Sea the Future Content

Food from the Sea and the Desert, Oct. 18-20, 2022, Eilat, Israel

Abstracts List ● Startups ● R&D Centers

1. Success Stories from Israel

1.1. Dr. Assaf Shechter - Israel

Enzootic / Co-founder & CEO

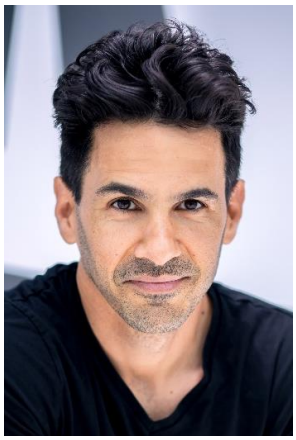


Photo by: Lior Lam

Shrimp is the most widely farmed and traded seafood in the world, totally dominated by one single commodity marine species, vannamei. Whereas the next two commercially important species, monodon and rosenbergii, despite their higher market value are lagging far behind. This massive farming industry is primarily focused on producing more of the same. Voices that call for diversity argue that another shrimp pandemic is unavoidable, that the alternatives have a higher sustainability profile, and that there is a responsibility to seafood consumers to have more farmed choices, as it is clear diversity from fishery is destined to disappear .

Enzootic is a fully vertically integrated biotechnology company with proprietary all-female mono-sex technology that tackles one of the biggest obstacles of scaling freshwater prawn (M. rosenbergii) farming, the aggressive territorial males. Without males, farming densities of females can quadruple with amazing size uniformity at short grow-out cycles, an ideal strategy for processing and exporting. In my talk, I will briefly discuss how developing such a potentially transformational technology as a genetics company was just not enough to create the impact on this industry, and what kind of adaptations we had made to our strategy to overcome these challenges.

Sometimes A breakthrough technology isn’t enough to change the world.

1.2. Prof. Berta Sivan - Israel
The Hebrew University of Jerusalem
Defeating Hunger through Aquaculture – the Story of Lake Victoria

Photo by: Fresh Start

האוניברסיטה העברית בירושלים
THE HEBREW UNIVERSITY OF JERUSALEM

Berta Levavi-Sivan1 and Justus Rutaisire2
1Department of Animal Sciences, The Robert H. Smith Faculty of Agriculture, Food, and Environment, Hebrew University of Jerusalem, Rehovot, Israel
2National Agricultural Research Organization (NARO), Entebbe, Uganda

The Nile perch (Lates niloticus) is one of the largest freshwater fish, it reaches a maximum length of nearly two meters, weighing up to 200 kg. The Nile perch was introduced to Lake Victoria in East Africa in the 1950s, and since then it has been fished commercially. The introduction of this species to Lake Victoria is one of the most cited examples of the negative effects invasive alien species can have on ecosystems. The fish's introduction to Lake Victoria, while ecologically negative, has stimulated the establishment of large fishing companies there. In 2003, Nile perch earned 169 million euros in sales to the EU. However, the alteration of the native ecosystem has also had disruptive socioeconomic effects on local communities bordering the lake. Large-scale fishing operations, while earning millions of dollars from their exported catch, caused a drastic decrease in the availability of fish for the local communities . Increasing scarcity in Africa has forced the local population to feed on the axial bony skeleton left behind after industrial fish processing due to a widening gap between supply and demand. It can be deciphered from global fish production trends that the only plausible way to increase fish production is through aquaculture. It is this situation that negatively impacted the cyprinid fishes in Uganda that were the subject of this project. The developers of the project have established ponds in small villages around the shores of Lake Victoria, stocking them with fish from the fish farms thus enabling the local population to eat carp. The project has since developed and now, four large fish farms, whose owners were trained in Israel, produce enough fingerlings to populate small ponds in villages around the lake. The people of each village, and especially their children, consume the project-fish as their main source of protein . The project has been financed by USAID-Project for International Development.
Defeating Hunger through Aquaculture – the Story of Lake Victoria.

1.3. Dr. Omer Grundman - Israel
Solabia-Algatech Nutrition / VP R&D

Photo by: AquaculTech

Algatech - creating life in the desert

Located in the Arava desert, Algatech, a leading astaxanthin manufacturer, grew to become one of the world's largest photobioreactor facilities containing more than 600 kilometers of glass tubes with a variety of cutting-edge cultivation and process technologies. We are leveraging the Arava desert's unique climate conditions, and remote location, to ensure the highest quality standards. Our team is relentlessly engaged with the study of microalgae and the development of new and groundbreaking microalgae cultivation technology for astaxanthin and fucoxanthin derived from microalgae.

2. National Perspectives on Aquaculture Future Development
Panel Discussion on Regional Challenges for Food Security Facing Climatic Change and Environmental Concerns

2.1. Dr. Abdelmalek Faraj, Director, National Research Institute for Fishery Resources, Morocco
2.2. Mr. Talal Judeh Ahmed Al-Zeq, Head of Water and Environment Department, Ministry of Agriculture, Jordan
2.3. Mr. Mohammed Mousa Al Ameeri, Assistant Undersecretary of Food Diversity Sector, Ministry of Climate Change and Environment, United Arab Emirates
2.4. Dr. Alexandra Troyano-Groux, Régional Agricultural Conseiller for Lebanon, Iraq, Iran & Egypt, French Embassy in Lebanon, France
2.5. Mr. Noam Mozes, Head of Mariculture Department, Ministry of Agriculture & Rural Development, Israel
2.6. Mr. Yaakov Poleg, Senior Deputy Director General for foreign trade and International Cooperation, at the Ministry of Agriculture & Rural Development, Israel

3. Professional Prelude Keynotes

3.1. Prof. David Passig – Israel

Futurist, lecturer, consultant and best-selling author who specializes in technological, social and educational futures.

Photo by: Serge Kass

The Trajectory of Human Nutrition

Associate Professor at Israel's Bar-Ilan University where he lectures on Systems Theories, Future Methodologies, and Technological, and Social and Educational Futures.The Trajectory of Human Nutrition

3.2. Prof. Yonathan Zohar – United States

Chair, Department of Marin Biotechnology, Director, Aquaculture Research Center, University of Maryland

Photo by: Cheryl Nemazie

The Biotechnology Evolution for The Blue Revolution

With 200,000 people added to our planet daily and an ever-growing increase in people's appetite for seafood, we are rapidly depleting our oceans' fishery resources. Responding to this challenge, aquaculture has become the fastest growing agricultural industry globally and, in the US, and is now supplying over 50% of seafood consumed worldwide. Yet, to fill the increasing gap more expeditiously between the demand and supply of

fishery products, aquaculture must become more efficient, cost effective, and environmentally responsible. This presentation will review how the evolution of biotechnology can accelerate and transform the blue revolution. It will describe how innovations and new generations of biology and technology platforms can overcome current challenges and help aquaculture sustainably produce more quality seafood while reducing our dependence on wild fishery stocks.

4. Fire Side Chat: The Future of Research

4.1. Dr. Michal Levy - Israel

Chief Scientist & Senior Deputy Director General, Agricultural Innovation
Ministry of Agriculture and Rural Development

Photo by: Yedida Bagrish

4.2. Dr. Hanna Rosenfeld - Israel

National center for Mariculture - Israel Oceanographic & Limnological / Director

Photo by: NMC

Aquaculture Improvement Toolkit for Grey Mullet (Mugil Cephalus): Broodstock Management & Production of All-Female Genetic Lines

Rosenfeld, H.1, Meiri-Ashkenazi, I.1, Bracha, C1., Zlatnikov, V.1, Dor, L.2, Curzon, A.Y.2,

Shirak, A. 2,Ron, M. 2, and Seroussi, E. 2(1) Israel Oceanographic & Limnological Research, National Center For Mariculture

The grey mullet, Mugil cephalus, are fished and farmed world-wide. To avoid the continuous pressure on the wild populations, we developed at the IOLR-NCM breeding and larval rearing protocols for captive mullets, along with developing formulated grow-out feeds for their rearing to market size. Following a success in closing the species' life cycle in captivity, improved economics of production is expected by culturing all-female mullet populations, largely due to their highly prized roe used for preparing a seafood delicacy called "Karasumi". To achieve this goal, the current study has adopted the indirect feminization strategy, involving the masculinisation of genotypic females, and crosses of the produced neomales with normal females, to produce a female monosex mullet population. Along these lines, our specific objectives were to: (i) optimize broodstock management and improve spawning success, (ii) establish functional neomales (=sex reversed females) (iii) develop sex-specific molecular markers for identification of the neomales, (iv) produce an all-female grey mullet genetic line.

5. A Blueprint for Sustainable Aquaculture and future trends of Aquaculture

5.1. Mr. Flavio Corsin – The Netherlands

Aqua Spark / Director of Partnerships

Photo by: Aqua Spark

Investing in Sustainable Aquaculture

Aqua-Spark is a holding company of innovative, novel solutions to some of aquaculture's biggest challenges, supported by a growing group of global investors committed to our future food system. Our mission is to move the aquaculture industry towards healthy, sustainable, affordable production with comparable financial returns.

We will present our blueprint for sustainable aquaculture and some of the trends that we believe will shape the future of aquaculture.

6. Environmentally Responsible Aquaculture and Aquafeeds

6.1. Dr. Amir Bitan - Israel

Israel Oceanographic & Limnological Research / Researcher

Photo by: IOLR

חקר ימים ואגמים לישראל
ISRAEL OCEANOGRAPHIC & LIMNOLOGICAL RESEARCH

Fish-AI- DEVELOPING AN ARTIFICIAL INTESTINE FOR THE SUSTAINABLE FARMING OF HEALTHY FISH

An artificial fish intestine (Fish-AI) composed of a scaffold mimicking the Rainbow trout (RT) intestinal villi lined with epithelial cells is currently being developed as part of the H2020-FETOPEN project initiative Fish-AI. The aim is to develop a screening platform based on RT intestinal cells to test the applicability of novel feeds for aquaculture. Towards this aim, we performed in vitro digestion (IVD) of fish feed in order to expose the feed to the gastric and intestinal digestive conditions, using either RT stomach or intestinal enzyme extracts. This will allow the introduction of partially digested feed to the Fish-AI to better simulate the conditions in the intestine of RT. On-the-bench analysis allows us to assess that proteolysis occurred during the IVD, and metabolomic analysis permits us to assess the nutrients profile in the IVD feed as compared to digested feed that was sampled from the intestine of RT fed the same diet. We demonstrated that the IVD feed produced by this method can be introduced to cultured enterocytes with no significant cytotoxic effect on the metabolic status, cell plasma membrane integrity, lysosomal integrity, and cell barrier integrity. The predictive power of the Fish-AI is presently being tested in vivo, in RT.

6.2. Dr. Sagiv kolkovski - Australia
Nutrakol Pty Ltd / Director

Photo by: Sagiv Kolkovski

The power of nature - Herbal medicine (Phyto-medicine) in aquaculture

With the continued expansion of cultured fish and shellfish species, aquaculture has become a key component of the animal health industry. Aquaculture is the fastest-growing industry around the world. With an average annual growth rate of 7.0%, more than 60% of the global seafood is currently supplied from aquaculture. However, this growth is not without its problems, as continuous diseases outbreaks in the shrimp industry, sea lice in the salmon industry, and a ray of other diseases and pathogens challenging the industry. Antibiotics in Aquaculture Due to the intensifcation of rearing methods and systems, diseases and pathogens have been an integral part and formidable obstacle to the aquaculture industry worldwide. Moreover, antibiotic resistance has become a major issue affecting the aquaculture industry. Currently, almost every section in the aquaculture industry is using some sort of chemotherapeutic agents including antibiotics and many other chemicals. Although the use of drugs such as Fluoroquinolones, Nitrofurans, Chloramphenicol, and many other are prohibited in many countries, the use of these drugs is still a common practice. During the past decade, several outbreaks of diseases devastated the aquaculture industry around the world. In southeast Asia and Mexico, shrimp industries were affected by the Hepatopancreatic Acute Necrosis Syndrome (AHPND) outbreak. The Chilean and Norwegian salmon industry suffered (and still does) devastating outbreaks of infectious salmon anemia (ISA) virus and sea lice causing losses of hundreds of millions of dollars. In India and other countries, several parasites species are causing huge losses to farmers growing different freshwater fsh species in ponds. The use (or misuse) of different chemotherapeutic agents trying to combat these parasites is common. However, controlling and/or monitoring the use of these drugs is either low or not existing.

6.3. Proscovia Alando – Kenya

he Fish Site - Columnist | Co-Founder - Ressect | Founder - Samaky Hub | University of Stirling Alumnus - 2019 | Commonwealth Scholarship Alumni | African Food Fellowship | Blue Economy

Photo by: Dr. Sonnia Nzilani

Black Soldier Fly Farming To provide Alternative Protein for Aqua-feed Formulation Towards a Circular Economy

Ever increasing poultry production and greater aquaculture expansion are increasing the demand for animal feed. In Kenya, depending on the region, there is little or no access to animal feed (fishmeal, for example).

The Ressect Company plans the promotion of insect-based, animal feed production. In this project, expertise in insect production has been afforded through a knowledge platform and local helpers. Additionally, a starter kit (shelf construction for keeping black soldier fly larvae) has been provided, with which farmers could utilize their waste for insect production. A digital trading platform compatible with mobile phones for marketing produced insects was set up, too. Through this simple insect production process, one of the aims was that the rural population should be positively convinced of this new, economical cultivation method.

7. Aquaculture Biotechnology, Genomics, and Genetics

7.1. Prof. John Buchanan - United States
Center for Aquaculture Technologies / CEO

Photo by: Center for Aquaculture Technologies

THE CENTER FOR AQUACULTURE TECHNOLOGIES

Genome Editing and the Future of Genetic Improvement in Aquaculture

Increasing ability to harness the power of genomics is forcing a rethinking of aquaculture genetic improvement strategies. Successful breeding programs will always be built on the careful selection of the next generation of broodstock, detailed record keeping, and accurate collection of phenotypic data. Genomics allows this base of phenotypic selection to be enhanced, and ultimately accelerated to increase genetic gain per generation. This is currently done in finfish and shrimp at the most sophisticated level through the use of Genomic Selection. However, another exciting technology is on the horizon that will fundamentally change how we deliver genetic improvement. This technology is Genome Editing.

7.2. Dr. Jakob Biran - Israel
ARO Volcani / Researcher

Photo by: Matan Golan

Genome editing using CRISPR-/Cas9 system to improve Nile tilapia (Oreochromis niloticus) aquaculture

Tilapia is a central fish species in the Israeli aquaculture constituting more than half of the aquaculture production in Israel. Nile tilapia (Oreochromis niloticus) is the second most aquacultured fish in the world. While genetic selection programs are lengthy, requires high investments and are usually limited phenotypic screens of size and coloration. Nevertheless, similar results may be achieved using genome editing methodologies such as CRISPR/Cas9 and TALEN. The CRISPR/Cas9 system is currently the favorite of the reverse genetics methods, mainly due to its technical simplicity and high efficiency. Accordingly, we have established the CRISPR/Cas9 method in Nile tilapia and utilized it for the generation of genetically improved lines addressing the current needs of the tilapia industry. For example, generating CRISPR-based solid red tilapia line which do not express the black blotching which is relatively common in the currently existing red tilapia lines. We have similarly used CRISPR/Cas9 to generate genetic lines for increased muscle mass and fillet size. Additional regulatory pathways are further screened and targeted to improve growth and appetite.

7.3. Dr. Geraldine Mlynarz – Chile
IctioBiotic / CEO

Photo by: Geraldine Mlynarz

IctioBiotic

Novel probiotics as biotherapeutics to prevent relevant diseases in aquaculture

IctioBiotic is a Chilean biotech company committed to developing novel probiotics that are friendly with the environment and allow sustainable development aquaculture. Our mission is to become a key supplier of probiotics that help reduce diseases and improve the sanitary status of fish farms.
With our products we aim at helping people consume healthy and sustainable protein from aquaculture, free of antibiotics and other chemicals. To achieve this, we have developed a new class of probiotics based on our proprietary platform of GRAS food-grade microbes that
produce a variety of proteins that can be used as immunostimulants or growth stimulants for different aquatic species.
Probiotics are microorganisms that are easily delivered with feed that provide health benefits. In IctioBiotic we are pioneers in the development of probiotics for fish farming. Our products release proteins that stimulate fishes' immune response against virus and bacteria preventing diseases and reducing mortality against relevant pathogens that affect aquaculture.
Chile is the second world largest salmon producers and we have developed 2 products that help Chilean salmon farmers prevent Salmonid Rickettsial Septicaemia or SRS, disease caused by P. salmonis that is responsible for high mortality and antibiotic use. IKA Forte® is our first commercially available probiotic and it is commercialized by BioMar as part of its premium diet. Our technology can generate an extensive portfolio of candidates for different pathogens and for different aquatic species (fish and others). We have expanded our R&D towards warm-water species, and we have now a probiotic mixture that protects Tilapia against Streptococcus agalactiae.

7.4. Lior David

Hebrew University of Jerusalem / Researcher

Photo by: The Hebrew University of Jerusalem

Technology for producing all-female progenies for aquaculture

The flathead grey mullet (Mugil cephalus) is a cosmopolitan marine food-fish fish, the availability of which depends mainly on capture fishery in seas, but also from increased production in aquaculture on land. Aquaculture production relies heavily on capturing wild fry in estuaries and acclimating them to grow in freshwater/brackish water ponds. Capturing wild fry puts pressure on wild populations, but also hampers further development of mullet aquaculture since wild fry availability fluctuates among years. The mullet is a desired aquaculture species, targeted by the EU as a priority species to develop for aquaculture in Mediterranean countries. Mullet females grow faster than males and mature females are used also by the roe industry to produce Botarga/Karasumi. Only recently, the life cycle of mullet in captivity was closed allowing to produce fry in hatcheries. Having done that, now is the right time to breed for improved brood stocks. Accordingly, the goal of this research was to establish a technology for producing all-female progenies for aquaculture. The technology is based on producing sex-reversed males, i.e. milt producing males with a female sex genotype, which are then crossed to normal females for producing all-female progenies. Production of sex-reversed males required developing hormonal sex-reversal protocol and genetic markers to determine the genetic sex. Hormonal sex-reversal was done by feeding methyltestosterone-treated food to batches of fry, while experimenting to calibrate the hormonal dose, timing and duration of application. Control and treatment groups were grown for 18 months to maturation, when fish were sampled and sacrificed to visually determine their gonad type. While all control groups had a 1:1 ratio between females and males, in three treatment groups an excess of 63%, 74% and 84% males were identified, indicating that some males were sex-reversed. Identification of genetic sex requires understanding of the sex determination system and mapping of the genomic regions affecting sex. Control groups were screened using genotyping by sequencing to identify several thousands of SNP markers used to construct a genetic linkage map. About 280 markers were significantly associated with sex and their mapping identified enrichment on a single linkage group, suggesting a

monogenic sex-determination system. Mullet has no karyotypic difference between sexes, but other results suggested an XY/XX system, where the male determines the sex of progeny. Next, markers tightly linked to sex were developed into genotyping assays. These markers had very good accuracy (over 98%) in correctly identifying sex in some families but lower to none in others, suggesting genetic variation among families in the sex-determining region. Therefore, the use of multiple markers was needed for identifying genetic sex across multiple families. Importantly, marker genotyping of fish from sex-reversed groups and their sib control groups identified which genotypes were of females and which were of males, allowing to identify males with female genotypes, i.e. sex-reversed males. Such live sex-reversed males were identified by markers and selected as broodfish, which were crossed with normal females to produce, for the first time, an all-females progeny group. We expect that incorporating this technology into the routine production of commercial hatchery fry, will push forward mullet aquaculture and profitability of this industry

7.5. Dr. Nissim Chen -Israel
AquiNovo / CEO

Photo by: Trendlines Group

AQUINOVO
Accelerating Fish Growth

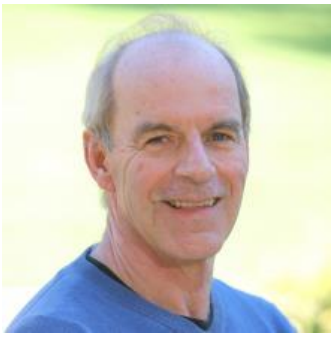
Innovative bio active peptides for sustainable fish yield enhancement

AquiNovo has licensed a technology, invented at the Hebrew University, that enhances growth of farmed fish, therefore shortening time to market for each growth cycle and allowing fish farms to generate more growth cycles using existing infrastructure, thus increasing fish yield using same resources. The technology is based on proprietary short peptides, which are basically a truncated, modified forms of naturally occurring peptides in the fish. The activities of these peptides in fish are employed to enhance fish growth when given externally.

8. RAS Production Platforms

8.1. Prof. Jaap Van Rijn - Israel

The Hebrew University of Jerusalem / Professor



האוניברסיטה העברית בירושלים
THE HEBREW UNIVERSITY OF JERUSALEM

Photo by: The Hebrew University of Jerusalem

Waste Management in Recirculating Aquaculture Systems

Fish perform all their bodily functions in water.
Because fish are totally dependent upon water to breathe,
feed and grow, excrete wastes, maintain a salt balance, and reproduce,
understanding and controlling the quality of water is critical to successful aquaculture. To a great extent, water determines the success or failure of an aquaculture operation

8.2. Mr. Yoav Dagan - Israel

AquaMaof Aquaculture Technology / VP Business Development

AquaMaof
Aquaculture Intelligence

Photo by: AquaMaof

We are made up of a new generation of fish farmers, aquaculture, and technology experts with years of experience and a passion for the industry. Working with nature, we leverage next generation techniques to develop a cost-effective, land-based indoor aquaculture technology which makes seafood production both efficient and sustainable.

8.3. Dr. Eran Hadas - Israel
ECOshrimp / CTO

Photo by: Moshik Brin

The future of shrimp production

ECOshrimp's unique indoor shrimp production platform offers an advanced, sustainable, and cost-effective solution for today's growing population needs. From concept to operational production facilities and ongoing service and support, the company's cutting-edge RAS technology, enables producing
fresh, tasty, healthy shrimp inland, in the currently importing markets.The company is currently building its first industrial facility in Israel as well as partnering to establish several industrial farms in Europe and US.
Following extensive research since 2016, with over 15 batches in the R&D center located in the middle of the Israeli desert, ECOshrimp developed a proprietary tank structure that enables high yield per sqm. The technology
utilizes smart water-treatment and filtering techniques to significantly cut water consumption along with efficient operation and energy management.
ECOshrimp offers a completely scalable solution to meet the growing needs for sustainable and healthy proteins. The production units are starting from 100 tons per year and flexibility to expand by simply adding modules. The smart system design along with proven growth protocols and ongoing support provided by ECOshrimp, result in the first economically viable inland shrimp farming solution and an ideal entry point for investors and entrepreneurs seeking to enter the growing aquaculture sector.
ECOshrimp is the first shrimp RAS company to break the commercial viability cost barrier, making inland shrimp that is delicious, healthy, sustainable, and available for widespread consumption. The company produce shrimp with environmental, health and ethical benefits that will radically transform the global production of shrimp.

8.4. Mr. Igal Magen - Israel
BioFishency / CTO

Photo by: Ronit Valfer

It's more than a recirculating aquaculture systems (RAS) water treatment solution. It's the future.

Aquaculture is the fastest-growing sector in animal protein production projected at 100 million tons by 2030. But with the limited availability of land and water, the only viable solution is intensification – to produce more fish per unit of area and water. This shifted the focus towards longevity and sustainability of aquaculture, now driven by innovative, highly sustainable, and cost-effective solutions. One such solution, Recirculating Aquaculture Systems (RAS), are based on the treatment and reuse of water via the application of mechanical filtration, followed by biofiltration, disinfection, and oxygenation. Available RAS technologies suffer from several limiting factors restricting their wide application: (1) Difficulty in meeting desired environmental standards, namely related to inefficient removal of nitrogen and phosphorus compounds; (2) bio-filter limitations, such as long start-up time, temperature dependency, possible amplification of pathogens within the biofilter (3) generation of fish off flavor agents such as MIB & Geosmin generating a muddy taste of the fish causing tremendous lost for the farmer. These factors result in increased production costs due to environmental-related expenses, fish health issues affecting both growth performance and survival rates, and high capital costs particularly apparent in RAS focusing on cold-water fish, which require large bio-filter surface areas. A new operational approach for RAS, is based on physicochemical water treatment techniques. Within this concept the fish are grown at high TAN concentration and around neutral pH that is calculated to maintain the toxic NH3 concentration lower than a predetermined threshold. The inherently high Cl− concentration in seawater enables efficient electro-generation of Cl2(aq) which consequently oxidizes ammonia directly into innocuous N2(g). The system's water passes in a semi-batch mode through the water treatment unit and then returns to the fish tanks, supplying disinfected water with zero TAN and off-flavor agents, and most of the acidity

required for maintaining the alkalinity mass balance in the RAS. A powered controller with a highly intuitive graphic UI monitors and controls the water's pH, temperature, O2, ORP, Cl2 and NH4+ levels for maintaining optimal water quality for the fish. The BioFishency ELX enables real-time data collection and management via an intuitive dashboard through a cloud-based solution. Remote monitoring and operation are facilitated by an easy-to-use mobile app, accessible from any location, at any time, via any mobile device or tablet. Intelligent process adaptation using Machine Learning technologies, are planned for future versions.

9. Fire Side Chat: The Road from Basic Science to Aquaculture Applications

9.1. Roni Sussman – Israel

AquaculTech / Director

Photo by: Moti Biton

AquaculTech community is a joint initiative of the Ministry of Economy and Industry, the Ministry of Agriculture, Israel Innovation Authority, and Israel Innovation Institute. Promoting innovative solutions to marine production by raise funding and providing a platform for startups, entrepreneurs, government officials, global companies, investors, innovation hubs and key stakeholders in the Biotechnology and Aquaculture ecosystem to interact, share knowledge and explore synergies for the positioning of Israel as a source of innovation in the field, focusing on the Eilat area as a national and international center.

9.2. Prof. Amir Sagi - Israel

Ben Gurion University of the Negev / Professor

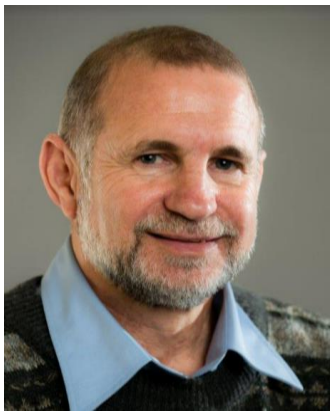


Photo by: Danny Machlis, BGU

אוניברסיטת בן-גוריון בנגב
Ben-Gurion University of the Negev

From basic Science to aquaculture applications - Prawn monosex biotechnologies for aquaculture and biocontrol

Novel husbandry approaches to favor investment of energy on growth in the expense of reproduction and aggressive behavior are suggested by monosex culture biotechnologies. In aquaculture of the giant prawn Macrobrachium rosenbergii two monosex approaches were investigated, all-male culture and all female culture. The first, based on temporal gene silencing through RNAi caters for large sized prawns under less dense conditions. The second, based on parental cell transplantation, aims at a uniform aquaculture product under a more intensive husbandry. Both contribute to more sustainable culture since it reduces the chances of escapees from the aquaculture operation to become an invasive environmental threat. The possibility of producing a single sex population that could not breed also opens the possibility to sustainably use prawns as biocontrol agents against pest snails in aquaculture, agriculture and even snails that carry human disease vectors. For environmentally safer biocontrol, possible future development of sterile biotechnologies based on genome editing through CRISPR will be discussed.

10. Algal Technology

10.1. Prof. Isaac Berzin - Iceland

VAXA Technologies / CTO

Photo by: Isaac Berzin

Impact Nutrition

Integrating clean power sources with micro algae cultivation creates a game-changing nutritional and environmental equation. Could a blue shake from Icelandic Spirulina replace beef meat?

10.2. Dr. Dorit Avni

MIGAL / Coordinator of Algae4IBD (HORIZON2020) and Head of Sphingolipids, Natural Biocomponds and Immune modulation Lab

Photo by: Lior Jorno

Algae Based Functional Food Ingredients

We propose innovative solutions for increasing the use of algae-based ingredients and to ensure the science-based improvement of nutritional quality and its effect on public health. The researchers, companies and hospitals involved in the different stages of the

project uses the biodiversity of algae, as a source for bioactives using state-of-the-art cultivation and extraction technologies to obtain sufficient amounts of active molecules. Those extracts have already generated bioactivity hits that will result in novel algal-based, high-quality bioactive compounds at GMP grade and lower costs for dual purposes – IBD prevention and treatment in relevance to the food as well as the pharmaceutical industries.

10.3. Dr. Na'ama Segal - Israel

National center for Mariculture - Israel Oceanographic & Limnological / Senior Scientist

Photo by: Na'ama Segal

Heterologous production of high-value products by micro and macro algae

The main goal of my research is the development of genetically engineered algae, such as Phaeodactylum tricornutum, and other marine algae as a heterologous system for gene expression and the creation of molecules needed by different industries. The potential that lies in marine micro and macroalgae as a sustainable source for heterologous production of recombinant proteins and metabolites is vast. However, there are still obstacles to overcome. In our research, we identified key players responsible for transgene silencing in green microalgae and investigated the role of those components in other marine microalgae groups with the potential to become the new cell-based factory for therapeutics production by the biotechnology companies. The production of algae grown on sea water in arid land either for its natural or engineered components the future of mariculture.

10.4. Dr. Yossi Tal
Seakura / CTO

Photo by: Michal Sharoni

Sustainable production of Seaweed in land-based systems: the future of world food supply

Seakura is an Israeli seaweed company located at Michmoret. Seakura team has developed unique patented technology for cultivating clean, organic, and nutritious seaweeds (Ulva & Gracilaria) in land-based system. The technology enables year-round cultivation of marine seaweed under fully control environment to produce clean, heavy metal free seaweed. Controlling the seawater quality and temperature support optimal growth condition for the seaweed resulting in high nutritional values including proteins, vitamins, and minerals with exceptional high growth rate. In the end of the growth cycle the seaweed are harvest under specific protocols developed by the Seakura team that keeps the high nutritional value of the seaweed and allow to market them as fresh-frozen seaweed as well as dry products. The Seakura seaweed cultivation technology has no environmental impact, and it is totally sustainable since seawater effluents go back to the sea totally clean. We consider our land-based seaweed cultivations technology as the future of healthy, sustainable, and ecological food production for generation to come.

10.5. Mr. Baruch Dach

AlgaeCore / Founder and CTO

Photo by: Algae Core

Solar cultured meat and fish analogs

Spirulina is a cyanobacteria that is known as the most efficient converter of solar energy to edible protein. AlgaeCore is an israeli tech company that developed a proprietary set of technologies to convert Spirulina cell culture into meat and fish alternatives. The presentation will review recent developments, discuss new market opportunities and challenges.

11. Future Trend of Agriculture in Arid Area

11.1. Tobias Baedeker - United States

The World Bank / Senior Agriculture Economist

Accelerating Agri-Food Transformation in developing countries.

Developing countries hold much of the remaining potential to increase production but find themselves under increasing pressure from climate change. The World Bank thrives to support its clients in fast tracking the transformation of agriculture-food systems.

11.2. Prof. Yoram Kapulnik – Israel - Panel Moderator

BARD / Executive Director

Photo by: Maayan Kez

The Binational Agriculture Research & Development Foundation (BARD) is a competitive funding program that supports collaborative agricultural research in areas of mutual interest to the U.S. and Israel. The primary mission of BARD is to bring together U.S. and Israeli scientists to jointly address key agricultural and food production challenges that concern both countries. BARD-funded research outputs led to new agriculture practices, commercial engagements, patents and breeding rights licenses, which serve as a growth engine to both US and Israeli economies.

11.3. Ms. Dganit Vered - Israel - Panelist

Smart Agro / CEO

Photographer: Ariel Besor

R&D partnership traded on the Tel Aviv Stock Exchange. Specializes in agritech investments and the growth of agritech companies. Smart Agro seeks to invest in the research and business development of companies which have the power to significantly impact our future and help transition them to independent professionally managed companies who at their core, have a unique technology with tremendous commercial promise and economic value.

mart Agro's highly experienced management team has an extensive business network that supports the development of ideas and start-ups from early stage through mature companies to exit.

11.4. Prof. Eran Raveh - Israel - Panelist
ARO / Head of Gilat Research Center

Photo by: Eran Raveh

The long-term effects of reclaimed irrigation water on the Israeli citrus industry

The last three decades of Israeli agriculture have been characterized by utilization of non-conventional (85% from recycled and brackish) water supplies for irrigation; initially, monitoring revealed no significant negative effects on orchard production. Yet, the effects of this water, characterized by relatively high levels of salt, built up gradually and after ~15 years, growers and the juice industry observed changes. Based on data that were collected, chloride and sodium concentrations in leaves had increased by ~200% and reach the toxicity level. At the same time sodium concentrations in juice increased above 5 mg/100 ml. High sodium concentration was also measured in other Israeli produce (24 fruits and vegetables) and was then above USDA standards. Perianal crops suffered greater increases as compared to annual crops. However, the story does not end there. Since 2008, Israel has addressed water scarcity by adding desalinated seawater into its drinking water, which is then recycled for agriculture. As of 2016, salinity concentrations of water supplies for irrigation had dropped by ~30% (e.g chloride concentration was reduced from 314 mg L-1 to 220 mg L-1). As a result, diagnostic citrus leaf chloride and sodium concentrations were found to have decreased by ~30%, and the average sodium level in Israeli fruits and vegetables was similar to the USDA reported standards. Although the move to desalination was reversing the prior problematic trends of salinization, it also removes the magnesium (an essential element for plant growth and human health) from the water. Indeed, along these years, magnesium concentration in diagnostic citrus leaves had drop by 30%, while its average level in Israeli fruits and vegetables is about 50% of the USDA reported standards. In conclusion, minor changes in mineral levels over the long-term can accumulate and become major issues.

11.5. Prof. Naftali Lazarovitch - Israel - Panelist
Ben-Gurion University of the Negev / Professor

Photo by: Naftali Lazarovitch

11.6. Ms. Sivan Cohen Shachari
DeserTech / Director

Photo by: Yarin Taranos

Presenting DeserTech startups

The DeserTech Community as a nonprofit Initiative that promotes regional economic development of the Negev by focusing on technology, research and innovation.

11.7. Mr. Matan Oz
Tomgrow / VP Sales & Business Development

A leading urban plant technology company. has moved beyond hydroponics and hydroculture and reinvented soil itself. We use cutting-edge science to provide the ultimate soil replacement. Our MediumX growth medium holds water, nutrients, and everything the plants need to thrive and ensures that the plant only takes what it needs when it needs it. Our plants grow, live, and thrive independently and need watering only once or twice a year at most. The technology is fully operational and is being used by

customers with our first planter product in the indoor urban market.

12. Transforming Aquafood systems: Avision and Prospectus

Mr. Vladimis Rakhmanin

Assistant Director-General, Regional Representative for Europe and central Asia, Food and Agriculture Oraganisation (FAO) of the United Nations (UN)

Food and Agriculture Organization of the United Nations

Transforming Aquafood Systems: A Vision and Prospectus

13. The Money Behind Aquaculture

13.1. Mr. Matt Craze

Spheric Research / Head of Research

Spheric

How recirculation dominates aquaculture investment

The global salmon industry is spending billions of dollars on recirculating aquaculture systems to create a hybrid farming model. Shrimp farmers are investing in basic forms of recirculation as well as automated feed systems to eke out new productivity gains. My 15-minute presentation will cover aquaculture investments globally and how recirculating technologies accounts for a big chunk of capital flow.

13.2. Dr. Barry Antonio Costa-Pierce
Ecological Aquaculture Foundation and Nord University
President / CEO and Professor

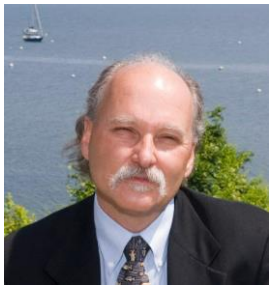


Photo by: Heather Rhodes

Money per square meter, not production: Successful, market-driven, industrial ecology approaches to aquaculture aligned to the FAO ecosystem approach to aquaculture

International data in aquaculture is dominated by production data but aquaculture businesses are driven by value. The “new geographies for aquaculture” outside Asia combine to a small amount of total global aquaculture production but receive higher values per unit production for almost all aquaculture products. A mountain of money is now being invested in aquaculture outside of Asia. Promises for higher than traditional market returns to new entrants/investors are based on production while highest profits are in the value chain. Scale is an important determinant of profitability. Can aquaculture develop at scale to satisfy market demands at scales to replace imports? Can an industrial ecology model for aquaculture with branding/ethics and values be more economically viable in global markets that incorporate the FAO Ecosystem Approach to Aquaculture, and UN SDGs and the Paris Agreement UNFCCC Conference of Parties? The answer is yes.

13.3. Mr. Keith Loo - Singapore
Trendlines Agrifood Innovation Centre / Deal Flow

Photo by: Keith Loo

Future Trends in Aquaculture and the Role of Investors

The aquaculture industry is one of the fastest growing sectors of the food industry and to maintain its growth trajectory, industry will need capital investment from governments, foundations, venture capitalists, and banks. As an investment opportunity, the aquaculture industry is still young compared to other sources of animal protein production. As such, there are many untapped opportunities for investors.
The role of investors is not just to provide capital, but also to act as the catalyst and the agent that can help bring all the stakeholders within the industry together into a cohesive unit, stakeholders such as farmers, governments, regulators, input providers etc.

13.4. Mr. Ron Shavit - Israel
GoSmart - precision farming / VP Business Development

Photo by: Ron Sharvit

Harnessing the power of AI to promote Aquaculture from prediction based to a real time data driven industry.

The lack of user friendly, continuous accurate underwater measurement and tracking means in the industry leads to suboptimal stock management and inefficient operations (e.g., inaccurate feeding, high labor costs, limited fish growth performance and environmental pollution).
All the above, result with a substantial loss of money to the farmer, mainly due to the execution of an incorrect feed plan (feed is more than 60% of the total costs). Another pain point for the farmer is the lack of ability to observe fish in live during feeding, to feed the fish according to their real appetite.
The GoSmart system provides the farmer with a real-time management support tool for optimal operation execution & planning, including live observation of the farm (underwater and above surface), saving the farmer a lot of money and time. The system is suitable for all aquaculture operations (also in off the grid ones) and species, comes at an attractive price and is simple and easy to operate. Furthermore, multiple systems data will

enable AI analysis of this big data, comparisons between sites, operations, conditions, etc., developing new protocols and improving by means farms performance.
Real time on-site BigData mining is also the key for enabling better prediction, automation, stock classification and giving traders the ability to see offers from farmers (and opposite). This will save money for both sides, improving execution of harvesting schedule and activities. Massive and ever-growing deployment of GoSmart systems will generate this valuable BigData for a new marketplace, opening new D2C & B2B growth channels for farmers and retailers.

13.5. Dr. Rotem Kadir - Israel

Mermade Seafoods / CTO

Photo by: Ofir Harel

MERMADE
PREMIUM CELL-BASED SEAFOOD

The cultured meat industry: Current challenges and future prospects."

The cultured meat industry is a rapidly growing field with numerous challenges that must be faced and overcome on the road for commercialisation. This novel industry brings new concepts and approaches to the way we wish to grow our food in the future. We will review the current hurdles faced by the conventional farming and by the cultured meat industry and introduce our groundbreaking concept of cytoponics to address these issues and offer cost-effective high-quality products to the market.

13.6. Dr. Asaf Lahav - Israel

DistanSea / CEO

DistanSea
LIVE SEAFOOD SHIPMENT SOLUTIONS

An innovative water-treatment approach to enable high bio-density and extended shelf-life along the live seafood supply chain

Live seafood such as lobsters, crabs, oysters, clams, and the like, are in high demand all over the world. The potential revenues from selling a live product (depending on species) are 300-1500% higher than a frozen or fresh product. Nevertheless, most premium seafood is not sold alive because of the technological challenges associated with the live seafood supply chain.

With the currently applied technologies, most live-species commerce is done in a delivery range of 24-hours from the port of origin to the end consumer, and only a small fraction is being transported for longer periods or distances due to the high transport prices. Prolonged holding inevitably leads to reduced bio density and an increased transport price per kg of product.

Today's high-end technologies for live seafood transports include temperature control, oxygen supply, CO_2 stripping, and solids floatation. The first bottleneck for increasing bio-loads along the live supply chain is the ability to remove toxic ammonia from the holding tank. Controlling the ammonia concentration in the live seafood tanks allows a safe transport for 2 to 5 days. The second bottleneck is the deterioration of the water quality due to prosperity of microorganisms. By controlling the microbial loads, safe live seafood transports may be extended to 3 to 7 weeks, allowing an affordable worldwide seafood commerce based on road, rail, and sea freight.

DistanSea, which is a spinoff company from Technion – Israel Institute of Technology, provides solutions for both local and long-distance live shipments, as well as for live holding facilities, such as live logistic centers and supermarket aquariums. DistanSea's technology is based on a self-contained patented systems that are placed in live seafood containers or holding facilities. The system includes a unique technology which does not require human intervention for ammonia and microbial load control within the live seafood holding tanks. DistanSea's solutions enable both to double the shipping duration and the shipped bio-load, or the shelf lifetime of live aquatic animals. At the heart of the system lies a novel composite material with a very high affinity to NH_4^+. The material can remove ammonium from the water regardless of temperature and salinity, and thus serve as a "removal sink" for toxic ammonia in seafood transportation.

The presentation in the AgrIsrael Sea the Future will include a technical description of DistanSea's solutions for local and long-distance live seafood transports, and its value proposition within these two market segments.

Startups & R&D's Exhibition

1. **Tomgrow, Matan Oz / VP Sales & Business Development**

TOMGROW

A leading urban plant technology company. has moved beyond hydroponics and hydroculture and reinvented soil itself. We use cutting-edge science to provide the ultimate soil replacement. Our MediumX growth medium holds water, nutrients, and everything the plants need to thrive and ensures that the plant only takes what it needs when it needs it. Our plants grow, live, and thrive independently and need watering only once or twice a year at most. The technology is fully operational and is being used by customers with our first planter product in the indoor urban market.

2. **Blue Fields, Zivan Shavit / CEO**

bluefields
ADVANCED FISH FARMING

Advanced Live Feeding System. ai driven, Saas model. 33% cost efficiency, better FCR, better fish health, better environmental footprint.

3. **TopGum Industries Ltd, Menahem Alexander / Marketing director**

TOPGUM
GUMMICEUTICALS™

Algae TopGum is a pioneering contract manufacturer of supplement gummies for the functional food and nutraceutical markets. Equipped with a state-of-the-art production facility, extensive food technology expertise, and proprietary manufacturing processes, TopGum produces top-of-the-line, high-quality gummy supplements. The company works closely with leading industry brands and retail partners worldwide, supporting them in producing differentiated gummy products, innovation, and winning formulations.

4. **Tiran Shipping (1997) ltd, Eyal Avioz / manager**

Tiran Shipping (1997) Ltd has the exclusive worldwide rights to utilize ALL MALE Macrobrachium roenbergii IP which developed at Ben Gurion University in the lab of prof. Amir Sagi. Tiran is commercializing the products via its own companies in Asia under the name of New Horizon. Our technology can increase farmer income for over 60% compared to mix/all-female populations.

5. **GG Biologicals, Sam Bevans / Co-Founder & CEO**

GG BIOLOGICALS
GENERATING GROWTH

GG Biologicals connects the various solutions found in nature in a strategic and practical manner. We are currently producing full spectrum biological fertilizers and amendments that are both effective and affordable. All our products are designed to offer simple, yet high quality, solutions for farmers and gardeners.

6. **BarAlgae, Omri Sharir / Business development manager**

BarAlgae

An Israeli company with an innovative, state of the art production technology for various microalgae species. Founded in 2018, BarAlgae had stated its vision to become a leading company in the global algae market through a combination of high-tech, cost-effective processes & biological know-how to introduce novel species of premium grade microalgae to multiple markets. Led by marine-biology scientists and engineering experts, BarAlgae has created a fully automated, remote command & control system that operates year-round with reproducible production of biomass to assure consistent supply. We pride

ourselves with cost-effective production of high quality and pathogen-free microalgae. Our modular design enables us to simultaneously cultivate several algae species, alongside specific nutritional enrichments, allowing to attend market & customer needs.
Today, BarAlgae photo-bioreactors can support the production of 18 MT of dry biomass annually, with a potential upscale of up to 60Mt (Additional facilities are planned in selected geographies). Our professional team developed thorough and exclusive know-how of commercial cultivation protocols for 9 selected species. Additional novel microalgae cultivation protocols are being developed. Our products come in a variety of forms such as extracts & crude biomass which are designated for major business sectors: Aquaculture, Nutritional supplements, Cosmetics & Food industry.

7. **Agrinoze, Noa Zell Marketing Communications Manager**

Agrinoze
Same Field, More Yield

Agrinoze is the first scalable solution for global food security, delivering an autonomous irrigation and fertigation system that manages the root zone in real time and maintains optimal conditions 24/7. The solution is proven to significantly increase the yield of any crop in any soil or growing environment while conserving water and fertilizer.

8. **CoreBone, Ohad Schwartz / CEO**

COREBONE
Bioactive Coral Bone Graft

CoreBone develops coral based medical devices for orthopedics and dentistry. Our bone graft solutions eliminate the use of human, bovine or porcine cadaver grafts. They are based on proprietary coral growing technology and raised in the Arava desert. The products are regulatory approved and have been used in thousands of surgical procedures around the globe.

9. Seakura, Avital Harel / VP Marketing & sales

"SEAKURA is a privately owned aqua-tech company, located in Mikmoret, Israel, established in 2007 by Mr. Yossi Karta, we believe that seaweeds are the core basis of food for all living creatures on earth and it will be an inseparable component of the global food industry in the not-so-distant future. We see Seakura's Technology as a way to provide people with quality, healthy food while preserving natures ecological balance. In order to preserve the ecological balance and the marine environment, at the end of each growth cycle we return clean water to the sea. Filtered, closely monitored, year-round unique cultivation, no human hands. This innovative method replaces the traditional method of harvesting seaweed from the open ocean, where it is exposed to pollutants of all kinds that results in unstable harvest of very low-quality seaweed. Unlike open ocean harvest, we are EU Organic, USDA, ISO and BRC AA certified.

10. BioFishency, Igal Magen / CTO

Biofishency develops an advanced water treatment systems for sustainable land-based aquaculture. BioFishency ELX is based on physicochemical water treatment techniques. The high Clλˆ’ concentration in seawater enables generation of Cl2 which oxidizes ammonia directly into N2g. The system work in a batch mode through the water treatment unit, supplying disinfected water with zero TAN and off-flavor agents

11. AquaMaof

AquaMaof
Aquaculture Intelligence

A technological company that establishes projects in the world with RAS technology (Recirculating Systems Aquaculture) for fish breeding facilities on land. The technology produces a sustainable growing environment, Sustainable, free of chemicals and antibiotics

12. Ecoshrimp

ECOshrimp
Aquaculture Innovation

ECOshrimp's unique solution enables successful, intensive land-based production of shrimp. Based on AquaMaof's proven Recirculating Aquaculture System (RAS) technology, it is sustainable, cost effective and flexible.

13. MARULA

Marula Lab
World Marula Center

Researches, develops and grows selected varieties of marula trees in plantations adapted for the production of Marula seed oil, develops unique extraction machines that have been submitted as a patent, in addition to establishing a zero-waste policy for all plant products - seed, bark and pulp.

14. AquiNovo

AQUINOVO
Accelerating Fish Growth

AquiNovo's pioneering technology addresses a key challenge of the aquaculture industry: sustainable increase of fish yields with same resources.
Innovative feed additives result in larger, meatier fish
AquiNovo's non-GMO and non-hormonal feed additives result in significant improvement in both growth and Feed Conversion Ratio (FCR). The same quantity of feed is thereby converted into more biomass. Size distribution also improves, providing farmers with more larger fish and less smaller fish.

15. STK Aqua

stk
bio-ag technologies

STK Aqua develops and commercializes botanical-based, food protection solutions that solve the myriad challenges of modern fish farming. From vaccination, transportation, and stress reduction through staving off the onslaught of parasites and bacterial diseases, STK's chemical-free formulations are a real game-changer in this space.

16 Wadi Araba Sustainability Hackathon, Eyal Kapulnik / Project Manager

WADI ARABA
SUSTAINABILITY
HACKATHON 2022

The Wadi Araba Hackathon brings together individuals, businesses, and educational institutions to improve the practices of local industries focused on desert tech, desert agriculture, aquaculture, renewable energy, and tourism. The 7-day hackathon- workshop (28/11-2/12) will include Jordanians, Israelis, Palestinians, and other participants from countries in the region (Egypt, Morocco, UAE, Cyprus, and Greece) Regional Collaboration.

Israeli Agriculture Research and Development Centers

17 The Volcani Institute

18 Central &Northern Arava-Tamar R&D

Central & Northern Arava-Tamar R&D

19 Dead Sea & Arava Science Center

מו"פ מדבר וים המלח
Dead Sea & Arava Science Center
בחסות אוניברסיטת בן גוריון בנגב
Under the auspices of Ben-Gurion University of the Negev

20 Ramat Negev Desert Agro-Research Center

RAMAT - NEGEV
DESERT AGRO-RESEARCH CENTER

21 Southern Arava R&D

22 Valley of springs Agriculture R&D

23 National center for Mariculture - Israel Oceanographic & Limnological