

Top Story: Maths, Ecology and the Virus + Cooperation MARISCO, INTERREG-Project, EKLIPSE + Research: Selected Publications + Editorial: Ecology because of or in spite of Corona + Open Call HIPP

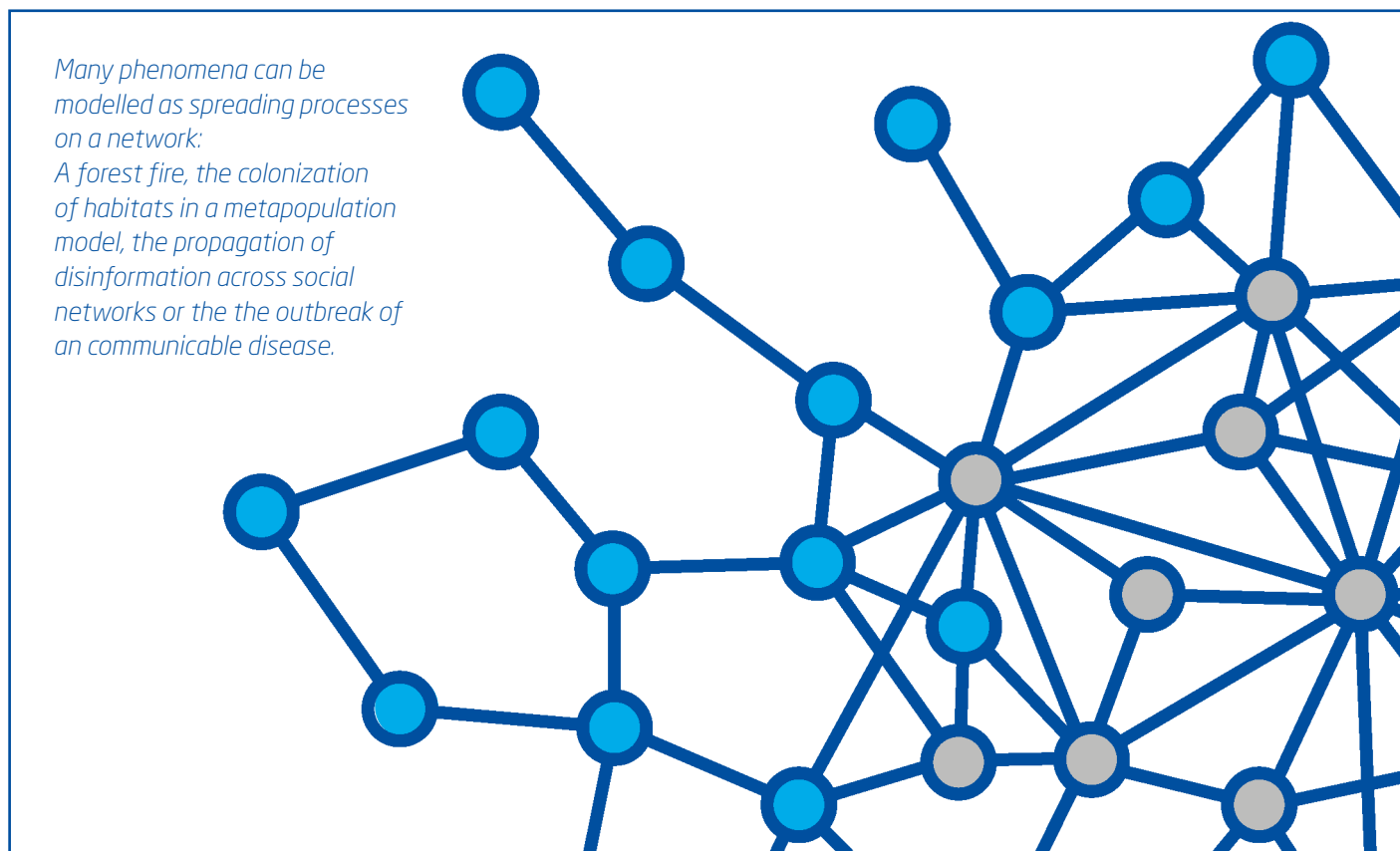


Illustration © Thilo Gross

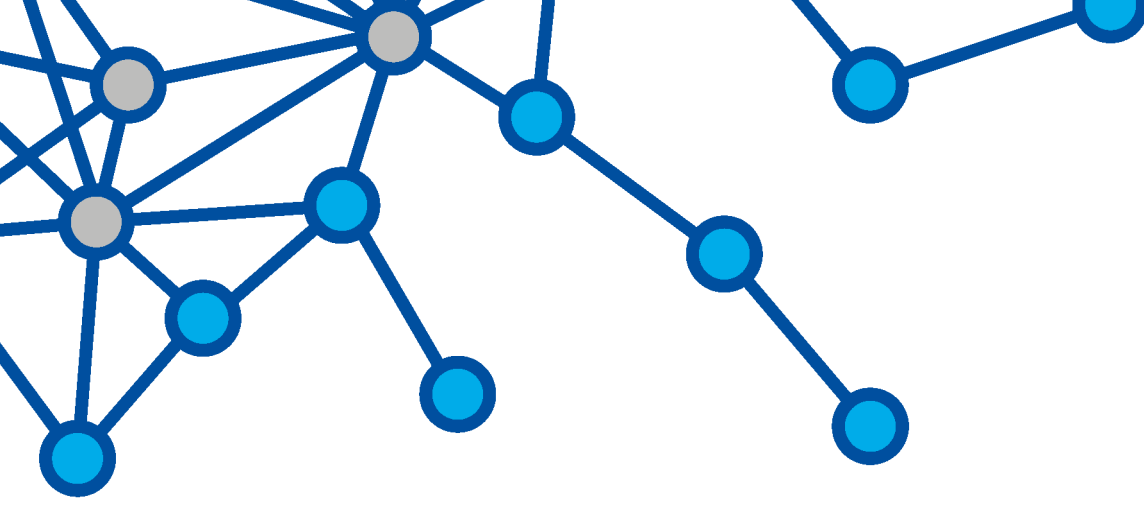
TOP STORY

Maths, Ecology and the Virus

Over the past months life has been severely impacted by Covid. The pandemic has wiped the previous problems, the Australian wildfires and the rise of disinformation, off the news and off people's minds. However, to the network scientist an important parallel exists: All of these phenomena can be understood as spreading processes on networks.

Many of the problems we face are symptoms of the ever more complex and interconnected world we live in. However, in every complex system there are simple truths that can be discovered. Consider the epidemic: In the beginning one infected person in Germany infected on average three others. Hence, the infection spreads exponentially. To turn this exponential growth into an exponential decline we must therefore reduce the number of chances that we give the disease to spread by a factor of three. If two of us meet and we don't know who is infected yet then

we give the virus two chances to spread: You could infect me or I could infect you. If three of us meet then each of us has a chance to infect the other two which adds up to 6 chances in total. Hence, the meeting between three people is three times worse than the meeting between two. For groups of size N the number of chances that we give the virus to spread is $N(N-1)$ leading to a quadratic increase until eventually saturation sets in and it becomes linear for large gatherings. This means a party with 20 guests provides 380 chances for the virus to spread. →



»Very similar models describe epidemic spreading, maintenance of diversity in meta-communities and the propagation of disinformation.«

→ The quadratic increase of the number of transmission chances with increasing group size explains why superspreading events can occur. It also shows that just by avoiding large gatherings we can make an important contribution to the fight against the pandemic.

The question that now seems to be on everybody's mind is if we are going to see a second wave of Covid. Using simple maths, one can easily understand that if we stop all mitigation efforts then we will return to exponential spreading and see a large second wave. By contrast, if we keep up a strong response then the epidemic will continue to decline. More likely we will see a scenario play out that sits between these extremes, how exactly it will turn out depends on political decisions made by a small number of people and hence is hard to predict.

Perhaps asking about a second wave is even the wrong question. Throughout history humans have acquired new infectious diseases in response to changes in the environment. The unprecedented environmental change that we are going to experience in the near future will undoubtedly bring humans into contact with new pathogens. An ever more connected age, where we transport humans and livestock around the globe, will allow some of these pathogens to spread widely and quickly.

Even though we might not see a second wave of Covid, other pandemics are certainly waiting for us in the near future.

It is good to remember that conserving marine biodiversity and mitigating consequences of environmental change can also help to prevent these future pandemics. In this sense HIFMB is already fighting the next global disease.

The biodiversity lab contributes to the goals of HIFMB by analyzing data and modelling effects of biodiversity loss and mitigation efforts. Incidentally, the dynamics of species colonizing habitat patches are another example of a spreading process. Large scale patterns of biodiversity can therefore be described with very similar maths as pandemics and forest fires.

The spreading process that affects us perhaps most profoundly is the rise of disinformation and post-truth politics. These have not only affected the Covid response in some countries, but also stymied our ability to fight the much more profound problem of climate change, which among many other consequences will be a driver of future pandemics. Perhaps a silver lining of Covid is that the pandemic has made it clear that problems can be addressed by fact-based politics, informed by mathematical models.

AWARD

CONGRATULATIONS, KIM PETERS

Dr. Kimberley Peters, Professor of Marine Governance at HIFMB, is the 2020 recipient of the Royal Geographical Society Gill Memorial Award. She has been given the Award in recognition of her 'outstanding early career research in the field of maritime geographies'.

Since 1832, the Royal Geographical Society's prestigious Medals and Awards have recognised those who have made outstanding achievements within the sphere of geography through research and fieldwork, teaching and public engagement.





COOPERATION

MARISCO

New project on sustainable ocean management

How can or must sustainable management of coasts and oceans look like? For the next 3 years, HIFMB will investigate this question together with its partners of the Institute for Coastal and Marine Research (CMR) at the Nelson Mandela University, Port Elizabeth, ZA, and the National Center for Ecological Analysis and Synthesis (NCEAS) at the University of California, Santa Barbara, USA. These three institutions from three continents form the team of the new MARISCO-project (Marine Research and Innovation for a Sustainable management of Coasts and Oceans), funded by the Belmont Forum and starting in June 2020. The research focus is on the multidimensional process of biodiversity change and its impact on society and nature's contributions to man (NCP).

Ecosystems have complex patterns of immigration and extinction dynamics, temporal turnover of composition, changes in the identity/proportion of dominant species, spatial homogenization and functional biodiversity changes, all of which resulting in novel interaction networks and processes.

Successful strategies for marine ecosystem management and biodiversity conservation must therefore incorporate this complexity. As for biodiversity, NCPs comprise a multitude of system properties, e.g., the size of a standing stock (biomass, harvest), the process rates affecting this stock (e.g., CO₂ sequestration), the temporal stability and resilience of stocks and rates, or their predictability or invulnerability to change.

MARISCO combines natural and social science approaches to data synthesis in globally distributed, well-monitored regions, with modelling of positive and negative feedback mechanisms between different aspects of biodiversity and NCP.

In this way, the project will produce the knowledge necessary for defining targets in sustainable marine ecosystem management, and develop the strategies and tools to help implement management approaches that address pressing socio-ecological consequences of human impacts on marine biodiversity.

Project website: <https://www.marisco-project.de/>

COOPERATION

EKLIPSE

Establishing a European Knowledge and Learning Mechanism to Improve the Policy-Science-Society Interface on Biodiversity and Ecosystem Services

Have you heard about EKLIPSE? EKLIPSE (<https://www.eclipse-mechanism.eu>) is an unusual project in several ways, initially funded for four years, EKLIPSE has established a European mechanism able to answer policy relevant questions at the European scale and is thereby a crucial element of the institutional science-policy-society landscape by filling gaps at the European level.

EKLIPSE works for policy: Based on years of research on the challenges of the science-policy interface, EKLIPSE provides outputs that decision-makers need, in the format and timescale they need them in, to the highest standard following robust, inclusive and transparent processes. EKLIPSE works for research: EKLIPSE has engaged with over 500 knowledge

holders, practitioners and decision makers since the start of the project. EKLIPSE's formative evaluation has shown that the process of engagement has increased the involved researchers' knowledge of policy processes, increased their scientific networks and led to them demonstrating policy impact.

Since Summer 2018 Dr. Ute Jacob is a member of EKLIPSE's Knowledge Coordination Body (KCB), the KCB is one of the key governance structures of the EKLIPSE project along with the Secretariat, the Strategic Advisory Board, and the Business Plan Group. In close collaboration with the Secretariat, the KCB's main responsibility is ensuring that requests from policy and other societal actors are answered through the coordination of joint evidence processes.

COOPERATION

Wasserqualität / Waterkwaliteit

„Harmonized assessment of phytoplankton in the Wadden Sea - WATER QUALITY“ (INTERREG VA)

The undesirable accumulation of nutrients (eutrophication) remains a problematic and important issue in many European coastal waters, although the measures taken in recent decades have already led to a reduction in river loads and nutrient concentrations in coastal seas, thus reducing the impact on coastal ecosystems such as the Wadden Sea UNESCO World Heritage Site. This project pursues an innovative way by adopting a multi-causal research approach and taking into account different phytoplankton and eutrophication related parameters in a joint ecosystem modelling approach across countries.

In addition, the project aims to strengthen the cooperation between Dutch and German authorities, ministries and research institutions and to promote a common understanding of this transboundary issue and thus contributes to a sustainable management of nutrient inputs into the coastal waters of the Dutch-German Wadden Sea.

The project is coordinated by the NLWKN- Brake-Oldenburg. Project partners are, University of Hamburg, Helmholtz-Institute for Functional Marine Biodiversity (HIFMB), Deltares and Rijkswaterstaat Noord-Nederland. The project is being funded as part of the INTERREG VA program Germany-Nederland by funds from the European Regional Development Fund (ERDF) and supported by the provinces of Drenthe, Fryslân and Groningen and from the Dutch Ministry of Economic Affairs and Climate Policy.



Participants of the Kick-Off Meeting of the INTERREG-Project in Oldenburg.
January 14 - 15, 2020

RESEARCH

5 Selected Recent Publications

Alneberg J., Bennke C., Beier S., **Bunse C.**, Quince C., Ininbergs K., Riemann L., Ekman M., Jürgens K., Labrenz M., Pinhassi J. & Andersson A.F. (2020). Ecosystem-wide meta-genomic binning enables prediction of ecological niches from genomes. *Communications Biology*, 3, 119.

Last K.S., Häfker N.S., Hendrick V.J., **Meyer B.**, Tran D. & Piccolin F. (2020). Biological Clocks and Rhythms in Polar Organisms. In: *POLAR NIGHT Marine Ecology: Life and Light in the Dead of Night* (eds. Berge J, Johnsen G & Cohen JH). Springer International Publishing Cham, pp. 217-240.

Teschke K., Karez R., Schubert P.R. & Beermann J. (2020). Colonisation success of introduced oysters is driven by wave-related exposure. *Biological Invasions*.

Tsakalakis I., **Blasius B. & Ryabov A.** (2019). Resource competition and species coexistence in a two-patch metaecosystem model. *Theoretical Ecology*.

Van Opzeeland I. & Hillebrand H. (2020). Year-round passive acoustic data reveal spatio-temporal patterns in marine mammal community composition in the Weddell Sea, Antarctica. *Mar. Ecol. Prog. Ser.*, 638, 191-206.

+ More on google scholar:
<https://bit.ly/HIFMB-publications>



VIEW FROM NORTHWEST #4

Ecology because of or in spite of Corona

As all research and teaching globally, HIFMB has been affected and changed by the spread of the coronavirus. Home office and social distancing had to be quickly implemented, all teaching has shifted courses online and created new ones, and travel restrictions have prevented several international hires from actually moving to Oldenburg. Important scientific tasks were cancelled, including field trips, research cruises, and workshops requiring in-situ attendance, which led to revising project schedules and research strategies. In some sense, scientists are privileged as they can continue working at all, even if many additional tasks are to be handled.

However, the crisis – as so often – affects those in science most that have the least security: students, PhD students and postdocs do not only have to share the worries mentioned above, but additionally need to cope with pressing deadlines for theses or projects, in addition to parenting and caring for elderly family members. As our “parents”, AWI and UOL, we try to come up with pragmatic solutions for this situation, and are grateful for each person walking the extra mile to create something new (online

course, virtual team meeting) or simply to keep things going. Additionally, as so often, crisis creates solidarity. At least personally, in direct discussions and social media I follow, I have seen a raised willingness to share information and experiences, ranging from complete lectures to targeted workshops for online transition of teaching, lab group meetings.

It is far too early in my view to predict what long-lasting consequences this crisis might have for ecology and marine conservation. As a pragmatic pessimist, I am not convinced that it overall will lead to a reduced human impact on ecosystems. However, I see that the value of science as such is

discussed more strongly, which is a good sign given that political movements with a clear anti-science portfolio were gaining importance in the last years. It also becomes clear that science has a role to play beyond the specific disciplines involved (medicine, epidemiology, virology). Fundamentals of theoretical ecology are needed to understand and model epidemiological dynamics (see contributions of HIFMB’s Thilo Gross and Bernd Blasius, top story).

The assessment of ecological networks is mandatory to understand the transfer and spread of pathogens. Interdisciplinarity is required as well, as humans are not external to these networks. Natural sciences alone will not be sufficient to understand viral dynamics in social-ecological systems, but economic, political and sociological aspects of human behavior are also key for understanding the pandemic spread.

Sincerely, Helmut Hillebrand
Director – Professor of Pelagic Ecology
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photo © H. Hillebrand



Long-lasting consequences of COVID-19 for ecology and marine conservation are unclear.



OPEN CALL

The HIFMB Integrative Postdoc Pool HIPP now open for applications

We are pleased to announce the first HIPP Postdoc research fellowships programme commencing in January 2021:

Unravel unifying principles of marine population response to climate change

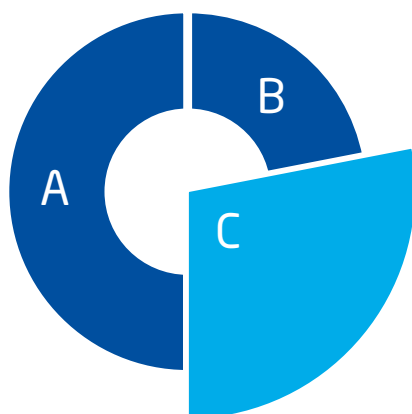
The HIPP is an annual funded opportunity for postdoctoral scientists to develop own research ideas and to actively shape their scientific careers. Its mission is to stimulate integrative and innovative research on functional marine biodiversity and marine conservation, funding is possible for up to three years.

The call is now open for applications (until August 15th 2020). <https://bit.ly/HIPPCall2021>

HIFMB TEAM

Fun Fact

Which activities do you practice in your free time during social distancing?



- A 50 %** Plant care (house or garden)
- 0 % Decluttering
 - 0 % Meditation / Yoga
 - 0 % Knitting / crafting
 - 0 % Going through pictures from past vacations at the sea side
- B 22 %** Video chats with friends / family
- 0 % Hoarding toilet paper



- C 28 %** Other
- A well mixture of everything
 - House renovation
 - Headphones on, listening to my „German for Beginners“ lessons
 - Trying to get everything delivered (recent highlights: wool, licorice, ice cream, strawberries)
 - Investigating what´s really going on here

PUBLISHER

Helmholtz Institute for Functional Marine Biodiversity at the University of Oldenburg (HIFMB)

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