LEIBNIZ CENTRE
for Tropical Marine Research

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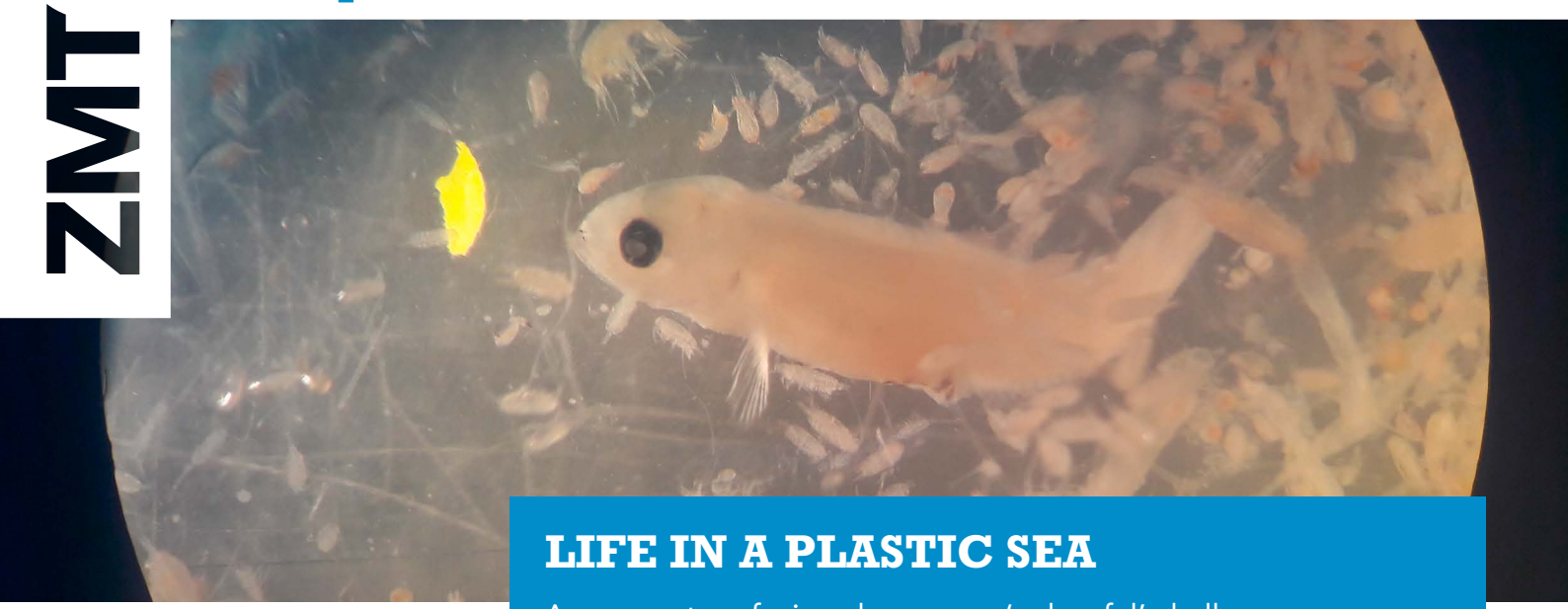

LIFE IN A PLASTIC SEA

An ecosystem facing dangerous 'colourful' challenges

ON EXPEDITION

Marine litter and plastic pollution are an ever increasing problem for our oceans. Images of fish bellies stuffed with plastic tell us the drama is reaching a crisis – but not every fish eats this poisonous, colourful stuff. "There are fish species that eat selectively. When they are offered microplastics as well as natural prey in a lab experiment, they immediately spit out the plastic," says fisheries biologist Carolin Müller. "Even in a shoal there are variations in feeding behaviour." The fact that some fish keep their cool when confronted with plastic food doesn't make the issue of trash in the sea any better. But the way different forms of marine life deal with human-induced pollution is complex and has not yet been adequately investigated. So, for some time now, ZMT has been taking a closer look.

From analysis to advice

Who eats what, where, why and what are the consequences? "Sometimes, the danger lurks in a Trojan horse, such as when fish eat prey organisms that already contain plastic," Carolin Müller explains. At ZMT, she is exploring questions like this in the context of the MicroplastiX international research project. Foraminifera, for example, could be trojans: In the lab at ZMT, scientists discovered that whilst these protozoa tended to disdain 'fresh' microplastic in favour of natural food, they did take a nutritional interest in 'older' particles covered in biofilm. "Later experiments with nanoplastic showed that they ingest relatively large amounts," reports ZMT geoecologist Marleen Stuhr – with an interesting result: "The protozoa simply regurgitate the majority of the plastic again, but some integrated it into their skeletons long term." This could have far-reaching consequences that still need to be studied, says Stuhr. If these miniscule organisms carry plastic around them long term, this would increase the extent to which plastic accumulates in the food chain – and thus the physical or toxic effects on organisms.

Plastic elevator to deeper sea levels

"You have to understand how and why plastic gets into an organism in the first place, in young fish and fish larvae, for example," says Carolin Müller. "Then you have to investigate all of the links in the food chain." It has been proved that fish take the plastic in their organisms down to deeper sea levels and eliminate it there. The extent and impact of this vertical plastic migration are still unclear and it will take time before studies provide a more complete picture of the effects of our pollution on marine life. MORE

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SEA VEGETABLES FOR LUNCH

Algae from the sea with peas and lamb's lettuce – a research approach to tomorrow's menu

Children are curious and adventurous. Touch, examine and even taste edible green gloop? Why not? At ZMT, intensive research on algae in marine aquaculture is being conducted – and now a researcher has found two ways of helping school students get a taste for it: together with Dr Martina Osmers of the School Chemistry Lab at the University of Bremen, doctoral candidate Lara Stuthmann developed the project "Meer-Essen!" (Marine Foods) to interest young children in scientific research on the one hand and vegetables from the sea on the other.

Sea food is not just salty

What can you do with Elodea, commonly known as water-weed? As of June 2023, when children spend three hours at the School Students' Lab at the University of Bremen doing their own experiments in biology, chemistry and the social sciences with water plants, they will, for example, put Elodea in different kinds of water and count the bubbles that escape from beneath the plant. "This is a very easy way of measuring the photosynthesis rate," explains Lara Stuthmann who has thought up this and numerous other experiments to help children overcome their reservations about marine plants.

"Lots of people in Germany tend to associate algae with bad experiences when swimming or with bacteria in lakes, but not with tasty vegetables," says Stuthmann. She wants to change the images in children's minds by asking questions like: What kind of living creatures are they? What can they do? Why do they turn to ash when they are burnt? Outside the lab there is an 'algae buffet' to try, as well. "In the process, we will also try to find words for a taste barely anyone in Germany knows."

It is crucial to experiment with sustainably producible food. What the world's people will eat in future will also be determined by population growth, climate crisis and limited resources. Producing food on land is becoming more difficult and the sea is gaining importance as a resource for food production – which does not just mean fish, molluscs and crustaceans. Salad and grapes can also hail from the sea and contain many healthy ingredients like unsaturated fats, proteins, minerals and antioxidants. How can they find their way onto the fruit and vegetable counters together with grapes, runner beans and broccoli?

Tomorrow's food

But you have to get used to new foodstuffs and that works best when you know more about the new sea food, says Lara Stuthmann who is doing her doctorate on sea grapes, aka green caviar. "Scientific research into marine vegetables helps people be better informed and better able to decide whether they want to go with algae on their plate or not."

In the long run, cultivating edible marine algae would have enormous advantages for food supplies, she says: less consumption of fresh water, very little use of fertile arable land, hardly any fertilisers; moreover, algae can be produced sustainably and don't have to be fed like fish.

On the contrary: "We can even use them to prevent the over-enrichment of nutrients in water as they ingest them and convert them into exploitable biomass." If many people discover at an early age that the result actually tastes really good, algae from marine aquaculture production could become a standard feature of menus in Germany just as they already have in many Asian countries.

Lara Stuthmann belongs to the Experimental Aquaculture working group at ZMT, is employed in the Meer-Essen project and is writing her doctorate on the algae Caulerpa lentillifera in co-operation with the Institute of Oceanography (IO) in Vietnam.
1. MORE 2.MORE

THE OLD SCRAP AND THE SEA

Humboldt Fellow Paul K. Botwe und ZMT Director Raimund Bleischwitz on the impact of electrical waste and shipwrecks on tropical coasts

Why are electrical waste and shipwrecks such a problem?

BOTWE: Every year, about 350,000 tons of electrical and electronic waste (e-waste) arrive in West Africa from Europe illegally. One of the most important hubs for this e-waste is Agbogbloshie in Ghana – thought to be the most polluted place on Earth. Every day, some 5,000 people endanger their lives there, informally recycling electronic waste by dismantling, leaching or open- burning – to recover and sell valuable metals like copper and aluminium. A lot of these activities take place along the river bank and toxic materials travel from there into the coastal ecosystems.

BLEISCHWITZ: Another problem are the big ships, some 50,000 of them, that are traversing the world's oceans. Built decades ago they are approaching the end of their lives. When these steel giants are decommissioned, they are simply rammed up on a beach, irresponsibly circumventing international regulations. This questionable but common practice, of which the EU is also guilty, is known as beaching. The wrecks are sent to tropical countries where exactly the same things happen as Paul just described: poor people break up the ships, seriously endangering their lives, and dangerous substances like asbestos pollute the environment.

What could be the solution?

BOTWE: One meaningful measure in Agbogbloshie would be to establish official recycling factories where people could deliver the waste and get money for it. But that would have to be more than what they get by separating and selling the valuable metals using informal recycling methods. The firm would then make money by recycling the materials. This measure would stop future pollution. However, existing pollution also has to be tackled by exploring remediation strategies. At ZMT, we are looking at how this could be implemented.

BLEISCHWITZ: Proper recycling processes and a circular economy are also key when it comes to solving the shipwreck issue. In the future, the steel industry, which is internationally committed to climate protection, could become a strong partner in an alliance against the reckless practice of beaching. Recycled ships' steel could be a source for future steel production. India, for example, has developed a strong steel industry which has partially made use of shipwrecks. This is an opportunity for Bremen, too, because there is a local steel industry, and the city state has port facilities, wharves and qualified workers. ZMT itself is well positioned to address this issue in cooperation with our established partners in the tropics.

What research work is still required?

BLEISCHWITZ: International statistics tell us about the stock of scrap steel from buildings and cars but, for various reasons, what comes from shipwrecks is usually overlooked. Is this a significant enough amount of steel to be used as a source of green steel? At ZMT we are now making these calculations and exploring how a substantial amount could come to Bremen, how it could fit into the local geography, and what industrial structures would be required.

BOTWE: In the Agbogbloshie project, we study the history of environmental pollution along the food chain in this area. We explore current pollution levels and predict future scenarios to make recommendations for urgently needed measures.

Dr Paul K. Botwe is a Senior Lecturer from the School of Public Health at the University of Ghana. He was awarded a fellowship for early career scientists from the Alexander von Humboldt Foundation (AvH) which enables him to spend two years as a member of the Submarine Groundwater Discharge working group at ZMT. Prof. Dr. Raimund Bleischwitz is a sustainability researcher and the scientific director of ZMT. 1. MORE 2. MORE

New ZMT building

The Leibniz Centre for Tropical Marine Research (ZMT) in Bremen is getting a new administrative building with laboratory capacity. The design by the Viennese architects, SWAP Architektur, was awarded the contract on the basis of a Europe-wide architectural design competition. Currently, ZMT's 160 staff work and conduct research at five different locations. In the next few years, a versatile working environment will be built on an area of approximately 6,500 square metres which will fulfil all the institute's scientific requirements as well as its sustainability ambitions. Amongst other things, there will be conference and meeting rooms with modern communication technology, several labs and flexible office spaces for international researchers to use when they visit. The new building has a budget of 34.8 million euros which will be split between the Federation (Bund) and the Land Bremen. The latter share will be borne by the Bremen Senator for Science and Ports. MORE

A beacon of science

The Mayor of Bremen, Dr Andreas Bovenschulte, is impressed by ZMT. "What we have here in our federal state is a beacon of science," he said during a visit to the research institute in May. Bovenschulte was enthusiastic about the exceptional international and interdisciplinary research work being done at the institute and its significance in the world. During his visit, he held intensive discussions with many members of ZMT's staff who told him about their work and research projects. MORE

Study in Nature Communications: Fish can regulate carbon

When it comes to containing climate change, new players, such as bony fish, could become relevant because they do amazing things on an unexpected level: during growth, they store carbon in their bodies and produce carbonates from marine salts in their gut. Carbonate excretion is very important for the oceans' inorganic carbon cycle and helps to neutralise acidification in seawater. How precisely a wide variety of fish species control their carbonate excretions was the subject of a study by a team of scientists led by ZMT. The results have now been published in Nature Communications. Thanks to the study, researchers will now also be able to factor in the role played by the fish in the marine carbon cycle when making predictions about marine ecosystems under conditions of climate warming and overfishing. MORE

CAMPUS AWARD: research for a sustainable future

What is the impact of wastewater from aquacultures on seagrass ecosystems? How do wind turbine rotor blades hold their own against the wind? These two questions have one thing in common: they were the point of departure for two final dissertations. The biologist, Dr Esther Thomsen of ZMT, investigated the seagrass beds for her thesis, whilst Alex Peer Intemann developed a laser-based method of testing wind turbine rotor blades for his Master's dissertation. For their outstanding achievements, the two scientists have now received the 2023 CAMPUS AWARD – granted the KELLNER & STOLL FOUNDATION FOR CLIMATE AND ENVIRONMENT, the Leibniz Centre for Tropical Marine Research (ZMT), the University of Bremen and its alumni network. MORE

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