DALHOUSIE UNIVERSITY

המכון הבינאוניברסיטאי למדעי הים באילת
The Interuniversity Institute for Marine Sciences in Eilat

Schulich Ocean Studies Initiative Conference
October 16-17, 2017

The Interuniversity Institute for Marine Sciences in Eilat, Israel

Schulich Ocean Studies Initiative

In 2015, with the generous support of Canadian Philanthropist Seymour Schulich via The Schulich Foundation, the Interuniversity Institute for Marine Sciences in Eilat (IUI) and Dalhousie University forged a collaboration and partnership entitled the Schulich Ocean Studies Centre Initiative in Eilat. This three-year program, which has subsequently been extended for a fourth year, has included joint research projects, co-supervision of doctoral students, joint field courses, and more.

The understanding of marine sciences is crucial to the understanding of the global environment and forms the basis of an ocean knowledge economy and well-founded public policy, governance and security. The two different ocean environments of the Red Sea and the North Atlantic provide both complementary and well-aligned settings for major applied and basic scientific discoveries in physical oceanography related to the phenomenon of deep water mixing, deep water corals, underwater natural and animal resources, aquaculture and marine biodiversity, marine animal behaviour as well as marine sovereignty, marine security and transportation.

This conference is a key component of the Initiative and provides an opportunity for researchers to share the results of their joint research projects with the broader research community and showcase the international collaboration supported by the Initiative.

About the Interuniversity Institute for Marine Sciences (IUI) in Eilat and Dalhousie University

The IUI is a national facility situated on the Red Sea at the southern tip of Israel, which involves seven Israeli universities and research institutions: University of Haifa, Ben-Gurion University of the Negev, Bar-Ilan University, Tel Aviv University, Technion, Weizmann Institute of Science, and The Hebrew University of Jerusalem.

Dalhousie University is Atlantic Canada's leading research-intensive university and a driver of the region's intellectual, social and economic development. Located in the heart of Halifax, Nova Scotia, with an Agricultural Campus in Truro/Bible Hill, Dalhousie is a recognized leader in ocean research. In 2018, Dalhousie will celebrate 200 years of academic and research excellence.

Acknowledgements

The conference organizers would like to thank all participants and contributors and to recognize the support of The Schulich Foundation.

Keynote speakers:

Dr. Paul Snelgrove, University Research Professor, Memorial University of Newfoundland

Dr. Snelgrove is a Professor of Ocean Sciences and Biology at Memorial University of Newfoundland in Canada. Dr. Snelgrove received a BSc. Hons degree in Biology at Memorial, a Master's degree in Oceanography from McGill University, and a PhD from the Massachusetts Institute of Technology and Biology Department at Woods Hole Oceanographic Institution.

Since 2008 he has been Director of the NSERC Canadian Healthy Oceans Network, a national research network in Canada that has already trained some 100 students working on all 3 of Canada's oceans to develop new tools and approaches to support sustainable oceans. He also currently plays the role of Associate Director of The Ocean Frontier Institute.

From 2003-2013, Dr. Snelgrove held a Canada Research Chair in Boreal and Cold Ocean Systems, and prior to that an NSERC Industrial Chair in Fisheries Conservation. He led the synthesis of the International *Census of Marine Life* research program, where he was a member of the program's Scientific Steering Committee.

Dr. Snelgrove published the book "*Discoveries of the Census of Marine Life: Making Ocean Life Count*" with Cambridge University Press in 2010 and was a TED Global speaker in 2011. He has published over 100 papers and book chapters on marine biodiversity in the deep sea and coastal ocean.

Dr. William M. Balch
Bigelow Laboratory for Ocean Sciences

William M. Balch ("Barney") began his career in oceanography working for Dr. Charles S. Yentsch in 1972 as a pimply-faced, 14-year old, doing microscope cell counting of phytoplankton cultures after school. That was 45 years ago and he has been doing oceanography ever since.

Barney went on and received his B.A. from Cornell University (1980) and Ph.D. from Scripps Institution Of Oceanography in Biological Oceanography (1985). He held post-doctoral fellowships at the Bedford Institute (1985; with Dr. W.G. Harrison) and at Scripps Institute Of Oceanography (1986; with Dr. R.W. Eppley).

From 1988-1995 he served on the faculty at the Rosenstiel School for Marine and Atmospheric Sciences (University of Miami), reaching the rank of Associate Professor (with tenure) before moving to Bigelow Laboratory for Ocean Sciences in Maine as a Senior Research Scientist in 1995, a position which he has held for 22+ years. His research has had a number of foci: (A) coccolithophores, their physiological ecology, bio-optical properties and biogeochemistry, (B) marine viruses and their impact on ocean optical properties, (C) for 19+ years he and his group have maintained a coastal productivity time series, the Gulf of Maine North Atlantic Time Series (GNATS), a NASA-centric time series focused on land-to-sea carbon transport, productivity and coastal bio-optics, (D) he has performed NOAA- and NASA-funded ocean acidification work and its effects on coccolithophore calcification and interactive effects with grazers and (E) he has led a number of major expeditions: (1) the ONR-funded, large-scale manipulative experiment, "Chalk-Ex", which elucidated the loss processes of particulate inorganic carbon from the surface ocean, (2) the NSF-funded COPAS'08 expedition to the Patagonian Shelf to study the mesoscale coccolithophore bloom there, plus factors affecting its growth and fate and (3) the NSF- and NASA-funded Great Calcite Belt expeditions to study the world's largest coccolithophore-rich region in the Southern Ocean, a feature covering some 16% of the global ocean.

As of 2017, Balch has published 115 research papers and was elected to deliver the 14th Annual Gordon Riley Memorial Lecture at Dalhousie University in 2012. He is a past member of the Ocean Carbon and Biogeochemistry (OCB) subcommittee on Ocean Acidification and OCB Steering committee. He was on the NASA Science Definition Team for the PACE ocean color satellite program and has just finished a stint on the NASA EXPORTS Science Definition Team. He is a member of ASLO, AGU and a founding member of The Oceanography Society (TOS). He currently is a Biological Oceanography Councilor on the TOS board.

As a counterbalance to his busy science career, Balch performs regularly around New England as a jazz trombonist with two bands, "The Novel Jazz Septet" and "The Downeast Jazz Babies"; he appears on nine CD albums.

Schulich Ocean Studies Initiative Conference Agenda

Oct 16-17, 2017-The Interuniversity Institute for Marine Sciences in Eilat, Israel

Sunday, October 15th

17:00 – 19:00	**Welcome Reception and Registration -** *IUI, Campus lawn*
19:30 -	**Dinner -** *Orchid Hotel Restaurant*

Monday, October 16th

***All presentations will take place in the Lecture Hall in the Teaching Building, unless otherwise indicated**

07:00-08:30	**Breakfast -** *Orchid Hotel Restaurant and IUI Dorms (students)*
08:30-08:45	**Welcome and opening remarks** Amatzia Genin, Scientific Director, Interuniversity Institute for Marine Sciences; Ian Hill, Associate Vice-President Research, Dalhousie University
08:45-09:30	**Keynote Address: "Biodiversity and the Health of Planet Ocean"** Paul Snelgrove, Faculty of Ocean Sciences, Memorial University of Newfoundland
9:30-10:00	**"Phytoplankton annual cycle and blooms: intuitive results from a simple analysis"** Emmanuel Boss, School of Marine Sciences, University of Maine
10:00-10:30	**Coffee Break**
10:30 – 11:15	**"Biogenic Fluxes and Nitrogen Isotopes from sediment traps in the Gulf of Aqaba, northern Red Sea"** Stephanie S. Keinast, Department of Oceanography, Dalhousie University
11:15-12:00	**"Oh the Places You'll Go!!! Lessons learned about Deposition, Burial, and Removal of Flood Sediments in the Gulf of Eilat-Aqaba"** Beverly Goodman-Tchernov, Moses Strauss Department of Marine Geosciences, University of Haifa
12:00-13:00	**Lunch** - *IUI Campus lawn*

13:00 – 13:45	**“Early succession on artificial and natural reefs at Eilat, Gulf of Aqaba”** Avigdor Abelson, Department of Zoology, Tel Aviv University; Emily Higgins, MSc Candidate, Department of Biology, Dalhousie University
13:45-14:30	**“Mechanisms of flashflood deposit preservation in shallow marine sediments of a hyperarid environment”** Alysse Mathalon, MSc, Dalhousie University and the Interuniversity Institute for Marine Sciences, Eilat **“Recent flood observations on land and in the sea in the Gulf of Aqaba-Eilat”** Akos Kalman, PhD candidate, Department of Marine Sciences, University of Haifa and the Interuniversity Institute of Marine Sciences, Eilat **“Recruitment and spill-over of reef organisms to artificial reefs”** Roy Yanovski, PhD Candidate, Department of Zoology, Tel Aviv University
14:30-15:00	**Coffee break**
15:00-15:45	**“Stress on the reef: response of reef fishes to chronic stress”** Renanel Pickholtz, PhD candidate, School of Zoology, Tel Aviv University
15:45-16:30	**“Dietary Butyric Acid as a Potential Epigenetic Accelerant of Growth and Enhancer of Survival and Essential Fatty Acid Content in early stage striped bass (*Morone saxatilis*) and sea bream (*Sparus aurata)* aquaculture”** Lindsey Gillard, PhD candidate, Department of Animal Science and Aquaculture, Dalhousie University
16:30-18:30	**Snorkeling at the reef**
19:00	**Dinner –** *IUI Campus lawn*

Tuesday, October 17th

05:00-07:30	**Sunrise hike from Mt. Zfahot** (medium-level walk, steep mountain) *Led by Amatzia Genin. Meet at IUI parking lot.*
07:30-08:30	**Breakfast -** *Orchid Hotel Restaurant and IUI Dorms*
08:45-09:30	**Keynote address: “Changing climate, carbon cycles and tea steeping in the Gulf of Maine"** William (Barney) Balch, Senior Research Scientist, Bigelow Laboratory for Ocean Sciences
09:30-10:00	**“Secchi disks and what they can tell us about the ocean”** Marlon Lewis, Department of Oceanography, Dalhousie University
10:00-10:30	**Coffee break**
10:30-11:15	**“Can physiological tolerance predict invasiveness potential of tropical ascidians?”** Noa Shenkar, School of Zoology, George S. Wise Faculty of Life Sciences, Tel Aviv University
11:15-12:00	**“Dynamics and contribution of N_2 fixation to “New” and “Export” Production in the Gulf of Aqaba”** Katja Fennel, Department of Oceanography, Dalhousie University
12:00-13:00	**Lunch -** *catered on campus lawn*
13:00-14:00	**Visit to the underwater observatory**
14:00 – 14:45	**"Dynamics of complex microbial communities during the spring bloom in the Gulf of Aqaba, Red Sea"** Debbie Lindell, Department of Biology, Technion; Joseph Bielawski, Department of Biology, Dalhousie University
14:45- 15:15	**Report on joint Winter/Summer Field Courses** Marlon Lewis, Dalhousie University & Amatzia Genin, IUI
15:15-15:30	**Coffee Break**
15:30 – 16:30	**Discussion on future cooperation; end of conference**
Evening	**Dinner –** *own arrangements*

Biogenic Fluxes and Nitrogen Isotopes from sediment traps in the Gulf of Aqaba, northern Red Sea

Stephanie S. Kienast[1], Adi Torfstein[2,3], Yonathan Shaked[4]

[1] Department of Oceanography, Dalhousie University, Canada, stephanie.kienast@dal.ca
[2] Interuniversity Institute for Marine Sciences, Eilat, Israel
[3] Institute of Earth Sciences, Hebrew University of Jerusalem, Israel, adi.torf@mail.huji.ac.il
[4] National Monitoring Program of the Gulf of Eilat, yonathan.s@mail.huji.ac.il

ABSTRACT

Knowledge of real time dynamics between dust input, primary production, and export production in oligotrophic waters is poor, and suffers from limited real-time observational support, especially in the context of the direct response and lag time between nutrient supply (e.g., dust), the oceanic biogeochemical response and the signal transfer from the water to sedimentary record.

Here, we present the first measurements of biogenic fluxes (TOC, TIC) and stable nitrogen isotopes ($\square^{15}N_{bulk}$) in the deep oligotrophic Gulf of Aqaba, northern Red Sea, between 2014-2016. The study is based on daily- and monthly- resolution sediment traps deployed at several depths. The sediment trap configuration allows for a unique collection of marine particles, whereby the annual and seasonal patterns can be evaluated in the context of discrete (daily-timescale) events such as abrupt dust storms, floods and biological blooms.

The organic C and total N fluxes range annually between 0.02-0.25 and 0.001-0.1 g d^{-1} m^{-2}, respectively. Both show a sharp decay with depth, corresponding with the “Martin curve” (Martin et al., 1987). Temporal patterns in fluxes and nitrogen isotopes are examined in the context of seasonal hydrographic changes and shorter events such as dust storms and flash floods. Importantly, the daily-resolution sampling provides insights into the seasonal increase in export production during the winter and early spring. Rather than a smooth seasonal cycle, this increase is driven by only very few short events, lasting no more than a few days, during which export production increases by an order of magnitude above the baseline.

Oh the Places You'll Go!!! Lessons learned about Deposition, Burial, and Removal of Flood Sediments in the Gulf of Eilat-Aqaba

Beverly Goodman-Tchernov[1], Paul Hill[2], Akos Kalman[1], Alysse Mathalon[2], Timor Katz[3]

[1]Moses Strauss Department of Marine Geosciences, University of Haifa, bgoodman@univ.haifa.ac.il, akoss.kalman@gmail.com
[2]Department of Oceanography, Dalhousie University, paul.hill@dal.ca
[3]Department of Marine Geology, IOLR, Haifa, timor.katz@mail.huji.ac.il

ABSTRACT

Worldwide, episodic rainfall over hyperarid desert areas like the GOA, may cause flash floods in ephemeral rivers, with periods of higher rainfall generally associated with increase in flood events. These events are critical for the maintenance of local ecology and recharging underwater aquifers. Only a few years ago, the understanding of the fate and relevance of flashflood sediments entering the Gulf of Eilat-Aqaba (GOA) was extremely limited, primarily anecdotal, and presumed to be only moderately significant.

In the southern Negev, Israel, flash floods constitute an essential factor in desert ecology but may also cause damage to infrastructure and result in loss of life. While many desert floods ultimately reach terrestrial terminal basins, some rivers around the GOA carry floodwater and sediments into the sea. The first direct observations and measurements of these deposits discovered that much of these sediments deposit on the continental shelf where they play an important role in structuring the seabed and related, benthic ecology; but then in a relatively short time (<1 year) become unrecognizable on the shelf's surface. Even more compelling was the discovery that the volume of sediments dominated all other contributing sources to the marine sediments. However, there was no understanding of the processes by which they were removed, buried, or transported.

In February 2015 a Schulich Foundation funded study began an effort towards characterizing and determining the fingerprint of newly introduced flood sediments, measuring incoming flood water and suspended sediment properties (e.g. salinity, temperature, turbidity), tracking the changing deposit over time, and determining whether these sediments can be identified in the deeper basin.

The study used sedimentological methodologies to characterize and describe flood sediments upon their arrival, elucidate the processes and mechanisms of their removal, and used these data to reconstruct, to the best possible resolution, a late Holocene flood record in the GOA and trends therein. Globally, ephemeral rivers in arid systems are common, yet they have been mostly ignored with regard to their contribution to the marine sediment budget or their potential as a marker within environmental archives. The major reason for this disregard has been their innocuous appearance relative to more conspicuous large perennial rivers. Therefore, this research is a unique first glance at an important global phenomenon. Here, we will share the study's rationale, findings, and thoughts for research moving forward.

Early succession on artificial and natural reefs at Eilat, Gulf of Aqaba

Anna Metaxas[1], Nadav Shashar[2], Robert Scheibling[3], Avigdor Abelson[4], Emily Higgins[3], Kelsey Desilets[3], Yotam Barr[4], Roy Yanovski[4]

[1] Department of Oceanography, Dalhousie University, metaxas@dal.ca
[2] Dept. of Biological Sciences. Ben Gurion Univ. nadavsh@bgu.ac.il
[3] Department of Biology, Dalhousie University, rescheib@dal.ca, em557063@dal.ca, kelseydesilets@gmail.com
[4] Dept. of Zoology, Tel Aviv University, avigdor@tauex.tau.ac.il,

ABSTRACT

Artificial reefs increasingly are being deployed as a mitigation strategy for effects of multiple stressors on coral reefs, although their efficacy remains equivocal. We compared patterns of colonization and succession of the benthic assemblage over 13 months in a mensurative experiment on a suspended and a seafloor artificial reef, and on two nearby natural reefs at Eilat, Gulf of Aqaba. We also examined the effect of large mobile consumers (fish and sea urchins) on these patterns in a concurrent manipulative experiment (using exclusion cages) over 7 months on the suspended artificial reef and one of the natural reefs. Ceramic tiles with identical top and bottom surfaces served as settlement collectors in both experiments. These were photographed monthly to monitor changes in planar cover of colonists using image analysis. At the end of each experiment, the collectors were recovered to measure biomass of established colonists. In both experiments, a dense algal matrix dominated the collector topsides, while sessile invertebrates (mainly bivalves, ascidians, and bryozoans) dominated the undersides, across all sites and treatments. In the mensurative experiment, undersides accumulated 67–99% more biomass than topsides. Mean biomass (fresh weight) on undersides was significantly greater on the two artificial reefs (22.2 kg m-2) than on one (7.3) but not the other (16.4) natural reef. Bivalves and polychaetes contributed most to differences between reef types in biomass on topsides, and ascidians, sponges and corals to differences on undersides. In the manipulative experiment, algal cover on topsides did not differ significantly between caged and open treatments at the suspended artificial reef (20 m above bottom), where demersal herbivorous fish (e.g. parrotfish) were generally absent. Consumer exclusion altered species composition on the undersides of the collectors at both sites, and significantly increased biomass relative to controls, indicating that fish and mobile macroinvertebrates strongly affect recruitment and early succession in sheltered microhabitats.

Examination of the effects of stepping stones on connectivity levels revealed that stepping stones serve as a partial filter on species dispersal. While some species can move from one site to the other without the need for stepping stones, others require them for reaching far away targets In general, he more stepping stones that exist, the more species that can pass through the filter. However, predators that position themselves on stepping stones, may reduce the number of individuals passing through them.

Examining of spillover has found contradicting trends where spillover is higher at protected reefs than at non protected ones, yet recruitment to modules was higher at locations distant from the reef that those close to it.

Our results highlight the potential of artificial reefs for increasing biomass of reef-associated assemblages, particularly those occupying sheltered microhabitats, for use as stepping stones between reef habitats, and as a conservation method in a coral reef environment.

Stress on the reef: response of reef fishes to chronic stress

Renanel Pickholtz[1], Jonatahn Belmaker[1], Moshe Kiflawi[2,3], Glenn Crossin[4]

[1] School of Zoology, Tel Aviv University, renanel.pickholtz@gmail.com, jonathan.belmaker@gmail.com
[2] Dept. of Life-Sciences, Ben-Gurion University of the Negev, Beer-Sheva, Israel
[3] The Interuniversity Institute for Marine Sciences, Eilat, Israel. mkiflawi@bgu.ac.il
[4] Department of Biology, Dalhousie University, gtc@dal.ca

ABSTRACT

Coral reefs are among the most vulnerable ecosystems on Earth, subject to many natural and anthropogenic stressors. The health and capacity of reefs to resist and recover from environmental stressors – i.e. their resilience – depends on the fishes that associate with them. A prominent example are parrotfish (Scaridae), which have been shown to drive accretion rates of coral reefs, and prevent reefs from shifting to macroalgal dominance. However, these fish are themselves under considerable pressure and must contend with stressors such as pollution, fishing, habitat degradation, pathogens, and rising sea temperatures.

In fish, as in other vertebrates, the physiological response to environmental stressors is mediated by glucocorticoid 'stress' hormones such as cortisol. While adaptive in the short-term, chronically elevated levels of stress hormones can be detrimental to factors such as locomotion, feeding, reproduction, and survival; all of which could have cascading ecological consequences. Despite the potential for direct ecological ramifications, little has been done to examine how chronic stress may scale-up from the level of the individual to the functioning of the associated ecosystem, e.g. through changes in habitat utilization.

To address this issue we combined hormonal manipulations, using cortisol implants, and acoustic telemetry to quantify changes in movement and habitat utilization in response to chronic stress in two species of parrotfish. An array of 13 receivers was established along the northwestern tip of the Gulf of Aqaba, covering a linear distance of 2.5km. A total of 32 fish were equipped with accelerometers and pressure sensors, which provide activity (m/s^2) and depth, respectively, as well as horizontal movements across the array. Over a period of 18 months we continuously recorded behavioral data of multiple tagged individuals, for durations of up to 150 days. Implanted transmitters are still active and are expected to transmit for as long as three years.

Initial analyses suggest that hormonal manipulations did not have major implications for fish depth profile, activity patterns or movement. That being said, results from the hormonal implant validation study are forthcoming, after which the efficacy of the cortisol implants would be determined. Further analyses that may detect more subtle responses are currently being conducted. Ultimately, our results may provide insights into the hormonal basis of habitat utilization, and the ecological effects of chronic stress in coral reef fishes.

Dietary Butyric Acid as a Potential Epigenetic Accelerant of Growth and Enhancer of Survival and Essential Fatty Acid Content in early stage striped bass (*Morone saxatilis*) and sea bream (*Sparus aurata)* aquaculture.

James Duston[1], William Koven[2], Lindsey Gillard[1], Amir Bitan[2]

[1]Department of Animal Science and Aquaculture, Dalhousie University, jduston@dal.ca, lindsey.gillard@dal.ca
[2]Israeli Oceanographic and Limnological Research, National Centre for Mariculture, bmkoven@gmail.com, bitanam@gmail.com

ABSTRACT

Most marine finfish larvae experience poor growth and high mortality, severely limiting their aquaculture potential. Inadequate protein absorption by the primitive intestine may be a key factor. Ingested protein is absorbed through a brush-border membrane transporter called Peptide Transporter 1 (PepT1). To test the hypothesis that butyric acid (BA) as dietary supplement can up-regulate Pept1 synthesis in larval fish and improve survival and growth, striped bass and sea bream, early larvae (9, 10, and 14 days post hatch, dph) were fed a microdiet containing either 0.0%, 0.5 or 1.0% BA for ten days. The mortality rate of striped bass larvae was >98%, associated with failure to wean from artemia onto the particulate diet. Early juveniles (39 dph; 85mg body weight, BW), by contrast, accepted the diet and grew fast on the BA diet. Mean body weight of bass fed either 0.5 or 1.0% BA increased by three-fold in 10 days (247 mg final) significantly greater than the control (176 mg final; P=0.016). Also, survival of bass consuming either treatment diet was significantly greater than the control (83% vs. 77%; P=0.032). Bass gut microvilli length and width were significantly greater in both1.0% and 0.5% BA treatments compared to the control (p<0.001). Bass whole body docosahexaenoic acid (DHA) (mg/g) in both 0.5% and 1.0% BA were significantly (70%) greater than control (0.0%; P=0.0028), but eicosapentaenoic acid (EPA) content was significantly lower in the 1.0% BA treatment (p=0.0028, and 0.000, respectively). The bass filtered whole annotated transcriptome analysis revealed the differential expression of 19 genes was significantly different between 0.0% and 1.0% BA, but no significant differences detected between either 0.5% and 1.0% BA, and 0.0% and 0.5% BA treatments. These genes were not linked to Pept1 but were involved in metabolism and various essential biochemical pathways.

Can physiological tolerance predict invasiveness potential of tropical ascidians?

Noa Shenkar[1], Sarah Stewart-Clark[2]

[1]School of Zoology, George S. Wise Faculty of Life Sciences, Tel Aviv University, Israel

[2]Department of Plant and Animal Sciences, Faculty of Agriculture, Dalhousie University

ABSTRACT

Introductions of invasive ascidians (Chordata, Ascidiacea) has caused damage in billions of dollars in recent years, raising public awareness for the importance of studying and monitoring this group in a variety of ecosystems. A major focus of invasion biology is understanding the traits associated with invasion success. Most studies assess these traits in the invaded region, while only few have compared traits of alien species to species with no introduction records at their native range. Here we compared physiological tolerance to three salinity and temperature conditions of local native Red Sea species and local species with extra-tropical records of invasions as a tool for predicting invasiveness potential. Survivorship of five common Red Sea ascidians was examined under the following salinity treatments: low (33-35‰), high (45-46‰), and control (40-41‰), and three temperature treatments low (16^{0}C), high (30-31^{0}C), and control (24-25^{0}C). Surprisingly, majority of species investigated presented a wide tolerance to changing environmental conditions, with *Herdmania momus*, a well-known invasive species in the Mediterranean Sea, exhibiting higher mortality rates in the high and low temperature treatments and the low salinity treatments. We conclude that short term salinity and temperature tolerance of tropical ascidians is not a good predictor of invasivness potential as the majority of species investigated demonstrated a mechanism for tolerance to varying environmental conditions. We suggest other traits such as colonization pressure in ports and marinas as a tool for determining invasiveness potential.

Dynamics and contribution of N_2 fixation to "New" and "Export" Production in the Gulf of Aqaba

Katja Fennel[1], Ilana Berman-Frank[2], Angela Kuhn[1], Etai Landau[2], Marlon Lewis[1], Julie LaRoche[1], Boaz Lazar[3]

[1]Dept. of Oceanography, Dalhousie University, Nova Scotia, Canada, katja.fennel@dal.ca, marlon.lewis@dal.ca; Julie.laroche@dal.ca
[2]Mina and Everard Goodman Faculty of Life Sciences, Bar Ilan University, Israel, ilana.berman-frank@biu.ac.il
[3]Earth Sciences Institute, Hebrew University Jerusalem, Israel, boaz.lazar@huji.ac.il

ABSTRACT

The ocean is a significant sink of anthropogenic CO2, in large part because organic matter is exported to oceanic depths driving the biological sequestration of carbon in the ocean's interior. Organic matter export depends on the supply of external nutrients to the euphotic zone (by processes such as deep mixing and biological fixation of atmospheric dinitrogen (N2)) and the subsequent production of organic matter by photosynthesis (a.k.a. "new" production). Currently, there are no reliable estimates of "new" and "export" production in the Gulf of Aqaba (Red Sea), but deep mixing in winter and N2 fixation in summer are thought to be important contributors. Our overarching objective is to assess the contribution of N2 fixation and deep mixing to new production in the Gulf of Aqaba. We implemented a 1-dimensional physical model coupled with four different biogeochemical model versions, one that does not include N2 fixation and three others that account for this process by explicitly representing different diazotrophs (N2-fixing organisms). The models were optimized to replicate monthly profiles of NO3, NH4, PO4, O2 and chlorophyll concentrations from a representative oligotrophic Station A (~700 m deep) in the northern tip of the Gulf of Aqaba. We show that a model without diazotrophs can replicate surface chlorophyll and O2, but fails to simulate the inorganic nutrient ratios in the subsurface. Inclusion of autotrophic diazotrophs, either as a generic group or as separated unicellular and colonial cyanobacterial groups, improves the simulated surface nutrient ratios. However, the interannual variability in deep O2 and inorganic nutrient concentrations is only replicated when an additional heterotrophic diazotroph group is included. This suggests that heterotrophic N2 fixation results in the observed deep-water excess NO3. While our results agree with earlier genetic and rate studies of N2 fixation from this location, there has been no systematic characterization of the players or the contribution of N2 fixation over an annual cycle (including aphotic heterotrophic N2 fixation). We thus employed a bi-monthly sampling program from Dec 2015 to March 2017 augmenting the routinely sampled physical/chemical/biological parameters to characterize the contribution of N2 fixation (composition and rates) to primary and bacterial production. Analyses are still incomplete yet results show higher N2 fixation rates in the spring and summer compared to rates from the mixed winter months. The *in-situ* data will be used to validate the model and quantify the relative contributions of N2 fixation and vertical mixing to new and export production.

“Dynamics of complex microbial communities during the spring bloom in the Gulf of Aqaba, Red Sea”

IUI Campus Map

1- Shelter
2- Storage containers
3- Maintenance shop
4- Dorms
5- Outdoors water table, tanks
6- Indoor exp. tanks, flumes
7- Labs
8- Offices
9- Entrance, Parking lot
10- R&D shop
11- Main building
12- Administration
13- Labs
14- Kitchenette, labs
15- Oceanogr. storage
16- labs, offices
17- Pump house
18- Research Pier
19- Dive center
20- Red Sea simulator
21- Teaching building
22- Constr. site new building
23- Road to Egypt

Please note:

- The Lecture Hall is located in the Teaching Building (21).
- The welcome reception on October 15th, lunch and dinner on October 16th, and lunch on October 17th will be held on the campus lawn located to the left of the Main Building (11).
- For the hike on Oct. 17th we will meet in the parking lot (9).

Registered Conference Participants and Affiliations:

Adi Torfstein	Interuniversity Institute for Marine Sciences, Eilat, Hebrew University of Jerusalem
Akos Kalman	PhD Candidate, Moses Strauss Department of Marine Geosciences, University of Haifa
Alysse Mathalon	MSc. Candidate, Dalhousie University; Interuniversity Institute for Marine Sciences, Eilat
Amatzia Genin	Scientific Director, Interuniversity Institute for Marine Sciences, Eilat
Amir Bitan	The National Center for Mariculture, Israel Oceanographic and Limnological Research, Eilat
Amir Neori	The National Center for Mariculture, Israel Oceanographic and Limnological Research, Eilat
Avigdor Abelson	Dept. of Zoology, Tel Aviv University
Beverly Goodman Tchernov	Moses Strauss Department of Marine Geosciences, University of Haifa
Bill Koven	The National Center for Mariculture, Israel Oceanographic and Limnological Research, Eilat
Bracha Farstey	Interuniversity Institute for Marine Sciences, Eilat
Danielle Andres	International Research & Development, Dalhousie Research Services
Debbie Lindell	Department of Biology, Technion
Emily Higgins	Department of Biology, Dalhousie University
Emmanuel Boss	School of Marine Sciences, The University of Maine, USA
Etai Landaou	Mina and Everard Goodman Faculty of Life Sciences, Bar Ilan University
Ian Hill	Associate Vice-President Research, Dalhousie University
Ilana Berman-Frank	Mina and Everard Goodman Faculty of Life Sciences, Bar Ilan University
Ilia Maidanik	Graduate Student, Department of Biology, Technion
Jonathan Belmaker	School of Zoology, Tel Aviv University
Joseph Bielawski	Department of Biology, Dalhousie University
Katherine Dunn	Department of Biology, Dalhousie University
Katja Fennel	Dept. of Oceanography, Dalhousie University
Lilach Polinsky	Department of Biology, Technion
Lindsey Gillard	PhD Candidate, Dept. of Plant and Animal Sciences, Faculty of Agriculture, Dalhousie University
Margalit Peleg	Department of Biology, Technion
Marlon Lewis	Dept. of Oceanography, Dalhousie University
Moshe Kiflawi	Dept. of Life-Sciences, Ben-Gurion University of the Negev, & The Interuniversity Institute for Marine Sciences, Eilat
Nitzan Shamir	Graduate Student, Department of Biology, Technion
Noa Shenkar	School of Zoology, George S. Wise Faculty of Life Sciences, Tel Aviv University
Noga Stambler	Mina and Everard Goodman Faculty of Life Sciences, Bar-Ilan University
Pat Rodee	Director, International Research & Development, Dalhousie Research Services
Paul Snelgrove	Faculty of Ocean Sciences, Memorial University of Newfoundland
Renanel Pickholtz	School of Zoology, Tel Aviv University
Roy Yanovski	PhD Candidate, Department of Zoology, Tel Aviv University
Simon Berkowicz	Interuniversity Institute for Marine Sciences, Eilat , and Authority for Research & Development, The Hebrew University of Jerusalem
Stephanie Kienast	Department of Oceanography, Dalhousie University
Timor Katz	Israel Oceanographic and Limnological Research, Haifa
William (Barney) Balch	Senior Research Scientist, Bigelow Laboratory for Ocean Sciences
Yonathan Shaked	National Monitoring Program of the Gulf of Eilat

Yotam Bar	Dept. of Zoology, Tel Aviv University