



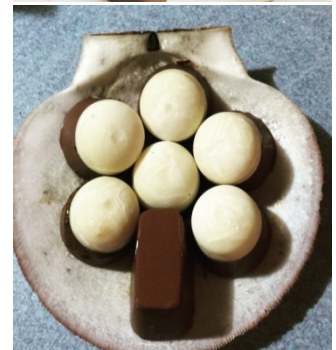
First harvest of sugar kelp, *Saccharina latissima*, at Magellan Aqua Farms Inc.

Steven Backman, the owner, having obtained an amendment from the Province of New Brunswick in 2015 to grow kelps at his scallop (*Placopecten magellanicus*) site in the Passamaquoddy Bay, kelp ropes were installed in the fall of 2015 and the first harvest took place in June 2016.

Yes, kelps can grow at his site! Steven being very entrepreneurial, a few products and applications are in the pipeline and you can already see how these tasty kelps can be accommodated:

- Magellan Aqua Farms Inc. roasted IMTA sugar kelp in peanut oil.
- Magellan Aqua Farms Inc. sundried IMTA sugar kelps in dark and white chocolates.
- Magellan Magical Chowder: Magellan Aqua Farms Inc. scallops, local farm raised salmon, haddock, New Brunswick russet potatoes, carrots, ground Magellan IMTA sugar kelps as umami taste developer and salt substitute, dab of sour cream and Magellan IMTA sugar kelp flakes.
- Magellan Aqua Farms Inc. sundried IMTA sugar kelp seasoning.
- Cedar planked salmon with dijonnaise, Magellan Aqua Farms Inc. IMTA sugar kelp flakes, fresh mint, lemon and powdered oyster mushrooms.
- Magellan Aqua Farms Inc. sundried IMTA sugar kelp seasoning with smoked mussels and crackers.

Steven, who is also a veterinarian at Skretting Canada in St. Andrews, obtained an amendment to grow the red seaweed *Palmaria palmata* (dulse) at his site as well, and that is the next challenge for our fruitful collaboration. Dulse has a complex life history (see [S... S... S...](#), or Seaweeds and Sex in the Sea) and its cultivation is far from easy.





On May 3, **Thierry Chopin** gave a presentation entitled “Responsibly farming marine and fresh-waters through the development of Integrated Multi-Trophic Aquaculture (IMTA) practices” at the **Lancaster Golden Service Club**, in Saint John, New Brunswick. This Club is an association of retired men from around Saint John, providing services to citizens of the city, volunteer work to the community and financial support for children’s activities.



Thierry Chopin with several members of the Lancaster Golden Service Club in Saint John, New Brunswick.

The audience of approximately 35 of its members was most diverse: a former school principal, a business man, a minister, a former director of a nuclear power plant, an engineer, a science teacher, a dentist, a consultant, a veteran of WWII having received the Légion d’Honneur from France, to cite a few. This led to an interesting discussion that went on for an hour after the presentation.

“It is very important to not only give presentations at scientific conferences around the world, but to also reach out to members, of all ages, of the local and regional communities” said Chopin. “They need to know about the interesting research, development and commercialization taking place right in their backyard too.

This gives them a better appreciation of the surprising research conducted at the university in their town and its implications for the local coastal economy. This also provides a wonderful opportunity for me to test how the societal acceptability of aquaculture activities evolves and progresses when innovative practices are explained and science is translated to show its impacts on everyday life”.

Chopin really enjoyed the experience and there are talks of giving another presentation next year; a 35 minute presentation was not enough to cover everything this inquiring audience wanted to know about seaweeds and aquaculture!

On May 6, in the Whitebone Lounge at **UNB Saint John, New Brunswick Innovation Foundation (NBIF)** **Chairwoman Cathy Simpson** and **New Brunswick Premier Brian Gallant** announced an investment in 188 research assistantships and startup grants issued to newly arriving professors.

“Investing in education is key for the New Brunswick economy to be innovative,” said Gallant. “Helping these students further their studies here in our province will help provide a strong workforce for the New Brunswick economy”.





Thierry Chopin was one of the recipients of a \$20,000 grant to support a research assistant under the Research Assistantships Initiative (RAI), which is a joint initiative between NBIF and the New Brunswick Department of Post-Secondary Education, Training and Labor (PETL). This grant will support a graduate student involved in the “Understanding of the microbial link of freshwater integrated multi-trophic aquaculture (FIMTA) systems towards the design of waste-free operations”, which should improve the biological and economic efficiency of aquaponic systems.

Thierry Chopin attended the **Jeju Forum for Peace and Prosperity**, which was held on **Jeju Island**, in the South of the **Republic of Korea**, on **May 25-27, 2016**.

As its title suggests, the Jeju Forum has always been driven by a central mission to build peace in East Asia by facilitating a multilateral dialogue on peace, diplomacy and security among related stakeholders. Though its core vision remains unchanged, the forum has been expanding its scope and boundaries to devote attention to not just international relations, but also a wide range of subjects from other fields: business, economy, technology, environment, renewable energy, climate change, women, education and culture.

Since its inauguration in 2001, the Jeju Forum has made a substantial impact worldwide with its discussion topics (peace, prosperity, sustainability, diversity and competitiveness), prominent speakers and high profile participants, establishing itself as one of the major international fora in Asia. Among this year’s key speakers was United Nations Secretary General **Ban Ki-moon**, who gave the keynote address. After the banquet, an impressive concert featured “Britain’s Got Talent” star Paul Potts and South Korea’s own remarkable singer Insooni.



There was a total of 65 sessions. The **Korean Society of Phycology** organized a session on **Strategic Approaches to CO₂ Sequestration, Algal Diversity and Integrated Multi-Trophic Aquaculture**, and invited **Thierry Chopin** as its international speaker. His presentation was entitled “Integrated Multi-Trophic Aquaculture (IMTA): responsibly farming waters with an ecosystem-based approach and taking advantage of the ecosystem services it provides”.

As the next International Seaweed Symposium (ISS) will take place on Jeju Island in 2019, it was also an opportunity for **Thierry Chopin** (Secretary General of the International Seaweed Association) to



meet with **Jeong Ha Kim** (Chair) and the National Organizing Committee to put the 23rd ISS on the right tracks.

Thierry Chopin also gave his presentation as a seminar at the **Sungkyunkwan University** (where Jeong Ha Kim is a faculty member), in Seoul. This university, founded in 1398 under the Joseon Dynasty, is the oldest in the Republic of South Korea; the University of New Brunswick is also the oldest English-language university in Canada, founded in ... 1785!).



Thierry Chopin was on the Examining Committee of the PhD thesis of **Charline Gentric**, defended at the Université Bretagne Loire, in Lorient, France, on June 6. The thesis was entitled “La bioremédiation *in situ* des parcs conchylicoles par les éponges marines est-elle envisageable?” (“Is *in situ* bioremediation of shellfish leases possible with marine sponges?”).

Marine sponges filter 10,000 times their volume of water per day and retain 80 % of suspended particles such as organic matter, minerals, bacteria and viruses. In addition, sponges are considered to be bio-accumulators of metallic trace elements such as lead, cadmium and copper.

In collaboration with the Comité Régional de Conchyliculture de Bretagne Sud, this thesis investigated the potential of marine sponges on the Brittany coast to reduce the impact of chemicals (heavy metals) and biological contaminants (bacteria, viruses) on shellfish breeding. The marine sponge *Hymeniacidon perlevis* (Demospongiae) was chosen as the model for this study. After demonstrating the feasibility of the culture of marine sponges, the study showed, in laboratory conditions, that this species can reduce the contamination of oysters by two bacteria, *Escherichia coli* and *Vibrio aestuarianus*, and by lead.



While in Lorient, **Thierry Chopin** visited the company **IDmer** and its Scientific Director, **Jean-Pascal Bergé**, who he met during the Monaco Blue Initiative conference last April in São Paulo, Brazil. IDmer supports its customers from the conception and design of new products (value-added by-products and recipe development), through the pre-series production, to the

market entry feasibility study and the implementation of the final products towards commercialization.





Thierry Chopin, then, visited the company **Olmix**, hosted by **Thomas Pavie**, the Director of One Health within the Olmix Group, and **Sébastien Balusson**, its Chief Operating Officer.

The Olmix Group was born at the heart of Brittany, in Bréhan, from the will to find natural alternatives to additives in agriculture. Founded in 1995 by **Hervé Balusson**, the company has been involved in the valorization of algae, basing its philosophy on the belief that they are the new “blue gold”. Olmix Group offers natural solutions made with trace elements, clay and red, green and brown algae. The group’s products are mainly intended for nutrition and health in the plant, animal and human care sectors. The group advocates algae-based natural solutions, which will lead to less pesticides, less antibiotics and less chemical additives. As we are entering a new era of agriculture production, we must learn to do better with less.

There is an obvious convergence between the approach of Olmix and the IMTA philosophy, both embracing an ecosystem-based management vision within a circular economy, taking advantages of both integrated sequential bio-refinery processing and the ecosystem services provided by seaweeds, these unparalleled natural resources still mostly undiscovered, little understood and underused.

Thierry Chopin gave a seminar entitled “Responsibly farming marine and fresh-waters with an ecosystem-based approach and taking advantage of the ecosystem services provided by Integrated Multi-Trophic Aquaculture (IMTA) practices” at the **Breizh Algae School** created in September 2015 in Saint-Etienne-du-Gué-de-l'Isle, after a beautiful renovation of the Balusson family farm.

A wonderfully prepared lunch - including pâté with seaweeds, rillettes with seaweeds, terrine with seaweeds, the Breizh Algae Chicken without antibiotics “thanks to algae”, cheese with seaweeds and a Bordeaux wine from an estate using seaweed-based plant care products - allowed for an animated discussion afterward.

The afternoon was spent visiting the Olmix factory and biotech center in Bréhan, a few kilometers away.





This visit with the Olmix Group was very interesting, fruitful and most enjoyable. The initial contact was taken during a visit (supported by **Business France** and **BioNB**) of a French delegation in November 2015, in Fredericton and Moncton. **Tony Da Cruz**, Food Applications Project Manager, represented Olmix.

Seeing an obvious complementarity, Thomas Pavie and Thierry Chopin have decided to remain in contact for future cooperation and initiatives.

Read the article:

www.breizhalgae.fr/news-posts/echange-scientifique-canadien-francais-de-haut-niveau-sur-les-algues-a-la-breizh-algae-school

Thierry Chopin continued his Brittany foray down to Nantes, to first give a seminar to the Biotechnology and Marine Resource Unit, under the direction of Régis Baron, at the Atlantic Centre of the Institut Français de Recherche pour l'Exploitation de la Mer (IFREMER).

The next day, he participated in the 3-day interdisciplinary conference **Oceanext “Risks and Opportunities in Marine and Coastal Socio-Ecosystems”**, wonderfully organized by **Philipp Hess** (IFREMER) and **Sophie Pardo** (Université de Nantes), with the very efficient logistical support of **Elodie Simon** (Université de Nantes).

This conference was one of the last events organized by COSELMAR, which is a 4-year (2013-2017) “Comprehension of the Marine and Coastal Socio-Ecosystems” network between 5 IFREMER research units and 11 laboratories of the Université de Nantes (and other academic and industrial partners). Its aim is to achieve a better understanding of the marine and coastal ecosystems and the associated resources. The network also provides insights into risk management and prevention of natural events and anthropogenic impacts. One of COSELMAR’s main objectives is to integrate and promote interdisciplinary research between environmental, engineering and social sciences.

Thierry Chopin was one of four plenary speakers:

- **Dorothy Dankel** (University of Bergen, Norway): “Transdisciplinary insights into integrated ecosystem assessments: what they are, what they can be, what they should be”.
- **Chris Bowler** (Ecole Normale Supérieure, France): “Tara Oceans: eco-systems biology at planetary scale”.
- **Thierry Chopin** (CIMTAN, University of New Brunswick, Canada): “Responsibly farming waters with an ecosystem-based approach and taking advantage of the ecosystem services provided by Integrated Multi-Trophic Aquaculture (IMTA) practices”.
- **Luc van Hof** (IMARES, University of Wageningen, the Netherlands): “Facing the future: can foresight studies help to integrate science and stakeholders?”.

There were 11 sessions during the conference, some spread over two days, that really demonstrated an interdisciplinary approach, covering “Coastal and marine management: uses, communities, planning”, “Oceans and human health: toxic and pathogenic organisms”, “Blue growth from marine bioresources and biotechnologies”, “New marine molecules”, “Multidisciplinary research in marine renewable energy”, “From the ecology to the societal impact of harmful algae”, “Risk perception and risk management” and “Climate change of coastal and marine socio-ecosystems: risks, mitigation and adaptation”.

At the end of the first day, there was a very special competition, “3 minutes for COSELMAR”, moderated by **Frédéric Denhez**, radio host on France Inter (show “CO2 mon amour” with **Denis Cheissoux**), journalist, debate facilitator and museographer. Nine duos, or trios, of researchers from



the network had 3, strictly enforced, minutes to popularize their scientific results on stage. An international jury of 7 members (**Elisa Berdalet** from Spain, **Alan Cembella** from Germany, **Thierry Chopin** from Canada, **Gilbert David** and **François Sassi** from France, **Stephen Jay** from England and **Koen Sabbe** from Belgium) and the public voted for the best performance. The winning team was **Vona Meleder** (Associate Professor at the Université de Nantes) and **Thierry Jauffrais** (postdoctoral fellow at the Université d'Angers) for their “Tribunal de la vasière” (“Tribunal of the mudflat”), in which the foraminifer *Haynesina germanica* was accused of kleptoplasty towards diatoms (kleptoplasty is a symbiotic phenomenon whereby plastids from algae are sequestered by host organisms. The word is derived from Kleptes (κλέπτης), which is Greek for thief. The alga is eaten and partially digested, leaving the plastid intact).

Kleptoplasty and its environmental impacts are not easy to explain, but this short and hilarious comedy sketch was remarkably simplified and efficient in its message! After “My thesis in 180 seconds”, this was a wonderful exercise, which should be repeated in graduate schools, workshops and conferences for its undeniable educational value.

The last day of the conference was composed of 4 round tables (Thierry Chopin was a panelist in the first two), facilitated by Frédéric Denhez:

- “Infinite food supplies from the oceans”.
- “What is the future for offshore aquaculture?”.
- “Challenges in marine renewable energy”.



- “Sharing our coasts and oceans”.

Overall, this was an excellent conference, truly interdisciplinary and with interesting format innovations.

From Nantes, **Thierry Chopin** flew to **Las Palmas de Gran Canaria** (Spain) to participate in teaching the course “**Marine Algae Culture: Techniques, Uses and Development Perspectives**” from June 13 to June 17.

The objective of this 5 day course was to give participants a solid overall understanding of basic and applied aspects of both micro-and macroalgae (seaweeds) culture methods and uses, increasing their understanding of their outstanding biotechnological potential. The course programme addressed different aspects related to the biology of cultivated algae, cultivation approaches, novel techniques, and biotechnology, as well as practical case studies.

The course, coordinated by **Bernardo Basurco**, is part of the programme from the **International Centre for Mediterranean Agronomic Studies (CIHEAM)** at the **Mediterranean Agronomic Institute of Zaragoza (IAMZ)**. This year, it took place at the **Universidad de Las Palmas de Gran Canaria (ULPGC)**, through the **EU EcoAqua project**, under the diligent and friendly organization of **Ricardo Haroun Tabraue** and **Gercende Courtois de Viçose**.

It was designed for approximately 30 professionals with a university degree. It was mainly aimed at policymakers, technical advisers, researchers (Master, PhD and Postdoctoral levels), teachers, and producers involved in aquaculture, food and feed industries, biotechnologies, etc.

The country of origin and professional diversity of the participants allowed for some very stimulating discussions and interesting exchanges. The 32 participants came from 13 countries: Algeria, Belgium, Brazil, Canada, Egypt, France (New Caledonia), India, Italy, Morocco, Portugal, Spain, Tunisia and Turkey. The 11 instructors came from 5 countries: Canada, France, Spain (Canary Islands), the Republic of Korea and the USA. Their breadth of expertise enable the coverage of a wide range of topics:

- Marine algae culture and application in a worldwide context (**Ricardo Haroun Tabraue** and **Thierry Chopin**).
- Photobiology and ecophysiology of algae (**Félix Diego López Figueroa**).
- Seaweed production systems and techniques (**Thierry Chopin** and **Ik Kyo Chung**).
- Microalgal production: open systems and photobioreactors (**Juan Luis Gómez Pinchetti**).
- Microalgal production systems and techniques: fermenters and mixotrophic reactors (**Eneko Ganuza**).
- Microalgae in aquaculture: from live to compound diets (**Eneko Ganuza**).
- Commercial applications and prospects for marine microalgae: ingredients for functional foods, nutraceuticals, pharmaceuticals, cosmetics, agrochemicals, pigments and others (**Jean-Paul Cadoret**).
- Commercial applications and prospects for seaweeds, in particular for human food and agriculture/aquaculture feeds (**Lynn Cornish**).
- Seaweed applications: phycocolloids (**Thierry Chopin**).
- Seaweed applications: biofuels (**Juan Luis Gómez Pinchetti**).
- Seaweeds as CO₂ sink (**Ik Kyo Chung**).
- Responsible ecosystem approaches to farming the sea through Integrated Multi-Trophic Aquaculture (IMTA) (**Thierry Chopin**).
- Fish/seaweed/mollusc IMTA in the Canary Islands (**Gercende Courtois de Viçose**).
- Ecosystem services and economic and societal values of the extractive species in IMTA systems (**Thierry Chopin**).



- Advances in seaweed growth and development: from the omics to the end-users (**Rafael J. Robaina Romera**).

- Intellectual property as it relates to marine biotechnology (**Esther Martínez Bravo**).

There were also some field and laboratory sessions covering: seaweed collection on the shore, species identification, measurements of ecophysiological parameters, micro- and macro-algal culture techniques, seaweed culture dynamics, population dynamics in microalgal cultures, and monitoring/collecting/processing of samples and data.

On the last day everybody participated in a round table on prospects for algal culture and commercial applications in the participants' respective countries.

Watch the two videos:

- [A scoop...!](#) The IMTA song finally caught on video at the Marine Algae Culture course in Gran Canaria (Spain).

- [Interview of Thierry Chopin](#) regarding his opinion of the Marine Algae Culture course, his explanation of the IMTA concept, and his comments about the main constraints to the development and implementation of IMTA.





The 22nd International Seaweed Symposium was held in Copenhagen, Denmark, June 19-24. **Thierry Chopin** co-chaired the session “IMTA and biomitigation” with **Alejandro Buschmann**. He also presented one of the 7 papers in this session: “The Canadian IMTA network (2010-16): what have we learned regarding the inorganic component”.

International Seaweed Symposia (ISS) are held every three years under the auspices of the International Seaweed Association (ISA). For more than six decades, the ISS have been the foremost international symposia for individuals and organizations involved with seaweed research and applications. Over the years, ISS have provided a renewed forum for scientists, technologists, business people and resource managers to present their latest research results, exchange ideas and network to develop synergies for strengthening this important bioresource sector.



This year was no exception as 451 participants from 49 countries presented and discussed many aspects focusing on the theme of this year's edition "Academia meets industry". This theme recognized the fact that scientific research plays a fundamental role in the development of seaweed cultivation, harvesting, processing and commercialization.

The program was a rich learning experience and provided opportunities for stimulating discussions. As much as it is interesting and uplifting to see a renewed interest in seaweeds, their cultivation and their use in very diverse applications, one sometimes had to exercise caution as there was a certain penchant in some presentations for Photoshop illustrations, absence of verification of some information obviously found on the Internet, and announcements of grandiose plans not always rooted in reality. It was also sometimes difficult to sit and listen to some presenters, who, obviously, did not have the ecological, physiological or biochemical knowledge that would simplify their investigations and explain some of their apparent confusing results. It was even more ironic when one could notice those who contributed that knowledge, in recent decades, in the audience. Maybe wisdom and experience are acquired after attending many ISS and, hence, with a certain age! There were 6 excellent plenary presentations, highly diverse and delivered in very different and captivating styles:

- (1) **Rocky de Nys** (Australia) took the audience through his IMTA experience with "The integrated culture of seaweeds in waste waters – environmental drivers and product options",
- (2) **Brian Rudolph** and **Hans Porse** (Denmark) covered "The seaweed hydrocolloid industry: 2016 updates, needs and outlook",
- (3) **Yimin Qin** (China) talked about "Research and applications of bioactive seaweed substances – a Brightmoon perspective",
- (4) **Ester Serrao** (Portugal) offered her perspectives on "Shifting genetic baselines in marine forests",
- (5) Chef **René Redzepi** (Denmark) was interviewed by **Ole Mouritsen** to talk about "The use of seaweeds in higher gastronomy", and
- (6) **Catriona Hurd** (Australia) illustrated the impacts of water motion through her in-depth lecture "Shaken and stirred: water motion regulates seaweed resource acquisition and productivity".

Forty oral presentation sessions and 2 poster sessions covered a suite of topical and varied subjects in which seaweeds play crucial roles: cultivation – land-based systems; cultivation – reproductive biology, breeding and genetics; cultivation – design and surfaces; cultivation – optimising temperate seaweeds; cultivation – tropical species; cultivation – stimulation of growth; phycocolloid processing; bioactives – fucoidans; bioactives – antioxidants; bioactives – non-food applications; seaweeds for food, feed and pharma products; seaweeds as food and feed – nutrition/taste/texture; biofuels; ecology – alien, invasive and bloom forming species; ecology – ecophysiology; ecology – diversity, biogeography and productivity; history; seaweed valorization; risk assessment; IMTA and biomitigation; seaweed farming – the next agriculture; seaweed cell wall and associated microbes; challenges and novel enzymes; molecular biology – systematics; molecular biology – stress and defense; socio-economic impacts of seaweed farming; seaweed management and harvesting; ecosystem services; biorefinery, processing and novel enzymes; climate and ecology; and the future of seaweed cultivation.

Throughout the week, a number of exhibitors displayed and sold food, seasonings, beverages and jewellerys made of seaweeds and table clothes and oven mittens with seaweed patterns.





Andrian Rackov (right) and Caroline Longtin (left) checking the reproductive stages of samples of the red seaweed *Palmaria palmata* (dulse) at Green's Point, Letete, New Brunswick (photo credit: Thierry Chopin).

Andrian Rackov, postdoctoral fellow with **David Burns** (Vice-President Research at the University of New Brunswick in Fredericton and Professor of Chemistry) and collaborating with **Thierry Chopin** and postdoctoral fellow **Caroline Longtin**, gave a presentation entitled “Determination of life history phases in the red seaweed *Palmaria palmata* by Raman and near infrared spectroscopy” at the 99th **Canadian Chemistry Conference**, in Halifax, Canada, on June 8.

Cultivation of the red seaweed *Palmaria palmata* (dulse) has great potential in aquaculture at a time when overharvesting of natural beds has been observed. Moreover, it could be an excellent summer candidate in integrated multi-trophic aquaculture systems. However, large-scale cultivation of *P. palmata* has been hampered by a complex life history

in which *P. palmata* alternates between sexual (with gametophytes) and asexual (with tetrasporophytes) reproduction. One of the current challenges is that male gametophytes are indistinguishable from tetrasporophytes by conventional microscopy when they are not reproductively mature.

Andrian is investigating the feasibility of classifying male gametophytes and tetrasporophytes based on their vibrational spectral fingerprints. Measurements of dried *P. palmata* sample sections, which were identified by microscopy when reproductively active, were performed by Raman and near infrared spectroscopy. Spectra were divided into bands, integrated, and subsequently used to compute all possible combinations of ratios. Ratios emphasized relative changes in spectra and were used to classify sample sections as male gametophyte or tetrasporophyte. Using individual ratios or combinations of ratios allowed for classification of samples with sensitivities and specificities of at least 80% for both Raman and NIR methods.

Andrian is now looking at adapting the method to work directly on fresh samples of *P. palmata* and to make the instrumentation portable to the shore. This would open the door to non-destructive sampling, study of population dynamics, and the improvement of cultivation practices without placing pressure on natural populations of *P. palmata*.

CIMTAN Snippets of February 2016 reported on recent forays by CIMTAN members and other experts into the field of economic valuation of IMTA's environmental benefits. Once again we can report on new research in the field of economic valuation and IMTA. A recent article involving CIMTAN economist **Duncan Knowler**, with his students **Winnie Yip** and **Ryan Trenholm** and colleague **Wolfgang Haider**, was published in the *Canadian Journal of Agricultural Economics*; it is entitled “Valuing the willingness-to-pay for sustainable seafood: integrated multi-trophic versus closed containment aquaculture”.

The paper differs from the earlier works (on which Duncan Knowler was also a co-author) by using a different methodology, by focusing on salmon farming in British Columbia (BC) only, and by including consideration of closed containment aquaculture (CCA) as a competing production option.



The CCA practice differs from IMTA by separating farming from the natural marine environment using closed water tanks on land or in water. While both systems provide environmental benefits compared to conventional aquaculture, they have key differences: IMTA is more ecologically based but does not address species escape and disease transfer to wild salmon stock, while CCA avoids the marine environment but has higher energy consumption and issues related to waste treatment and land-use conflict.

The research considered the level of awareness of IMTA and CCA on the USA West Coast and



assessed the willingness-to-pay for salmon produced with these methods. Using a discrete choice experiment, the authors estimated that the average salmon consumer in these key markets for BC farmed salmon would pay a price premium of 39.0% and 15.7% for IMTA and CCA, respectively. Interestingly, 44.3% of the respondents preferred IMTA to conventional salmon farming, while only 16.3% preferred CCA. One group of respondents would only be willing to pay a negative price premium for CCA produced salmon, as it was perceived to be less ecologically friendly than IMTA.

The implications of this research are that perceptions and attitudes towards alternatives to

conventional salmon farming in the *consuming* region for BC farmed salmon appear to favor IMTA over CCA quite significantly. These views are quite different from those in the *producing* region (BC), where the policy discussion mostly revolves around CCA (paper in preparation). Policymakers would be wise to keep this in mind when considering policies supporting more environmentally friendly aquaculture technologies.

Read the paper:

Yip, W., Knowler, D., Haider, W., and Trenholm, R., 2016. Valuing the willingness-to-pay for sustainable seafood: integrated multi-trophic versus closed containment aquaculture. *Canadian Journal of Agricultural Economics* 00: 1-25. DOI: 10.1111/cjag.12102

Read the article:

“Vancouver researchers examine IMTA economics – Study examines willingness to pay for environmental benefits”) by Matt Jones, in *Aquaculture North America*, July-August 2016, p. 26. <http://aquaculturenorthamerica.com/research/research-project-examines-economics-of-imta/>



News from **Marcia Kafensztok**, the wife of the late and dearly missed **Alexandre Wainberg**, the owner of **Primar Orgânica** and pioneer of IMTA in Brazil.

I'm writing to let you know how we are doing here at the farm. The farm is moving forward. It is not easy and we struggle with difficult moments, mostly because of the void left by Alexandre's absence and his vast knowledge of aquaculture. But his network of colleagues and associates has been instrumental in providing us guidance and advice on all the necessary parameters for moving forward. More than 40 professionals are voluntarily contributing with their knowledge (by emails, Whatsapp or via Skype meetings), in order to help us give continuity to our projects.



With Alexandre Wainberg, on our way to visit Ana Carolina de B. Guerrelhas, the owner and director of Aquatec, in July 2014 (photo credit: Thierry Chopin).

Shrimps and oysters are growing in the ponds, the hatchery produced over 600 thousand seeds during the 2015/2016 harvest, the sea horse project has started... So, a lot is going on and many tasks to care for! Here is a link to PRIMAR's current projects:

<http://www.youblisher.com/p/1384313-Primar-2016-institucional-5/>

*Alexandre was very ambitious in opening a hatchery on his own. All the oyster hatcheries that I know are always linked to a university or research center. It has been very difficult to maintain an oyster hatchery. Alexandre took a bank loan in 2013 to develop the lab, and the 2015/2016 harvest was financially supported by **Aquatec** (a shrimp*

*hatchery, one of the largest in Brazil whose owner and director, **Ana Carolina de B. Guerrelhas**, was a personal friend of Alexandre). We will need support to reopen the hatchery for the next harvest seasons, and I am looking for funding support opportunities as well as for learning about models of financial sustainability for hatcheries.*

On a personal note... Bianca is studying Social Sciences at the Federal University of Rio Grande do Norte (UFRN) and living in Natal. I'm still residing in the farm, managing PRIMAR and my own graphic design studio (MK Design), and finishing my master's degree on Interaction Design (human-computer interaction).

I miss Alexandre's presence tremendously, but life is taking its course and going on well, I think...

Marcia, what you do is just simply admirable and impresses us all. Do not hesitate to ask for our help and support when needed.



Caroline Longtin looking for reproductive *Palmaria palmata* (dulse) at Green's Point, Letete, New Brunswick (photo credit: Adrian Hamer).

Caroline Longtin was born and raised in Victoria, British Columbia, and obtained her BSc from the University of Victoria. After completing a semester in the Fall Programme at the Bamfield Marine Sciences Centre, on Vancouver Island, she realized that she wanted to follow her passion to become a seaweed biologist. This passion led her to a PhD at the University of New Brunswick under **Gary Saunders**, where she met **Thierry Chopin** through their shared interests in phycology and membership in the Northeast Algal Society.

After completing a PhD on kelp ecology and taxonomy, Caroline decided to shift gears and start a postdoctoral fellowship in applied phycology with Thierry Chopin where she is currently working on developing *Palmaria palmata* (dulse) as a summer IMTA species, which will

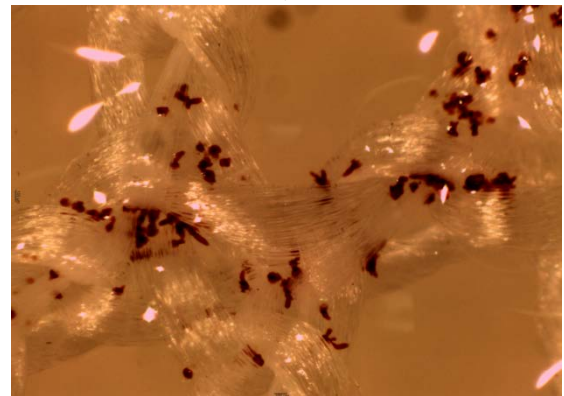
complement the current cultivation of kelps (*Alaria esculenta* and *Saccharina latissima*) as fall to spring IMTA species to increase the biomitigative capacity of the IMTA system.

While *P. palmata* has been harvested for centuries for human consumption, its large-scale cultivation has never been successful. The problem is that *P. palmata* has a complex life history, alternating an asexual tetrasporophyte phase with a sexual gametophyte phase; moreover, female gametophytes are microscopic crusts, while male gametophytes are macroscopic and indistinguishable from tetrasporophytes when they are not reproductive.

Caroline is cultivating juvenile *P. palmata* in the laboratory in the spring for deployment at Magellan Aqua Farms Inc. in summer. She was able to integrate seeded lines at the site in the summer of 2015 with **Samuel Backman** (BSc Honours student and son of **Steven Backman**, the owner of Magellan Aqua Farms Inc.) and seeded panels in the summer of 2016. Caroline is looking at optimizing growth conditions in the laboratory and in the field.

Caroline is also applying the molecular knowledge that she acquired as a PhD student in an attempt to identify a sex-linked molecular marker to aid in the differentiation between immature males and immature tetrasporophytes. The fact that sexual reproduction depends on females being fertilized by males of the previous generation, in combination with the observation that mature tetrasporophytes are present in high abundance during all seasons, suggests that there may be an unknown asexual life history phase. Caroline is currently investigating this possibility of using molecular tools, as this could benefit culturing practices by eliminating the need for sexual reproduction to create multiple generations in culture, thereby reducing the pressure on natural populations.

When Caroline is not working she can be found relaxing at her cottage in Chance Harbour or enjoying a hike on a local trail.



Clusters of 4 week old juvenile male and female gametophytes of *Palmaria palmata* (dulse) settled on nylon netting (photo credit: Caroline Longtin).

CIMTAN member quote of the month: “Dulse has a quirky and complicated life history, which makes it difficult to cultivate because I am unable to keep all stages of the life history in culture at the same time. However, it’s the difficulties that make it exciting and rewarding when I can observe the colonization of a new generation” (*CIMTAN postdoctoral fellow Caroline Longtin*).



Kasper Brandt using a spectrophotometer to measure the colour of recently harvested *Ulva lactuca* (photo credit: Caroline Longtin).

As part of his MSc in Aquaculture and Marine Resource Management at **Wageningen University** in the Netherlands, **Kasper Brandt** joined the IMTA team of **Thierry Chopin** for a 16 week internship.

Kasper started at Wageningen University where he studied for his BSc in biology. He, then, continued to study in the field of aquaculture. For his MSc thesis, he studied the effect of cell-wall strength on the digestibility of microalgae as a feed ingredient for Nile tilapia. Considering algae to be an interesting food- and feed source for the future, he wanted to know more about algae. This led him to the University of New Brunswick, Saint John, where he is working on macroalgae.

Kasper is currently studying how the colour of *Ulva lactuca* (sea lettuce) could be related to its nitrogen

content. If this relationship can be understood properly, then, measuring *Ulva* colour could become a faster, cheaper and simpler valuable tool for measuring nutrient levels in the environment and, hence, eutrophication. To study this relationship, he has set up both a field study and a lab experiment. Every few weeks he goes out into the field, with members of the laboratory, and harvests samples which are then analysed for colour (lightness, chroma and hue) and nitrogen content. For the lab experiment, he has set up a culturing system with seawater with different concentrations of nutrients. Not all the results are in yet, but preliminary results indicate that *Ulva* turns from a deep green colour to a yellow-greenish colour when nitrogen is being depleted. Data from the field also suggest that the amount of nitrogen stored in seaweeds is high in winter and decreases during spring and early summer.



Three of the nine tanks containing *Ulva lactuca* at different enrichments in nitrates at the beginning of the experiment in the laboratory (photo credit: Kasper Brandt).

CIMTAN member quote of the month: “These changes in colour in sea lettuce are amazing... I thought *Ulva* was just green... Yes, bright green in the winter/early spring, but then we go through the whole palette of greens” (*CIMTAN visiting MSc candidate Kasper Brandt*).



To those who say, without having practiced it, that seaweed aquaculture is the low hanging fruit of aquaculture... just try it and then we will talk!!!