Gitai Yahel - Curriculum Vitae

Updated January 2021

1. Personal Details

Born: 21 April 1964, Kibbutz Yad Mordechai, Israel
Home: Hamifras 16. St. Kfar-Vitkin 40200, Israel
Work: The School of Marine Sciences
Ruppin Academic Center
Mikhmoret, Israel, 402970
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2. Higher Education

A. Undergraduate and Graduates Studies

Period of study	Name of institution, department, and host	Degree	Year of completion
1990-1994	Hebrew University of Jerusalem (HUJI), faculty of mathematics and sciences, Biology - major, Statistics – minor	**B.Sc.** With distinction	1994
1995-1997	The Hebrew University of Jerusalem (HUJI), Department of Ecology, Systematic, and Evolution (E.S.E, currently Ecology, Evolution & Behavior) and the Interuniversity Institute for Marine Sciences in Eilat (IUI), Advisor: Prof. Amatzia Genin	**M.Sc**. with distinction	1997
1997-2003		Ph.D. with distinction	2003

B. Post-Doctoral studies

Period of study	Name of institution, department, and host
2003-2006	Rothschild Postdoctoral fellowship at the Biology Department, University of Victoria (UVic), British Columbia, Canada. Host: Prof. Verena Tunnicliffe.

3. Academic Ranks and Tenures in Institutes of Higher Education

Dates	Name of institution and department	Rank / Position
2007-2008	The School of Marine Science, Ruppin Academic Centre, Israel	Lecturer
2008-2016	The School of Marine Science, Ruppin Academic Centre, Israel	Senior Lecturer
2016-Present	The School of Marine Science, Ruppin Academic Centre, Israel	Associate Professor

4. Offices in Academic Administration

5. Scholarly Positions and Activities outside the Institution

(a) Community contribution and outreach

- 2009-Present: BASHAAR – Academic Outreach activity in High schools at the periphery
- 2009-2014: EcoOcean board member
- 2010-Present: EcoOcean marine science advisor and scientific committee
- 2017-Present: Scientific committee Mediterranean Sea Research Center of Israel (MERCI)
- 2019-Present: National Stirring Committee for Israel Marine Science – Israel Science Academy

(b) Membership in professional/scientific societies

Since 1996 - American Society of Limnology and Oceanography
Since 2008 – Israeli Association of Aquatic Sciences
Since 2013 - Israeli Microbiology Society

(c) Seminar presentations at universities and institutions (last 5 years)

2017 – Volcani Institute
2016 – Denmark Technical University (Copenhagen, invited seminar)
2016 – Weizman institute
2016 – ILOR (KLL)
2014 – Tel- Aviv University

(d) Reviewer for (among others): Aquatic Biology, Aquaculture Research, Frontiers in Marine Science, BMC Physiology, Bulletin of Marin Science, Diversity and Distribution, Ecosystems, FEMS Microbiology Letters, Limnology and Oceanography, Limnology and Oceanography Methods, PLOS ONE, Marine Ecology Progress Series, NSF, ISF, MOST

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6. Participation in scholarly conferences (last five years)

Date	Name of Conference	Place of conference	Subject of lecture/discussion	Role
2015	ASLO Aquatic Sciences	Granada, Spain	Teflon bacteria? Can *Pelagibacter ubique*, the most abundant bacterium in the ocean, evade predation by slipping through mucus nets?	Presenter
2016	Israel Ecology and Environment	Tel-Aviv	Persistent hypoxia and prolonged anoxia in a Mediterranean micro-estuary are controlled by the interplay of seawater intrusions and anthropogenic pollution	Presenter
2016	Early evolution of multicellular sponges	Copenhagen, Denmark	Teflon bacteria? Microbe specific biological filtration at the submicron range	Presenter
2016	Microscale Ocean Biophysics	Eilat, Israel	Teflon bacteria: The most abundant " bacterium in the ocean evades predation by slipping through mucous nets	Presenter
2018	Particles in Europe 2018	Lisbon, Portugal	Biological activity: an overlooked, mechanism for sediment resuspension, transport, and modification in the ocean	Presenter
2019	Red Sea Marine Ecosystems Under Environmental and Anthropogenic Changes	Eilat, Israel	Benefits and lessons from 20 years of in situ studies of suspension feeders nutrition and metabolism	Presenter

7. Invited lecturer /Keynote speaker

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8. Research Grants

A. Grants Awarded (active within the last five years)

Role in research	Co-researchers	Topic	Funded by	Amount	Years
Co-PI	M. Ribes, R. Coma (Spain)	Environment changes and mass mortality events: Underlying causes and mechanisms in Mediterranean gorgonians and sponges (En-Changes)	Ministerio de Ciencia Innovación (Spanish Science Ministry)	700,000 Euro	2012-2015
Co-PI	H.U. Riisgård, D. Canfield, N. T. Eriksen, P. Funch, P. S. Larsen, J. H.Walther, K. E. Meyer, T. Fenchel, C. Nielsen (Denmark)	Early evolution of multicellular sponges - a bioenergetic and bio-fluid mechanical approach for understanding evolutionary adaptation to animal filter-feeding in the sea	The Villum Foundation grant (Denmark)	800,000 Euro	2015-2018
PI	A. Genin, M. Ilan (Israel)	Study of the deep Israeli continental margins of the red and Mediterranean seas in light of local and global changes (ROV)	Israel Ministry of Science and Technology (MOST)	1,638,000 NIS	2014-2017
PI	S. Gafny Y. Suari (Israel)	Rehabilitation of the micro estuaries along the Mediterranean coast of Israel	Yad Hanadiv	1,084,000 NIS	2013-2016
PI	-	Examining size independent biological filtration at the submicron range.	Israeli Science Fund (ISF)	1,232.000 NIS	2013-2018
PI	K. R. Sutherland (USA) Y. Tikochinski (Israel)	Interactions between marine picoplankton and mucous-net filter feeders	United State-Israel Binational Science Fund (BSF)	$244,000	2013-2018

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PI	Yair Suari	Ruppin Marine LTER (Long Term Ecological Research) Station at Michmoret	Ruppin Academic Center	204,000 NIS	2014-2021
PI	B. Chefetz R. Egozi G. Eshel S. Gafny Y. Suari (Israel)	The role of estuaries in controlling pollution of the Mediterranean Sea: The Alexander River as a case study	Yad Hanadiv	2,475,000 NIS	2016-2019
PI	U. Shavit T. Katz T. Treibitz Y. Schaner	Developing new methodologies for quantifying biological sediment resuspension in the sea and for studying its dynamics	Israel Ministry of Science and Technology (MOST)	2,500,000 NIS	2016-2019
PI	E. Ward (USA) S.E. Shumway (USA) U. Shavit (Isarel)	Mediation of biological filtration in marine suspension feeders: significance of intrinsic and extrinsic factors	IOS-NSF-BSF	~$1,315,000	2018-2021
PI		Assessing the role of invasive bivalves in controlling ecosystem dynamic as a tool for better management of Israeli Marine Reserves and Marine Protected Areas	IMPA (Supported by Yad-Hanadiv)	600,000 NIS	2018-2021
PI	B. Chefetz Y. Suari	Long term monitoring of the Alexander Estuary	Jewish National Fund (JNF)	723,000 NIS	2019-2021
Co-PI	S. E. Monismith (USA) M. Ribes, R. Coma (Spain)	Role of sponges in Biogeochemical benthic-pelagic coupling: carbon and nutrient Exchange between the Coraligenous and adjacent communities (Be-Calm)	Ministerio de Ciencia Innovación (Spanish Science Ministry)	700,000 Euro	2019-2021

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CO-PI	T.K. Kiørboe A. Andersen (Denmark) U. shavit R. Holtzman (Israel)	FLOWMAR: The role of flow in marine life	Styrelsen for Forskning og Uddannelse (Denmark)	111,537 NIS	2019-2021
PI	Tom Topaz	Science based management of the Kishon Estuary	The Kishon Authority	25,000 NIS	2020-2021

B. Submission of Research Proposals - Pending

Role in research	Co-researchers	Topic	Funded by	Amount	Year Submitted

C. Submission of Research Proposals - Not Funded (last five years)

Role in research	Co-researchers	Topic	Funded by	Year	Score
PI	U. Hentchel T. Dagan (Germany) L. Staindler (Israel)	In situ monitoring of sponge physiology and its impact on metabolism and genetic connectivity of the associated microbiota	DFG	2015	??
PI	E. Ward S.E. Shumway	Rethinking biological filtration: Intrinsic versus extrinsic controls on feeding efficiency in marine suspension feeders	NSF-BSF	2017	High
PI	U. Hentchel Nicolina Musat (Germany) L. Staindler (Israel)	The Sponge-Microbe Holobiont - Towards an Integrated Understanding of Metabolism and Function within a Complex Microbial Consortium	DIP	2017	High

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PI	Ariel Olsner	Monitoring of the Alexander stream and estuary – infrastructure for science-based management	Isareli Landscape found "Keren Stachim Ptuchim"	2018	Rejected on technical basis
PI	T. S. Oliveira M. Ribeiro U. Shavit T. Katz	Novel methodologies for the quantification of Sediment resuspension in the ocean	Portuguese Fundação para a Ciência e a Tecnologia (FCT) and the Israeli Ministry of Science and Technology (MOST)	2019	??
PI	S. Gafny (Israel)	Science based management of the Hedera Estuary	Ministry for Protection of the Environment	2019	High
PI	Katz T Shavit U Boss E (USA)	Determining the rate and relative contribution of biological resuspension of sediment from the seafloor	NSF-BSF	2019	Fair

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9. Awards, Citations, Honors, Fellowships

- 2003-2004 Rothschild Post-Doctoral Fellowship (KEREN YAD-HANDIV)
- 2013 Ruppin Academic Center – Research Excellency award
- 2014 - 2019 Ruppin Academic Center – Research and Teaching Excellency award

10. Teaching

a. Courses taught in recent years

Year	Name of Course	Type of Course	Degree	No. of students
2007-2013	Chemical Oceanography	Lecture (Mandatory)	BSc	90-120
2007-Present	Biological Oceanography	Lecture (Mandatory)	BSc	90-120
2008-Present	Oceanographic Cruise	Field + Lab (Mandatory)	BSc	60-120
2008-Present	Underwater Research Methods	Field + Lab + Lecture (elective)	BSC+MSc	24
2008-Present	Guided project for outstanding students	Lab and field	BSc	6-12

b. Supervision of Graduate Students

Name of student	Title of Thesis	Degree	Supervised with:	Date of completion / in progress	Student's Achievements
Ayelet Dadon-Philosof	Quantification of biological filtration in the ocean at the phylotype level of the microbial prey	PhD	Amatzia Genin (IUI, HUJI)	2019	IUI PhD award 2015 MERCI Scholarship 2016 Best lecture award IAAS 2016 MERCI Scholarship 2017 Publication in Nature Microbiology
Tom Topaz	The role of estuaries in controlling pollution of the Mediterranean Sea:	PhD	Benny Chefetz (HUJI)	In progress	MERCI Scholarship 2016

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	the Alexander as a case study				
Yuval Jacobi	Biomechanics and ecological aspects of Ascidian filtration	MSc	Noa Shenkar (TAU)	October 2016	Best Lecture award Microscale Ocean Biophysics 2016 Publication in Limnology and oceanography
Yuval Jacobi	Revisiting biological filtration – The role of surface properties in prey capture	PhD	Uri Shavit (Technion) Guy Ramon (Technion)	In progress	Publication in Limnology and Oceanography; Nature Microbiology; Marine Biology IUI PhD award 2018
Merav Gilboa	Toward Quantification of biological resuspension rate	MSc	Adi Torfstain (HUJI)	2019	
Aviv Ben-Tal	Ecology of feeding in Ascidians – Factors controlling the mucus net production	MSc	Noa Shenkar (TAU)	2018	Publication in Marine Biology
Tal Amit	An in situ study of the metabolic strategies of bivalves residing in oligotrophic seas	PHd	Yossi Loya (TAU)	In progress	
Raz Moskovich	In situ study of the metabolism of HMA and LMA sponges	MSc	Micha Ilan (TAU)	2020	
Raz Moskovich	Sponge metabolism	PhD	Micha Ilan (TAU)	In progress	
Rei Diga	The impact of invasive bivalves on Mediterranean Rocky habitats	MSc	Jonathan Bellmaker (TAU)	In progress	

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11. Miscellaneous

a. Military and civil service

1982-1986, Airborne Rescue Squadron of the Israeli Air Force (Unit 669), last position – Rescue Team commander, discharge at the Rank of Captain.
1996-2003, Rescue Team commander in reserves
1997-1999 Field Guide for the Society for Protection of Nature in Israel (SPI) at the Mount Hermon Field School

- I started university only at the age of 28 and thus my academics career is lagging behind my age

12. Professional Experience

2006 - Environmental Impacts of air-gun surveys on Glass Sponges for the Ministry of Energy and Mines, BC, Canada

2010 – Evaluation of Environmental Impact Monitoring programs for the Ministry for Protection of the Environment

2012-Present - Environmental Impact Monitoring of the Herzelyia sewage treatment plant outfall

2015-Present – Turbidity monitoring of the port construction work in Namal Hadarom, Ashdod.

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Publications

A. Ph.D. Dissertation

Feeding on ultraplankton and dissolved organic carbon in coral reefs: from individual-based rates to community processes (2003) Submitted to the Hebrew University in Jerusalem under the supervision of Prof. Amatzia Genin.

All chapters were published, and they are now items no. 3, 4, 5, 7, 10, 12, and 19 in the publication list below.

D. Articles in Refereed Journals

* denotes papers published after last rank (Professor)

1. Fabricius K, Benayahu Y, Yahel G, Genin A (1996)
Herbivory in soft corals: Correction.
Science 273, 293b-297.

2. Yahel G. (1998)
Suspension feeding in coral reefs - what about dissolved matter?
Isr. J. Zool. 44, 90-91.

3. Fabricius KE, Yahel G, Genin A. (1998)
In situ depletion of phytoplankton by an azooxanthellate soft coral
Limnol. Oceanogr. 43, 354-356.

4. Yahel G, Post AF, Fabricius KE, Marie D, Vaulot D, Genin A (1998)
Phytoplankton distribution and grazing near coral reefs.
Limnol. Oceanogr. 43, 551-563.

5. Genin A, Yahel G, Reidenbach MA, Monismith SG, Koseff JR (2002)
Intense benthic grazing on phytoplankton in coral reefs revealed using the control volume approach.
Oceanography 15, 90-96.

6. Yahel R, Yahel G, Genin A (2002)
Daily cycles of suspended sand at coral reefs: A biological control
Limnol. Oceanogr. 47, 1071-1083.

7. Yahel G., Sharp J.H., Marie D., Häse C., and Genin A. (2003)
In situ feeding and element removal in the coral-reef sponge *Theonella swinhoei*: Bulk DOC is the major source for carbon
Limnol. Oceanogr. 48, 141-149.

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8. Yahel R, Yahel G, Genin A (2005)
Near-bottom depletion of zooplankton over coral reefs: I. Diurnal dynamics and size distribution.
Coral Reefs 24, 75-85.

9. Yahel R, Yahel G, Genin A (2005)
Diel pattern with abrupt crepuscular changes of zooplankton over a coral reef.
Limnol. Oceanogr. 50, 930-944.

10. Yahel G, Marie D, Genin A (2005)
"InEx" – an *in situ* method to measure rates of element intake and excretion by active suspension feeders.
Limnol. Oceanogr. Met. 3, 46-58.

11. Perkol-Finkel S, Shashar N, Barneah O, Ben-David-Zaslow R, Oren U, Reichart T, Yacobovich T, Yahel G, Yahel R, Benayahu Y (2005)
Fouling reefal communities on artificial reefs: Does age matter?
Biofouling 21, 127-140.

12. Yahel G, Zalogin T, Yahel R, Genin A (2005)
Phytoplankton grazing by epi- and in-fauna inhabiting exposed rocks in coral reefs.
Coral Reefs 25(1), 153-163.

13. Monismith SG, Genin A, Reidenbach MA, Yahel G, Koseff JR (2006)
Thermally driven exchanges between a coral reef and the adjoining ocean.
Journal of Physical Oceanography 36(7), 1332-1347.

14. Reidenbach MA, Monismith SG, Koseff JR, Yahel G, Genin A. (2006)
Boundary layer turbulence and flow structure over a fringing coral reef.
Limnol. Oceanogr. 51, 1956-1968.

15. Yahel G, Eerkes-Medrano DI, Leys SP (2006)
Size independent selective filtration of ultraplankton by hexactinellid glass sponges.
Aquatic Microbial Ecology 45, 181-194.

16. Yahel G, Whitney F, Reiswig HM, Eerkes-Medrano DI, Leys SP (2007)
In situ feeding and metabolism of glass sponges (Hexactinellida, Porifera) studied in a deep temperate fjord with a remotely operated submersible.
Limnol. Oceanogr. 52, 428-440.

17. Yahel G, Yahel R, Katz T, Lazar B, Herut B, Tunnicliffe V (2008)
Fish activity, a major mechanism for sediment resuspension and organic matter remineralization in coastal marine sediments.
Mar. Ecol. Prog. Ser. 372, 195-209.

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18. Genin A, Monismith SG, Reidenbach MA, Yahel G, Koseff JR (2009)
Intense benthic grazing of phytoplankton by the coral reef community.
Limnol. Oceanogr. 54, 938–951.

19. Yahel G, Beninger PG, Marie D, Genin A (2009)
In situ size-independent retention of phytoplankton and bacteria by the tropical bivalve *Lithophaga simplex*.
Aquat. Biol. 6, 235-246.

20. Katz T, Yahel G, Yahel R, Tunnicliffe V, Herut B, Snelgrove P, Crusius J, Lazar B (2009)
Groundfish overfishing, diatom decline, and the marine silica cycle: Lessons from Saanich Inlet, Canada, and the Baltic Sea cod crash.
Global Biogeochem. Cycles, 23, GB4032.

22. Leys SP, Yahel G, Reidenbach MA, Tunnicliffe V, Shavit U, Reiswig HM (2012)
The sponge pump: The role of current induced flow in the design of the sponge body plan.
PLOS ONE 6(12), e27787.

21. Chu JWF, Maldonado M, Yahel G, Leys SP (2011)
Glass sponge reefs as a silicon sink.
Mar. Ecol. Prog. Ser. 411, 1-14 (feature article).

23. Katz, T., Yahel G., Reidenbach M. A., Tunnicliffe V., Herut B., Crusius J., Whitney F., SnelgroveP., and Lazar B. (2012)
Resuspension by fish facilitates the transport and redistribution of coastal sediments.
Limnol. Oceanogr 57, 945-958.

24. Ribes M, Jiménez E, Yahel G, López-Sendino P, Diez B, Massana R, Sharp JH, Coma R (2012)
Functional convergence of microbes associated with temperate marine sponges.
Environ. Microbiol 14,1224-1239.

25. Kahn AS, Yahel G, Chu JWF, Tunnicliffe V, Leys SP (2015)
Benthic grazing and carbon sequestration by deep-water glass sponge reefs.
Limnol. Oceanogr 60, 78-88.

26*. Katz T, Yahel G, Reidenbach MA, Tunnicliffe V, Herut B, Crusius J, Whitney F, Snelgrove P, Lazar B (2016)
The silica cycle in a Northeast Pacific fjord; the role of biological resuspension.
Prog. Oceanogr. 147, 10-21.

27*. Morganti T, Yahel G, Ribes M, Coma R (2016)

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VacuSIP, an improved InEx Method for in situ measurement of particulate and dissolved compounds processed by active suspension feeders.
JOVE J. Vis. Exp., e54221-e54221

28*. Lavy A, Keren R, Yahel G, Ilan M (2016)
Intermittent hypoxia and prolonged suboxia measured in situ in a marine sponge.
Front Mar Sci 3:1–11.

29*. Morganti T, Yahel G, Ribes M, Coma R (2017)
In situ study of carbon and nitrogen fluxes reveals a partial trophic niche separation between high and low microbial abundance species that facilitates their co-existence.
Limnol Oceanogr 62, 1963–1983.

30*. Suary Y, Shaish L, Gafny S, Amit T, Gilboa M, Brokovich E, Yahel G (2017)
Prolonged anoxia in the Alexnader estuary – a consequence of the interaction between seawater intrusions and high nutrients load.
Ecol. Enviro. 8, 44-52 (in Hebrew).

31.* Dadon-Pilosof A, Conley K R, Jacobi Y, Haber M, Lombard F, Sutherland K R, Steindler L, Tikochinski Y, Richter M, Glöckner F O, Suzuki M T, West N J, Genin A, and Yahel G (2017)
Surface properties of SAR11 bacteria facilitate grazing avoidance.
Nature Microbiology (On Line first). doi:10.1038/s41564-017-0030-5

32.*Morganti T, Coma R, Yahel G, Ribes M (2017)
Trophic niche separation that facilitates co-existence of high and low microbial abundance sponges is revealed by in situ study of carbon and nitrogen fluxes.
Limnol Oceanogr , 62(5), 1963-1983.

33*. Jacobi Y, Yahel G, Shenkar N (2018)
Efficient filtration of micron and submicron particles by ascidians from oligotrophic waters.
Limnol Oceanogr, 63(S1).

34*. Conley KR, Ben-Tal A, Jacobi Y, Yahel G, Sutherland K (2018)
KR Not-so-simple sieving by ascidians: re-examining particle capture at the mesh and organismal scales.
Marine Biology 165(3), 45.

35* Suari Y, Shaish T, Sarig, G, Amit T, Gilboa M, Brokovits E, Yahel G (2018)
Prolonged oxygen stress at the Alexander estuary.
Ecology and environment (Hebrew) 9.

36.* Suari Y, Amit T, Gilboa M, Sade T, Krom MD, Gafny S, Topaz T, Yahel G (2019)

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Sandbar breaches control of the biogeochemistry of a micro-estuary.
Front Mar Sci 6, 224.

37.* Dadon-Pilosof A, Lombard F, Genin A, Sutherland KR, Yahel G (2019)
Prey taxonomy rather than size determines salp diets.
Limnol Oceanogr 65, 1996-2010.

38. *Morganti TM, Ribes M, Yahel G, Coma R (2019)
Size is the major determinant of pumping rates in marine sponges.
Front Physiol 10, 1474.

39. *Suari Y, Dadon-Pilosof A, Sade T, Amit T, Gilboa M, Gafny S, Topaz T, Zedaka H, Boneh S, Yahel G (2019)
A long term physical and biogeochemical database of a hyper-eutrophicated Mediterranean micro-estuary.
Data Brief 27, 104809.

40. *Topaz T, Egozi R, Suari Y, Ben-Ari J, Sade T, Chefetz B, Yahel G (2020)
Environmental risk dynamics of pesticides toxicity in a Mediterranean micro-estuary.
Environ Pollut 265, 114941.

41. * Asadzadeh SS, Kiørboe T, Larsen PS, Leys SP, Yahel G, Walther JH (2020)
Hydrodynamics of sponge pumps and evolution of the sponge body plan.
Elife. 9, e61012.

42. Ben-Tal A, Shenkar N, Paz A, Conley KR, Sutherland K, Yahel G (accepted)
High mucous-mesh production by the ascidian *Herdmania momus*.
Mar Ecol Progr Ser

43. Morganti TM, Ribes M, Moskovich R, Weisz J, Yahel G, Coma R (accepted)
The in situ pumping rates of 20 marine demosponges are a function of osculum area.
Front. Mar. Sci.

44. Jacobi Y, Shenkar N, Ward EJ, Rosa M. Ramon GZ, Shavit U, Yahel, G (accepted)
Evasive plankton: Size-independent particle capture by ascidians.
Limnol Oceanogr.

K. Submitted Publications

1. Dadon-Pilosof A, Conley K, Lombard F, Sutherland KR, Genin A, Richter R, Glöckner FO, Yahel G (under review)
Natural diet of appendicularians: effects of prey size and taxonomy.
Limnol Oceanogr.

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Archived Preprints:

Shavit U, Marom N, Holzman R, Boss E, Katz T, Yahel G (2020) Formulation of a new footprint model for measuring fluxes of biological resuspension. Oceanography:131. https://www.essoar.org/doi/10.1002/essoar.10502102.1

L. Summary of my Activities and Future Plans

Updated 2018

My research focuses on the diverse processes that link the seafloor to the overlying ocean. These processes range from feeding mechanisms of individual suspension feeders such as sponges and bivalves through the behavioral pattern of groundfish and migratory zooplankton to the interplay between hydrodynamics and the benthos (organisms that inhabits the bottom of the sea). Fieldwork and the development of new methods and instrumentation for underwater studies are major themes in my work.

Nutritional ecology of suspension feeders

Capturing particles suspended in the water is a unique feeding strategy for aquatic animals. My studies focus on measuring the metabolism, diet composition, feeding preferences, and feeding rates of marine suspension feeders. I am particularly interested in developing underwater (*in situ*) methods that facilitate the study of undisturbed animals in their natural environment.

Many benthic suspension feeders feed on micron and submicron scale particles such as bacteria, small protists, and phytoplankton. However, despite a century of extensive lab research, only few studies addressed basic questions such as metabolic rates, biomechanics of submicron biological filtration, filtration rates, selectivity, and community scale fluxes *in the field*. To address these questions I have developed methods for the *in situ* study of grazing rates and metabolism of benthic suspension feeders. These methods include new scuba-based sampling techniques such as the InEx (L&O Methods 3, 46) and the ROV (Remotely Operated Vehicle) compatible water sampler for deep sea work, named SIP (L&O 52, 428). These methods have allowed us (and subsequently many others) to sample point sources in the deep sea much more efficiently. We used SIPs to study the enigmatic deep dwelling glass sponges of the Canadian Pacific continental shelf (L&O 52, 428; Fraser Ridge, submitted; PLOS One 6, 12). We have recently

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developed a shallow version of the SIP, which we call VacuSIP, that allows efficient and prolonged sampling with much greater spatial resolution.

The ability to sample undisturbed organisms, in the field, was a key to the discovery that dissolved organic matter (DOM) is the major carbon source for tropical reef sponges (L&O 48,141). This finding ended a century-old debate over the existence of dissolved organic feeding in metazoans, and since our original 2003 paper, it has been corroborated for many sponges in a number of follow up studies in different marine habitats. Using our new *in situ* sampling technique (VacuSIPs), as well as controlled laboratory experiments, we are now studying DOM and nitrogen transformation, nitrogen and carbon budgets, respiration, and selectivity in over 25 suspension feeder taxa, including bivalves, ascidians, sponges, and most recently also pelagic tunicates (salps and appendicilurians). A comparison of 15 species of marine sponges from contrasting environments (tropical reefs, boreal waters, and the Mediterranean) revealed a unique, yet not a trivial connection between the microbial populations within sponges and the metabolic pathways that they mediate (Environ Microbiol. 14, 1924).

For many years active suspension feeders were considered non-selective. Using direct sampling techniques, we discovered that some benthic suspension feeders are in fact highly selective. Surprisingly, this selectivity is size independent in coral reef bivalves (Aquat Biol 6, 235) as well as in boreal sponges (AME 54, 181) and Mediterranean ascidians and bivalves (Yahel, unpublished data). To better understand these processes we are now using next generation genomic techniques that will help us elucidate the identity of the microbes that are not retained by the filter feeders and describe the underlying selectivity mechanisms. Our preliminary data (ISM 2013) suggest that *Pelagibacter ubique*, the most abundant marine bacterium in the ocean, as well as other phylotypes belonging to the SAR 11 clade, can usually evade filtration. We are currently applying advanced molecular techniques to study species specific and size independent filtration by both benthic and pelagic suspension feeders in order to better understand predator-prey relationships that underlie the marine food-web. This study may also shed new light on the phenomenal success of the SAR 11 clade in the ocean.

The nutrition of benthic suspension feeders is ultimately controlled by the amount of water they can process. So far, the energetic cost of pumping was assumed to be negligible (0.1-4% of total metabolism), implying that water processing is not a limiting factor for pumping in suspension feeders. Using careful measurements of a sponge aquiferous system, we have

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challenged this paradigm. Our measurements revealed that a tiny proteinaceous mesh, that has been previously overlooked, is responsible for ~50% of the sponge hydraulic resistance, and that the overall cost of pumping is at least 28% of total metabolism in these sponges (PLOS One 6, 12). Combining *in situ* and laboratory measurements of sponge pumping, as well as modeling of hydraulic resistance, we have also demonstrated, for the first time, that sponges can harness the ambient flow to enhance flow through their bodies. These results call for a new look at the mechanisms underlying current-induced flow and for reevaluation of the cost of biological pumping and its evolutionary role. We are currently trying to expand on this research, with a focus on solitary ascidian as models.

Benthic-pelagic coupling

Benthic organisms depend on hydrodynamics and water column processes for almost every aspect of their life (e.g., nutrition, metabolisms, and reproduction). In many cases, the activity of benthic communities affects water column processes. A major thrust of my work is the effort to understand and quantify the biological and geochemical processes that control mass fluxes between the seafloor and the overlying water. I am specifically interested in the development and implementation of methods and instrumentation for *in situ* work (i.e., underwater) that will circumvent many of the biases associated with lab based measurements.

My work on coral reefs, for example, has demonstrated that the joint feeding activity of benthic organisms controls both the concentrations and the distribution of phytoplankton and bacteria (L&O 43, 551), zooplankton (Coral Reefs 24, 75 ; L&O 50, 930), and suspended sediments (L&O 47, 1071) in the water overlying the reef. To quantify benthic grazing at the community level, we have developed and implemented the “control volume” method (L&O 54, 938; Oceanography 15,90). Using individual-based *in situ* methods (InEx, L&O Methods 3, 46), we have documented the key role of benthic suspension feeders, such as sponges, bivalves, and ascidians, in the import of phytoplankton (and hence N and P) from the open ocean to the reef (L&O 54, 938; Oceanography 15,90). The micro-fauna that inhabits "bare" rock surfaces, the most abundant substrate in coral reefs, is also playing an important, and thus far relatively neglected, role in benthic pelagic exchange at the reef (Coral Reefs 25,153), as do thickets of soft corals (L&O 43, 354) where they abound. This mass transfer is controlled by hydrodynamic processes (Oceanography 15, 90), such as thermal cycling (J. Physical Oceanogr. 36, 1332) and bottom micro topography (L&O 51, 1956).

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Similar benthic-pelagic processes operate wherever dense populations of suspension feeders exist. For example, deep glass sponge communities residing below the photic zone of North-East Pacific fjords consume and recycle most of the bacteria and organic matter exported to the deep fjord waters (L&O 52, 428). Using ROV and novel instrumentation *in situ* at 150 m depth, we have recorded sponge pumping rates, respiration, and feeding at the Fraser Ridge glass sponge reef (PLOS One 6, 12). Our data suggest that in terms of water processing capacity, these reefs are likely to be the most active benthic systems ever described (Kahan et al. submitted), with filtration capacity of over 160 $m^3\ m^{-2}$ day. These reefs are also an important, yet overlooked, sink for biogenic silica (MEPS 411, 1)

Our work has also called attention to the fact that benthic processes and benthic-pelagic mass exchange in coastal waters is also controlled by fish activity (MEPS 372, 195; Global Biogeochem. Cycles 23, 16 and L&O 57, 945, and see below).

Sediment resuspension by fish

Benthic (ground) fish resuspend large amount of sediments while foraging and seeking for shelter. We discovered that fish activity alone could maintain a layer of turbid water near the bottom (nepheloid benthic layer), enhance the transport of nutrients and benthic oxygen demand, and considerably reduce organic carbon sequestration (MEPS 372, 195). We showed that benthic fish activity controls sediment resuspension and near bottom water quality in coral reefs (L&O 47, 1071).Benthic fish that resuspend sediment as they search for food and shelter are abundant throughout the ocean. Unlike other resuspension processes, fish-induced resuspension events are typically brief (seconds) and localized, and in some habitats occur at a rate of several events per square meter per hour (L&O 47, 1071, MEPS 372, 195). Nevertheless, the contribution of benthic fish activity to sediment resuspension and nutrient recycling has not been fully acknowledged in marine studies. Using the remotely operated vehicle ROPOS, the VENUS underwater observatory, and a suit of geochemical, optical, and acoustic measurements, we have quantified bottom fish abundance and activity in a partly anoxic north-east Pacific fiord (MEPS 372, 195). Our data suggest that in the Saanich Inlet, fish rework >40% of the seafloor daily. Unlike bioturbation by infauna, the brief resuspension events mediated by fish expose large quantities of sediments to the overlying waters, thereby reducing organic carbon sequestration to 50% of its annual vertical flux. Sediment resuspension by fish also accounts for sediment transport and focusing (L&O 57, 945), and enhances near-bottom turbidity, oxygen demand, as well as the

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mass flux of inorganic nutrients, which are all vital for primary marine production across the water-sediment interface (MEPS 372, 195). To date, these processes are missing from geochemical models. We have argued that the ongoing decimation of ground fish populations by commercial fisheries is likely to affect global geochemical cycles in unforeseen ways. A striking example of such a process is the regime shift of the Baltic Sea ecosystem (Global Biogeochem. Cycles 23, 16). We are currently focusing on developing new tools for *in situ* recording and quantifying of benthic fish activity though imaging sonars and optical backscatter devices. We also work on real-time quantification of sediment resuspension rate with novel electronic devices.

Micro estuaries dynamics and rehabilitation

An estuary is the place where the river meets the sea. In these semi-close water bodies river water overlies and mixes with the seawater, a process that makes estuaries a hotspot of biodiversity that provides multitude of ecological services for coastal human communities worldwide. Micro-estuaries (a few km long and a few m deep) are among the most abundant, valuable, and disturbed costal systems. Surprisingly, these systems are severely understudied. We are conducting a long-term monitoring program of the Alexander micro-estuary in an effort to develop efficient monitoring, modelling, and management tools that will facilitate the rehabilitation of these important systems.

Read more about the estuaries rehabilitation project at (http://www.ruppin.ac.il/reco/)

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