The Israeli Association for Aquatic Sciences

העמותה הישראלית למדעי הימים

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Program book

מכון ויצמן למדע
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The De Botton Center for Marine Science

חקר ימים ואגמים לישראל
Israel Oceanographic & Limnological Research

אוניברסיטת חיפה
جامعة حيفا
University of Haifa

המרכז הישראלי לחקר הים התיכון

LEON H. CHARNEY
SCHOOL OF MARINE SCIENCES
בית הספר למדעי הים על שם ליאון צ'רני

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<u>דבר נשיא העמותה, פרופ' אורן לוי</u>

שלום לחברי העמותה הישראלית למדעי הימים,

היום אני מסיים את תפקידי לאחר כארבע שנים כנשיא העמותה ומעביר את השרביט לנשיא הנבחר החדש. שמחתי לשאת בתפקיד יחד עם חברי וועד העמותה ולהמשיך את פעילותה החשובה, כמו גם לנסות לקדם, להגדיל ולהנגיש את מדעי הים לקהל הרחב. ארגון הכנסים, תוך חשיפת תחומים שונים תחת קורת גג אחת, הצמיחו מפגשים מעניינים ופוריים ונתנו במה לסטודנטים וחוקרים צעירים להציג את מחקרם ופועלם המתקיים היום במדינת ישראל. אני סמוך ובטוח שהפעילות החשובה של העמותה תצמח בשנים הקרובות, אני רואה חשיבות גדולה בשילובם של סטודנטים וחוקרים בקיומו של גוף אחד. אני רוצה להודות לכל חברי הוועד שהיו שותפים איתי לאורך הדרך ומאחל דרך צלחה לחברי הוועד החדש הנמרצים ולכולם כנס פורה ומוצלח.

בברכה,

אורן לוי

Meeting program

08:00-08:45	Registration		
Room 1 - ALMOG			
08:40-09:00	IAAS Welcome + General assembly + Board election – **Eyal Rahav**, representative of the IAAS board		
09:00-9:55	Plenary talk- **Prof. Robert H. Weisberg**, College of Marine Science, University of South Florida *"From Climate to a Grouper Sandwich: Why we Study the Ocean Circulation "*		
Room 1 - ALMOG		***Room 2 - AQUAMARINE***	
MARINE POLLUTION Chairs: Edo Bar-Zeev, Yaeli Rosenberg		**NOVEL TECHNOLOGIES FOR MARINE SCIENCE** Chairs: Tali Treibitz, Derya Akkaynak	
10:00-10:15	**Brokovich** - *Offshore oil and gas exploration and production strategic environmental assessment (SEA)*	10:00-10:15	**Allaka** - *Motion analysis of a small unmanned planing craft in seaway*
10:15-10:30	***Preiss** - *Zinc Pyrithione-based compounds as novel antifoulants toxicity assays*	10:15-10:30	***Idan** - *Oases of diversity: East-Mediterranean mesophotic sponge grounds*
10:30-10:45	**Rosenberg** - *Canonical and cellular pathways timing gamete release in Acropora digitifera, Okinawa, Japan*	10:30-10:45	**Edelist** - *Automatic Identification Systems (AIS) as a risk assessment tool for submarine infrastructure*
10:45-11:00	**Silverman** - *Mercury enrichment in fish from northern Haifa bay - sources and mechanism*	10:45-11:00	**Akkaynak** - *Bridging optical oceanography and underwater computer vision*
11:00-11:15	**Vered** - *Ascidians as bio-indicators of micro-plastic and phthalates in marine environments*	11:00-11:15	**Miller** - *Preliminary study of the movement of the Mediterranean slipper lobsters using an acoustic technology*
11:15-11:30	**Wood** - *Desalination brine from multiple sources may have large spatial scale impacts on Israeli Mediterranean coastal waters*	11:15-11:30	**Polinov** - *Optimizing Surveys for Coastal Engineering Projects*
	10:00-11:30 Round Table- *Knowledge Gaps Regarding Marine Reserves in the Israeli Mediterranean* Chairs: Ruthy Yael and Noga Sokolover [PNINA HALL]		
11:30-12:00	Coffee break		

Room 1 - ALMOG		***Room 2 - AQUAMARINE***	
MARINE ECOLOGY AND BIODIVERSITY Chairs: Noa Shenkar, Zafrir Kuplik		**MICROBIOMES AND MICROBIAL INTERACTIONS IN THE OCEANS** Chairs: Miguel Frada, Sabine Keuter	
12:00-12:15	***Nguyen** - *Responses of invasive and native Halophila stipulacea populations to thermal stress*	12:00-12:15	**Lindell** - *Cyanobacterial-cyanophage coevolution: from genes to populations* (Invited)
12:15-12:30	***Yosef** - *A tentacle for every occasion: comparing the hunting tentacles and sweeper tentacles, used for territorial competition, in the Red Sea coral Galaxea fascicularis*	12:15-12:30	**Barak-Gavish** - *Algal DMSP mediates bacterial virulence against a bloom-forming alga in the ocean* (Invited)
12:30-12:45	***Chernihovsky** - *Living on the edge: Planktonic foraminifera biodiversity and fluxes along the Red Sea and Gulf of Aqaba*	12:30-12:45	**Subhajit** - *Foes or friends - mutualism or competition for dust- iron between Trichodesmium and its associated bacteria*
12:45-13:00	***Shlesinger** - *Can mesophotic reefs replenish shallow reefs? Reduced coral reproductive performance casts a doubt*	12:45-13:00	**Britstein** - *The effect of a photosynthetic symbiont on the sponge microbiome*
13:00-13:15	**Rilov** - *Impact of bioinvasions and climate change on benthic biodiversity and ecosystem functions – lessons from the fast-changing Levant reefs*	13:00-13:15	***Maidanik** - *T7-like cyanophage populations dominated by the less virulent clade in the Red Sea*
13:15-13:30	**Mejia** - *Assessing the ecological status of Halophila stipulacea meadows in Eilat - Combining morphological and biochemical descriptors with analyses of the associated microbial community*	13:15-13:30	***Geisler** - *Visual assessment of the heterotopic N_2 fixation on transparent exopolymer particles*
13:45-14:45	Lunch break		
14:45-15:30	Posters session + Coffee		

Room 1 - ALMOG		***Room 2 - AQUAMARINE***	
BIOGEOCHEMICAL PROCESSES IN SEDIMENTARY INTERFACES Chairs: Orit Sivan, Michal Adler		**PERSPECTIVES IN MARINE SCIENCES** Chairs: Orr Shapiro, Uri Yogev, Sarit Avrani	
15:30-15:45	**Arnon** - *The effect of flow conditions on solute mass transfer and oxygen consumption near sedimentary interfaces* (Invited)	15:30-15:45	***Shoham** - *Soft corals forming a calcite-made columnar spiculite in mesophotic reefs*
15:45-16:00	**Jacobson** - *Lattice bound trace elements in vermetids shells from the Mediterranean Sea as proxies for sources of land derived matter in the past millennium* (invited)	15:45-16:00	***Sharoni** - *Phytoplankton community structure governs the elemental composition of marine particulate organic matter*
16:00-16:15	**Boyko** - *Impact of aeolian dry deposition of reactive iron on sedimentary sulfur cycling in the Gulf of Aqaba*	16:00-16:15	***Amsalem** - *Thermal performance (physiological and behavioral) of the rockpool shrimp Palaemon elegans in the context of climate change*
16:15-16:30	**Gilboa** - *The contribution of fish activity to sediment resuspension in the deep-sea - Preliminary results from the Gulf of Aqaba*	16:15-16:30	**Sher** - *Developing the Eastern Mediterranean as an accessible model for microbial oceanography: baselines, observatories and collaborations*
16:30-16:45	**Sela-Adler** - *Co-existence of methanogenesis and sulfate reduction with common substrates in sulfate-rich estuarine sediments*	16:30-16:45	**Sisma-Ventura** - *The combined effects of fast warming and the damming of the Nile have turned the Southeast Mediterranean into a net source of atmospheric CO_2*
16:45-17:00	**Jonathan** - *Understanding stable isotopic fractionation in microbial methanogenesis*	16:45-17:00	**Krom** - *Why the Eastern Mediterranean Sea, although an inland sea, has the characteristics and behaviour of an ocean gyre?*
Room 1			
17:00-17:15	**Neta Lipman**, Communicating Science to the general public – ZAVIT		
17:15-18:00	Concluding remarks, student's best poster/talk awards Wine/beer on the balcony…		

List of posters

Poster #	Authors & Titles
1	**Amiel et al.,** *Authigenic magnetite in deep sediments*
2	**Bar-Or et al.,** *Iron-coupled anaerobic oxidation of methane performed by a mixed bacterial-archaeal community based on poorly-reactive minerals*
3	**Levi et al.,** *Enhanced anaerobic microbial activity in Dead Sea deep core pore fluids during the African Humid Period (9.5−8.7 kya)*
4	**Vigderovich et al.,** *Microbial coupling between methane, sulfate and iron in the sediments of the oligotrophic SE Mediterranean shelf*
5	**Wurgaft et al.,** *Insights into sulfur and carbon coupling in the sulfate-methane transition zone from dissolved inorganic carbon and total alkalinity pore water profiles*
6	**Yorshansky et al.,** *Methane involving processes in sediments of Eastern China Sea Shelf*
7	**Zaarur et al.,** *87Sr/86Sr in lake sediments reveals local and global climatic and environmental changes*
8	**Ashkenazi et al.,** *Reproduction strategy and timing of a mesophotic sponge*
9*****	**Burgsdorf and Steindler***, Living inside a 'black hole': dynamics of microbe-phage interactions within sponge-associated communities and compared to their planktonic counterparts*
10	**Flores et al.,** *Mapping the marine aerosol pattern across the Atlantic and Pacific Oceans during the TARA Pacific expedition*
11	**José Flores-Uribe et al.,** *A novel uncultured marine cyanophage lineage: possible link to cyanobacterial prophages*
12	**Keuter et al.,** *Coccolithophore life cycle dynamics in the Red Sea*
13*****	**Landou et al.,** *Spatial and temporal dynamics of N_2 fixation in the Gulf of Aqaba*
14	**Luzzatto-Knaan et al.,** *Characterizing the cell metabolome of Prochlorococcus MED4 in mono-culture and in co-culture with a heterotrophic bacterium, Alteromonas macleodii HOT1A3*
15	**Mescioglu et al.,** *Diversity of airborne bacteria and fungi across the Mediterranean Sea*
16	**Rahav et al.,** *Significant N_2 fixation by airborne diazotrophs in the Northern Red Sea*
17*****	**Reich et al.,** *Bridging the gap between the lab and the ocean: development of a novel in-situ incubation apparatus*
18	**Roth-Rosenberg et al.,** *Are all cells in batch culture equal? Single-cell heterogeneity and the evolution of chlorotic sub-populations in Prochlorococcus*
19*****	**Sizikov and Steindler***, Isolation of novel microbial sponge symbionts using a modified Dilution-to-Extinction method*
20*****	**Elmaliach et al.,** *Genetic identification, foraging habits, and trophic levels of the Bluefin tuna population in the Eastern Mediterranean Sea*
21	**Gewing et al.,** *Anthropogenic factors influencing invasive ascidian establishment in natural environments*
22*****	**Levi et al.,** *The role of GABAB receptor during development and regeneration of the sea-anemone Nematostella vectensis*

23	**Liberman and Benayahu***, Life history traits of an upper mesophotic octocoral in comparison to the shallow reef one*
24	**Morgulis et al.,** *The regulation of sea urchin tubular spicule cord formation by VEGF signaling and cytoskeletal remodeling*
25*****	**Sa'ar et al.,** *Primordial germ cells lineage characterization in the basal sea anemone Nematostella vectensis*
26*****	**Rosenfeld et al.,** *The spatiotemporal distribution of Aedes phoeniciae in coastal rock pools of the Israeli coastline*
27*****	**Reuven et al.,** *Profiling Nematostella vectensis transcriptome during spawning induction*
28*****	**Gafni et al.,** *The use of stable isotopes of chlorine and carbon to identify biodegradation mechanisms of trichlorethylene in the Israeli coastal aquifer*
29	**Grossowicz et al.,** *Modeling the effects of desalination plants brine on the coastal East Mediterranean food-web*
30	**Avrani and Lindell***, Prochlorococcus-phage coevolution and the potential implication on host genome evolution and population dynamics*
31*****	**Marmen et al.,** *The effect of environment and seasonality on the distribution of toxinogenic cyanobacteria in a semi-arid region*
32	**Arland et al.,** *Comparison of physiological and growth responses of Halophila stipulacea with its closest fresh water relative, Vallisneria americana*
33	**Mizrachi et al.,** *Phenotypic variability in response to oxidative stress unveils a link between chloroplast redox dynamics and cell fate in marine diatoms*
34*****	**Zemah and Tchernov***, What is the ecological-economic value of sharks?*
35	**Bronstein,** *On the distribution of the invasive long-spined echinoid Diadema setosum and its expansion in the Mediterranean Sea*
36*	**Ramon et al.,** *Microplastic consumption by marine biota of the Israeli coastal waters*
37*	**Oppenheimer and Tchernov,** *Adaptive Photosynthetic Characteristics in the Mesophotic Zone*
38	**Alkalay et al.,** *The deep Levantine marine station - A first glimpse to the dark zone*

Plenary talk

From climate to a grouper sandwich: Why we study the ocean circulation

Robert H. Weisberg

Distinguished University Professor
College of Marine Science, University of South Florida
St. Petersburg, FL 33701, USA

Physical Oceanography, the study of the ocean circulation, provides the underpinning for much of the natural phenomena experienced on Earth. Beginning with the transport of heat, by virtue of the solar input being distributed non-homogeneously, the ocean circulation is what determines Earth's climate. This requirement for heat redistribution results in the ocean and atmosphere being intimately coupled, which determines the global distribution of moisture and nutrients and hence primary productivity. Thus while philosophers may argue the fine points of human thought, the ocean circulation is unarguably existential. The role of the ocean circulation in our Earth experiences will be discussed from global (climate and ecology) to local (harmful algae blooms, juvenile fish recruitment, transport of harmful substances) perspectives with the goal of providing an appreciation for why the study of physical oceanography, seemingly the least popular of the marine sciences, is important.

Bridging optical oceanography and underwater computer vision

Akkaynak Derya[1,2], Treibitz Tali[1], Shlesinger Tom[3], Tamir Raz[3], Loya Yossi[3] and Iluz David[4]

[1] University of Haifa; [2] The Hebrew University, the interuniversity institute; [3] Tel Aviv University; [4] Bar Ilan University.

Many practical underwater computer vision applications, such as visibility enhancement and color restoration, require the knowledge of attenuation coefficients per color channel to reconstruct better quality images and video. However, these coefficients are difficult to obtain accurately. Their estimation requires specialized hardware for *in situ* calibration, and the estimation process needs to be repeated anew for different locations because the optical properties of the global ocean vary significantly spatially and temporally. Here, we utilize underwater light spectrum measurements taken worldwide by optical oceanographers in the last eight decades, and calculate the locus of all physically meaningful attenuation coefficients in RGB space. We find that two lines in 3-space sufficiently represent the extremes of oceanic and coastal waters, which are characterized by very low and very high attenuation coefficients respectively, and the variation in between. The slopes and intercepts of these lines depend on the spectral response of the camera sensor, and the distance between the scene and the camera. Our results demonstrate that the constrained estimation of these coefficients improves color correction accuracy of underwater images even when the geographic location or the depth at which photos were taken is not precisely known. The derived loci also serve as a dictionary for realistic computer-generated imagery and rendering of natural waters, and we show that it is easily extendable to other participating media. Finally, by connecting the bio-optical properties of the water constituents to a known locus in the RGB domain, this work constitutes an important step towards enabling the use of RGB cameras in two new functions: for reliable ecological monitoring of natural processes like plankton biomass estimation, as well as for hazards including harmful algal blooms, floods, and oil spills; and for validation of remotely sensed datasets of ocean color.

Motion analysis of a small unmanned planing craft in seaway

Allaka Himabindu and Groper Morel

The Hatter Department of Marine Technologies, Leon H. Charney School of Marine Sciences, University of Haifa, Israel.

To promote the development and operation of an unmanned small planing crafts, the capability to predict in real time the accelerations and motions the craft is expected to develop based on the knowledge of the incoming waves is much required. As part of this a nonlinear mathematical model for the simulation of motions and accelerations of planing monohulls in seaway having a constant or variable deadrise angle, in head or following waves has been formulated. This model, based on the 2-dimensional strip theory, improves previously developed models and provides accurate results for the acceleration, velocities and expected motions of a planing craft in the vertical plane and in the time domain. The sectional hydromechanic forces are determined by the theory of wedge penetrating water surface. The sectional wetted breadth and immersion are directly integrated into the expressions for the hydromechanic forces. A near transom pressure correction affecting both the hydrostatic and the hydrodynamic terms of the load distribution is introduced. The dynamic drag force is calculated based on a semi-empirical model. To validate and calibrate the developed model a JetSki platform is fitted for remotely controlled operation and is instrumented with an Inertial Measurement unit (IMU) to log the linear and angular accelerations and the angular attitude of the craft. The incoming waves are measured by a separately deployed buoy. The model based computed wave induced heave, pitch and vertical accelerations has been validated with these experimental data and the differences are addressed. Comparison of the computed vertical acceleration with various classification societies' semi empirical relations is also presented and examined. Visual sensors assisted algorithm to support in the selection of a feasible speed and navigation path in rough seas will be integrated into the existing platform to support the craft's autonomous operation.

The deep Levantine marine station - A first glimpse to the dark zone

Bar Ilan University: Ronen Alkalay, Tslil Bar, Olga Zlotkin, Yishai Weinstein, Ilana Berman-Frank

Israel Oceanographic and Limnological Research (IOLR): Timor Katz, Barak Herut, Eli Biton, Eyal Rahav, Tal Ozer,

Tel Aviv University : Yaron Toledo

Hebrew University :Hezi Gildor

Geological Survey : Ahuva Almogi

The DEEP LEVANTINE Marine Station (DeepLev) is the first deep-moored station in the ultra-oligotrophic Levantine Basin of the EMS. The mooring was deployed in Nov 2016 50 km west-NW of Haifa at 1500 m depth (known as Station H05), with the support of the newly refurbished Israeli research vessel (R/V Bat Galim). It includes an array of instruments and sensors designed to measure physical and environmental parameters along the water column, as well as sediment traps, which are intended to characterize C export production. A fundamental component of the mooring is the time-series sediment traps. deployed at 180 m, 280 m and 1300 m depths and contain 21 sampling bottles each, which allow sediment collection at fixed time intervals of 11 days during 6 months. Then, the particles' organic C:N:P , as well as the ballast, are studied in order to establish C export and the fate of organic matter at the twilight zone and the dark ocean. Two couples of cylindrical traps were added at depth of 700 and 1480m, as to complete the profile of vertical flux and to add information about re-suspended sediment. The information collected by the mooring is complemented by water column profiling of dissolved organic matter and microbiology, as well as ^{234}Th and ^{228}Ra activities, which are used to determine vertical POC fluxes, as well as to determine the POC/DOC export ratios, which is a major issue related to oligotrophic seas. The mooring was successfully recovered and re-deployed in May 2017. Most instruments worked properly. However, the collection bottles of the two shallow McLane traps were full of fish (Paralepis Coregonoides), which did not allow analysis of most 180 and 280 m sediment samples. The 1,300 m McLane trap and the cylindrical traps were intact and all collected sinking material. The ballast is mainly (90%) composed of fine-grained (<20 μm) terrigenous clay, while the medium-and coarse-grained material is composed of mineral grains (mainly quartz) and organic matter (mainly fecal pellets and organo-clay complexes), as well as several species of diatoms, radiolarian fragments and small foraminifers, with the latter following a seasonal pattern (largest proportions in March). A few pteropod shells were also found in this trap, while in one bottle from the 280 m trap (which was not filled with fish) many pteropods were found, in accordance with the less-stable aragonitic composition of the pteropod shells, compared with the calcitic forams. The 1,300 m McLane time series shows significantly higher total mass flux in the winter (Jan-Feb) than during autumn or spring, in association with frequent storms during this period. PIC correlates nicely with the total mass, apparently due to it being dominantly terigeneous (either dust or resuspension). Although not so prominent, POC is also higher during the winter, which possibly suggests the involvement of an abiotic driver in C export. which should be carefully characterized during future deployments. ^{234}Th profile, taken in May 25, shows a large deficit in the euphotic zone, while close to equilibrium in deep water. This indicates that significant particle sinking is taking place in the DeepLev site. Although not calibrated, therefore export production cannot yet be quantified, this suggests that C export via particulate flux is not so minor, as previously suggested by modelling (Guyennon et al. 2015). We are looking forward to the results of the 2nd deployment, to be recovered November 2017.

Authigenic magnetite in deep sediments

Amiel Nitai, Vigderovich Hanni and Sivan Orit

Department of Geological and Environmental Sciences, Ben Gurion University of the Negev.

Magnetite is a semi-conductive iron-oxide mineral that contains both ferrous and ferric iron and has the ability to record the earth magnetic field components. Magnetite crystals can be produced chemically in volcanic and metamorphic rocks, or biologically as intra-cellular crystals by magnetotactic bacteria or as an extra-cellular by-product of dissimilatory iron reduction (so called authigenic magnetite). Due to its mixed-valent structure, magnetite can serve also as an electron acceptor in the dissimilatory anaerobic respiration process. Recently we observed unexpected iron reduction below its traditional zone in the deep methanogenic zone both in Lake Kinneret and in the Mediterranean continental shelf sediments. In this study, we explore the association between this iron reduction and the production or consumption of authigenic magnetite. Preliminary profiles from Lake Kinneret sediments show a peak of maximum magnetite concentrations at the same depth of the increase of ferrous iron. This suggests that part of the magnetite particles were precipitated during the iron reduction. In addition, there is a good correlation between magnetite concentrations and Natural Remanence Magnetization (NRM) intensity, which suggests that the authigenic magnetite has the ability to obtain the magnetic field and to enhance the NRM intensity. Preliminary results from the Mediterranean continental shelf sediment profiles show a decrease in magnetite concentrations at the methanogenic depth and a good correlation to NRM intensity, which in this case suggests that magnetite is being probably used as an electron acceptor or is being dissolved by hydrogen sulfide.

Thermal performance (physiological and behavioral) of the rockpool shrimp *Palaemon elegans* in the context of climate change

Amsalem Eyal [1, 2] and Rilov Gil [1, 2]

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Different species are expected to have different vulnerabilities to ocean warming driven by climate change. One of the most fast warming marine realms is the eastern Mediterranean Sea and conditions may become more extreme in the intertidal zone. On the other hand, rocky intertidal species, given their naturally harsh environment may be more resilient to increases in extreme conditions. One such hardy species that inhabits intertidal rockpools is the little shrimp *Palaemon elegans*. This is a euryhaline shrimp with a wide global distribution. Along the Israeli shore It is abundantly found in tidepools that often disconnect completely from the open sea and can reach extremely high temperatures (37.8^{O}C, were measured in a rockpool in Shikmona during low tide in the summer). In this study, I characterized the shrimp's habitat physical conditions and population dynamics, determine its upper thermal limits tested its physiological, behavioral and growth performance under a wide range of temperatures (12-36 ^{O}C in both winter and summer). So far, I found that the shrimp survive in most of the tested range and have a wide optimum performance range (measured as respiration rate) between 20-30^{O}C in the summer. Its Critical Thermal Maximum (CTMax) is 38.08 ^{O}C, which is higher than the CTMax measured for this species in the eastern Atlantic, suggesting adaptation to regional conditions. However, this value means that it has low capacity for dealing with extra warming (warming tolerance, CTMax - maximum habitat temperature = 0.3^{O}C). Such low warming tolerance means that *Palaemon* is living very close to its thermal limits in Israel, and additional warming (of both air and water) can add stress and potentially reduce its fitness.

Comparison of physiological and growth responses of *Halophila stipulacea* with its closest fresh water relative, *Vallisneria americana*

Arland Michelle[1,2*], Barak Simon[2] and Winters Gidon[1]

[1] The Dead Sea-Arava Science Center, Central Arava Branch, Tamar Regional Council, neve Zohar 86910, Israel; [2] Ben-Gurion University of the Negev, Jacob Blaustein Institutes for Desert Research, French Associates' Institute for Agriculture and Biotechnology of Drylands, Midreshet Ben-Gurion, 8499000, Israel.

Halophila stipulacea is a tropical seagrass native to the Indian Ocean and Red Sea, but it has been spreading in the Mediterranean, and recently the Caribbean Sea. Its success as an invasive species has been partially attributed to tolerance to variations in salinity. Thus, elucidating the mechanisms involved in salt tolerance in this species will contribute to the modeling of its future invasive distribution. *H. stipulacea* is also closely related phylogenetically to *Vallisneria americana*, a fresh water plant. Comparing salt tolerances in *H. stipulacea* with that of its fresh water relative will contribute to understanding the evolution of seagrasses from their freshwater ancestors. For this, *H. stipulacea* plants were exposed to control (40), hypo (15, 20, 25) and hyper (60, 65 PSU) salinities for 3 weeks followed by a 4-week recovery phase. Similarly, *V. americana* plants were exposed control (0), and hyper (5, 10, 15 PSU) salinities. Plants were followed over time for changes in leaf counts and surface area, C/N ratios, biomass, dark-adapted quantum yield of photosystem II and chlorophyll content. In comparison with both the control (40 PSU) and hyper salinity treatments (60, 65 PSU), *H. stipulacea* plants exposed to hypo-salinities, lost more leaves and decreased in leaf area and chlorophyll content. The C/N ratios of the below-ground tissues of the *H. stipulacea* plants after hypo- and hyper-salinity stress were lower than control plants suggesting certain adaptive mechanisms employed by the plant. In comparison with control (0 PSU), *V. americana* plants exposed to 10 PSU, suffered reductions in leaf blade elongation, leaf number, biomass and quantum yield and were not able to survive at all at 15 PSU. In both species, the ongoing work is to link these physiological responses with transcriptomics and metabolomics to investigate the differences in the molecular mechanisms involved in salinity stress tolerance.

The effect of flow conditions on solute mass transfer and oxygen consumption near sedimentary interfaces

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Flow conditions and sedimentary structures are the major factors affecting the exchange of nutrients between the bulk water and the sedimentary environment. The process of water flow in and out of the streambed is commonly termed hyporheic exchange (HE). In this study, we use a novel flume system, which enables the control on the overlying water velocity and losing and gaining fluxes between the stream and the groundwater to systematically evaluate how they affect HE and oxygen consumption by benthic biofilms. The flume was packed with sandy sediments from the Yarqon Stream. HE was measured by conducting tracer experiments with NaCl. Oxygen dynamics was investigated by using planar optodes to measure their sedimentary concentrations at a high temporal and spatial resolution. The experiments revealed that when either losing or gaining fluxes were increased (regardless of whether the flux was upward or downward), HE followed an exponential decline, the volume of the hyporheic flow cell drastically reduced, and the mean residence times declined moderately. It was also found that oxygen consumption did not follow a clear pattern such as the HE. Oxygen consumption was highly depended on transport and was increased in a predictable manner with increasing overlying water velocity and losing or gaining fluxes. When the upwelling groundwater was anaerobic, losing conditions yielded much higher consumption as compared with gaining flow conditions. In another example it was found that oxygen uptake under non-steady flow conditions in the stream were higher than under steady flow conditions. These results enable us to show the importance of the coupling between flow conditions and oxygen consumption in sediments and are expected to improve our understanding of nutrient cycling in aquatic ecosystems.

Reproduction strategy and timing of a mesophotic sponge

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Stryphnus mucronatus is one of the most conspicuous species at the mesophotic sponge grounds of the Israeli Mediterranean coast. It is a large and massive sponge (reaching a capacity of 4601.39 cm^3) with significant presence at its habitat. It acts as an ecosystem engineer by increasing the habitat complexity and creating niches for a most diverse assemblage of invertebrates and fish, including other sponges. Yet, data regarding the life history traits of *S. mucronatus* are scarce. We have studied the sexual reproduction of *S. mucronatus* between March 2016 and July 2017, with samples collection taken during several expeditions to the mesophotic zone of the Israeli Mediterranean. Using a remotely operated vehicle (ROV), 22 individuals were sampled. Analyzing histological sections enabled to document *S. mucronatus* reproductive strategy and timing. Nine of the sampled individuals exhibited female reproductive elements (oocytes); two individuals exhibited male reproductive elements (spermatocytes, spermatids and spermatozoa); and the rest of the specimens did not exhibit any reproductive elements. None of the individuals displayed coexistence of oocytes and sperm cyst, indicating that *S. mucronatus* is a gonochoristic sponge. In addition, embryos or larva were not found, suggesting that the sponge is oviparous (broadcaster). The maximum reproductive effort (highest oocytes abundance and maximum diameter) occurred in March and April, while sperm cysts were detected in April only. The sexual reproduction of species from *S. mucronatus*'s family, Ancorinidae, is known as seasonal. While the different stages of oocytes and sperm cysts imply that the specimens produce reproductive elements throughout the year, which contributes to thought that *S. mucronatus* might reproduce year long. It should be emphasis that since our sampling was done seasonally, we might have missed documentation of fully developed oocytes and sperm cysts in months we did not sample.

Prochlorococcus-phage coevolution and the potential implication on host genome evolution and population dynamics

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Prochlorococcus is an abundant marine cyanobacterium that grows rapidly in the environment and contributes significantly to global primary production. This cyanobacterium coexists with many cyanophages in the oceans, likely aided by resistance to numerous co-occurring phages. Spontaneous resistance occurs frequently in *Prochlorococcus* and is conferred by mutations in cell surface related genes, which are found in genomic islands (hyper variable regions). This resistance is often accompanied by a pleiotropic fitness cost manifested as either a reduced growth rate or enhanced infection by other phages. These phage-resistant strains continued evolving toward an improved growth rate and a narrower resistance range, resulting in lineages with phenotypes intermediate between those of ancestral susceptible wild-type and initial resistant substrains. Changes in growth rate and resistance range often occurred in independent events, leading to a decoupling of the selection pressures acting on these phenotypes. These changes were largely the result of additional, compensatory mutations in noncore genes located in genomic islands, although genetic reversions were also observed. The similarity of the evolutionary pathway followed by multiple independent resistant cultures and clones suggests they undergo a predictable evolutionary pathway. This process serves to increase both genetic diversity and infection permutations in *Prochlorococcus* populations, further augmenting the complexity of the interaction network between *Prochlorococcus* and its phages in nature. Last, our findings provide an explanation for the apparent paradox of a multitude of resistant *Prochlorococcus* cells in nature that are growing close to their maximal intrinsic growth rates.

Iron-coupled anaerobic oxidation of methane performed by a mixed bacterial-archaeal community based on poorly-reactive minerals

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Anaerobic oxidation of methane (AOM) was shown to reduce methane emissions by over 50% in freshwater systems, its main natural contributor to the atmosphere. In these environments iron oxides can become main agents for AOM, but the underlying mechanism for this process has remained enigmatic. By conducting anoxic slurry incubations with lake sediments amended with ^{13}C-labeled methane and naturally abundant iron oxides the process was evidenced by significant ^{13}C-enrichment of the dissolved inorganic carbon pool and most pronounced when poorly-reactive iron minerals such as magnetite and hematite were applied. Methane incorporation into biomass was apparent by strong uptake of ^{13}C into fatty acids indicative of methanotrophic bacteria associated with increasing copy numbers of the functional methane monooxygenase *pmoA* gene. Archaea were not directly involved in methane oxidation, but their crucial participation, likely being mediators in electron transfer, was indicated by specific inhibition of their activity that fully stopped iron-coupled AOM. By contrast, inhibition of sulfur cycling increased ^{13}C-methane turnover, pointing to sulfur species involvement in a competing process. Our findings suggest that the mechanism of iron-coupled AOM is accomplished by a complex microbe-mineral reaction network, being likely representative of many similar but hidden interactions sustaining life under highly-reducing low energy conditions.

Algal DMSP mediates bacterial virulence against a bloom-forming alga in the ocean

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Emiliania huxleyi is a bloom forming coccolithophore that impacts the global sulfur cycle by producing large amounts of dimethylsulfoniopropionate (DMSP) and its volatile metabolic product dimethyl sulfide (DMS). Top-down regulation of *E. huxleyi* blooms is attributed to viruses and grazers, however, the possible involvement of algicidal bacteria in bloom demise is still elusive. We isolated from a North Atlantic *E. huxleyi* bloom a *Roseobacter* strain, *Sulfitobacter* D7, which exhibited algicidal effects against *E. huxleyi* upon co-culturing. Both the alga and the bacterium were found to co-occur during a natural *E. huxleyi* bloom, therefore establishing this host-pathogen system as an attractive, ecologically relevant model for studying alga-bacterium interaction in the oceans. During interaction, *Sulfitobacter* D7 consumed and metabolized algal DMSP to produce high amounts of methanethiol, an alternative product of DMSP catabolism. We found a strain-specific response, in which *E. huxleyi* strains that exuded higher amounts of DMSP were more susceptible to *Sulfitobacter* D7 infection. Intriguingly, exogenous application of DMSP expedited infection dynamics and induced susceptibility to the bacterial pathogen in a resistant algal strain. We propose a novel function for DMSP, in addition to its central role in mutualistic interactions, as a mediator of bacterial virulence that may regulate *E. huxleyi* blooms.

On the distribution of the invasive long-spined echinoid *Diadema setosum* and its expansion in the Mediterranean Sea

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Sea urchins from the genus *Diadema* are some of the most widespread and ecologically important species in tropical marine environments. Two distinct clades of *Diadema setosum* have been previously recognized based on DNA sequence data: the widespread *clade a*, distributed throughout the Indo-west Pacific and *clade b*, native to the Arabian Peninsula. We use published and novel molecular data to assert the distribution of the two *D. setosum* clades and compile a comprehensive, georeferenced occurrence list for both clades throughout their range. These data are then used to model the global distribution of *D. setosum* with respect to the two molecularly inferred clades and evaluate their invasive potential throughout the Mediterranean. We combine morphological with molecular data to assert the taxonomic identification of the single Mediterranean *Diadema* recovered to date and provide an updated phylogenetic analysis of this genus. Species Distribution Modelling predicts suitable habitats for the two clades including some along the Egyptian and Israeli coasts of the Levantine Basin, and in restricted areas in the Aegean and Adriatic seas. Genetic data show that the Mediterranean *Diadema* derives from mitochondrial *clade b* of *D. setosum*. The spatio-temporal pattern of *D. setosum*'s Mediterranean invasion does not follow a gradual succession of directional population expansion as may be expected from an unmediated larval transport through the Suez Canal, indicating potential anthropogenic involvement. Without intervention, further spread of *D. setosum* in the Mediterranean seems likely, elevating the risk of population release that may have far-reaching anthropogenic and environmental consequences.

The effect of a photosynthetic symbiont on the sponge microbiome

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In this study we investigated how the sponge microbiome is affected by loss and gain of a cyanobacterial photo-symbiont. The Mediterranean Sea sponge *Petrosia ficiformis* hosts a wide variety of microbes, one being the cyanobacterium *Candidatus* Synechococcus feldmanni which is a facultative symbiont. Symbiosis with this cyanobacterium can be manipulated by *in situ* transplantation of specimens from illuminated to dark habitats and *vice versa* resulting in the loss or uptake of *Ca*. S. feldmanni. Here, we analyzed the structure and activity of the microbiome in such different symbiotic states (with and without photosynthetic symbiont), using 16S rRNA amplicon sequencing on gDNA and cDNA, respectively. We demonstrated for the first time, uptake of *Ca* Syn. feldmanni by *P. ficiformis*. The results also indicate the presence of two different, yet phylogenetically closely related, *Ca.* S. feldmanni symbionts, whose presence affects the relative abundance of few operational taxonomic units (OTU) within the microbial consortium, causing a shift in the type of autotrophic microbes hosted; potential dark carbon fixing microbes were lost while photosymbionts were acquired.

Impact of aeolian dry deposition of reactive iron on sedimentary sulfur cycling in the Gulf of Aqaba

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The Gulf of Aqaba is an oligotrophic semi-enclosed marine system with oxygen-rich water column and organic carbon-poor sediments. Dust inputs from adjacent (e.g. Arabian and Sinai Peninsulas) and distal (e.g. Sahara) arid environments is an important source of highly reactive iron minerals, especially at the deep-water sites of the Gulf of Aqaba, which are less affected by sediment transport from the Arava Desert during winter flash floods. This study was aimed to evaluate the role of airborn iron(III) minerals in sedimentary sulfur cycling of the Gulf of Aqaba. Speciation of redox-sensitive elements was studied in the upper 90 cm of the sediments at sites with various water depths (19-694 m). Microbial sulfate reduction in sediments was inferred from the presence of pyrite, the presence of sulfide oxidation intermediates, and sulfur isotopic composition of sulfate and solid-phase reduced sulfur species. At shallow water sites (19-21 m), which are affected by a combination of aeolian and fluvial iron inputs, sedimentary reactive iron content is lower than at the deep-water sites. Lower reactive iron content allows relatively high amounts of hydrogen sulfide to persist in the pore-waters and does not prevent preservation of reduced sulfur in the form of pyrite. At deep-water sites (306-694 m) high sedimentary content of reactive iron(III) (hydr)oxides (mainly goethite and hematite), originating from mineral dust deposition, leads to fast re-oxidation of H_2S produced during microbial sulfate reduction and limits pyrite formation in the sediments. Therefore, at these sites the sedimentary sulfur cycle may be defined as cryptic.

Living inside a ‘black hole’: dynamics of microbe-phage interactions within sponge-associated communities and compared to their planktonic counterparts

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Phages have a huge impact on the composition and behavior of microbial communities in every ecological setting. Phages can affect the evolution of the host in different ways including transduction of novel genes, maintain biodiversity, influencing cellular evolution et cetera. Besides direct influence on the host evolution, phages might take a regulatory part in complex tripartite symbiotic relations, an example from the field of entomology being symbioses between eukaryote, cellular microorganism and phage where the abundance of bacterial symbionts is controlled by phages. Similar complex interactions might exist in marine organisms. Sponges filter large quantities of planktonic microbes, and act as oceanic 'black holes' consuming bacteria, dissolved organic matter and viruses. Thus sponge-associated bacteria are likely exposed to many more viral particles than their free-living counterparts. Previous metagenomic studies revealed that Clustered Regularly Interspaced Short Palindromic Repeats (CRISPRs) and restriction modification defense mechanisms are abundant features in sponge microbial metagenomes providing indirect evidence for a higher phage-pressure in sponge associated microbiomes. During my study I sampled viral and microbial fractions of the Red Sea sponge *Theonella swinhoei*. Prior to sponge sampling, the planktonic microbial and viral fractions were collected in the same sampling site. My study will reveal bacteria-phage interactions within the sponge holobiont, by comparing richness and functional profiles of the sponge associated and planktonic viromes. I will try to assess whether phages may function as part of a tripartite symbiotic interaction (sponge-bacteria-phage), and contain a reservoir of the genes related to symbiosis (auxiliary genes). I will estimate the proportion of ‘host-adaptation signature genes’ (genes unique to sponge-associated bacteria, lacking in free-living bacteria) in the sponge associated virome comparing to its planktonic counterpart. Estimate horizontal gene transfer mediated by phages within the sponge associated community and between sponge and planktonic microbial communities.

Living on the edge: Planktonic foraminifera biodiversity and fluxes along the Red Sea and Gulf of Aqaba

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Planktonic foraminifera (PF) assemblage composition and accumulation rates in the open oceans are considered to be robust proxies of past oceanographic conditions, yet very little is known about their characteristics and life cycles in extreme oligotrophic environments. The Red Sea spans between the very productive upwelling zone of the NW Arabian Sea (NWAS), across a >2000 km transect that ends in the marginal and extreme oligotrophic northern tip of the Gulf of Aqaba (GOA). This transect is characterized by a gradual northward depletion in nutrients, increasing salinities and changing sea surface temperatures, all strongly influencing PF dynamics and distributions. Here, PF species fluxes and assemblage composition were obtained from monthly-deployed sediment traps during 2014-2016 in the northern GOA. The results were compared with published values from the Red Sea, Gulf of Aden and the NWAS (Somalian Basin). PF ecological gradients along the NWAS - GOA transect include: 1) Species richness, decreasing from 32 to only 10, among the lowest PF richness values globally in low latitudes, while species belonging to the Globorotalidae are scarce from the southern Red Sea and northwards; 2) PF fluxes range between a maximum of ~28,000 shells m^{-2} d^{-1} in the NWAS, to approximately 10-fold lower at the GOA (2662 shells m^{-2} d^{-1}) and 3) PF abundances, decrease from ~1000 shells m^{-3} to ~18 shells m^{-3}, respectively.PF biodiversity and succession along the NWAS - GOA transect are controlled by nutrients and food availability which are directly connected to primary productivity. The subsequent unique PF assemblage in the GOA is composed of well adapted species to both oligotrophy and extreme hydrography that differs considerably from the other side of this gradient represented by the NWAS upwelling zone thus enabling evaluation of the impact of the environment on PF ecology and further interpretation of down-core records.

Automatic Identification Systems (AIS) as a risk assessment tool for submarine infrastructure

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Automatic Identification Systems (AIS) are vessel tracking systems installed on medium and large ships worldwide in order to facilitate safe passage at sea. Almost 1m vessels today carry AIS transponders; pulsing out their location, velocity, heading and time stamp. Since 2009 this big data has been made public and available, spawning a multitude of novel applications. Here we propose an AIS-based tool for assessing risks to hydrocarbon pipelines, power lines and communication cables from fishing (e.g. bottom trawling) and shipping (e.g. dragged anchors) operations. Failure of such infrastructure often results in tremendous costs, and in the case of oil spills potential environmental catastrophe as well. Conventional pipeline and cable risk assessment models rely on extremely accurate engineering parameters to assess single impact severity; yet they often rely on poor methodology for predicting impact frequency, which results in a wide range of uncertainty or even a biased assessment. We ran a spatial algorithm on data generated by AIS to replace conventional estimates with real impact frequency information. The size and configuration of the gear, vessel and fleet, local fishery compliance, shipping trends, meteorological and other data incorporated into the model allow us to show exact crossing locations, angles and velocities which are crucial for the process, identify high and low risk segments of the infrastructure and improve planning of future infrastructure deployment. As coating, burial and other forms of infrastructure protection are often extremely costly, and considering the possible implications of infrastructure failure, the use of AIS is set to become an industry standard in the spatial management of offshore assets.

Genetic identification, foraging habits, and trophic levels of the Bluefin tuna population in the Eastern Mediterranean Sea

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Atlantic Bluefin tuna (ABFT, *Thunnus thynnus*) is an important species due to its high commercial value and its ecological importance across the globe. Conservation of higher trophic level biota has a cascading effect on the stabilization of the entire marine ecosystem. It is, therefore, important to assess and monitor the status of this key species and establish a baseline to enable further research to be carried out towards its conservation. Thus far, there has been little or no research on the distribution and genetic structure of ABFT within the marine space of Israel. This work seeks to address this deficiency of data, and provide data in support of the international research effort for the conservation of this species. The long-term goal of this research was to collect data regarding the specific population that migrates through the EMS. 42 local (Israeli coast) ABFT samples and 28 ABFT samples from west Mediterranean Sea were collected during the fishing seasons of 2016-2017. Using GCMS-IRMS analysis of stable N and C isotopes from muscular tissue, this study provide data on the trophic level of this specie and with the support of stomach constant analysis on their dietary composition. Such insights may serve as the missing link for a better understanding of the EMS changing food web. Using molecular markers from tuna specimens sampled in both locations (east and west), this research show some differences between individuals and even suggest the possibility of a genetically discrete population in the eastern basin of the Mediterranean Sea and some genetic structure of ABFT populations from different locations in the Mediterranean Sea and Atlantic Ocean.

Mapping the marine aerosol pattern across the Atlantic and Pacific Oceans during the TARA Pacific expedition

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The role of marine aerosols in the atmosphere and their interaction with marine ecosystems remains one of the largest uncertainties in climate research. Marine aerosols constitute one of the most important natural contributors to global aerosols mass and play a pivotal role in the Earth's climate system. They not only contribute to Earth's radiation budget, the microphysical properties of clouds, and therefore the hydrological cycle and climate, but they can also affect marine ecosystems. Fluxes of aerosols and volatiles between the ocean and the atmosphere modulate cloud properties and carbon cycling in the ocean and thus play a key role in largescale climate processes. The Tara PACIFIC expedition is a 2.5 year scientific expedition crossing the Atlantic and Pacific Oceans. Here we present the spatial and temporal variability of the physical properties of marine aerosols across the TARA route. We examine the main variation between the aerosols in the Atlantic and Pacific Ocean, and we explore the differences between the marine aerosols emitted in the oligotrophic parts of the ocean with highly productive areas. Finally, we show the occurrence of a diurnal cycle of emission of large particles (diamter > 0.7 μm) in the tropical Pacific Ocean. The TARA data will help provide base information linking marine physics and ecology to aerosol fluxes, to provide a fundamental new understanding of marine aerosols emissions and their interaction with marine ecosystems and its key role in the climate system.

A novel uncultured marine cyanophage lineage: possible link to cyanobacterial prophages

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Marine cyanobacteria are important contributors to primary production in the open oceans. The effects of viruses that infect cyanobacteria (cyanophages) depends on whether the infection is lytic or lysogenic. Lytic infections end with the lysis of the host cell and release of virions, in contrast in lysogenic infections the viral genome integrates into the host chromosome and replicates with cells without virion production[1]. Despite some reports of lysogeny in marine cyanobacteria, the phenomena remain largely uncharacterized and isolation of lysogenic cyanophages has not been reported yet. Using the sequence of BAC21E04, a Bacterial Artificial Chromosome (BAC) from a library BACs used previously to survey environmental photosystem II protein D1 diversity[2], we recovered complete genomes for a novel uncultured marine cyanophage family assembled from the Tara Oceans metagenomic datasets[3]. This lineage of viruses possesses circular DNA genomes with an average size of 85 kb, are widespread, and could be detected in different oceanic regions. Annotation of the genomes revealed the presence of several cyanophage marker genes and a split DNA polymerase, however, they do not contain known structural viral protein coding genes. Phylogenetic analysis shows the unexpected clustering of the split DNA with a split DNA polymerase from *Synechococcus* WH8016. Examination of the vicinity of the DNA polymerase in the genome of WH8016 revealed the existence of a possible prophage in an area of 100 kb with a distinctive genomic signature. The putative prophage does not resemble any known cultured marine cyanophage genome reported to date but do contains several genes shared with the newly identified cyanophage family. This is the first report of a possible prophage in cultured marine *Synechococcus* and the genomic characterization of its uncultured cyanophage relatives.

The use of stable isotopes of chlorine and carbon to identify biodegradation mechanisms of trichlorethylene in the Israeli coastal aquifer

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Trichloroethylene (TCE), is a carcinogenic volatile organic chemical used primarily in the textile and metal industry, which pose a pollution risk water resources worldwide. Two main processes for TCE degradation are known: anaerobic reductive dechlorination and aerobic co-metabolism. Combining carbon and chlorine isotope analysis may be powerful for distinguishing between both processes. However, so far dual element isotope fractionation in TCE transformation has been investigated for reductive dechlorination only. The other part of the picture – aerobic biodegradation – is missing. The main objective of this study is to assess the potential and importance of aerobic decomposition of TCE in groundwater. We have measured chlorine and carbon enrichment factors during TCE biodegradation experiments with aerobic bacteria, after optimizing the methods for chlorine isotopes. These measurements are the basis for assessing the importance of the aerobic biodegradation in the aquifer. To evaluate our analytical approach, we recently assessed the potential of TCE oxidation at a contaminated site where chemical treatment is taking place (Permanganate). Preliminary results show enrichment in carbon isotopes, but not in chlorine, indicating oxidation processes, which in turn allows us to quantify the process. This method is especially important at sites where the levels of pollution vary with time regardless of the rehabilitation process. This enables us to evaluate the effectiveness of the treatment and improve the way the site is treated.

Visual assessment of the heterotopic N_2 fixation on transparent exopolymer particles

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Previous studies indicated that heterotrophic diazotrophs can actively fix N_2 at oxygenated and N-rich environments. We hypothesized that transparent exopolymer particles (TEP) may promote diazotrophy in such 'unexpected' environments by providing favorable physiochemical conditions such as high C content (energy source), high C:N ratio ('limiting N conditions') and low oxygen microenvironment (inhibiting factor). Here, we examined the link between a model diazotrophic bacterium (*Vibrio natriegens*) and TEP using a newly developed visual triplicate staining technique. This new approach captures TEP (Alcian blue), bacteria (DAPI) and active diazotrophs (nitrogenase - immunolocalization). Concurrently, bacterial activity, TEP concentrations and N_2 fixation rates were also measured. Our results support the hypothesis that TEP is favorable microbial hotspot for heterotrophic N_2 fixation. Further, we evaluated the link between diazotrophy and TEP in a field study at the Qishon Estuary using the newly develop visualization approach. Our field results indicate that TEP may promote N_2 fixation, even in highly eutrophic environments such as the Qishon Estuary. Results of this study suggest, for the first time that diazotrophs-TEP coupling may occur and thus explain the measured N_2 fixation in unexpected environments.

Anthropogenic factors influencing invasive ascidian establishment in natural environments

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Marine environments are constantly impacted by bioinvasions. Invasive ascidians (Chordata, Tunicata) are well-known for their ability to rapidly overgrow any available substrate. While the majority of studies have investigated the factors contributing to the successful establishment of ascidians on artificial substrates, the anthropogenic factors that contribute to such establishment on natural substrates have rarely been investigated. Here, we studied non-indigenous ascidians presence on natural substrate for the first time, using underwater field surveys at eight natural sites along the Israeli Mediterranean coast, in order to provide an analysis of factors assisting their establishment. The findings revealed that sites exposed to extended sewage-spill events experimented a reduction in native ascidian species. Understanding which factors alter ascidian population is essential for further monitoring efforts, to protect areas that are more susceptible to invasion, and for developing effective management tools to control further spread of invasive species in natural environments.

The contribution of fish activity to sediment resuspension in the deep-sea - Preliminary results from the Gulf of Aqaba

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Sediment resuspension shapes the characteristics of the sediment - water interface by affecting rates of carbon sequestration, nutrient cycling, water quality and contaminant dispersion. Traditionally, marine scientists had focused on physical processes that resuspended sediment such as waves, wind and currents. These processes are most prominent in the upper ocean but their magnitude diminished with depth. In contrast to physical resuspension, sediment resuspension by fish is an ongoing chronic process characterized by localized and sporadic events with high temporal and spatial variation. To date, our knowledge regarding the rate and extent of fish induced sediment resuspension in the ocean is scarce, partly due to the lack of accepted and applicable methods designed for its quantification. Specifically, there is a lack in methods to quantify resuspension flux and to estimate the contribution of biological resuspension to this flux. We developed a moored setup containing sediment traps equipped with remote opening mechanism that are deployed at the bottom and above the benthic nepheloid layer along with optical backscatter sensors, current meters and a custom made trap camera. Subtraction of the downward sedimentation flux measured above from the flux measured on the bottom provides a direct estimate of the total sediment resuspension rate. The system was tested in the northern tip of the Gulf of Aqaba during several deployments, each lasting several weeks. Near-bottom currents at the sites were low (medians 6-8 and 0.5-3 cm s^{-1} at 85 and 600 m, respectively). Turbidity was much higher near the bottom than 10 m above (medians 0.4 -1.3 and 0.1-0.2 FBU, respectively). Total resuspension at 85 meter, east of the IUI was moderate (450 mg m^{-2}). To estimate the contribution of fish activity to the resuspension rate we used a custom made video camera that documented near bottom biological activity and its correlation to spikes in the backscatter time series. The magnitude and frequency of turbidity spikes provides an indication of the intensity of fish induced resuspension.

Understanding stable isotopic fractionation in microbial methanogenesis

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Microbial methane (CH_4) production (methanogenesis) occurs mainly by reducing CO_2 with H_2 (hydrogenotrophy) or by fermenting acetate (acetotrophy). During hydrogenotrophic methanogenesis, dominating methanogenic activity in marine sediments, CH_4 is depleted of the heavier ^{13}C isotopes. This isotopic fractionation is highly variable within both natural and laboratory culture setups, with carbon isotope fractionation factors between CO_2 and CH_4 ($^{13}\alpha_{CO2\text{-}CH4}$) in the range ~1.02 to ~1.09. These empiric α values are often used in literature to assess the origin of CH_4 reservoirs. It is believed the isotope fractionation in multistep enzymatic processes, such as methanogenesis, depend on the reversibility degree of enzymatically catalyzed reactions, and not only on the isotopic equilibrium effects, thus allowing variation to occur. The mechanistic reasons for this phenomenon are not entirely understood. We developed a bio-isotopic model describing the metabolism and isotopic fractionation of stable carbon isotopes during hydrogenotrophic methanogenesis. We solved the model using a set of kinetic and thermodynamic parameters under a steady state assumption, yielding the reversibility of each reaction in the pathway. We later predicted the net isotopic fractionation during methanogenesis using a set of novel equilibrium fractionation factors and assigned kinetic fractionation factors. We finally compared our results to previous culture studies of methanogens. Our model can generate the isotopic fractionation trend related to the actual Gibbs free energy of the overall reaction (ΔG_r). Through the reaction reversibility map we created, we show that kinetic isotope effects (KIE) of the last enzymes in the pathway control carbon isotopic fractionation when ΔG_r tends to zero, and KIE of the upstream enzymes in the pathway control fractionation in highly negative ΔG_r conditions. Thus our model provides a possible mechanism for the relation of carbon isotope fractionation and ΔG_r of methanogenesis, further elucidating the factors governing the isotopic signature of CH_4 in the environment.

Modeling the effects of desalination plants brine on the coastal East Mediterranean food-web

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Seawater reverse osmosis (SWRO) plants discharge brine concentration that is nearly twice that of the ambient seawater. Furthermore, they contain chemicals used during the SWRO process, and their pH and temperature are different from ambient conditions. It has been suggested, based on in-situ experiments and observations that the brine at discharge sites may impact water quality and marine life, especially the lower trophic levels. In this study, a food-web model of the desalination plant environment is formulated, and data collected in the field is used for its calibration and validation. The model is built using the Ecopath and Ecosim (EwE) software, a mass-balance model describing trophic interactions between functional groups. The Ecospace extension will be used to create 2D simulation of the brine plume effects on the local ecosystem.

Coccolithophore life cycle dynamics in the Red Sea

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Coccolithophores are globally distributed marine phytoplankton, bearing a composite exoskeleton made of calcite plates (coccoliths), with important roles in the global carbon cycle. They display life cycles alternating between two heteromorphic phases. One phase is coated by simpler coccoliths (holococcoliths; HOL) and the other by complex coccoliths (heterococcoliths; HET). Moreover, HOL and HET bearing cells display contrasting ecophysiological properties suggesting a marked niche differentiation. Yet, the extent of differential properties and the environmental controls driving life cycle dynamics are unknown, limiting our understanding of the functional role and responses of coccolithophores to environmental changes. To tackle this issue, we assessed the seasonality of coccolithophores in the Gulf of Aqaba over a multi-layered (0-140m) monthly time series using electron microscopy. Thus far, our analyses encompassed the end of nutrient-replete winter mixing and the spring/summer oligotrophic stratification periods (March-July). Mixed assemblages from winter (20 taxa) were almost exclusively composed of HET-bearing cells, with HOL cells representing <1%. As stratification strengthened, both the overall diversity (up to 41 taxa) increased as well as HOL abundances (>10%) in the upper nutrient-poorer zone (<60m), with a peak at 30m in July (48%). To test whether simply a shift to warmer nutrient-poor conditions enabled an increase of HOL cells, we performed mesocosm experiments in which HOL-rich (48% HOL; 17.5 cells mL-1) summer assemblages (~25°C; 0.1µM NO3; 0.04 µM PO4) were swapped over 3 days to winter conditions (21.5°C; 0.8 µM NO3; 0.08 µM PO4; reduced light). This shift led to a decline of HOL cells relative to HET cells, which suggests that abiotic environmental conditions regulate HET to HOL successions in natural settings. Further experiments will involve single parameter manipulations and contrasting seasonal shifts in order to further understand the regulators of coccolithophore life cycle dynamics.

Oases of diversity: East-Mediterranean mesophotic sponge grounds

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Sponges are important habitat builders in the Mediterranean Sea, yet data regarding the Levantine-Sea sponge communities are scarce, outdated, and limited to shallow water. In this study we examined newly-discovered mesophotic sponge grounds that lay on a submerged sandstone ridge at 100-130 m depth, using a remotely operated vehicle (ROV). On that ridge, two of the studied locations, Herzliya and Atlit, form of a series of pinnacles. The third location, Haifa, is the underwater extension of the terrestrial Carmel mountain ridge. During quantitative surveys conducted at these locations, the ROV was used to take photo–quadrats and samples. Based on these surveys we estimated that over 80 sponge species reside at these sites. Sponge cover was on average 30% 32% 37% in Herzliya, Atlit and Haifa, respectively, and constitute ca. 80% of total live coverage. The sites were rich and divers and differed significantly in all measures of diversity. Sponges are not only the most dominant phylum in these mesophotic sponge grounds, they also act as ecosystem engineers, increasing the structural complexity and creating niches for invertebrates and fish. Most of the mesophotic sponge species were documented for the first time from the Israeli coast, some are also new to the Levantine-sea. The mesophotic species include some that disappeared decades ago from the Israel's shallower coastal habitats, and were re-discovered as flourishing in these much deeper habitats. We suggest that the mesophotic sponge grounds may serve as refugia for species stressed by the rising temperatures in shallow waters, and by other anthropogenic disturbances affecting mostly the shallower coastal habitats. These recently identified mesophotic sponge grounds are under threat due to bottom trawling and gas exploration, making it important to study these unique habitats, to better understand their role in the local ecosystem and how best to protect them.

Lattice bound trace elements in vermetids shells from the Mediterranean Sea as proxies for sources of land derived matter in the past millennium

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Atmospheric deposition, riverine and hydrothermal inputs may affect Trace element (TE) concentrations in seawater. The Mediterranean Sea is subject to these processes, but little is known about its TE cycling. We measured lattice bound TE in Mediterranean vermetid shells dated to the past millennium, following a rigorous cleaning procedure. Stable isotope records of vermetids from the South East Mediterranean (SEM) have been shown to accurately record SST and $\delta^{13}C_{DIC}$ over the past Millennium. Here we present elemental ratios of Al, Fe and Rb from the last millennium at a basinal scale. We use the ratios of these elements as tracers of sources of terrigenous matter, assuming that ratios in soluble fractions of land-derived matter preserve the source end member ratios. Generally, Fe/Al is low in dust end member samples, and increases in basaltic, hydrothermal and volcanic sources. Rb/Al is lower in Saudi-Arabian than in Saharan dust, hence used to assess relative contributions of dust from these sources. In the absence of an upper end-member value, qualitative assessments of relative contributions are made. We observe high Fe/Al, evident of high basaltic fluxes in the SEM, during the 13th and 14th centuries, a period described as wet in the origin of the Nile tributaries. In the Central and Western basins high Fe/Al values may be associated with volcanic sources.

Spatial and temporal dynamics of N_2 fixation in the Gulf of Aqaba

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The Gulf of Aqaba (GOA) is an excellent model system for simulating processes in the ocean. The gulf is characterized by oligotrophic conditions and predictable seasonal behavior alternating between deep winter mixing (reaching some years a depth of more than 800 m) and summer stratification. Despite its oligotrophic nature, the GOA appears to support significant rates of primary productivity. This suggest that there are one or more sources that provide "new" nutrients outside of the photic zone to support production. Published data regarding "new" nitrogen sources in the gulf is limited, but deep mixing in the winter and N_2 fixation during spring and summer are thought to be important contributors. In this project, water samples were collected from surface to 700 m during bi-monthly cruises over two following years (Dec 2015 to March 2017) distinguished by different maximal winter mixing depths (480 m and 660 m). The spatial and temporal distribution of inorganic nutrients (DIN, DIP) were determined alongside with chlorophyll a concentration, simultaneous measurements of dinitrogen (N_2) and carbon fixation rates ($^{15}N_2$ and ^{13}C incorporation into particulate organic matter) and bacterial production. Changes in N_2 fixation primary and bacterial production, DIN pools, and alterations of diazotrophic and bacterial communities between seasons and years will be discussed in view of predications obtained from a biogeochemical model (the first one for the GOA, to our knowledge) that propose the combined role of autotrophic and previously-ignored heterotopic diazotrophs in nitrogen fixation at the GOA.

Characterizing the cell metabolome of *Prochlorococcus* MED4 in mono-culture and in co-culture with a heterotrophic bacterium, *Alteromonas macleodii* HOT1A3

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Marine microorganisms are major players in the biogeochemical cycle of our planet. As such, understanding how interactions between such microorganisms affect their physiology and metabolism of the interacting cells, is an essential field of research. In this study, we explore how the cell physiology and metabolome of a primary producer, *Prochlorococcus* MED4, change over different stages of batch culture, in mono-culture and in co-culture with a heterotrophic bacterium (*Alteromonas macleodii* HOT1A3). Our main analytical approach, untargeted metabolomics, enables the characterization of differentially expressed primary as well as specialized metabolites by applying state-of-the-art analysis tools such as molecular networking. So far, we have been able to characterize the changes in chemistry across the growth cycle of *Prochlorococcus* and associate unique masses to the phases of peak growth and culture decline. These metabolomic associations to population physiological state are supported by fluorescence measurements, cell counts and electron microscopy. Our vision is that such analysis will help identify the molecular mechanisms of microbial interactions, support predictive genome-scale models of cells interacting, and potentially provide novel biomarkers to enable the rapid identification and quantification of interactions between these important microorganisms in their natural marine environment.

Enhanced anaerobic microbial activity in Dead Sea deep core pore fluids during the African Humid Period (9.5−8.7 kya)

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The Dead Sea is one of the most extreme and hypersaline natural bodies of water on earth with more than a third of the brine consisting of dissolved salts and is surprisingly a hotbed for robustly adapted micro-organisms. It is also terminal lake where brine composition changes as a result hydro-climate variability. Here we investigated the microbial processes in the deep Dead Sea sediments dating to 9.5-8.7 thousand years ago (kya). At that time strong cyclone activity promoted a period of higher inland rainfall and increase of Dead Sea lake levels which led to changes in lake composition. Major ion and isotopic compositions were analysed from pore fluid samples taken from that sedimentary window (69- 59 meters below lake floor) of fine detrital sediment sandwiched between halite layers in a deep ICDP core drilled from the deep lake during 2010-11. The conservative Mg^{2+} concentrations in pore fluids drop from 1.17 to 0.66 (mol/L) over ~1,000 years at that interval, inferring that also the deep lake was quickly diluted likely the result of significantly enhanced freshwater influx. $\delta^{34}S$ and $\delta^{18}O$ isotopes for SO_4^{2-} are enriched from 15.8 ‰ to 40.2 ‰ (CDT) and 13.0 ‰ to 20.4 ‰ (SMOW), respectively, and infer SO_4^{2-} reduction, while there is also an increase of SO_4^{2-} concentrations at this interval with $CaSO_4 \cdot 2H_2O$ close to saturation levels. The plot of $\delta^{34}S$ vs. $\delta^{18}O$ isotopes for SO_4 from both the deep ICDP core shows a linear trend with a slope of ~0.3, which is slighter than the slope for SO_4 in anoxic saline groundwater along the western shores where AOM takes place (Avrahamov et al., 2014). The slope is evidence that fast SO_4^{2-} reduction had occurred and that there were little limitations to sulfate reduction process (i.e. organic material, sulfate). There is also a drop in $\delta^{13}C$ of the dissolved inorganic carbon (DIC) to -15.6 ‰ (PDB) at the same interval, inferring that utilization of organic material had occurred, possibly during the sulfate reduction process. Indeed it might also suggest anaerobic oxidation of methane (AOM) had occured in the deep Dead Sea sediments at that time. In contrast to chemical and isotope compositions or pore fluids and sediments from other depths in the core this interval is unique, and as such shows that there is a direct relationship between anaerobic microbial activity in the anoxic sediments of the deep Dead Sea and significantly enhanced regional precipitation and increased freshwater influx into the Dead Sea and bottom waters.

The role of $GABA_B$ receptor during development and regeneration of the sea-anemone *Nematostella vectensis*

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Nematostella vectensis is a member of the Cnidaria, a sister group to Bilateria. Dated to 700 million years ago cnidarians are the oldest metazoan taxa that possess a nervous system. My research goal is to understand the role of gamma-aminobutyric acid (GABA) during development and regeneration of the sea- anemone *Nematostella*. GABA is the main inhibitory neurotransmitter in the nervous system that binds and activates two groups of receptors; $GABA_A$ and $GABA_B$. Several studies have shown that GABA receptors' action is not restricted to synaptic transmission but also regulates developmental processes. In this work we are focusing on the $GABA_B$ receptor which is a G-protein coupled receptor. Our results show that constitutive activation of $GABA_B$ receptors by using $GABA_B$ agonist inhibits metamorphosis of the planula into primary polyp. Our aim is to understand the pathways and the molecular mechanism underling these processes. Transcriptomic profiling by RNA-seq showed that transcription factors and genes involved in neurogenesis are downregulated following GABA agonist treatment and up-regulating following agonist removal. Those results were confirmed by In-situ hybridization experiments that demonstrated downregulation of neuronal markers as well as stem cells markers. By using immunofluorescent staining, we showed a decrease in nerve cells and poor development of the neuronal network following GABAB agonist treatment. Our results indicate that $GABA_B$ receptor is an important negative regulator of neurogenesis and that it might have another role in stem cells pluripotency during *Nematostella* development.

Life history traits of an upper mesophotic octocoral in comparison to the shallow reef one

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Mesophotic coral ecosystems (MCEs) are deep reef light-dependent communities found at 30-150 m and considered as potential reservoir of reef diversity. The 'deep-reef refugia' hypothesis (DRRH) is based on the assumption that MCE communities might have the potential to serve as a local recruitment source for the shallow reef populations. The mode of reproduction of shallow octocorals (<30 m) has been studied for numerous species, however to date, no study has dealt with the reproduction of any mesophotic reef-dwelling species. The current study examines the reproduction of an octocoral, *Rhytisma fulvum fulvum,* found along a wide depth gradient, including Eilat's upper MCE (northern Gulf of Aqaba). This species exhibits surface brooding of its planula-larvae being entangled in mucus on the colony surface during their embryonic development. The results are expected to contribute to our understanding of the biology and ecology of the MCEs inhabitants in general and of the octocorals there in particular.

Cyanobacterial-cyanophage coevolution: from genes to populations

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Cyanobacteria are extremely abundant in the oceans, as are the phages that infect them. How hosts and phages coexist in high numbers in nature has remained unclear for many years. Using the T7-like podoviruses and their cyanobacterial hosts as a model system, we set out to test the hypothesis that the presence of both susceptible and resistant cells facilitates long-term coexistence and to investigate the impact resistance has on genome evolution and diversification. We found that cyanophages serve as a selective force enhancing host genome diversification in genomic islands. This resistance imposed two different types of fitness costs, manifested as either reduced growth rates or enhanced infection by other phages. Furthermore, resistant strains continued to evolve over time towards an improved growth rate and a narrowing resistance range, leading to lineages with phenotypes intermediate between those of ancestral susceptible wild-type and initial resistant substrains, but resulting from further genome diversification. In addition, we found that some host mutations serve as a genetic barrier to phage counter-mutations. Combined our findings indicate that the coevolutionary process leads to a complex and dynamic network of interactions between phages and their cyanobacterial hosts in nature.

Responses of invasive and native *Halophila stipulacea* populations to thermal stress

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Biological invasions in marine environment are increasingly occurring throughout the world, and their impacts to the biodiversity have been widely recognized. The seagrass *Halophila stipulacea* (Forssk.) Asch. is a dioecious tropical seagrass species, native to the Red Sea, Persian Gulf, and Indian Ocean. Following the opening of the Suez Canal in 1869, this species invaded rapidly to the eastern Mediterranean and in 2002 this species was reported in the Caribbean Sea, where it was shown to displace local seagrass species. With water temperatures in the Gulf of Aqaba (GoA) increasing and predicted to exceed 31.5°C by the end of this century, the native populations of *H. stipulacea* will face increased frequency and severity of thermal stresses. In parallel, global warming and the ongoing tropicalization of the Mediterranean Sea, facilitated by the recent doubling of the Suez Canal, could contribute to the spreading of *H. stipulacea* in the Mediterranean, potentially threatening the local seagrass biodiversity. In this study, we compared the biochemical, fitness, and photo-physiology responses of both native (Red Sea – Eilat) and invasive (Mediterranean Sea – Cyprus) *H. stipulacea* populations to current and expected thermal maxima in a controlled experimental environment (microcosm). While leaf area increased with temperature in invasive plants, it decreased in native plants. Effective quantum yield decreased with increased temperatures in both populations. Interestingly, the invasive population accumulated less antioxidants (SOD) under thermal stress than its native counterpart. Taken together, these results suggest a rapid adaptation of the invasive population to the ongoing warming of the Mediterranean Sea, while we expect the GoA population to be threatened by predicted climate changes. By including gene expression with the other measurements shown here, we expect to reveal some of the mechanisms responsible for *H. stipulacea*'s adaptation and invasiveness.

T7-like cyanophage populations dominated by the less virulent clade in the Red Sea

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Synechococcus and *Prochlorococcu*s are the numerically dominant primary producers in the oceans and contribute significantly to global primary production. They are infected by T7-like cyanophages, as well as by other cyanophages. Phylogenetic analyses show two discrete T7-like cyanophage lineages, clade A and B. Phages from clade B encode the *psbA* photosystem II gene and infect either *Synechococcus* or *Prochlorococcus*, whereas phages from clade A lack *psbA* and primarily infect *Synechococcus*. Laboratory experiments showed that clade A phages generally have shorter latent periods, greater virulence and larger burst sizes and can thus be considered *r*-strategists, in comparison to clade B phages which can be considered *K*-strategists. We used a novel solid-phase PCR-based polony method to assess the population dynamics of these two clades in a seasonally stratified body of water over the yearly cycle in the Red Sea. The T7-like cyanophages were highly abundant in all seasons, with highest abundances during the stratification period. Their abundances varied from a minimum of $2*10^4$ phages·ml^{-1} to a maximum of ~$1.3*10^6$ phages·ml^{-1} in the upper 200 m of the water column. Highest abundances were found in August at the deep chlorophyll maximum, where cyanobacterial abundances were also greatest. The T7-like cyanophages made up between 0.2%-10% of the dsDNA virus community as determined from VLP counts. Within the T7-like cyanophages, clade B phages were at least an order of magnitude more abundant than clade A phages in all samples. The abundances of clade B phages were strongly correlated with *Prochloroccocus* during periods of stratification. Furthermore, at least in April and July, clade A phages correlated with *Synechococcus* abundances. These findings indicate that the K-strategist clade B T7-like cyanophages that carry the *psbA* gene and infect either *Synechococcus* or *Prochlorococcus* have a benefit over the more aggressive clade A phages that infect *Synechococcus,* throughout the year in the subtropical, oligotrophic Red Sea.

The effect of environment and seasonality on the distribution of toxinogenic cyanobacteria in a semi-arid region

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Water quality, agriculture and human health are inextricably linked through aquatic microbial populations. Harmful Algal Blooms (HABs) are one of the main reasons for reduced water quality worldwide, and can especially impact regions with limited fresh-water supplies such as parts of the Mediterranean and the Middle East. We have previously shown that potentially-toxic *Microcystis* cyanobacteria are common in freshwater bodies in Israel, with a specific phylogenetic clade of *Microcystis* that were preferentially associated with fish ponds. To better understand how biotic and a-biotic factors affect HAB formation in intensively impacted ecosystems such as aquaculture facilities, we monitored a series of interconnected fish ponds at the Dor Aquaculture Research Unit and their functional water reservoir over three years, assessing the microbial population structure through 16S rRNA sequencing and monitoring toxin concentrations. Our results indicate seasonal patterns with cyanobacterial dominance during spring and summer, associated with the production of microcystins, potent hepatotoxins. The seasonal patterns in community structure were stronger than those associated with the intensive fish culturing itself. These results suggest that even in highly impacted ecosystems, natural seasonal rhythms may dictate microbiome dynamics and HAB formation. Our results and the genomic datasets we have produced can be useful for further investigation of fish – bacteria interactions and bacterial population dynamics that may promote HABs outbreaks.

Assessing the ecological status of *Halophila stipulacea* meadows in Eilat - Combining morphological and biochemical descriptors with analyses of the associated microbial community

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Seagrasses meadows are considered one of the most valuated ecosystems on the planet, yet they are disappearing at alarming rates. There is growing interest in developing diagnostic tools that could more effectively identify changes in seagrass ecological status at an early stage. Here, three meadows of *Halophila stipulacea*, the most common seagrass in the Gulf of Eilat, were characterized by using an integrated approach to highlight the possible differences in their ecological status. For this, leaf morphometrics (leaf size, leaf number/plant, leaves with lost apex), photosynthetic pigments (Chlorophylls, Carotenoids) and total phenols contents, were coupled with the plants' epiphytic microbial community structure and composition, studied using pyrosequencing. The combination of these descriptors was successful in characterizing differences in ecological condition of the three meadows, despite their small geographic distances. Leaf surface area and the concentration of photosynthetic pigments, responded in to the different amounts of light on the various sites and were found the highest on the northern beach meadows, where light penetration was the lowest. Concentration of phenols, an indication of grazing pressure was found to increase the along the north-south gradient. The populations of associated bacteria differed between the various stations, and between the different parts of the same plant, with gamma Proteobacteria and Bacteroidetes being dominant in north beach meadows where light penetration was low, compared to cyanobacteria and Rhodobacteraceae that flourished in south beach meadows where light penetration was high. This is the first time that these measures are integrated and used monitoring of ecological condition of seagrasses. The interplay of morphological and biochemical measures with changes in the composition of the associated bacteria populations provides evidence that the functional link between them, which requires further study, but could be applied already no as an effective tool for monitoring of seagrass in a changing world.

Diversity of airborne bacteria and fungi across the Mediterranean Sea

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Aerosol deposition to the surface ocean may supply a high diversity of airborne organisms including bacteria, archaea, fungi and fungal spores. These airborne microorganisms can remain viable during transport and affect surface seawater populations once deposited. The role of these microbes in seawater and their impact on marine ecosystems is largely unknown. The Mediterranean Sea is subject to frequent aerosol deposition from dust storms originating in the Sahara Desert and Arabian Peninsula, as well as from air masses originating in Europe. Here, we determined the diversity of bacteria, archaea and fungi collected away from shore throughout the Mediterranean Sea (Israel to Gibraltar). Aerosol samples were collected aboard the R/V Meteor (M84/3 cruise) during springtime. Total DNA was extracted from the samples, amplified using universal 16S and 18S rRNA primers, and sequenced using the Illumina MiSeq platform. The results show that airborne fungal communities collected in different basins of the Mediterranean Sea are distinct, although some species are observed at all sites. Bacterial phylotypes were... The results from our project can be used as a baseline for future studies on microbes in aerosols and how they can affect the microbial ecology of marine ecosystems.

Preliminary study of the movement of the Mediterranean slipper lobsters using an acoustic technology

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The Mediterranean slipper lobster, *Scyllarides latus*, is the largest crustacean in the Mediterranean water of Israel and among the largest in the whole Mediterranean. It has become rare in most of its distribution range (central- east Atlantic throw-out the Mediterranean) due to overfishing. In the coastal water of Israel, it has been prohibited to fish this species in the recent years, yet this legal protection is effective mainly in nature reserves. Therefor, our research goals were twofolded: (a) to examine the abundance of *S. latus* as in the well-functioning nature reserve of Rosh-HaNikra-Akhziv in comparison to a nearby, similar, but not protected habitat, and (b) to characterize the spatial requirement of the species, in order to establish nature reserve that would enhance the protection of this rare species. In this talk, we will present our findings from a six-month survey in the Rosh-HaNikra-Akhziv national marine nature reserve. During the survey, we have detected the movement of 18 lobsters using acoustic tags. The underwater acoustic technology enables to characterize the activity of the tagged lobsters during 24 hours. Contrary to previous laboratory studies, our initial field findings indicate activity of the lobsters also during part of the daytime hours. The acoustic tagging also reveals that substantial number of lobsters remain in their shallow water winter habitat until the end of the summer. The talk will also demonstrate the technological difficulties encountered during the project, and our solutions.

Phenotypic variability in response to oxidative stress unveils a link between chloroplast redox dynamics and cell fate in marine diatoms

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Diatoms are photosynthetic microorganisms of great ecological and biogeochemical importance, contributing about 40% of marine primary production. They form vast blooms that are frequently characterized by “boom and bust” dynamics. These dynamics include rapid proliferation of the population followed by a coordinated demise, which has been suggested to involve programmed cell death. However, the molecular basis and cellular mechanisms that underline the ecological success of diatoms are still underexplored. Recent studies performed in our lab demonstrated how subcellular oxidation patterns in response to environmental stress conditions may play a pivotal role in cell fate determination in the diatom Phaeodactylum tricornutum. Here, we aim to further investigate the phenotypic variability within diatom populations in response to oxidative stress. To this end, we combined flow cytometry and microfluidic fluorescence imaging to measure organelle-specific oxidation dynamics at the single-cell level using the redox-sensitive sensor roGFP2. The chloroplast targeted roGFP2 exhibited a bi-stable oxidation pattern in response to oxidative stress, revealing two distinct sub-populations. Cell death was subsequently induced in the oxidized sub-population, while the reduced sub-population survived the stress. We further characterized an early phase of pre-commitment to cell death in response to oxidative stress, after which there was an irreversible induction of a cell death cascade. Chloroplast oxidation preceded the commitment to cell death, and was used as a novel cell fate predictor. We propose that intra-species phenotypic variability among individual diatom cells may provide an ecological strategy to cope with rapid environmental fluctuations in the marine ecosystem.

The regulation of sea urchin tubular spicule cord formation by VEGF signaling and cytoskeletal remodeling

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The vascular endothelial growth factor (VEGF) pathway that in humans stimulates the formation of new blood vessels (angiogenesis) is a critical element in the development of an embryonic calcite skeleton in sea urchins (skeletogenesis). The exact role of VEGF in spicule formation and whether there are other similarities between the control of sea urchin skeletogenesis and vertebrates' angiogenesis were largely unknown. Here I study the one of the cellular and molecular machinery activated by the VEGF pathway during sea urchin skeletogenesis and find similarities to the mechanisms that drives tubulogenesis during vertebrate angiogenesis. I show that human VEGF is capable of inducing ectopic spicule branching in the sea urchin embryo, indicating the conservation of VEGF-VEGFR recognition between the two organisms. A screen for VEGF target genes performed in our lab, revealed novel targets, among them GTPase-activating protein, *rhogap24L/2*, a critical element in the cytoskeleton remodeling machinery. The human orthologue of this gene is highly expressed in human endothelial cells (EC) and controls cell morphology, adhesion and motility through the rearrangement of actin cytoskeleton. Interestingly, perturbations of *rhogap24l*/2 affect spicule branching. Previous studies have shown that the inhibition of VEGFR completely abolishes spicule formation yet, it was not clear which spiculogenesis processes require VEGF signaling: calcium accumulation, calcium deposition, the construction of the tubular cord or all of the aforementioned? Here I show that VEGF signaling is also necessary for calcium deposition at 24 hours post fertilization, just after spicule initiation. I propose that the regulation of tube formation through VEGF signaling and cytoskeleton remodeling is a conserved program common to sea urchin skeletogenesis and vertebrates' angiogenesis but also have an important role in biomineralization process in sea urchin embryos.

Offshore Oil and Gas Exploration and Production Strategic Environmental Assessment (SEA)

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In 2016 the Ministry of Energy concluded the 1st Strategic Environmental Assessment (SEA) for Oil and Gas Exploration and Production in the Mediterranean Sea. The SEA formed a knowledge base and acts as a decision making tool for the Petroleum Commissioner in granting petroleum exploration rights offshore Israel. The SEA is designed to weigh in environmental considerations in the development of offshore oil and natural gas resources, and minimize potential harm to the ecosystem while evaluating other benefits of environmental, social, and economic value. The final SEA report contains maps of habitats and environmentally sensitive areas and provides a set of policy recommendations, identification of information gaps and suggesting methods for the monitoring of its' implementation. We hereby report on a number of the SEA's recommendations that were already implemented in Israel's regulations and policy:

1. The blocks offered in the first Offshore Bid Round 2016-2017 are concentrated in the EEZ in areas of low vulnerability.
2. Operators are required to submit their environmental and safety management plan and safety records prior to getting a license (Petroleum Regulations (Principles for Offshore Petroleum Exploration and Production) 5777-2016).
3. General environmental guidelines were published for environmental impact documents, monitoring requirements, seismic surveys, control of invading species and an oil spill contingency plan.
4. Seismic surveys are banned in the Achziv deep underwater canyon. In other areas, temporal limits were set during sea turtles reproduction season.
5. The Israeli EEZ was mapped with high-resolution bathymetry.
6. The ministry supports the national monitoring program in the deep sea, bathymetric and visual surveys, and SEA related academic research.

The SEA, with its related maps, is a dynamic document and will be further reviewed and updated during 2018.

Adaptive Photosynthetic Characteristics in the Mesophotic Zone

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Photosynthetic coral reefs represent some of the most important ecosystems on earth and are commonly found in tropic and subtropics regions worldwide. Along with their phototrophic endosymbiotic dinoflagellates (commonly referred to as zooxanthellae or zoox), they may be found inhabiting a variety of habitats from the sundrenched coastal areas to the "twilight" of the mesophotic zone located at depths below 30 meters. This change in photic environment represents a change in light intensity of about 15 fold and is accompanied by a change in spectral composition. As a result, photosynthetic coral reefs require an assortment of strategies in order to successfully utilize the light for biological assimilation as well as protection from photoinhibition. Until recently, research of the mesophotic zone was limited by technological and fiscal restrictions, and much of the focus on coral research has been restricted to the upper 30 meters. However, advancements in scuba diving technology have made these ecosystems more available for research to the scientific community. Recent studies have shown that mesophotic corals exhibit unique strategies for enhancing efficiency in harvesting light in low light conditions allowing them to perform well below their compensation depth. These strategies are unique to mesophotic corals and include maintaining a specific clade of zooxanthellae along with possible structural changes to the photosynthetic apparatus. In this research project we hope to further elucidate some of the mechanisms found that allow mesophotic corals to thrive in condition low light conditions.

Optimizing Surveys for Coastal Engineering Projects

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Marine construction requires frequent surveying of breakwaters above and below the waterline. Multibeam systems are often limited in surveying the shallowest areas which are often surveyed by Sounding Ball and Land Survey leveling. Some interferometric systems have a major advantage over regular Multibeam systems as they transmit right up to the water surface. Drones with high definition digital cameras are being used for photogrammetric surveying and may supplement the hydrographic survey to provide a high resolution integral dataset above and below the waterline. Horizontal Laser scanning can also provide another high-resolution perspective of the structures. In the Mifratz Port construction project in Haifa the surveys serve various purposes including: checking status of the project according to construction plans and predefined tolerances, daily work planning, volume calculations for payment etc. All surveys, land and marine, as well as the RTK Base Station and a radar Tide Gauge in the port, are referenced to the ILSD (Israel Land Survey Datum). The maximum daily tidal range reaches almost 50cm at Spring Tide. Sounding Ball (down to -5m) and Land Survey measurements were taken at discrete points along predefined profiles with Multibeam measurements up to -3m depth creating a 2m overlap. Each of the three survey techniques mentioned above has its limitations, both in accuracy and resolution. Sounding Ball surveys on a rocky surface are particularly problematical. There is no way of knowing exactly how the ball is lodged relative to the rocks below the water line, on the top of a rock or lodged between two rocks, therefore measured depths may not be precisely indicative of the depth at the measured GPS position. In order to provide more detailed, accurate and efficient data, we successfully tested the use of an interferometric MB survey system up to -1m depth with a Drone photogrammetric survey to the waterline, leaving a small gap between 0m to -1m.

Zinc Pyrithione-based compounds as novel antifoulants toxicity assays

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Since the antifouling toxin TBT (Tributyltin) has been proven to be extremely toxic and consequently its use has been banned, intensive search for antifouling active compounds has been initiated in order to design a product, which should be environmentally friendly and cost-effective. Within the context of the BYEFOULING EU project (https://www.sintef.no/projectweb/byefouling/) a wide array of efficacy and toxicity tests have been performed on newly developed antifouling materials. Zinc Pyrithione (ZnPT), a compound which is commonly used as a biocide has been adopted for newly designed compounds. A novel nano-engineered material has been uploaded with ZnPT in order to achieve active antifoulant to be incorporated into commercial paints. The toxicity of free ZnPT and additionally of the uploaded form has been tested on *Danio rerio* (zebrafish) embryos in order to find out the LC_{50} of both materials and scaling their toxicity also in comparison to other antifoulants. The fish embryos toxicity test (FET) is considered by the OECD as an imperative standard for testing chemicals prior introduction into the market. It also circumvents the use of adult fish tests which are associated with ethical considerations. In the current study the FET was used for defining the LC_{50} of ZnPT and the above mentioned uploaded form in series of laboratory tests under which the zebrafish embryos were exposed to a concentration range of solutions for 96 hours. The percent mortality of the embryos was plotted against the tested concentrations thus enabling calculation of the LC_{50} values of the compounds. Microscopic examination revealed delayed hatching from the embryonal sac as well as morphological abnormalities of the fish-tail already occurring at concentration of 0.0075 mg/L up to 0.3 mg/L for ZnPT and 0.01 mg/L up to 0.08 mg/L for the uploaded form. LC_{50} of both materials were calculated and found to be already at low concentrations. The morphological deformations were found both at concentrations above and below the LC_{50} levels. So far, the current study has indicated that the toxicity of both tested materials occurs at low levels and should be carefully considered before launching into the market.

Why the Eastern Mediterranean Sea, although an inland sea, has the characteristics and behaviour of an ocean gyre?

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The (Eastern) Mediterranean is an inland Sea, similar in location to bodies of water like the Baltic Sea and the Gulf of Mexico. As with all inland seas, there are significant inputs of nutrients (N & P) from the adjacent land from chemical weathering and nowadays from major anthropogenic inputs. However despite having a similar flux of external nutrients per unit area as the Baltic Sea, the response of the system is very different. The Baltic and Gulf of Mexico suffer from problems of eutrophication including areas of hypoxia caused by their inherent estuarine and thus upwelling circulation system. By contrast the Mediterranean is oligotrophic to Ultra-oligotrophic. Using a nutrient mass balance approach we have shown that the Eastern Mediterranean has similar characteristics and behaviour of a mid-ocean gyre. Like a mid-ocean gyre where the circulation is anticyclonic with water flowing towards the centre where it downwells, the Mediterranean circulation is also dominated by strong lateral flow and downwelling. The principle nutrient supply for new production is from lateral inputs and ~25% of the primary productivity is supported by the in-situ breakdown of DOM. As a result both ocean gyres and the Mediterranean are dominated by nano and picoplankton. In this talk will conclude by looking at some of the implications for future research studies created by this new paradigm.

Significant N_2 fixation by airborne diazotrophs in the Northern Red Sea

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Desert dust storms are common in the Northern Red Sea (NRS) region, providing nutrients (*i.e.,* PO_4) and possibly also trace-metals that stimulate dinitrogen (N_2) fixation. Recent studies show that dust also carries a high diversity of airborne microbes, including diazotrophs that may remain viable during transport. Here, we evaluate the impact of atmospheric deposition and its associated airborne diazotrophs on N_2 fixation in surface water of the low-nutrients NRS, using mesocosm bioassay experiments. We compared the chemical and biological effects of aerosol additions using 'live-dust' (which adds soluble nutrients/trace-metals and viable airborne microorganisms) and 'UV-killed dust' (adding only the chemical constitutes) respectively. Airborne diazotrophy accounted for ~25% of the measured N_2 fixation. Dust deposition can therefor contribute N to the oligotrophic NRS directly through N release from aerosols and indirectly by enhancing N_2 fixation of *in-situ* marine diazotrophs and by adding viable airborne diazotrophs to seawater. We expect that aerosols play similar multiple roles in the N cycle in other low-nutrient oceanic systems subjected to high dust deposition.

Microplastic consumption by marine biota of the Israeli coastal waters

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Microplastics, plastic particles smaller than 5mm in size, have become an increasing concern as a marine pollutant over recent years. These contaminants have been shown to contain higher concentrations of pollutants such as plasticizers, polycyclic aromatic hydrocarbons, metals, and other persistent organic compounds than that of the surrounding aquatic environment. With their small size and increased bioavailability, it enables them to become vectors of contaminant transfer from the environment into biota. As of today, almost no research has been conducted on the subject in Israeli coastal waters, with none addressing the biota. The present study aims to act as an initial screening of which marine biota off of Israeli waters are ingesting microplastics and the potential ecotoxicological outcomes consumption may result in. Preliminary results show that blue colored microplastic fibers are present in the filter feeders *Brachidontes pharaonis* (muscle) and *Ostrea edulis* (European flat oyster), collected from Neve Yam. This observation is reinforced by research conducted in a similar matter from around the Mediterranean Sea. Future work will include the assessment of multiple fish species from different trophic levels and feeding styles, as well as include chemical analysis on microplastic associated contaminants such as the plasticizer BPA within sample tissue.

Bridging the gap between the lab and the ocean: development of a novel in-situ incubation apparatus

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Marine microorganisms perform ~50% of the primary production on our planet, and are at the base of the trophic food web. Interactions between these microbes occur at micrometers scale and, have a far-reaching implications on global biogeochemical cycles, weather and the climate. While interactions can be studied in the lab, understanding when such interactions occur under natural conditions is challenging. Diffusion chambers allow the culturing of organisms in a defined space yet in constant contact with an soluble external milieu through a semi-permeable barrier, providing a tool to study interactions under close-to-natural conditions. Building upon experience gained in previous studies we have designed a robust diffusion chamber sampler (DCS) aimed for *in-situ* deployment in oceanographic studies (e.g. from a ship or mooring). The DCS is coupled to an automatic Phytoplankton Sampler (PPS) module. The DCS holds six 1.6 litre diffusion chambers (see inset for photo), controlling the rate of injection of analytes into the chambers (e.g. infochemicals) as well as the transfer of collected samples to the PPS, which is an off-the-self auto-sampler modified to enable sample preservation using RNA-later. The DCS also controls the rate of exchange between the diffusion chambers and the surrounding seawater. We aim to use this system to study interactions between *Prochlorococcus* and co-occurring microbes in the Eastern Mediterranean.

Profiling Nematostella vectensis transcriptome during spawning induction

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The sea anemone Nematostella vectensis is a member of the Cnidaria phylum, a sister group to Bilateria dated back to 700 Ma. Nematostella has become a common genetic model because of its published genome and controlled sexual reproduction. Studying a basal metazoan such as Nematostella, may reveal ancestral reproduction characteristics thereby improving our understanding of bilaterian evolution and development. In this study, in order to understand what drives sexual reproduction, we analyzed the genes that are involved in the induction process that eventually leads to the release of egg sacks. In addition, we examined whether the processes occurring in Nematostella are similar to those occurring in corals, which also belong to the Anthozoa class. Transcriptomic analysis of female Nematostella was carried out before spawning induction and at 1, 2, 5 and 8 hours during induction. We found more than 1500 transcripts that were up-or down-regulated, some which were related to the circadian clock or the Insulin pathway. Transcripts that were upregulated during the first hour of induction were mainly related to the reception of signals indicating the onset of induction, whereas genes whose expression changed 8 hours into induction were mostly related to cytoskeletal changes preparing the mesentery for oocyte maturation and release. Lastly, comparison with Acropora spawning revealed a core set of transcription factors that were shared between the two organisms. Our findings provide initial insight into the regulation of sexual reproduction in Nematostella as well as into common features of this process in Anthozoa.

Impact of bioinvasions and climate change on benthic biodiversity and ecosystem functions – lessons from the fast-changing Levant reefs

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Climate change and bioinvasions strongly affect marine biodiversity, but understanding if and how this change is manifested in shifts in community traits and ecosystem functions is required. We tested these impacts on eastern Mediterranean reefs, a bioinvasion hotspot where coastal waters have recently warmed by around 3 ^{o}C. In the field, we have compared three benthic community types: (1) native brown-algae meadows that are now rare, (2) turf barrens overgrazed by invasive herbivores fish, and (3) areas covered by an alien, calcifying, red algae, to test if the habitat and metabolic functions presumably lost in turf barrens (now dominating the reefs) are, at least partially, regained in the expanding alien-macroalgae covered areas. We found that while overall richness was similar in the native and invasive communities (and very low in turf), and biomass was partially regained by the alien algae, the community has shifted from overall autotrophic to heterotrophic. Under warming and acidification conditions in long-term mesocosm experiments, the native community itself becomes more heterotrophic, and more dominated by alien species, although this change was not evident from regular biodiversity indices (e.g., richness). These dramatic alterations in traits and functions mean that the Levant reefs are going through a regime shift to a novel ecological state that will intensify in the future.

Canonical and cellular pathways timing gamete release in *Acropora digitifera*, Okinawa, Japan

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Natural light cycles are important for synchronizing behavioral and physiological rhythms over varying time periods in both plants and animals. An endogenous clock, regulated by positive and negative elements, interacting in feedback loops controls these rhythms. Many corals exhibit diel cycles of polyp expansion and contraction entrained by solar light patterns and monthly cycles of spawning or planulation that correspond to nocturnal lunar light cycles. However, despite considerable interest in studies of coral reproduction, there is currently not enough molecular information about the cellular pathways involved with synchronizing spawning/planulation in broadcast spawners and brooders. To determine whether the endogenous clock is implicated in the regulation of reproductive behavior in corals, we characterized the transcriptome of *Acropora digitifera* colonies at twelve time points over a 2-month period of full and new moons, starting with the day of spawning in June 2014. We identified 608 transcripts with differential expression only on the spawning night during the coral setting phase and gamete release. Our data revealed an upregulation of light-sensing molecules and rhodopsin-like receptors that initiate signaling cascades, including the glutamate, SMAD signaling and WNT signaling pathways, neuroactive ligand–receptor interactions and calcium signaling. These are all involved in cell cycling, cell movement, tissue polarity, focal adhesion and cytoskeleton reorganization and together lead to gamete release. These findings can improve the understanding of many time-based cycles and extend our knowledge of the interplay between exogenous signals and the endogenous clock in cnidarians. After finding this novel pathway we were interested in Profiling gene expression of coral reefs under natural light cycles in the era of light pollution. We started with a short term “light pollution” experiment exposing *Acropora eurystoma* colonies to four months of artificial light. Our results indicate that corals under un-natural light cycles exhibit an extreme shift in gene expression when compared to corals under natural light cycles. Corals that were kept under constant light showed an elevated number of DE genes that are involved in many pathways controlling cell cycle and tumor suppression. From this work I will present preliminary results.

The spatiotemporal distribution of *Aedes phoeniciae* in coastal rock pools of the Israeli coastline

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The *Aedes mariae* complex, which consists of *Aedes mariae*, *Aedes zammitii*, and *Aedes phoeniciae*, is endemic to the coastal rock pools of the Mediterranean basin. To date, very little is known about the *Aedes* spatiotemporal variability along the Israeli coast, despite being a potential vector of diseases and great nuisances to humans. The overarching objective of this work is to characterize the driving factors that controls the distribution of *Aedes spp.* at the Israeli rock pools. Our results show that *A. phoeniciae* is the only species from this complex that exists in Israel based on polymorphisms observed at allozymic markers. Further, twelve monthly surveys were carried out to assess which abiotic (pool volume and depth, vertical and horizontal distance from the sea, temperature, pH, salinity and nutrients, etc.) and biotic (larvae and pupae performance, invertebrate community structure, microbial and algal community structure etc.) variables explain the distribution of *A. phoeniciae* among coastal rock pools at HaBonim Nature Reserve. Lastly, a laboratory controlled experiment was conducted to examine the influence of algae and bacteria on the survivorship and development of larvae and adults of *A. phoeniciae*. To this end, *A. phoeniciae* eggs were collected from coastal rock pools and the larvae were reared in seawater vs. filtered seawater (<0.2 µm). Artificial food was added to all treatments. Results show a significant (X^2_2=4.049, p=0.044) effect on the survivorship of females, but not male, in the seawater treatments compared to filtered seawater, while their weight remain unchanged. These results may suggest a potential interaction between female larvae and algae. This research sheds new light on the ecology and controlling factors affecting the distribution of the poorly sampled *A. phoeniciae* in the Israeli coast and may lead to a better science-based mosquito control.

Are all cells in batch culture equal? Single-cell heterogeneity and the evolution of chlorotic sub-populations in *Prochlorococcus*

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Every milliliter of seawater contains millions of microbial cells, however, to date, it is unclear what fraction of these cells is alive and active, and what fraction is senescent or dead. In the much more simple system of phytoplankton batch cultures, chlorotic cells appear as the cultures age, characterized as a sub-population of cells with lower chlorophyll autofluorescence identifiable by flow cytometry. These cells have been observed in cultures of both prokaryotic and eukaryotic algae under different growth conditions and nutrient depletions (Phosphorous and Nitrogen starvation; Light/dark cycles) and are typically considered to be severely stressed or dying. We have characterized the dynamics of the emergence of these sub-populations in different *Prochlorococcus* strains and different growth conditions. Using FACS sorting followed by NanoSIMS (nano secondary ion mass spectrometry) analyses, we measured two aspects of the metabolic activity of these cells, namely photosynthesis (^{13}C-bicarbonate incorporation) and inorganic nutrient assimilation (^{15}N ammonium uptake). Our results show that semi-chlorotic *Prochlorococcus* cells, from ageing cultures, still photosynthesize and take up nutrients (~20% of the semi-chlorotic cells are active with $^{13}C/^{12}C$ ratio above 1.25%, half of which also have $^{15}N/^{14}N$ ratios above 5.5%), while fully-chlorotic cells are mostly metabolically inactive (~97% of the fully-chlorotic cells are inactive with $^{13}C/^{12}C$ and $^{15}N/^{14}N$ ratio lower than 1.25% and 1.2%, respectively). Thus, the interpretation of chlorotic cells as dying should be questioned. We also observed high variability in the photosynthesis and uptake rates of single cells within each FACS-defined population. We are now working on determining whether populations of *Prochlorococcus* (and other phytoplankton) in nature are as variable as those seen in lab cultures, including the presence of chlorotic cells. If so, the relative contribution of individual cells to oceanic primary productivity and export production might need to be re-assessed.

Primordial germ cells lineage characterization in the basal sea anemone *Nematostella vectensis*

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In the process of sexual reproduction, a germ cell is any cell capable of differentiation from which gametes arise, either eggs or sperm. The mechanisms underlying germline segregation have been documented in various species and are mainly classified into two distinct modes: (1) inheritance of maternal determinants during early embryogenesis and (2) inductive signals from surrounding tissues later in development. While it has been reported that in Cnidaria, the sister group of Bilateria, germ cells are generated continuously throughout reproductive life, little is known about the molecular pathways governing this process. In order to track the lineage of Primordial Germ Cells (PGCs) in the basal anthozoan *Nematostella vectensis*, we have generated positive fluorescent transgenic animals by microinjecting fertilized eggs with transgenesis vectors driven by promoters of known PGCs markers. Furthermore, we have established a stable mosaic F0 generation of transgenics, from which fully transgenic heterozygous F1 animals could be obtained once they reach sexual maturity. Using transgenic lines of *Nematostella,* we aim to characterize expression profiles of PGCs markers such as *nanos2, PL10* and *Vasa,* and gain insights into the origin of gametogenesis and the evolution of bilaterian traits in the common metazoan ancestor.

Co-existence of methanogenesis and sulfate reduction with common substrates in sulfate-rich estuarine sediments

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The competition between sulfate reducing bacteria and methanogens over common substrates has been proposed as a critical control for methane production. In this study, we examined the co-existence of methanogenesis and sulfate reduction with shared substrates over a large range of sulfate concentrations and rates of sulfate reduction in estuarine systems, where these processes are the key terminal sink for organic carbon. Incubation experiments were carried out with sediment samples from the sulfate-methane transition zone of the Yarqon (Israel) estuary with different substrates and inhibitors along a sulfate concentrations gradient from 1 to 10 mM. The results show that methanogenesis and sulfate reduction can co-exist while the microbes share substrates over the tested range of sulfate concentrations and at sulfate reduction rates up to 680 µmol L^{-1} day^{-1}. Rates of methanogenesis were two orders of magnitude lower than rates of sulfate reduction in incubations with acetate and lactate, suggesting a higher affinity of sulfate reducing bacteria for the available substrates. The co-existence of both processes was also confirmed by the isotopic signatures of $\delta^{34}S$ in the residual sulfate and that of $\delta^{13}C$ of methane and dissolved inorganic carbon. Copy numbers of *dsrA* and *mcrA* genes supported the dominance of sulfate reduction over methanogenesis, while showing also the ability of methanogens to grow under high sulfate concentration and in the presence of active sulfate reduction.

Mercury enrichment in fish from northern Haifa bay - sources and mechanism

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During the last decade mercury (Hg) levels in commercial fish and other marine species from northern Haifa Bay (HB) have increased consistently from their minimum value in 2004, despite mitigation measures reducing Hg loads from surrounding land based industries to effectively zero starting in 2001. The primary aim of this study was to determine the cause of this increasing trend. During the study period (2015-2016), we conducted 14 samplings of seawater, beach water-table (BWT) water, sediments, beach sand and various species of benthic and pelagic biota from different habitats in HB and in control stations north and south of it. Total-Hg (THg) was found in abnormally high levels (up to 251 µg/L) in the BWT water below the Electrochemical Chlore-Alkali plant (ECI) beach and other locations along the nearby Acre municipal bathing beaches as well as in the bathing water (0.5 m) in this area. In all the biota examined in the study (plankton, macro-algae, mollusks, sponges), THg and MeHg levels were higher in samples from Shavey Zion and northern HB. A qualitative correlation was found between the MeHg in benthic biota that feed on plankton (mainly filter-feeders) and plankton THg concentrations, with a clear differentiation between the sampling areas. Based on these observations, it is concluded that the source of Hg enrichment in the biota of HB is primarily the increased discharge of polluted groundwater from the area of ECI since 2004 following the closure of the plant and the recovery of the hydraulic head. The Hg from this source is incorporated into the plankton and may be adbsorbed to other suspended particles, and then transported with the generally prevailing longshore northward flow, northward of HB, at least as far north as Shavey Zion, which is about 7 kilometers north of Acre.

Can mesophotic reefs replenish shallow reefs? Reduced coral reproductive performance casts a doubt

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Mesophotic coral ecosystems (i.e. deep coral reefs at 30-120 m depth) appear to be thriving while many shallow reefs in the world are declining. Amidst efforts to understand and manage their decline, it was suggested that mesophotic coral reefs might serve as natural refuges and provide larvae to replenish shallow reefs. However, our knowledge of how reproductive performance of corals changes with depth is sparse. Light plays a key role in coral life functions being both a major source of energy via photosynthesis, and an important proximate cue for reproduction. However, its reach decreases exponentially with depth. Hence, it may be expected that coral fitness will decrease with depth. Here, we present a comprehensive study of the reproductive phenology, fecundity, and abundance of reef-building conspecific corals in shallow and mesophotic habitats throughout three annual reproductive cycles. Significant differences were found in the synchrony and timing of gametogenesis and spawning between shallow and mesophotic coral populations. All seven species investigated in this study demonstrated reduced fecundity and/or oocyte sizes at mesophotic depths (40-60 m). This indicates that reproductive performance decreases with depth; and that although some species are capable of reproducing at greater depths, their contribution to the replenishment of shallow reefs may be inconsequential. Reduced reproductive performance combined with the possible narrower tolerance to environmental changes further suggests that mesophotic corals may in fact be more vulnerable than previously conceived. Furthermore, we posit that assortative mating induced by temporal reproductive isolation of a significant part of the population exists, and this, in turn, may facilitate divergence across depth.

The combined effects of fast warming and the damming of the Nile have turned the Southeast Mediterranean into a net source of atmospheric CO_2

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Recent studies in the Mediterranean have shown steep decreasing temporal trends in seawater pH, also known as Ocean Acidification (OA), resulting from the increase in atmospheric CO_2. However, in marginal seas and shelf environments OA trends may be obscured mostly by riverine influx of alkalinity and nutrients, which increases the buffer capacity of seawater and organic matter sequestration. In a previous study it was shown based on salinity time series measurements and a $\delta^{13}C$ in *Dendropoma* $CaCO_3$ proxy record that following the damming of the Nile the South-Eastern Mediterranean Sea (SEMS) has experienced a significant acidification trend of $\Delta pH/\Delta t = -0.0022 \pm 0.0002\ yr^{-1}$. This rate exceeds those of the open-ocean time series, but is lower compared to rates measured in the Western Mediterranean. The continued increase of salinity/alkalinity in the SEMS since the damming of the Nile appears should have strengthened the carbon buffer with respect to acidification, which lowered the acidification rate of this region by an estimated 27%. However, this is masked by the effect of relatively rapid warming trends (~+1 °C/decade) in the SEMS, which resulted in nearly year-round super-saturation of pCO_2 in the surface layer. Our recent observations (2009-2017) of dissolved inorganic carbon and total alkalinity in the SEMS open waters show that the SEMS have become a pronounced source of CO_2 to the atmosphere.

Isolation of novel microbial sponge symbionts using a modified Dilution-to-Extinction method

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Sponges (phylum Porifera) are filter feeders that take up microorganisms from seawater and digest them by phagocytosis. At the same time, sponges are known as hosts of a wide diversity of bacteria, which populate the extracellular matrix of the sponge and its specialized bacteriocyte cells. The microbial communities hosted by the sponge may be a source of natural products with diverse, pharmacologically promising activities, such as antitumoral, antiviral and antimicrobial activities. However, today, most of the bacterial strains in marine ecosystems, and especially microbial symbionts, are non-culturable. In recent years, significant efforts have been made to develop culturing methods that will increase the number of cultivated bacterial strains. The purpose of this work is to isolate novel microbial symbionts from the sponge *Petrosia ficiformis*, using the Dilution to Extinction method – a high-throughput culturing method, developed by Stephanie A. Connon and Stephen J. Giovannoni. In this experiment, a bacterial sample is extracted from the sponge, diluted into seawater-based oligotrophic medium and incubated in aliquots of 5 ml with final concentration of 3-10 cells/aliquot. This approach reduces bacterial competition in the inoculum and enables isolation of most abundant, oligotrophic bacteria. In order to raise culturing efficiency and final concentration of isolated microbes, a complex carbon source will be used – planktonic lysate, which will be prepared from a non-symbiont cyanobacterial strain. We hypothesize that since heterotrophic bacterial symbionts of *P. ficiformis* grow next to the cyanobacterial symbiont *Candidatus* Synechococcus feldmanni, cyanobacteria may be a good carbon source for isolating sponge symbionts.

Foes or friends - mutualism or competition for dust- iron between *Trichodesmium* and its associated bacteria

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We studied the interactions between natural colonies of the ecologically significant nitrogen fixing marine cynaobacterium *Trichodesmium* and their associated bacteria during dust-iron utilization. Dust is a significant potential iron source to phytoplankton in the open ocean, but its biological use is restricted by its low solubility. Many marine bacteria have the genetic knowhow of excreting siderophores, strong iron chelators capable of solublizing mineral iron. We hypothesize that bacteria associated with *Trichodesmium* play a role in solubilizing dust-iron by releasing siderophores. These dissolved iron complexes may be accessible or inaccessible to *Trichodesmium*, raising the possibility of mutualistic and/or competitive relationships. Assaying cultured bacteria isolated from Red Sea *Trichodesmium*, we found that most isolates are indeed capable of producing siderophores. Using advanced separation and identification techniques we detected and partially quantified large array of siderophores naturally occurring in Red Sea and Arabian Sea Trichodesmium blooms. We examined the differential ability of the colony members to acquire iron from minerals by incubating fresh natural populations with radiolabelled *Ferrihydrite* and separating *Trichodesmium* from its associated bacteria by size. By adding active and inactive siderophores (extracted from bacterial isolates) to paired experiments, we probed for the effect of siderophores on Ferrihydrite solubilization and uptake. The added siderophores enhanced Ferrihydrite solubilization and iron uptake by both *Trichodesmium* and its associated bacteria, suggesting that their quest for dust-iron is mutual.

Developing the Eastern Mediterranean as an accessible model for microbial oceanography: baselines, observatories and collaborations

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The Levantine basin of the Eastern Mediterranean Sea (EMS) is one of the most oligotrophic regions of the world ocean, yet supports relatively diverse populations of organisms from microbes to fish. In this ecosystem, processes involving both seasonal bottom up control (nutrient limitation) and biotic interactions (such as coupling of primary productivity to heterotrophic growth and grazing) likely control community structure and function. The EMS, despite being an inland sea, has many of the characteristics of a major ocean gyre, while being highly accessible - only a few hours by ship from shore. Thus, the EMS is an accessible natural laboratory to study biotic and a-biotic processes affecting microbial communities at global scales. Here, we present some initial steps towards characterizing the dynamics of the EMS microbial population structure and function over time, through a series of seasonal cruises. Our data show that the populations of microbial primary producers and heterotrophic bacteria clearly change over time, over depth, and between particle-associated and free-living size fractions. We then describe two new scientific endeavors: the Texas-Haifa Eastern Mediterranean Observatory (THEMO), which will provide important oceanographic and biological data in real time from two stations in the EMS, and a related series of monthly research cruises to the THEMO stations. These cruises will complement the real-time data from THEMO (e.g. temperature, current velocity and chlorophyll) and with samples for chemical, physiological and genetic analyses. These efforts, combined with enhanced sharing of data and resources within the scientific community, are important first steps in the development of the EMS as a globally-important model system for microbial oceanography.

Phytoplankton community structure governs the elemental composition of marine particulate organic matter

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Marine particulate organic matter (POM) is mostly produced in the photic zone by single celled autotrophs (phytoplankton). As phytoplankton form organic biomass from inorganic substrates, their elemental stoichiometry dictates the amount of nutrients transferred to higher trophic levels, and the amount of carbon that is exported into the deep ocean via the biological pump. Therefore, phytoplankton elemental stoichiometry, i.e., their carbon to nitrogen to phosphorus (C:N:P) ratio, is a key component in global biogeochemistry and climate regulation. The stoichiometry of POM is often regarded as a fixed ratio (106C:16N:1P), the so-called ``Redfield ratio'', and despite increasing recognition that the elemental stoichiometry of POM is variable, the factors underlying this variability have not been confidently identified. We compiled taxon-specific elemental compositions from experimental data, and used the compiled C:N:P ratios together with global phytoplankton group distributions from the NASA Ocean Biogeochemical Model (NOBM) to calculate the regional average C:N:P in seven oceanographic regions. Agreement between the calculated ratios and in-situ measurements suggests that phytoplankton community composition is the main determinant of C:N:P variability in modern marine POM. Furthermore, our analysis suggests that most marine phytoplankton are not severely stressed for the major nutrients (phosphate and nitrate). A dynamic population structure may lead to overall plasticity in the stoichiometry of particulate organic matter, which can modulate the amount of carbon dioxide that is removed from the atmosphere by organic carbon production and export, possibly posing a negative feedback on global warming scenarios.

Soft corals forming a calcite-made columnar spiculite in mesophotic reefs

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Surveys conducted at the Eilat upper mesophotic coral ecosystem (MCE) revealed unique columnar calcareous structures with a *Sinularia* colony growing on the top of each. Intrigued by this finding, the current study addressed the hypothesis that these colonies produce columnar spiculites. The research aims in this regard have been to determine (a) the spatial occurrence and dimensions of the spiculite-forming colonies and their species assignment; (b) the microstructural features; and (c) the elemental composition of the spiculites in comparison to the spindle-shaped sclerites of the colonies. All spiculite-forming colonies are of *S. vrijmoethi* and exclusively found at the Eilat's upper MCEs. This type of spiculite is reported here for the first time for coral reefs in general and for the MCEs in particular, including its elemental composition. The underwater survey has yielded 60 columnar spiculites, with an average side-view area of 187.7 ± 12.1 cm^2 and an average height of 18 ± 0.9 cm. SEM examination of the spiculites has revealed spindle shaped-sclerites cemented by crystallites. The elemental composition of the spindle-shaped sclerites differs from that of the cementing crystallites, being ~8% magnesium in the former and nearly none in the latter. The laser ablation profile of a single spindle-shaped sclerite reveals homogeneous distribution of the measured elements: Na, Mg, Sr, Ba in the calcium matrix (average relative SD of 10%). The elemental content in the spindle-shaped sclerites varied within 10% for Na, Sr and Ba, whereas that of Mg was higher (>30 %). Therefore, it is suggested that the formation of the crystallites which lithify the sclerites is purely chemical, essentially being an inorganic precipitation of aragonite.

Ascidians as bio-indicators of micro-plastic and phthalates in marine environments

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Global occurrence of micro-plastic (MP) in the marine environment is a major aspect of plastic pollution and an increasing threat to marine organisms and ecosystems. MP can cause mechanical damage to tissues and release toxic chemicals in the body of an organism. One group of such chemicals is the phthalate family of plasticizers, which are added to plastics during manufacturing. These compounds are introduced into the environment primarily through plastic debris. Phthalates can bio-accumulate in exposed organisms and are known to be endocrine disruptors that may interfere with reproduction and development functions. However, the eco-toxicological impact of these chemicals on marine life remains unclear. Thus, we are in need of scientific methods aimed at assessing MP and phthalates contamination and their effects. Our aim is to test the use of solitary ascidians (Chordata, Ascidiacea) as in-situ biological indicators of MP and phthalates. As sessile filter feeders, ascidians filter high volumes of seawater and retain particulate matter. Ascidians have a worldwide distribution in both polluted and pristine waters, and some are very successful invasive species. Being so, they make ideal bio-indicators for MP and their additives in numerous marine habitats. Firstly, we have developed analytical methods for detection of MP and phthalates in solitary ascidians. Next, we implemented these methods to examine ascidians sampled along the Israeli coast for phthalates and MP content. Here we reveal a first analysis of the presence of phthalates in the species Herdmania momus and Microcosmus exasperatus, collected in popular bathing beaches along the Mediterranean coast of Israel and the Aqaba bay (Eilat). High concentrations of Dibutyl phthalate (DBP) and Bis(2-ethylhexyl) phthalate (DEHP) were detected in most of the sampled sites. Our novel findings present a new and applicable tool for bio-monitoring MP and phthalates using ascidians in a wide variety of marine environments.

Microbial coupling between methane, sulfate and iron in the sediments of the oligotrophic SE Mediterranean shelf

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This study presents geochemical evidence for biogenic methane formation (methanogenesis) and iron oxides reduction in the methanogenesis zoon, in the shallow sediments of the oligotrophic SE Mediterranean continental shelf (~ 85 m water depth). Depth profiles of methane, dissolved Fe(II) and dissolved sulfate concentrations were measured along with related chemical parameters e.g., dissolved inorganic carbon (DIC), and the stable carbon isotope composition of DIC and methane ($\delta^{13}C_{DIC}$, $\delta^{13}C_{CH4}$, respectively) in three 5 m long sediment cores in order to quantify the processes involving methane production and anaerobic oxidation (AOM). Sulfate reduction was carried out to completion in all cores and *in-situ* microbial methanogenesis was detected in all sediment cores. The $\delta^{13}C$ of methane had low values between -80 to -100‰ in all cores, strongly indicating a biogenic production of methane from the H_2/CO_2 pathway. AOM was evident in the sulfate-methane transition zone, showing a distinct isotope signature and diffusion limited conditions. From the pore water profiles and incubation experiment it is evident that microbial iron reduction is occurring in the methanogenic depth, which suggests a link between the methane and the iron cycle.

Desalination brine from multiple sources may have large spatial scale impacts on Israeli Mediterranean coastal waters

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Desalination of seawater is becoming an increasingly important source of potable water in Israel. Unfortunately, one of the side effects in the production of drinking water is the return of a high saline brine into coastal waters. Previous studies have demonstrated the deleterious effects of desalination brine on benthic and pelagic microbial communities in the near field (0102 -103m from the source), where the salinity may increase by as much as 10% relative to the ambient level. Along the Israeli coast desalination brines are discharged a 5 locations along a 100km stretch of coast. In this study the far field effects of brine discharge on coastal water dynamics along the coast of Israel are investigated using a 3D hydrodynamic model (MIKE3 by DHI). Where, the albeit small far field salinity increase may affect the density of seawater and cause changes to the dynamics on much larger spatial scales. The model was run over a yearlong period with and without the brine discharge. According to these simulations the brine spread out along the coast and reached the brine zones of adjacent desalination plants. Thus, the brine from each plant should not be considered in isolation. In another experiment, a passive tracer was released from the sea floor mimicking benthic fluxes of nutrients to the water column. Under conditions of brine discharge, we found that nearly 15% of the tracer was transported off the shelf without mixing into the upper layers of the model over an annual cycle. Thus, the primary production in the nutrient impoverished waters along the Mediterranean coast of Israel may be further limited by the reduced supply of nutrients from benthic recycling of organic matter. This result suggests that discharge from multiple desalination plants may impact coastal waters on larger spatial scales and is not limited to the immediate near field mixing zone around the outfalls as previously considered.

Insights into sulfur and carbon coupling in the sulfate-methane transition zone from dissolved inorganic carbon and total alkalinity pore water profiles

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Sulfate reduction by oxidation of organic material (OSR) and oxidation of methane (S-AOM) create important links between sulfur and carbon cycling in sediment pore waters. Here, we resolved the OSR and S-AOM rates in one location in the Eastern Mediterranean Continental Shelf (EMCS), using the total alkalinity (TA) and dissolved inorganic carbon (DIC) profiles. This was achieved using the fact that each of these processes has a different stoichiometric effect on TA and DIC. Although the calculated sulfate reduction rates are similar to estimates based on pore water sulfate profiles from other sedimentary systems, they are 3-30 times lower than rates estimated from $^{35}SO_4^{2-}$ incubations. This discrepancy suggests that TA and DIC profiles represent the net of not only S-AOM, OSR and carbonate mineral precipitation, which were accounted for in our model, but also of other processes, such as the further cycling of sulfide produced by OSR and S-AOM. Our results demonstrate that OSR is responsible for a significant fraction of sedimentary sulfate reduction, even in an ultra-oligotrophic environment such as the EMCS. Furthermore, we calculated that although OSR contributes 85% of the carbonate alkalinity, it is the onset of S-AOM, which is likely to promote carbonate minerals precipitation due to the pH increase it induces.

Methane involving processes in sediments of Eastern China Sea Shelf

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This study uses sedimentary geochemical profiles to explore the processes that involve methane in the Eastern China Sea shelf. This is a marginal sea forming the west boundary of the Pacific Ocean, which receives large amounts of terrigenous material from the Yangtze River. In order to explore methane involving processes in the sediment, three sediment cores (five meter long) were collected from water depths of 40-58 meters during a cruise in July 2017. One core was collected from the Yangtze river estuary, and two others were taken from Sothern locations along the shelf. The sediment cores were sliced into 40 cm intervals, and pore water was extracted from them by centrifugation. The pore water samples were measured for the concentration of major ions, ferrous, dissolved inorganic carbon (DIC) and $\delta^{13}C_{DIC.}$ Headspace from sediments samples was measured for methane (CH_4) concentration and its carbon isotope ($\delta^{13}C_{CH4}$). The profiles performed from these measurements show that two of three cores reached the microbial production zone of the methane, penetrating the Sulfate-Methane Transition Zone (SMTZ). This transition zone was detected in the estuary core (A3-5) at around 370 cm depth, and in the southern core (B3-2) at 400 cm depth. In the core collected between them the SMTZ was below the sampling depth. Methane production appeared in these shallow sediments probably due to high fluxes of labile organic carbon from the river. Sediment incubations enriched with artificial sea water from the SMTZ were prepared to explore the oxidation of methane by sulfate at this zone. The results of the incubation are planned to be compared to incubations from the SMTZ in the Mediterranean Sea shelf.

A tentacle for every occasion: comparing the hunting tentacles and sweeper tentacles, used for territorial competition, in the Red Sea coral *Galaxea fascicularis*

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Competition for space among sessile organisms is a common process in coral reefs, which can exert major impacts on reef biodiversity and community composition. Corals have developed a variety of competition strategies against other reef organisms aimed for protection and space clearing for further colony growth. One strategy is the usage of sweeper tentacles, elongated tentacles suggested to originate from the polyp catch tentacles (used for prey capture). Sweeper tentacles directly damage the soft tissues of opponents, yet to date much remains unknown regarding the functional mechanism underlying this damage (e.g. toxins) or the regulatory and developmental processes regulating the use of these tentacles. This present study focuses on the biological mechanism of sweeper tentacles in the scleractinian coral *Galaxea fascicularis,* known to be a highly aggressive species. We compared the tissue structure, toxic activity and gene expression patterns of sweeper and catch tentacles, achieved by using a set of toxic assays, histological methods and transcriptome comparison of the two types of tentacles. Hemolytic paralytic and phospholipase A2 toxic assays were performed and while catch tentacles demonstrated a far greater hemolytic activity and were the only ones in which paralytic (presumably neurotoxic) activity was detected, phospholipase activity was significantly higher in sweeper tentacles. In addition, structural differences were observed in histological sections between the two tentacle types in the number and position of cilia, in nematocysts composition in tentacle tips (acrospheres) and potentially, in the abundance of secretory (goblet) cells. Our results show a clear functional differentiation between sweeper and catch tentacles which may be related to their distinctive ecological roles. Together with the comparison of gene expression patterns between the two tentacles, these studies are beginning to uncover the physiological and molecular basis of the corals competitive ability.

87Sr/86Sr in lake sediments reveals local and global climatic and environmental changes

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Mineralogical, chemical and isotopic signatures of sediments can be used to trace sediment sources in marine and lacustrine environments. In this study, we implement this method to identify the sources of sediments to lake Huguangyan maar in SE China, and then use the identified sources and the changes in material sources to the lake over time to induce the prevailing climatic conditions in the region during the past ~80 kyrs. Huguangyan maar is ideal for this type of study; it is hydrologically confined with its catchment area comprising only the inner slopes of the crater rim, such that particulate matter can only reach the lake from the volcanic rims, as windblown dust, or precipitate in the lake from dissolved constituents of the last two sources or from groundwater discharge. Sediment cores obtained by the GermanChinese drilling project have been previously dated and generally characterized (Mingram et al. 2004). Lake-rim materials are dominated by local volcanic sources, while the soils collected nearby the lake have a granitic origin, most noted through their 87Sr/86Sr ratios. 87Sr/86Sr ratios of the lake-core sediments vary between lake-rim values and the nearby soils. We infer from the correlation between high 87Sr/86Sr ratios and dry periods (e.g. Heinrich Events) and vice versa that the nearby granitic soils are derived from weathering products of the granitic basement north of the lake alluvially transported to the lake area during wet periods; during dry intervals, particles from these soils are blown into the lake and accumulate in the sediment with lake-rim materials. In a larger climatic context, contrary to regional cave deposit climate records that are dominated by precession cycles, long-term 87Sr/86Sr ratios in the lake sediments are dominated by obliquity, suggesting that obliquity plays a more pronounced role in the low-latitude East Asian monsoonal system than previously thought.

What is the ecological-economic value of sharks?

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Sharks and rays are among the most endangered group of marine animals and include many species for which there is little information on abundance and distribution. Conservation and management increasingly become important in many marine regions, since there is several species that are threatened and their population decline due to overfishing and over exploitation. About 100 million sharks are killed every year for commercial reasons (for fins, meat and oil). As a result, over the last 20 years many species have dropped to 1%-10% of their original population. Quantifying the extent of sharks' decline, the risk of species extinction, and the consequences for marine ecosystems have been challenging and controversial, mostly due to data limitations. This multidisciplinary conflict has three aspects of ecological value, economic values: use and non-use values of shark's population, through different parameters. Today, the main use of sharks is for food industry, where fishers harvest 100 million sharks for their livings. Another use is the ecotourism industry, which is one of the fastest growing industries. However, this raise new problems that we still don’t know enough- like increasing metabolic rate and behavioral changes because the food that we supply, inbreeding and inter-specific aggressiveness (as a result of the reduction of shark mobility), and more. Another use is the ecological value for the habitat as part of the ecosystem's resilience. The research will define, identify, quantify and analyze the ecological and economic aspects of sharks'' ecotourism.