potential. Additionally, qPCR can be employed to validate the RNA-seq findings and conduct a more in depth analysis of gene expression on GOIs related to growth, calcification, and stress responses. Results obtained from such a study may be used to provide a baseline for future studies on coral nurseries and outplant designs; insights garnered could therefore be used to further optimize nursery set-up and outplanting procedures, while safeguarding the genetic diversity of corals in general and *A. cervicornis* in particular.*

- 12:45–13:00 **Physical drivers are obscured by local human impacts at outer reefs in the tropical Pacific**
Amanda Ford (Leibniz Centre for Tropical Marine Research, Germany)
Co-authors: Jouffray J-B, Norström A, Nugues MN, Moore BR, Bejarano S, Magron F, Wild C, Ferse SCA
While most coral reefs are accessible to humans, the role of local impacts in driving reef degradation or homogenizing benthic communities remains under debate. We investigated the influence of contrasting levels of local impact using a spatially extensive dataset spanning 63 inhabited Pacific island sites. Low versus high local impact was determined using a threshold of 25 inhabitants km⁻² reef and investigated in relation to benthic (i) composition, and (ii) relationships with environmental predictors. Data on benthic and fish communities were collected from field surveys across inshore and outer reefs at each site, and storm exposure was extracted from public repositories. Sites with higher human impacts had relatively more turf algae, and at outer reefs also lower coral cover. At outer reefs, models including physical drivers (reef depth, latitude, storm exposure) exhibited high explanatory power for benthic assemblages when local impacts were low (60%), but were weak under higher local impacts (10%). The results imply that climate change-related impacts may be unpredictable under higher local impacts where human dependency on future ecosystem services is often greatest. Contrastingly, inshore reefs exhibited consistent relationships with predictors regardless of local impact level, likely due to them comprising more stress-tolerant assemblages in response to their naturally challenging environment.
- 13:00–14:30 **Lunch, poster presentations and possibilities to meet one-on-one**
- 14:30–14:45 **Invasive marine species in the Dutch Caribbean**
Auke Florian Hiemstra (Naturalis Biodiversity Center)
- 14:45–15:00 **High marine population genetic structure influenced by habitat fragmentation**
Diede Maas (Wageningen University & Research)
Co-authors: Bi Ke, Prost Stefan, Aji Ludi, Toha Abdul, Gillespie Rosemary, Becking Leontine
Processes underlying the incredible marine biodiversity of the Coral Triangle remain difficult to elucidate. One of the hypotheses why this area harbours such diversity is the relatively high amount of isolated peripheral environments. Here, we used marine lakes in Indonesia, located in the center of the Coral Triangle, to elucidate the role of different processes of isolation in shaping population genetic structure of mussels (*Brachidontes* sp.). Marine lakes are landlocked bodies of water that maintain a marine character through subterranean connections to the sea. They represent peripheral environments with a unique combination of multiple heterogeneous environments with varying degrees of connection to the surrounding sea. Using double-digest Restriction-site Associated DNA (ddRAD) sequencing of seven mussel populations, we observed high genetic differentiation (F_{ST} ranged from 0.07 – 0.24). On small spatial scales we show no

significant influence of geographical distance ($r = 0.52$, $p = 0.12$) or environment ($r = 0.21$, $p = 0.29$), but a significant role of connection to the sea ($r = 0.62$, $p = 0.03$). We hypothesize that priority effects in highly isolated fragmented habitats contribute greatly to the formation of population structure. We show that peripheral environments contribute greatly to the biodiversity of marine animals in the Coral Triangle.

15:00–15:15 **Bonaire's reef, back to the Archaean?**

Godfried van Moorsel (Ecosub)

The abundance of cyanobacteria on Caribbean reefs is increasing. On Bonaire and Curaçao, nowadays they are the most important part of the reef community in terms of cover. Especially fine filamentous 'cyanos' are omnipresent.

On Bonaire, another type of cyanobacteria has appeared in recent years and is increasing rapidly. They are a few cm in diameter and are coloured grey, sometimes with a purple haze. The surface feels like cartilage and a section shows a fine lamination.

These humps were observed for the first time in 2015 and during 3 subsequent visits to Bonaire I saw them in increasing numbers. In October 2017 they were observed in 27% of dives. They grew on living as well as dead coral.

*After a long search on the web and in the literature, similar structures called 'microbialites' were found, i.e. stromatolite-like structures formed by Cyanobacteria. The species ID is as yet unknown, but a likely candidate for the humps on the reef of Bonaire is *Leptolyngbya hendersonii*.*

So on the one hand this is a very interesting organism which reminds us to stromatolites, one of the earliest life forms on earth, already present 3480 million years ago in the Archaean. On the other hand, this may be another example of the significance of cyanobacteria on Caribbean reefs. Considering its increasing presence, it is important to recognize these structures, to incorporate them in monitoring programs and to study their effects on Scleractinian corals.

15:15–15:30 **Microbiomes of seagrasses on Curaçao**

Aschwin Engelen (University of the Algarve, Portugal)

15:30–15:45 **Variation of prokaryote communities in Indo-Pacific giant barrel sponges**

Thomas Swierts (Naturalis Biodiversity Center)

*Sponges harbor complex communities of microorganisms that carry out essential roles for the functioning and survival of their hosts. To better understand how geography and intricate phylogenetic relationships within the hosts cause variation in the microbial community of sponges, we compared the microbial community of 47 giant barrel sponges (*Xestospongia* spp.). These sponges belonged to six reproductively isolated genetic groups from eight regions throughout the Indo-Pacific. The prokaryote community of giant barrel sponges was characterized by a relatively small number of 84 core OTUs (i.e. OTUs present in each specimen) that represented a majority of the total number of sequences.*

The relative abundance of these core OTUs varied significantly between the samples, and this variation was predominantly related to the geographic origin of the sample.

Especially the more distant and isolated regions were characterized by unique OTUs, and they also showed significantly higher or lower abundances of certain sets of OTUs. These

results show that in groups of sponges that have retained similar body plans, the variation in the prokaryote community is much more related to geography than to phylogenetic relatedness.

15:45–16:00 **Sugar Wars: The role of DOM composition on future reefs**

Ben Mueller (University of Amsterdam)

16:00–16:15 **Adaptive life research at GELIFES, Groningen**

Sancia van der Meij (University of Groningen)

The University of Groningen has a long history of marine biology education and research. Current strengths include polar phytoplankton research, benthic community ecology in the Baltics, and marine mammal population structure and conservation. A new line of research with a focus on adaptive diversification in tropical reef systems will start in February 2018. The main focus will be on host-specific speciation in associated organisms, which will be studied from genetic, ecological and morphological perspectives.

16:15–17:00 **Discussion, open floor and possible future plans**

17:00– **Drinks at the nearby bar “The Polder”**