CATCH THE LATEST IN FISHERIES

INFOFISH International

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Cover image : Cottage industry in Mersing, Johor, Malaysia. Women making satar, a traditional delicacy made of spiced fish (sardine, mackerel or scad) wrapped in banana leaves and cooked on a grill.

Credit: ©FAO/INFOFISH

This manual is meant to give the seafood industry in the Asia-Pacific region, particularly in the developing countries of South and South East Asia, some basic guidelines on production, packaging and presentation of fifteen selected value added fishery products of potential economic importance to them. The publication specially caters to the needs of the upcoming entrepreneurs in these countries who lack direct access to technical know-how and expertise on the processing steps related to the products.

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Amazing how quickly 2023 has sped by and here we are, about to start 2024. This year, the world marks the 10th anniversary of the endorsement of the Voluntary Guidelines for Securing Sustainable Small-scale Fisheries in the Context of Food Security and Poverty Eradication (SSF Guidelines). INFOFISH fully supports the spirit and intent of this groundbreaking document, which constitutes the first international instrument dedicated entirely to the vitally important, yet widely under-recognized small-scale fisheries and aquaculture sector. Consequently, starting from this first INFOFISH International issue of the year and throughout until December, we will highlight the sector while relating it to the SSF Guidelines wherever possible.

Our lead article on democratizing the implementation of the SSF Guidelines begins this necessary conversation by reminding all parties that the participation of all stakeholders is paramount. Among other factors, this requires democratizing or localizing the consultation process so that its implementation and monitoring is a process by, for, and of the community. In the same vein, two other articles in this January/February issue underscore how working together with communities can bring about results: one discusses the potential of seaweed farming and processing in contributing to livelihood development and empowerment of women in Sri Lanka; and the other details how FAO-Thiaroye Technology (FTT) is addressing the challenges of fishery post-harvest losses and providing better market opportunities for communities in Papua New Guinea.

Under our category of Aquaculture, we bring to you the results of trials being undertaken in a high-efficiency shrimp farm in Brazil. The authors assert that uniformity of size in shrimp culture (which leads to better productivity and higher sale prices) can be assessed manually as well as using artificial intelligence. We also have an article on innovative food and consumer products which are being marketed by Thai Union, one of the biggest seafood companies in the world. The author states that such innovations enable companies to remain relevant to consumers and customers, but that they are not without their regulatory challenges.

In our category of Industry Profile, we are privileged to feature Dr Essam Yassin Mohammed, Director General of WorldFish and Senior Director, Aquatic Food Systems, CGIAR. He presents valuable insights into, among others, the key drivers of growth in global aquaculture; the innovative technologies which can continue to transform the lives of hundreds of thousands in the sector; climate-resilient food production systems; and the role of sustainable finance markets in addressing environmental, social, and governance (ESG) challenges in developing countries.

Also, have a read through our FishBytes section where we present a personal account (or rant) by a well-known voice in the Asia-Pacific, Francisco Blaha, related in his inimitable colourful style.

In addition to the articles and Industry Profile mentioned above, we invite you to peruse the rest of the magazine, the contents of which are intended to provide a holistic view of the global fisheries industry – such as industry notes, marketing information, as well as notes on innovations and equipment. This issue of the magazine is also important in that it carries advance notice of the 18th INFOFISH TUNA Trade Conference and Exhibition (TUNA 2024), our highly successful biennial flagship event for the tuna industry worldwide. Please go to this link for more details: www.tuna.infofish.org

And finally, taking the opportunity of this being the start of another year, allow me to extend our sincere appreciation to INFOFISH Member Countries; FAO and other regional and international organisations; voices from the entire industry and small-scale sector for their continued support and collaboration over the years; and of course, our readers. May 2024 bring better times for all!

Gemma Meermans Matainaho
Acting Director

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Por John Kurien

A diferencia de las convenciones y declaraciones formales de las Naciones Unidas, las directrices voluntarias otorgan un papel integral a los actores de la sociedad civil y a las comunidades a la hora de darles forma. Centrándose en las Directrices voluntarias para lograr la sostenibilidad de la pesca en pequeña escala (Directrices PPE), este artículo subraya la importancia de la implementación a nivel local, dada la importante contribución de las comunidades pesqueras en pequeña escala a las economías nacionales. También sugiere que la democratización requiere participación comunitaria activa, consultas significativas, así como la identificación de indicadores relevantes y acciones participativas. En última instancia, la implementación exitosa de las Directrices PPE requiere el empoderamiento contemporáneo de las comunidades a nivel local y el reconocimiento del verdadero valor de la pesca en pequeña escala en todo el mundo.

Estado de la producción, el comercio y la comercialización de algas en Sri Lanka.....22
Por J.Y.V. Sumanarathna

Las exportaciones de algas de Sri Lanka abastecen a las industrias de fertilizantes y alimentos principalmente en Europa, seguida de Asia, siendo India el mayor país importador de la región. Se están tomando iniciativas para expandir la industria, pero hay algunos obstáculos cruciales que superar, como las condiciones climáticas adversas, la falta de cepas parentales sólidas, sistemas de compra insuficientemente regulados, depredadores y barreras técnicas. El potencial de las algas marinas para contribuir al desarrollo de los medios de vida y al empoderamiento de las mujeres en Sri Lanka podría mejorarse enormemente mediante enfoques tecnológicos, asistencia continua del gobierno, instancias de sensibilización y promoción, inversiones y la creación de un sistema de aprobación de "ventanilla única".

Desafíos regulatorios en la innovación de productos pesqueros: la experiencia de Thai Union 40
Por Sirilak Suwanrangsi

Las innovaciones en la industria pesquera son muy prometedoras para abordar la sobrepesca, reducir el impacto ambiental y satisfacer la creciente demanda mundial de alimentos ricos en proteínas. Destacando el hecho crucial de que tales innovaciones permiten a las empresas seguir siendo relevantes para los consumidores y clientes, este artículo ofrece la visión de la empresa atunera más grande del mundo, Thai Union PCL: desarrollar soluciones innovadoras para mejorar la satisfacción del consumidor, el valor compartido y la sostenibilidad. Sin embargo, estas innovaciones no están exentas de desafíos regulatorios. El autor del artículo examina el complejo panorama regulatorio que rodea las innovaciones en productos pesqueros y analiza las implicaciones de estas reglas para el crecimiento sostenible y el desarrollo responsable.

Empoderar a las pescadoras de Papúa Nueva Guinea mediante la introducción de tecnología innovadora (técnica de procesado FAO-Thiaroye)..... 43
Por Amir Khaleghiyan, Muhammad Atif Nasim y Patu Jume Shang

La Organización de las Naciones Unidas para la Alimentación y la Agricultura (FAO) ha introducido la técnica de procesado FAO-Thiaroye (FTT) en Papúa Nueva Guinea para abordar los desafíos de las pérdidas poscosecha dentro del sector pesquero y brindar mejores oportunidades de mercado. Para determinar la viabilidad financiera y económica, la FAO estableció dos sitios demostrativos y realizó un análisis financiero y económico para comparar las prácticas tradicionales de ahumado con la técnica de FTT. Los resultados mostraron que el beneficio incremental es del 59% TIR, y el análisis también identificó los parámetros sensibles del negocio. Además, el FTT empodera a los operadores pesqueros al resolver las limitaciones de la cadena de frío, el acceso al mercado y el transporte en áreas remotas. También aumenta la producción y la calidad del pescado, reduce las pérdidas y prolonga la vida útil entre 5 y 6 meses.

La importancia de monitorear la uniformidad del camarón para un mejor desempeño en el ciclo productivo..... 50
Por Diego Maia Rocha y Ana Paula G. Teixeira

La uniformidad de las tallas en el cultivo de camarón es un indicio de un buen manejo de la granja, lo que contribuye a una mayor productividad, previsibilidad, consistencia y también, lo que es más importante, mejores precios en el punto de venta. La evaluación de la uniformidad implica observar el coeficiente de variación; porcentaje de uniformidad; y distribución en términos de longitud y peso. Estas evaluaciones pueden realizarse tanto manualmente como mediante inteligencia artificial, como se describe en este artículo, que basa sus observaciones en datos extraídos de los resultados de producción registrados en una granja de alta eficiencia en Brasil.

Rodrigo Misa

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文 章 摘 要

民主化实施小规模渔业自愿准则.....8
作者 John Kurien

尽管与联合国的正式公约和宣言不同，但自愿准则仍然为规范民间社会组织和社区活动发挥着不可或缺的作用。本文重点介绍了《保障可持续小规模渔业自愿准则》（《准则》），并鉴于小规模渔业群体对国家经济的重大贡献，强调了地方层面执行的重要性。本文指出，民主化需要社群的积极参与、有意义的协商，以及相关指标的确定和参与性行动。最后，《准则》的成功实施需要同时在地方层面为社群赋权，并在世界范围内认识到小规模渔业的真正价值。

斯里兰卡海藻生产、贸易和市场情况.....22
作者 J.Y.V. Sumanarathna

斯里兰卡出口的海藻主要供应欧洲的肥料和食品工业，其次是亚洲，而印度是亚洲最大的单一进口国。虽然目前斯里兰卡正在采取措施扩大这一产业，但仍需要解决一些关键的难题，包括不利的气候条件、优良亲代菌株的缺乏、监管不足的采购系统、掠食者和技术壁垒。通过技术方法、政府的持续支持、宣教和推广活动、投资以及建立"一站式审批"系统，可以大大提升海藻在促进斯里兰卡生计发展和妇女赋权方面的潜力。

水产品产业变革面临的监管挑战：泰万盛（Thai Union）经验.....40
作者 Sirilak Suwanrangsi

水产品产业变革有望解决过度捕捞问题，降低环境影响，并满足全球对于高蛋白质食物日益增长的需求。本文强调了一个关键事实，即水产品产业变革可使企业保持与消费者和客户的相关性，基于此，本文对泰万盛集团（Thai Union PCL）的系列产品进行了深入研究。该集团是世界上最大的金枪鱼企业，其使命是为提高消费者满意度、共享价值和可持续性而提供颠覆性的解决方案。不过，这些变革并非没有监管的挑战。本文考察了水产品产业变革中复杂的监管情况，并就这些监管规定对可持续增长和负责任发展的影响进行了探讨。

通过引进创新技术（粮农组织"第阿诺亚"技术，FTT）为巴布亚新几内亚女性渔民赋权.....43
作者 Amir Khaleghiyan, Muhammad Atif Nasim 与 Patu Jume Shang

在巴布亚新几内亚，联合国粮食及农业组织（FAO）引进了"第阿诺亚"技术（FAO-Thiaroye Technology，FTT），以应对渔业产业链中捕捞后损失所带来的挑战，并提供更好的市场机会。为了确定财务和经济上的可行性，FAO设立了两个示范点并进行财务和经济分析（Financial and Economic Analysis，FEA），以此对传统烟熏和FTT烟熏技术进行比较。结果表明，内部收益率增加了59%，通过该分析也得出了烟熏产业的敏感参数。此外，通过解决偏远地区的冷链、市场准入以及运输限制问题，FTT技术提升了渔业产业者的能力。同时，FTT技术也提高了鱼产品的产量和质量，减少了捕捞后损失，并且延长了5-6个月的鱼产品保质期。

监测虾在生产周期中的均匀性对于提高产能的重要性.....50
作者 Diego Maia Rocha and Ana Paula G. Teixeira

在虾类养殖中，大小均匀性是养殖场管理良好的标志之一，它有助于提高生产率、可预测性和一致性；更重要的是，它还可以提高销售价格。评估大小均匀性包括观察变异系数、均匀性的百分比，以及在长度和宽度方面的类别分布。通过分析巴西的一家高效养殖场的生产数据，本文指出对大小均匀性的评估可以通过人工以及人工智能开展。

Wang Beiyang

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خلاصة لأهم المقالات

إضفاء الطابع الديمقراطي على تنفيذ الخطوط التوجيهية لمصايد ألسماك المحدودة النطاق 8

بقلم John Kurien

تلعب المبادئ التوجيهية الطوعية، على نقيض االتفاقيات وإلعالنات الرسمية لألمم المتحدة، دورا أساسيا للجهات الفاعلة في المجتمع المدني والمجتمعات المحلية في تشكيلها. وبالتركيز على المبادئ التوجيهية الطوعية لتأمين مصايد ألسماك المستدامة المحدودة النطاق، تؤكد هذه المقالة على أهمية التنفيذ على المستوى المحلي، نظرا للمساهمة المهمة لمجتمعات الصيد المحدودة النطاق ضمن االقتصاديات الوطنية. ويشير الكاتب إلى أن التحول الديمقراطي يتطلب مشاركة مجتمعية نشطة، ومشاورات هادفة، فضال عن تحديد المؤشرات ذات الصلة وإلجراءات التشاركية. وفي نهاية المطاف، يتطلب التنفيذ الناجح للمبادئ التوجيهية لمصايد ألسماك المحدودة النطاق التمكين المتزامن للمجتمعات على المستوى المحلي واالعتراف بالقيمة الحقيقية لصيد ألسماك على نطاق محدود في جميع أنحاء العالم.

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بقلم J.Y.V. Sumanarathna

تزود صادرات ألعشاب البحرية من سريالنكا ألسمدة والصناعات الغذائية بشكل رئيسي في أوروبا وتليها آسيا، حيث تعد الهند أكبر دولة مستوردة في المنطقة.

ويجري حاليا اتخاذ مبادرات لتوسيع هذه الصناعة وبالرغم من ذلك توجد بعض العقبات الحاسمة التي يجب معالجتها، بما في ذلك الظروف المناخية المعاكسة، واالفتقار إلى الروابط القوية، وأنظمة الشراء غير المنظمة بشكل كاف، والحواجز التقنية. ويمكن تعزيز إمكانيات ألعشاب البحرية في المساهمة في تنمية سبل العيش وتمكين المرأة في سريالنكا بشكل كبير من خالل ألساليب التكنولوجية والدعم المستمر من الحكومة وجلسات التوعية والترويج واالستثمارات وإنشاء نظام "الموافقة الشاملة.

التحديات التنظيمية في مجال ابتكار المنتجات البحرية: تجربة االتحاد التايالندي 40

بقلم Sirilak Suwarangsi

تحمل االبتكارات ضمن مجال صناعة المنتجات البحرية وعودا جمة للتصدي للصيد الجائر، والحد من التأثير البيئي، وتلبية الطلب العالمي المتزايد على ألطعمة الغنية بالبروتين. والجدير بالذكر أنه من خالل تسليط الضوء على الحقيقة الجوهرية المتمثلة في تمكين مثل هذه االبتكارات الشركات من المحافظة على الصلة بالمستهلكين والعمالء، تقدم هذه المقالة نظرة ثاقبة لمجموعة أكبر أعمال التونة في العالم، Union PCL Thai، حيث تتمثل مهمة الشركة المعلنة في تطوير حلول تغير قواعد اللعبة لتعزيز اكتفاء العمالء والقيمة المشتركة والستدامة. وبالرغم من ذلك، ال تخلو هذه االبتكارات من التحديات التنظيمية. ويستعرض الكاتب المشهد التنظيمي المعقد المحيط بابتكارات المنتجات البحرية ويناقش آثار هذه القواعد على النمو المستدام والتنمية المسؤولة.

تمكين النساء الممتهنات لصيد ألسماك في بابوا غينيا الجديدة من خالل إدخال التكنولوجيا المبتكرة (FAO Thiaroye Technology-FTT) 43

بقلم Amir Khalaghiyar و Muhammad Atif Nasim و Patu Jume Shang

أدخلت منظمة ألغذية والزراعة)الفاو(تقنية الفاو-ثيارويي (FTT) في بابوا غينيا الجديدة لمواجهة تحديات خسائر ما بعد المصيد ضمن قطاع مصايد ألسماك وتوفير فرص أفضل في السوق. ولتحديد الجدوى المالية واالقتصادية، أنشأت منظمة ألغذية والزراعة موقعين تجريبيين وأجرت تحليال ماليا واقتصاديا (FEA) لمقارنة ممارسات التدخين التقليدية مع تقنية الفاو-ثيارويي)FTT(. وأظهرت النتائج أن الفائدة إلضافية تبلغ 59% من معدل العائد الداخلي)IRR(، كما حدد التحليل أيضا المعلمات الحساسة لألعمال. وعالوة على ذلك، تعمل تقنية الفاو-ثيارويي)FTT(على تمكين مشغلي مصايد ألسماك من خالل حل قيود سلسلة التبريدوالوصول إلى ألسواق والنقل في المناطق النائية مما يعزز إنتاج ألسماك وجودتها، ويقلل الخسائر، ويطيل مدة الصالحية من5 إلى6 أشهر.

أهمية مراقبة توحيد حجم الربيان للرفع من ألداء ضمن دورة إلنتاج 50

بقلم Ana Paula G. Texeira و Diego Maia Rocha

يعد توحيد الحجم ضمن استزراع الربيان مؤشرا على إلدارة الجيدة للمزارع، مما يساهم في الرفع من إلنتاجية والقدرة على التوقع والتوحيد، وألهم من ذلك، تحسين ألسعار عند نقطة البيع. ويتضمن تقييم التوحيد ألخذ بعين االعتبار معامل االختالف ومعامل التباين؛ ونسبة التوحيد وتوزيع الطبقات من حيث الطول والوزن. ومن الممكن إجراء هذا التقييم يدويا فضال عن استخدام الذكاء االصطناعي، وفقا لما هو موضح في هذه المقالة التي تعتمد في مالحظاتها على البيانات المستقاة من نتائج إلنتاج المسجلة بمزرعة عالية الكفاءة بالبرازيل.

Aziza E Amghari

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DEMOCRATIZING THE IMPLEMENTATION OF THE SMALL-SCALE FISHERIES GUIDELINES

By John Kurien

Unlike formal conventions and declarations of the UN, voluntary guidelines provide an integral role for civil society actors and communities in shaping them. Focusing on the Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries (SSF Guidelines), this article underscores the importance of local-level implementation, given the significant contribution of small-scale fishing communities to national economies. It suggests that democratization requires active community participation, meaningful consultation, as well as identification of relevant indicators and participatory actions. Ultimately, successful implementation of the SSF Guidelines requires contemporaneous empowering of communities at the local level and recognizing the true value of small-scale fishing worldwide.

Credit: FAO

In the early decades of the 21st century, the United Nations (UN) system witnessed an array of negotiations and the subsequent adoption of numerous voluntary guidelines. These discussions, largely facilitated by the Committee on Food Security (CFS) and the Food and Agriculture Organization of the United Nations (FAO/UN), have been pivotal in addressing the needs of communities reliant on the Earth's land and water resources.

Prominent among these guidelines were the following: the Voluntary Guidelines to Support the Progressive Realization of the Right to Adequate Food in the Context of National Food Security (VGRT); the Voluntary Guidelines on the Responsible Governance of Tenure of Land, Fisheries and Forests in the Context of National Food Security (VGGT); the Voluntary Guidelines for Sustainable Soil Management (VGSM); the Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries in the Context of Food Security and Poverty Eradication (VGSSF); and the Voluntary Guidelines on Food Systems for Nutrition (VGFSyN). While these guidelines were adopted by collective consensus of participating States, the final decision regarding their adoption and implementation at the national level rests primarily with individual Member States of the UN system.

This article explores the significance of guidelines and underlines the pressing need to democratize their implementation and monitoring, with a specific focus on the Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries in the Context of Food Security and Poverty Eradication (SSF Guidelines).

The negotiation process

One notable aspect of the negotiation process for these guidelines has been the diverse involvement of non-State, civil society actors. This category encompasses an array of groups, including social and environmental organizations, indigenous associations, trade unions, professional bodies

representing peasants, rural labourers, and fishermen, support groups, industry representatives, and academics. These actors have played instrumental roles in shaping the initial drafts of the guidelines, forming the bedrock upon which the final negotiated texts stand. Their active participation in the negotiation process has been invaluable.

A pertinent example is the Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries in the Context of Food Security and Poverty Eradication, or SSF Guidelines. From the very outset, there was a remarkable grassroots effort to incorporate the concerns of the small-scale fisheries sector. Over 4 000 individuals, with a significant majority being fishers and fish workers—both women and men—alongside diverse civil society representatives from over 120 countries, took part in this process. They voiced their concerns and aspirations, ensuring that these Guidelines would be inclusive and representative.

Post-adoption pressures

Following the adoption of these voluntary guidelines, divergent approaches and perspectives unfold regarding implementation.

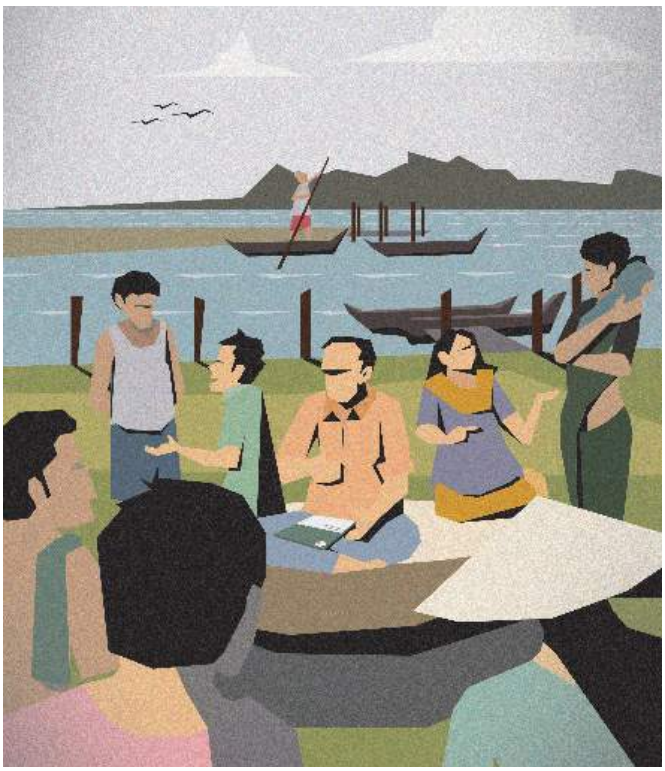
UN organizations make quick steps that lead in providing technical guidance on how to implement the Guidelines and take measures to garner support from all relevant stakeholders. Monitoring mechanisms are put in place to ensure implementation progress is tracked, primarily at the national level.

States on the other hand, may often merely adopt international agreements and guidelines, but without having clear strategies for national implementation. This can stem from their multitude of concerns spanning various economic sectors. Additionally, the commitment to implementation may be influenced by strategic considerations. Also, the absence of public pressure from the grassroots level can lead to inaction. Nevertheless, the moral pressure exerted by the UN system, pushing States to report on the actions taken, does compel some commitment to implementation.

Civil society actors, with their manifold objectives and commitments related to socio-economic, environmental, and political factors, may not always share common perspectives and strategies for advocating implementation. For instance, prominent environmental organizations usually lead the charge in advocating for resource conservation and environmental protection during international negotiations. Academics may focus on generating new research questions and facilitating knowledge-sharing and innovation in relevant sectors. On the other hand, social activists and community facilitators are typically eager to implement actions that improve conditions and ensure human rights for those involved in the sector.

Local communities left out?

Surprisingly, the communities themselves, who are dependent on the land and water for their livelihoods, are often uninvolved in implementation. Generally, this is due to the lack of awareness of the content and significance of international guidelines designed to enhance their rights and capabilities for a better life. Several factors contribute to this situation. In some cases, the guidelines may not be available in a language or format that is easily understandable to the community. Even when language barriers are overcome, understanding how to put the guidelines into action may remain unclear or challenging without proper guidance. These factors deter and discourage local communities from actively participating in the implementation of guidelines designed for their benefit.



Go to the people *Credit: Deepak Sivan*

While communities may have actively contributed to the formulation of these guidelines by proposing inputs, as in the case of the SSF Guidelines, their role in monitoring and evaluating the implementation of the adopted texts is often limited, if not entirely absent. At best, they may observe implementation, carried out in their name, as passive onlookers.

Need for a transformative shift

A transformative shift is imperative to mainstream community participation in the implementation and monitoring of such guidelines. The call is for "taking back voluntary guidelines to the community"; de-mystifying their contents; consulting communities to determine the indicators they will use to evaluate progress; and collaborating with them to develop suitable tools for this purpose. Essentially, the aim is to democratize the implementation and monitoring of voluntary guidelines, making it a process by, for, and of the community.

Let us examine how local communities can undertake these tasks of democratization, with a specific focus on the SSF Guidelines.

Implementation at the local level

The SSF Guidelines were officially adopted by Member Countries of the Food and Agriculture Organization of the United Nations in June 2014. What

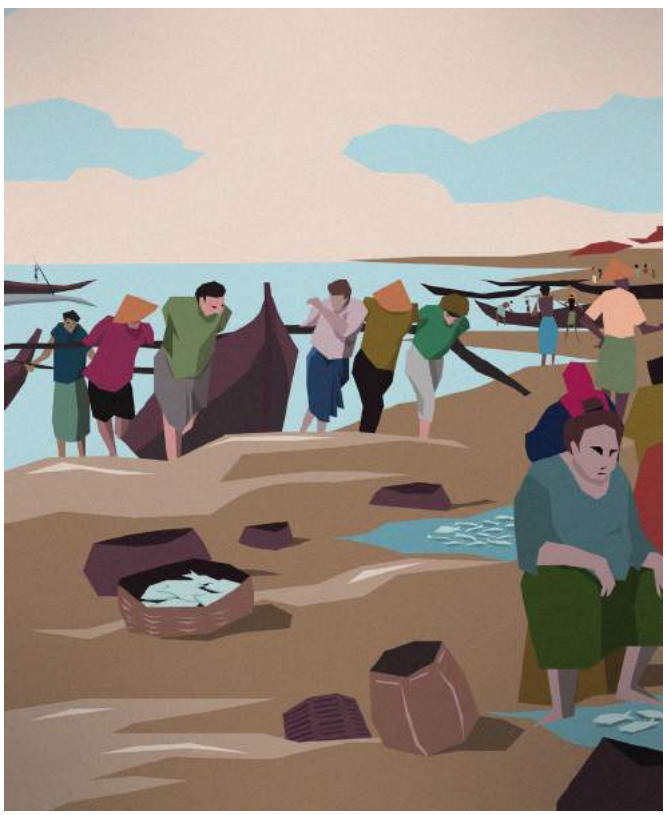
sets the SSF Guidelines apart is their origin in the long-standing struggles of small-scale fishworkers worldwide, advocating for recognition of their status and role in their respective countries' fisheries sector.

Small-scale fishers are the backbone of the fisheries sector in many countries worldwide; yet they have often been marginalized and neglected during the modernization of the sector. Despite this neglect, small-scale fishing communities continue to contribute significantly to national economies. However, this contribution is under-valued, and the communities themselves are left impoverished and deprived of their human rights for socio-economic and cultural development. The SSF Guidelines acknowledge this reality and aim to refocus attention on small-scale fisheries' development and management.

The SSF Guidelines also recognize the diverse nature of small-scale fisheries. They acknowledge that there is no single agreed-upon definition for small-scale fisheries, and that the Guidelines do not prescribe how they should be applied nationally.

Perhaps it is only in small island States where the role and economic contribution of small-scale fisheries are adequately recognized and accounted for at the national level. In most other countries, while small-scale fisheries may seem unimportant at the national level, they are often best acknowledged and addressed at the local level, where they are simply too significant to ignore socio-economically or culturally.

The SSF Guidelines, throughout its text, place considerable emphasis on the local context, referring to "local communities," "local economies," "local government," and similar terms.



SSF at the Local Level *Credit: Deepak Sivan*

It is at the local level that the contributions of small-scale fishing communities to the economy, employment, nutrition, social and cultural heritage, knowledge, and technical skills are most readily perceived and recognized. This is where these communities interact most intimately with nature, each other, and the rest of society.

Thus, it is at the local level of governance, known by different terms across the world—*commune, municipalidad, desa, parishad, panchayat, barangay, phum, cunji, phuong, kampung*—and so forth, where small-scale fishing communities must be facilitated to engage and participate fully in the implementation and monitoring of their present status, continued welfare, and emerging future.

This is the governance scale where relevant indicators and participatory monitoring tools should be fostered to track changes in the lives of small-scale fishers. The SSF Guidelines serve as a guiding light and a Magna Carta of sorts.

How to democratize implementation of the SSF Guidelines

As alluded to above, the effort to implement the SSF Guidelines is genuinely meaningful only at the realm where people are interacting between themselves and nature most intimately. At this local level, they need to comprehend the issues which are of consequence to their life and livelihoods, which engage the minds of community members. These can be fathomed by civil society facilitators who will be willing and able to enter into deep conversations with individuals and groups in the community.

In other words, democratizing the SSF Guidelines at the local level requires full and committed participation of the members of the community.

The SSF Guidelines frequently mention the term "participation" and the need for "participatory" processes. One of its guiding principles (Principle 6) specifically emphasizes consultation and participation, highlighting the importance of active, free, effective, meaningful, and informed participation of small-scale fishing communities, including indigenous peoples, in decision-making processes related to fishery resources. Participation is not a passive activity; it involves judicious collective action.

Effective and meaningful participation requires facilitation and fostering. People's participation in any process may initially be hesitant and apprehensive; but with respectful facilitation, information-sharing, opportunities, and experiential learning, attitudes and barriers can gradually change. Participation becomes effective and meaningful when individuals and communities gain knowledge, strength, confidence, and a vision to work together for positive change and empowerment.

The first task is to identify the processes, policies, and activities mentioned in the SSF Guidelines, which need to be monitored. The attempt should be to identify the overlaps between people's issues and relevant paragraphs in the Guidelines.

The second task is to consider what issues/questions arise regarding the processes, policies, and activities discussed in the relevant paragraphs.

https://www.fao.org/voluntary-guidelines-small-scale-fisheries/en/

FAO. 2015. Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries in the Context of Food Security and Poverty Eradication. Rome.

Box 1: What is in the SSF Guidelines

The SSF Guidelines contains a Preface and three Parts, composed of 13 chapters and a total of 100 paragraphs

The Preface describes and situates small-scale fisheries in the context of global fisheries.

Part 1 is an Introduction, composed of four Chapters and ten paragraphs. They contain the objectives, nature, and scope, provide the guiding principles, and elaborate on the relationships with other international instruments.

Part 2 containing five Chapters and 61 paragraphs deal with the realm of responsible fisheries and sustainable development and relate to processes, policies and events that are of important material consequence to the small-scale fisheries. These include the crucial issues of tenure, resource management, social development, work, post-harvest, trade, risks of disaster, climate change and gender equality across them all. It is here that the overlaps between people's lives and livelihood concerns and this internationally-negotiated instrument are obviously evident.

Part 3 containing four Chapters and 29 paragraphs elaborates on how to support an enabling environment and ensure implementation. This Part covers the need for policy coherence and coordination, while stressing the need for information, research, communications, and capacity development to aid implementation and monitoring of progress towards achieving the objectives spelt out in **Part 1.**

Main thematic areas of the SSF Guidelines

Undoubtedly, the levels of participation of the community in each of these tasks will vary. But what we need to remember is that participation – of a community or any group within it – to monitor processes, policies and activities which affect their lives should be premised on a collective human-centered and human-rights approach that affirms both the specificity of context and cultural and socio-economic diversity.

Effective and meaningful participation is ultimately about people gaining knowledge, strength, confidence, and vision to work together towards positive change. It is about empowerment. This is the sure approach to ensure democratization of the SSF Guidelines.

To achieve the aspirations outlined in the SSF Guidelines regarding monitoring and implementation, efforts must begin at the local community level and then extend to higher levels of governance. Only such a nested and contemporaneous approach can lead to building the pressures at the national and global levels to recognize the true, often hidden significance and value of small-scale fishing and the millions of women and men who are joyfully and earnestly engaged in it.

"Go and meet your people, live and stay with them, love them, work with them. Begin with what they have, plan and develop from what they know, and in the end, when the work is over, they will say: we did it ourselves."

Chinese philosopher Lao Tsu (600 BC)

The third task is then to suggest the relevant indicators which can be used to assess/measure the status and changes which occur regarding these issues/questions, and ascertain with the real actors in the small-scale fishery, what and how they will measure them.

And finally, the fourth task is to spell out the participatory actions, methods, tools which can be used to monitor these indicators. Fathoming the way communities collectively undertake and resolve certain local social issues; for example, solving disputes, implementing tenurial practices, assessing new technologies or delineating boundaries, can provide key insights into methods and practices which are customarily in use. While this task may be creatively facilitated by civil society animators, respecting and retaining the ethos and customary practices of the community is paramount.

Dr John Kurien *is a reflective practitioner. His involvement with small-scale fishing communities started five decades ago in Kerala State, India, living and working with them to organize local-level cooperative institutions for fish marketing. Moving later into action-oriented research, he helped to highlight the true significance of small-scale fisheries from various perspectives. In 1984 he took the initiative to organize the first international conference of fishworkers and their supporters which was held in Rome. He later founded the International Collective in Support of Fishworkers (ICSF) in 1986. He has worked with the FAO/UN in various capacities in Cambodia and Indonesia and was also the Vice-Chair of the FAO/UN Advisory Committee for Fisheries Research (ACFR) for a decade. He retired as Professor from the Centre for Development Studies, Trivandrum, India.*

The war in Ukraine and trade sanctions on fish and fishery products from the Russian Federation

Introduction

The war in Ukraine had an immediate and dramatic impact on the global economy, especially food and energy markets. There was a worsening of a number of pre-existing trends that emerged following the COVID-19 pandemic; further, the consequential effects of the war formed a part of the 2021–2023 global energy crisis, 2021–2023 inflation surge and 2022–2023 food crises.

Since the start of the war, its impact on global commodity markets has abated somewhat, lessening upward pressure on input costs. The Black Sea Grain Initiative allowed Ukrainian maritime trade for certain goods from July 2022, easing global supplies of cereals and lowering aquatic feed prices. Brent crude oil prices have remained below pre-invasion levels since November 2022, easing fuel and input costs.

These two Market Trends pages are a succinct overview of the major repercussions of the war in Ukraine and consequent trade sanctions on fish and fishery products from the Russian Federation, in relation to global markets. The following relevant excerpts are from the GLOBEFISH Highlights (Issue 02, 2023), chronicling the impact of the war in Ukraine as events unfolded.

Trade sanctions

While sanctions have largely focused on other goods, a number of countries have issued trade sanctions covering fish and fish products, ranging from tariffs to import bans on Russian goods and bans on Russian Federation-flagged vessels accessing ports. Certain countries already had restrictions in place following the occupation of Crimea in 2014. Major markets for fisheries and aquaculture products, most notably the United States of America, have banned imports of Russian seafood. Other markets, such as the European Union and Canada, have banned imports of caviar and caviar substitutes, crab and shrimp.

Trade disruptions

The Russian Federation is the third largest exporter of fish and fish products in the world, by value. The Russian fisheries sector is highly export-oriented, with more than half of production destined for international markets. Crab (snow crab, king crab), groundfish, salmon and small pelagics are the most valuable exports. Ukraine is a net importer of fish and fish products and prior to the war, was a relatively large import market for salmon and mackerel. Ukraine has a modest processing sector, primarily fileting imported salmon and cod. The war has severely impacted infrastructure, and trade is likely to be impacted for some time to come.

Energy prices

Early 2022 saw oil prices spike, with the Brent index jumping from USD 92 towards the end of February to USD 123 in early March 2022. Prices experienced a period of volatility, but since November 2022, they have remained below pre-invasion levels. The importance of fossil fuels across all stages of the fish value chain has the potential to change costs and prices significantly.

Inflation

Exacerbating COVID-19 pandemic-driven trends, the war in Ukraine has been a major driver of global inflation, with food and fuel inflation being the primary sources of recent inflation.

Excerpts from GLOBEFISH material

The following texts are taken from commentaries written by GLOBEFISH analysts, touching on overall impacts and commodity-specific changes. In addition to the excerpts, data on fisheries and aquaculture production, trade and other information for the Russian Federation and Ukraine may be found in the GLOBEFISH Market Profiles.

Fish and fishery products – Food outlook June 2022

The war in Ukraine has introduced several additional concerns and uncertainties that are affecting the market. The extensive trade sanctions and boycotts of Russian products imposed by governments and businesses have prompted a reshuffling of trade routes and a scramble to fill shortfalls with alternative suppliers. In addition, inflation rates are now at extreme levels in many countries, while increasing commodity prices mean more expensive inputs, including feed and fuel. Combined with the continuing high cost of freight, this is squeezing margins all along the supply chain, particularly for processors, and pushing many seafood prices up.

Groundfish – Highlights June 2022

The outbreak of the war in Ukraine and subsequent sanctions on the Russian Federation have affected whitefish prices considerably. Prices for Norwegian headed and gutted cod shot up in March 2022 as many traders saw Russian fish as too risky. A shortage of fish is pushing prices up, and if sanctions against the Russian Federation are intensified, supplies will become even more problematic, and prices increase further. In addition to the effects of the war, inventories of several products are currently low. Normally, prices slip a bit during February and March as landings pick up, but that scenario did not happen in 2022.

Salmon – Highlights June 2022

The war in Ukraine, the resulting international sanctions, as well as the consequent impacts on logistics and the world economy are now central in

the minds of analysts and observers of the global salmon sector. The rise in commodity and food prices directly impacts businesses' bottom lines, while the political repercussions of the war are deep and far-reaching. Large Western retail chains have pulled out of the Russian Federation in response to the war, and although the majority of European salmon production has been subject to a Russian embargo for many years, the Republic of Chile has expanded its share of the Russian market significantly and now exports some 50 000 tonnes annually to the Russian Federation. For retailers outside of the Russian Federation, the war is nevertheless still a primary determinant of business decisions. Many have committed to reducing or eliminating products sourced from the Russian Federation, including seafood products. At the same time, the combination of increased costs, tight supply, recovering demand and widespread uncertainty is creating difficulties for many stakeholders, particularly processors and other supply chain intermediaries, despite the substantial increase in revenues resulting from spiking price levels.

Shrimp – Highlights June 2022

Imports in the Russian Federation are seriously affected because of the war in Ukraine. Shipments to the Russian Federation, the Republic of Ecuador's sixth-largest shrimp market in 2021, have been forced to divert to other markets due to logistical complications and payment difficulties.

Shrimp – Highlights March 2023

The year-long war between the Russian Federation and Ukraine reduced shrimp consumption in both markets. The estimated imports in the Russian Federation would be about 30 000 tonnes – 50 -60 percent lower than in 2021. Imports in Ukraine fell by 57.6 percent at 5 640 tonnes during this period.

Crab - Highlights June 2022

The war in Ukraine is having a major impact on the crab industry. The Russian Federation is the largest supplier of king crab and a major supplier of snow crab, and is now cut off from important markets. Trade has been diverted to countries that have not imposed trade sanctions on the Russian Federation. A result of all this turbulence is skyrocketing prices.

N.B trade data based on mirror data, as Russia has stopped reporting all trade data.

The Russian Federation exported USD 2.4 billion of crab in 2021, and secured 94 percent of the global red king crab quota for 2022. With Russian seafood now facing import bans in a number of countries, Russian crab is expected to be diverted to and through the People's Republic of China and the Republic of Korea, neither of which have imposed sanctions on the Russian Federation.

Crab – Highlights March 2023

Supplies of king crab will be very tight in the coming months, as US distributors are running out of stocks of Russian crab. A year ago, there was a surge in imports of Russian king crab just before the ban was introduced in June 2022. But these stocks are now running out, and it does not seem that there are any substitute supplies. Thus, supplies of red king crab on the US market will decline further, and prices are expected to rise.

Small Pelagics – Highlights June 2022

The war in Ukraine has disrupted the market for small pelagics. While the Russian Federation is a major producer, market, and trader, Ukraine is an important market, especially for capelin. The Russian Federation, itself a big consumer of small pelagics, has had to rely more on domestic landings since trade was restricted following the 2014 invasion of Crimea. In the normal course of events, some of the Norwegian herring catch would find its way to the Russian Federation and Ukraine; however, the war has disrupted this trade for the foreseeable future.

N.B trade data based on mirror data, as Russia has stopped reporting all trade data.

Mussels – Highlights March 2023

Total trade in mussels shrunk in the first nine months of 2022, mainly due to a sharp decline in trade with the Russian Federation due to the war in Ukraine. As a result, the Russian Federation imported 920 tonnes of mussels in the first nine months of 2022, which compares to 16 190 tonnes during the same period of 2021. The Republic of Chile, which used to be the main mussel trading partner for the Russian Federation, was impacted by the disappearance of this trade. In fact, in the first nine months of 2022, Chile exported some 76 380 tonnes of mussels, down 6 000 tonnes from 2021. Despite this decline, Chile continues to be the main mussel-exporting country.

Source: Globefish Highlights Issue 02, 2023 (https://www.fao.org/in-action/globefish/globefish-home/en/)

Overview: Production to remain stagnant in 2023

2023 has proven to be a challenging year for the fisheries and aquaculture sector, with supply being generally tight, with weak demand and notable shifts in trade patterns. Economic factors, particularly inflation and changing consumer preferences, are influencing the industry, resulting in stagnant consumption and production.

While overall consumption has recovered to pre-pandemic levels, there are widespread concerns for the market in the face of rising living costs. Average global consumption has remained the same as in 2022 at 20.6 kg per capita. As disposable incomes have shrunk, so has consumption growth, with aquatic foods suffering ever-increasing price competition with other protein sources. Especially in richer economies, higher-priced fish products have seen weak sales as consumers trade down to cheaper options. This has been reflected in weak demand for categories such as snow crab and lobster. Other products, such as shrimp, are seeing intense competition, with producers complaining of low prices and, in particular, poor price transmission despite higher production costs.

On the production side, total output for the year is projected to reach 185.4 million tonnes, a modest increase of 0.6 percent compared to the previous year. Aquaculture output saw a modest increase of 2.8 percent on 2022 levels, with rising operational costs and inflation hindering production. Output from wild capture fisheries decreased by 1.7 percent to 89.6 million tonnes, mainly due to reduced fishing quotas for several principal whitefish species and the effects of the El Niño phenomenon. El Niño has had a particularly pronounced impact on Peruvian anchoveta catches, which represent one of the largest fisheries in the world. Peru's first anchoveta season of 2023 was cancelled, which has resulted in a shortfall of some 2 660 000 tonnes of fish compared to previous years.

The outlook for aquatic commodities is varied, and continues to evolve. The cephalopod sector is dealing with declining octopus landings and a decrease in Loligo squid supplies, while the crab market is experiencing tight supplies of king crab in North America. The groundfish segment will see a 20 percent reduction in cod quotas, but an increase in pollock. The lobster industry is under pressure from reduced US landings, and small pelagic fish like herring and mackerel are facing recommended catch reductions. Tilapia production and trade volumes are stable but facing high costs and demand instability. Pangasius farmers are struggling with stagnant production and reduced harvests, compounded by the El Niño event affecting the Mekong delta.

(Source: Globefish Highlights Issue 04, 2023)

Pangasius: Production stagnant, trade volumes down

Farmers are struggling to break-even at current prices, with stocking levels for harvest in 2023 being conservative compared to 2022. Harvests so far this year have been significantly reduced, while major markets have also reduced their imports of pangasius. Furthermore, the impact of the 2023 El Niño weather event is already being felt, with limited rainfall across the catchment area of the Mekong delta expected to increase saltwater intrusion for Vietnamese and Cambodian pangasius farmers, in turn further limiting global supplies.

Production

Viet Nam, the main global producer of pangasius, has seen harvests fall dramatically so far this year, following high rates of growth in 2022 which saw pangasius harvest rise by 8 percent year-on-year. The first half of 2023 has, however, seen a large reduction in harvest volumes, particularly for key marketable sizes. High rates of disease incidence in fingerling production have been chiefly to blame, as this pushed prices beyond the means of many farmers. Poor weather has also played a role, with the current El Niño weather event disrupting normal farming operations. Perhaps most importantly, there has been greatly reduced rainfall across the catchment area of the Mekong delta, which has brought anticipated saltwater encroachment into growing areas. Temperatures are considerably higher than in previous years, leading to higher pond mortality rates. The net result is a likely further reduction in output volumes, as well as reduced availability of larger sizes as farmers move to harvest earlier.

Fingerling prices in October are now significantly lower than they were at the beginning of the year, reflecting weak demand from farmers who remain highly conservative with their stocking levels. Feed prices, which constitute the majority of farmers' costs, have seen considerable volatility over the past two years. However, having remained relatively stable since the first quarter of the year, there is some indication that a degree of stability is returning to the market.

Trade

Vietnamese exports so far this year are well below previous levels, with volumes of just 231 000 tonnes in the first six months of the year, down 35 percent on the same period of 2022. Major markets are failing to support the levels of demand that were seen last year, with significant reductions across the board.

The Chinese market, still the largest by volume, has seen a stark contraction so far this year. This is believed to be largely due to increased competition from domestically farmed fish, although reduced availability of supplies has also played a key role. While they imported 125 000 tonnes of Vietnamese pangasius in the first six months of 2022, in the same period of 2023 this dwindled to just 60 000 tonnes. The United States of America, the second largest market by volume, has seen a similar reduction with imports in the first half of the year falling to 39 000 tonnes, down from 75 000 tonnes.

Prices

Farmgate prices stabilized at VND 27 000 per kg (USD 1.10 per kg) in September 2023. While prices are slightly below their peak earlier in the year, they are still considerably higher than levels seen in previous years; at the beginning of 2020 farmgate prices were VND 18 000 per kg (at that time 0.78 USD). At the same time, farmers' costs have increased considerably, especially for feed. One estimate by the Viet Nam Pangasius Association puts production costs at the equivalent of USD 1.20 per kg, highlighting that farmers are losing money at current prices.

Outlook

Low prices and falling profitability have made pangasius farmers cautious, severely reducing supply. The short rearing cycle of pangasius does mean that the industry has the capacity to change relatively rapidly, with previous periods of low output often followed by higher prices and increased stocking. This boom-and-bust cycle has repeated itself several times over the past several years, with the industry struggling to maintain stable output. However, if the current El Niño weather conditions persist this will severely limit the available farming area while keeping mortality rates high, restricting production.

DR ESSAM YASSIN MOHAMMED

Director General, WorldFish and Senior Director, Aquatic Food Systems, CGIAR

Q: *Dr Essam, you have multi-country experience in Sub-Saharan Africa, (South, Southeast and East) Asia, Latin America and Europe. In which region of the world have you observed the most significant progress in aquaculture over the past decade, and what have been the factors that have been the main drivers in this process?*

A: In reflecting upon my experiences in various global regions, it's evident that Asia stands out for its significant progress in aquaculture over the past few decades. The key drivers of this growth have been well-aligned policies and the adoption of adaptable technologies, especially by small-scale operators.

Asian governments have implemented policies that effectively align incentives with sustainable aquaculture practices. These policies have not only promoted environmental stewardship but also ensured economic viability. By offering fiscal and other incentives, governments have encouraged investment in aquaculture, leading to its expansion and modernization. For example, China's 13th Five-Year Plan for the Development of National Fisheries outlined specific goals for sustainable and efficient aquaculture, emphasizing green development. This policy support, along with incentives for adopting eco-friendly practices, has been instrumental in modernizing China's aquaculture industry.

A crucial aspect of Asia's aquaculture success has been the development and dissemination of technologies that are easily adaptable by small-scale operators. These technologies include cost-effective feed management systems, simple yet effective disease control measures, and low-cost water quality management techniques. For example, Bangladesh has seen a significant adoption of simple pond aeration techniques and low-cost feed management systems among small-scale farmers, greatly increasing production efficiency and fish health. By making these technologies accessible, small-scale operators, who form the backbone of the industry in many Asian countries, have been able to increase their productivity and sustainability.

The growth in aquaculture has been further bolstered by a supportive financial ecosystem. Banks and microfinance institutions in Bangladesh, Malaysia and other places have played a crucial role by providing tailored financial products and services, ensuring that small-scale operators have access to necessary capital.

In short, the phenomenal growth of aquaculture in Asia can be attributed to the synergy between policy-driven incentives, investments, and the availability of adaptable technologies for small-scale operators. These factors have collectively created an environment where aquaculture can flourish sustainably, offering a model for other regions to emulate.

WorldFish has introduced a digital survey tool for tracking on-farm aquaculture systems performance and risk factors, including productivity, profitability, input use and farm management practices, fish epidemiology and environmental changes, using a smartphone.

Q: *FAO has declared priority areas for the transformation of Asian aquaculture, where digital technologies and intelligent systems, value chain efficiency, and addressing climate change impacts were highlighted (SOFIA 2022). Taking digital technologies as an example, WorldFish is reported to have developed several useful digital tools such as FishBase, FishScores and Lab-in-a-Backpack. Will there be other digital tools on the way, but more specifically for the artisanal sector?*

A: WorldFish, as a pioneer in this field, has indeed developed several innovative tools like FishBase, FishScores, among others, demonstrating our commitment to leveraging digital technology for sustainable and inclusive aquaculture. A couple of notable innovations include:

Climate Information Services for Fish Farmers in Bangladesh: Recognizing the challenges posed by climate change, particularly for small-scale fish farmers, WorldFish has been instrumental in developing climate information services in Bangladesh. These services, which have reached >100,000 fish farmers provide vital information on weather patterns, water conditions, and potential climate risks. By delivering this information through accessible digital platforms, these services have empowered small-scale fish farmers to make informed decisions, thereby enhancing their resilience to climate variability.

Lab-in-a-Backpack: Another innovative tool, the Lab-in-a-Backpack, exemplifies the kind of practical, field-oriented technology we aim to develop for the artisanal sector. This portable lab allows for on-site water quality analysis, disease diagnosis, and more, making advanced scientific tools accessible to small-scale fish farmers. This kind of innovation is not just about bringing technology to the field; it's about adapting it to meet the specific needs and constraints of small-scale fish farmers.

As we look towards the future, a key focus for WorldFish in transforming aquaculture lies in the strategic integration of our widely used databases into the choice architecture, complemented by the deployment of Artificial Intelligence (AI). Our goal is to develop user-friendly decision tools that can inform both policy and investment decisions in the sector.

Q: *This leads us to the next question. Recently WorldFish launched The Africa-Asia BlueTech Superhighway (AABS) Project, described as a "two-continent program to transform the lives of hundreds of thousands of stakeholders working across aquatic food systems in Africa and Asia." One Project focus was stated as "to bridge data gaps in small-scale aquatic food systems". How does WorldFish and its partners plan to build the necessary digital infrastructure and expertise from a local perspective in both continents, while leveraging local means and networks?*

A: The Africa-Asia BlueTech Superhighway project, initiated by WorldFish and supported by the UK's Foreign, Commonwealth & Development Office (FCDO), is set to make a profound impact in the realm of small-scale fisheries, particularly in Coastal East African countries—Kenya, Tanzania, and Mozambique. A critical component of this transformative initiative is the scaling of Peskas, an innovative open-source fisheries monitoring system, which has already shown promising results in Timor-Leste.

The expansion of Peskas to these East African nations is pivotal in addressing the perennial challenge of data gaps in small-scale fisheries. Historically, these fisheries have been under-represented in national and regional statistics, leading to a lack of informed policy and investment decisions. Peskas offers a robust solution to this issue by enabling the collection of accurate and comprehensive data on fishing activities, catch volumes, and fish stocks. Its successful implementation in

Trialed successfully in Timor-Leste, Peskas is one of the most sophisticated data collection systems for small-scale fisheries in the world.

Timor-Leste. has demonstrated its potential to revolutionize data collection and management in small-scale fisheries.

In Kenya, Tanzania, and Mozambique, Peskas will be tailored to the local contexts, taking into account the unique environmental conditions and fishing practices of each region. This localization is crucial for the system's effectiveness and user adoption. By equipping local fishers and stakeholders with this tool, Peskas not only enhances data accuracy but also empowers these communities with the knowledge and insights necessary for sustainable fishery management.

Moreover, the role of Peskas in these countries extends beyond mere data collection; it represents a significant stride towards inclusive and participatory fisheries governance. By filling the data void, Peskas enables better representation of small-scale fisheries in policy dialogues and investment decisions, ensuring that these crucial sectors are no longer marginalized but rather recognized as vital contributors to national economies and community livelihoods.

Q: *You mentioned climate change as "the whale in the room" during your keynote speech at the World Seafood Congress 2023 held in Peniche, Portugal, in September 2023. As a fisheries scientist, you would have heard all the dire predictions regarding the future of aquatic food production systems, redistribution of fishery stocks in the oceans and islands disappearing below water. Earlier, in May 2023, you had delivered a presentation entitled "Towards climate-resilient aquatic food systems for shared prosperity" during the ICCCAD- IUB Distinguished Guest Lecture Series. For the benefit of our readers, could you highlight the salient points from your presentation?*

A: I have often emphasized the importance of shifting our perspective on climate change in aquatic food systems from doom-and-gloom to proactive solutions. Recognizing the severe impacts of climate change, including the redistribution of fishery stocks, ocean acidification and the threat to island nations, my focus is on harnessing science and innovation to enhance our ability to predict and respond to climate shocks, thereby identifying viable livelihood opportunities in this new reality.

The core message is one of resilience and adaptability. By improving predictive capabilities through advanced climate science and data analytics, we can better prepare for, and mitigate the risks posed by climate change. This approach opens up avenues for sustainable and viable livelihoods opportunities, even as we confront the challenges of changing aquatic ecosystems. The goal is to achieve shared prosperity, acknowledging that while we strive to mitigate greenhouse gas emissions, we must also develop strategies to live with the irreversible changes that have already occurred. This requires a collaborative effort, integrating policy, science, community engagement, and private sector innovation, to develop aquatic food systems that are resilient to both current and future climate impacts. Ultimately, my argument is that there is potential for not just surviving but thriving in the face of climate change, through innovative and adaptive strategies.

Q: *Still on the same topic, could you mention a few examples where WorldFish has worked to empower communities through climate-smart aquaculture?*

A: WorldFish has demonstrated a strong commitment to empowering communities through climate-smart aquaculture. One of our key initiatives is the Smart and Innovative Climate Information Services project focused on managing climate variability by providing critical climate information and advisories to fish farmers and other stakeholders in aquatic food systems. These services enable them to make informed decisions, enhancing their resilience to climate shocks and improving overall productivity.

Another is our project on Transforming Communities through Climate-Smart Innovations. This project involves the introduction and scaling of climate-resilient agricultural practices. These innovations are pivotal in boosting the productivity of aquatic food systems and enhancing the livelihoods of local communities, making them more resilient to the impacts of climate change.

Additionally, in Mali, our Rice-Fish Farming project represents an innovative approach to sustainable aquaculture. This integrated farming method combines rice and fish cultivation, offering multiple benefits such as improved food security, enhanced farm productivity, and better ecosystem health. It's an excellent example of adapting traditional practices to modern challenges and significantly contributes to the livelihoods and resilience of local communities.

Q: *Moving on to markets, one of your fields of interest is reported to be investigating the role and potential of implementing market-based instruments for sustainable financing of natural resources governance in the developing world. Would it be correct to say that sustainable finance markets can generate positive changes to address environmental, social and governance issues in developing countries? What are the prerequisites that must be in place in these countries?*

A: Sustainable finance markets hold immense potential for addressing environmental, social, and governance (ESG) challenges in developing countries, especially within sectors like aquaculture. However, the key to unlocking this potential lies in prioritizing 'financial inclusion' over mere financing. It's crucial that finance reaches and positively impacts those who need it most, such as small-scale fish farmers. This approach means focusing on the quality, suitability, and accessibility of financial services and products, ensuring they are tailored to meet the specific needs of these communities.

To effectively implement sustainable finance in developing countries, several prerequisites are essential. First, robust regulatory frameworks are needed to foster responsible lending and investment practices aligned with ESG criteria. Enhancing financial literacy among small-scale operators is also vital, equipping them with the knowledge to access and utilize financial services effectively. Furthermore, financial products must be accessible and tailored to local needs, ensuring relevance and practicality for small-scale fish farmers. Finally, forging strong partnerships among governments, financial institutions, NGOs, and community groups is critical. These collaborations can facilitate the development of inclusive financial products and ensure effective channeling of resources towards sustainable practices.

In essence, the transformation of natural resource governance through sustainable finance hinges not just on the availability of funds but on ensuring these funds are accessible, affordable, and relevant to those at the grassroots level. By emphasizing financial inclusion, developing countries can leverage sustainable finance as a powerful tool to drive meaningful change in addressing ESG issues.

Q: *WorldFish has been successful in developing new production technologies, including at the small-producer level. Have there been, or will there be, innovations related to bridging the gap between producer and the end-consumer to make the supply chain more inclusive and in the process, each party being able to trade directly in aquatic foods?*

A: WorldFish has made significant strides in developing new production technologies, even at the small-producer level. A key aspect of our approach is recognizing that impactful innovations should be community-led.

A prime example of this is our project involving solar freezers in the Solomon Islands. These solar-powered freezers are a simple yet highly effective technology that has revolutionized the way local fishers store their catch. By extending the shelf life of fish, these freezers have opened new markets for small-scale fishers and reduced post-harvest losses, thereby increasing incomes and ensuring a more stable supply of fish for local communities.

This initiative demonstrates how even relatively low-tech solutions can bridge critical gaps in the supply chain. By providing small-scale producers with the tools and technologies to preserve their catch, we are not only enhancing their capacity to meet consumer demand but also ensuring that these producers can participate more effectively and directly in the marketplace.

When is a freezer more than just somewhere to store food? When it's solar-powered and spearheading women's economic change in the Solomon Islands.

Q: *What are your thoughts on a shared and sustainable blue economy, defined in World Bank terms as the "sustainable use of ocean resources to benefit economies, livelihoods, and ocean ecosystem health". What, in real terms, would a sustainable blue economy look like, and under what conditions is it most likely to develop?*

A: From a WorldFish perspective, while the World Bank's definition of a 'sustainable blue economy' is a step in the right direction, it perhaps doesn't fully encapsulate the depth of transformation required. The sustainable use of ocean resources for economic growth, livelihood enhancement, and ecosystem health is a crucial goal. However, true sustainability in the blue economy extends beyond mere resource use to include regenerative practices and deep-rooted social inclusion.

In real terms, a sustainable blue economy as envisioned by WorldFish would be one where aquatic resources are not just sustainably exploited but are actively regenerated and restored. This means moving beyond maintaining current levels of marine health to enhancing them. Initiatives like rebuilding fish stocks, restoring coral reefs, and protecting mangroves are integral to this vision. Moreover, social inclusivity should be at the core of the blue economy. It's vital that this economic model supports not only large-scale commercial ventures but also uplifts small-scale fishers and coastal communities, often the most vulnerable and marginalized groups.

For such a model to develop, robust governance frameworks are necessary, ones that ensure equitable resource-sharing and prioritize long-term ecological health over short-term gains. Additionally, community-led management and decision-making processes are key, as they bring local knowledge and needs into focus. Leveraging technological innovation for sustainable practices and fostering international cooperation for ocean conservation are also critical components.

In essence, WorldFish advocates for a blue economy that is not just about sustainable utilization of ocean resources as per the World Bank's definition, but one that is regenerative, equitable, and inclusive, ensuring the prosperity of both the oceans and the communities that depend on them.

Q: *WorldFish is organizing the 21st International Institute of Fisheries Economics & Trade (IIFET 2024) Conference next July in Penang with the theme "Aquatic Food Systems in the Blue Economy". Would you like to say some words on the Conference so that readers can decide on their participation?*

A:This edition of the biennial conference is being held in Asia for the first time since 2008 and in collaboration with Malaysia's Department of Fisheries, offering a unique opportunity for participants from the West to learn and network with stakeholders in the Asia-Pacific region, the biggest producer of fish in the world..

The Conference will focus on the intersection of fisheries and aquaculture economics and trade with major global challenges we are facing today, such as food system sustainability, rising economic and social inequality, the climate crisis and the fallout from, and possibility of future pandemics - all pertinent in shaping a resilient blue economy that delivers on its promise for healthy people, healthy planet and shared prosperity.

In addition to sessions proposed by IIFET members and sessions that reflect key research arenas of IIFET members, this year's IIFET will have four novel sub-themes, expanding discussions into sustainable and equitable economic development via aquatic food systems, alongside traditional research areas. It promises to be a rich exchange of ideas and I strongly encourage readers, researchers, policymakers, and industry stakeholders to join us at the conference.

More information on the conference can be found **here**.

A PERSONAL RANT ON THE DAY OF MY 40TH YEAR ANNIVERSARY IN FISHING

By Francisco Blaha

Crew fixing the net on a purse-seiner in the Marshall Islands

Today is 21 September 2023; back in 1983, it was my first trip on a commercial fishing boat. I had to be 18 years old to get my "2nd mate ticket", and even if I had done the equivalence from my Navy one a couple of weeks before while still 17, the day after my b'day (16/9), I was at the Argentinean coastguard (Prefectura) with all the papers.

I had a job lined up as a deckhand in a small coastal trawler of Mar del Plata because while I knew how to take a boat and operate it from A to B, I didn't know anything about fishing. Thankfully, a skipper *(a good man named Braulio who lost his son in the war just the year before)* took me under his wing and allowed me to learn from him and many others after him.

It was a steep learning curve that, after 40 years, hasn't stopped yet. After a few years of fishing, I got into university and got involved in fisheries science and management to then go back to fishing in the Pacific in the early 90s and to re-start the road that took me to being here today.

Yes, many things have changed since then, some for good, some for bad (and some that feel the same).

I like to be a positive person, so start with the good things:

Stock assessment and data...this is where I see the most significant change. The stock assessment models of today and the data path feeding them is sooooo much better than it ever was. I remember coding in Cobol on pathetic (for today's standards) loops to run Virtual Population Analysis on computers that had less than 0.1 % of the computational capacity of my running phone today. I remember doing plots by hand and working with models that were just minor upgrades from the Beverton-Holt model. Today, my colleagues in the Pacific Community (SPC), for example, run some of the most sophisticated models in the world that have moved aeons from then; hence the accuracy of the assessments is astronomically better than then. Add to that the almost live capacity of electronic monitoring to feed those models in real-time, and we could be talking about a different universe (even if some of the assumptions of those models stayed the same).

Monitoring, Control and Surveillance... technology allows us to know so much more than ever before about fleet dynamics and fishing efforts, when I started, we just left port and came back some time later. We had a radio, and that was it. No one knew where we were, what we were doing, if we sold fish or unloaded fish on the side before coming to port, if the catch declaration on paper (if necessary) matched entries at factories.

Sonar and satellite technology combined, in particular, have made such massive changes to the controls we have on fishing. The other side of the coin about advanced sonar and satellite technology is "effort creep"; finding fish was never so easy as today. We then relied on experience and advice from other friendly or family-related skippers. I remember being a "weirdo" by bringing knowledge about "water mass", fronts and thermoclines. The crew were looking at me like mad when I was dropping thermometers or vertical longlines with a potato every 10 m, leaving it there for a while and then checking the temperatures like a freak to see where the thermocline was... this has become Stone Age in less than 30 years. Fish finding sonars were crude and exorbitantly expensive and required calibration every few weeks with cables on either side of the fishing boat holding a bronze ball that will be progressively levered and the "bouncing" rate adjusted as needed – a total nightmare!

This is me, about forty years ago. The fisheries world had a lot of promise back then.

And here I am today, a bit more cynical and weary, but hoping fishing can be more fair to fishers.

Communication and positioning safety... another area of incredible development. We just relied on VHF and, if lucky, UHF radios for everything. My mother would not know anything of me for weeks at a time. The idea of the internet on board was science fiction. Positioning was also very complex; all was dead reckoning. I knew how to use a sextant, which I used to take the meridian at lunchtime if the sun was visible; the rest was just guessing. A bit later on the biggest boats we got the capacity to triangulate via coastal radio stations and Loran C. I remember vividly going over the manual of the first proper GPS I got (I was already fishing in the Pacific) and being bewildered by how much safety and efficiency this would bring, particularly as all this tech gets progressively cheaper as well.

This, of course, meant that more and more vessels got built as things became cheaper and the "need" for fish got up. Fishing was a family/cultural job, with the odd one out like me. But back then, high-seas fisheries weren't really a thing. Freezing technology hasn't changed so much, but it has become way more generalized, and crewing was primarily tied to nationals of the Flag State plus highly protected by unions... I will come back to that later.

The number of boats exploded since then, chasing the same amount of fish initially and progressively less since then... we caught fewer fish overall because there were fewer of us, and we had less tech to find them even if the abundance was bigger.

I remember hitting a school of Southern blue whiting on a bottom trawl in the south of Argentina by chance (I could not really estimate biomass with the sounder, yet I knew that the bottom contour was good). In a few minutes, we packed the net all the way to the mouth; the boat slowed down while maintaining the same revs. We struggled to get the net to surface; all hydraulics were at the limit. I cleared the deck as the cables were at full tension. Once afloat, it was a monster; we could not bring it in, as the fully packed net was wider than the boat. The fish was so squashed that it was useless. I had to get on the inflatable dingy and cut the cod end open to let go of the catch... it was a nightmare. We lost a day and then had to repair the net for a further day. I don't think abundance as such is typical today, even if all-around catch volumes may be way higher.

I guess I could go on and on and on. But let me focus on what I personally think has gone worse... or at least burns me up the most.

Big business and the geopolitics of fish... fishing does not seem to be only about catching fish for others to eat (and making good money for the hardest and most dangerous job in the world). Fishing has become a huge business and, as such, so much more linked to politics both domestically and internationally, and with that, has taken on board what is, for me, the worst of politics in general and human behaviour in particular, hypocrisy.

I'm constantly biting my tongue in meetings when I see statements, presentations, or read news by NGOs, industry associations, marketing people, eco-labels and private certifications on fisheries issues; and even more so when those delivering them as if it was the ultimate truth, are people that NEVER worked on fishing boat... it really gets to me.

Let's get to the geopolitics first and its ugliest influence on fisheries: subsidies. I preface it with a principle of diplomacy *"If you have a presence, you have rights".* Let's say high seas longlining does not make money, albeit paying a pittance to the crew and cutting maintenance and living standards... subsidies will support them because the benefit of being in the table (i.e. having X amount of vessels there), outweighs the cost of subsidizing fuel, giving tax exemptions, etc.

The industry has become globalized. It is not just a former fisherman that had a few boats and became a fishing company. It is a corporate business, and as such, like any other big business (from tech to wine and food), it takes advantage of ALL possible (purposely made or not) shortcomings and loopholes in legislation, tax systems and crewing rules, amongst others, that it can. Compounding to this, the regulatory framework for the high seas was regulated when there wasn't almost any High Seas fisheries, so when you have these gaps (as dictated by capitalism), business runs rampant. And this is just not fishing in every industry, so here is one thing that REALLY annoys me ...fishing gets rightly pointed out for many things (around environmental and social impact, tax evasion, etc), but as if it exclusively was a fishing problem and is not in every primary industry as soon as you start peeling layers.

Example: bottom trawling has environmental impacts, no doubt about it, and the gravity of these impacts depends on many issues, ranging from

the benthos in which they happen to the species being trawled. This is not "one size fits all". Then I hear people saying that bottom trawling is like two bulldozers at each end of a chain going over a forest and destroying everything; then I look outside my house and I see farms, roads, houses, sport fields, etc., and that is literally what has happened to most of the land! There were forests there at some stage not so long ago! A field of soybeans has a biodiversity impact of 100%... everything there was killed and removed to plant an exotic species. So where are the "stop agriculture" or "stop housing development" coalitions?

And another thing I rant on usually: high seas transhipment in the WCPFC, textbook geopolitics-driven hypocrisy.

And the hypocrisy doesn't stop there. Politics and business drove colonialism up to the 1980s and still drive the more subtle neo-colonialism today. I see a direct line between many NGOs, eco-labels, private certifications, some "developing" programmes, etc., with "white (or perhaps rich country) saviourism" as the latest expression of the colonial mindset, where outsiders think they know better what is best for the locals.

But let me focus the end of my rant on what has definitively gone worse as the consequence of all the above:

The fisherman's income and rights are worse today than 40 years ago, and this is so soul-destroying for me personally, to the point of me wanting to walk off the only job I ever had.

The whole edifice of fishing, from boatbuilders to bureaucrats at RFMO meetings, from truck drivers picking up fish to politically-appointed ministers of fisheries, from marketing people in the industry to NGO activists, from eco-labels to industry marketing, and so on... has grown immensely and become so much richer in the last 3-4 decades than it was before. All these people (in 99% of the cases, never worked on a fishing boat), and all their jobs, and all industries associated with them, depend for their existence on fishermen whose income and life perspectives have gone down since then instead of up like the rest.

There is no way that an 18-year-old kid, like I was then for the first time on a fishing boat, could do the path I've taken to get here and be writing this (while taking a break from my present work for the World Bank, the EU, FAO and NZ MFAT), and that saddens me a lot.

The whole business/politics/certification empire has risen on the backs of people, which is worse at all levels than 40 years ago. A union protected my rights, and my income was based on standardized agreements and catch shares. I could take breaks for exams, I would earn enough to live while having access to a decent education and health system, and the flag in the back of the vessels did actually mean something... all that is gone for someone starting today in most (if not all) countries in the world.

For example: I sit in meetings for crewing CMM at an RFMO, and I only see people who have NEVER worked on a fishing boat, trying really hard to find red herrings in an already diluted text; it seems that they are just basically being opposed to act as decent humans and grant fishermen their rights, protections and payments that they will not even think of doing to their own children.

This is the tragedy of fisheries, my 40 years in it... we created an empire, and like all empires, it was built on the backs of those at the basis of it: the essential workers, the fishermen. They are worse off instead of better than when there wasn't an empire, and that is just not right.

So yeah, it is not a happy 40th anniversary, unfortunately. I owe my life to fisheries, yet I find myself increasingly struggling in the moral no-man's land in between cynicism and mercenaryism, the exact two aspects of my work I struggle with the most. Mainly because those two aspects are the basis of the two "attitudes" I dislike the most in people, and fight hard to never fall into as a person: they are ingratitude and pretentiousness. Yet, both seem to abound in the circles I move today. Nevertheless, I try to remain optimistic. Fisheries is about people more than about fish in my opinion, and I know people can make a difference.

On a purse-seiner in the Marshall Islands

Transhipping crew, Solomon Islands

On-board a pole-and-line vessel, Solomon Islands

SEAWEED PRODUCTION, TRADE AND MARKETING STATUS IN SRI LANKA

By J.Y.V. Sumanarathna

Seaweed exports from Sri Lanka supply the fertilizer and food industries mainly in Europe, followed by Asia, with India being the single largest importing nation in the region. Initiatives are being taken to expand the industry but there are some crucial hurdles to address, including adverse climatic conditions, lack of robust parental strains, inadequately-regulated purchasing systems, predators and technical barriers. The potential of seaweed in contributing to livelihood development and empowerment of women in Sri Lanka could be greatly enhanced through technological approaches, ongoing assistance from the government, awareness and promotion sessions, investments and the creation of a "one-stop-shop approval" system.

Credit: National Aquaculture Development Authority of Sri Lanka

Food and Agriculture Organization (FAO) 2021 data revealed that global seaweed production illustrated significant growth from 2000 to 2019 from 118 000 tonnes to 358 200 tonnes (Perumal et *al.*, 2023)[1]. The main seaweed-producing continent in the world is the Asian region which contributes 97.38% of the total production in the world. China is the biggest seaweed producer with 56.82% followed by Indonesia, amounting to 28.6% of the total Asian production. Almost all (99%) of the total seaweed production in Asia comes from farms (Zhang et *al.*, 2022). The European region also farms large amounts of seaweed and according to the Centre for the Promotion of Imports from developing countries (CBI), France, Spain, and the Netherlands are recorded as major producers in the industry.

Seaweed are defined as a category of photosynthetic organisms known as macroalgae which do not produce flowers and thrive in marine environments. They are rich in a biologically-active substance that plays a major role in social, economic, and ecological arenas in the world (Zhang et *al.*, 2022)[2] and grow successfully in both freshwater and marine environments without the need for application of antibiotics or pesticides (Durairatnam, 1961[3]; Somasundaram et al., 2014)[4]. Seaweed also has a significant position in the global food system while holding a vital regulator role in the impact of climate change, and contributing to blue carbon strategies (Farghali et *al.*, 2022)[5].

Oarweed *(Laminaria digitata),* tangle *(Laminaria hyperborean),* and rockweed or knotted kelp *(Ascophyllum nodosum)* are the main seaweed varieties in demand in the EU while non-EU countries tend to focus on kombu *(Saccharina* and *Laminaria),* nori *(Pyropia yezoensis* and *Pyropia tenera),* and wakame *(Undaria)* (CBI, 2022)[6].

According to a recent World Bank report, high potential growth has been identified in ten emerging seaweed markets in the world. Trade in the industry could reach USD 11.8 billion by 2030 based on the importance of seaweed as a carbon sink, women-led business generator, marine biodiversity supporter, and in the opening up of value chains (The World Bank, 2023)[7].

Uses of seaweed

Possessing unique biological, physiological and chemical characteristics, seaweed is used in a wide range of applications, making them a valuable and versatile resource.

It is important as food for direct human consumption besides being processed into edible additives, nutraceuticals, and animal feeds. In Asian cuisine, seaweed is consumed in fresh, dried, flaky, and flour forms and as a vegetable. Notably, red seaweed *(Porphyra),* commonly known as nori, is rich in valuable edible protein and is used as an outer wrapping for sushi, either uncooked or lightly baked. Brown seaweed, *Undaria spp,* is widely used in culinary preparations, while dried Laminaria species are incorporated into various dishes.(Pereira R. et *al.*, 2008)[8].

Nutritional-rich seaweed species are also used in the pharmaceutical industry to produce tablets and capsules especially *Chlorella, Spirulina,* and nutritional supplements, while some *Spirulina spp (Spirulina platensis)*

[1] *Pitchurajan Krishna Perumal, Chun-Yung Huang, Chiu-Wen Chen, Grace Sathyanesan Anisha, Reeta Rani Singhania, Cheng-Di Dong & Anil Kumar Patel (2023) Advances in oligosaccharides production from brown seaweeds: extraction, characterization, antimetabolic syndrome, and other potential applications, Bioengineered, 14:1, DOI: 10.1080/21655979.2023.2252659*

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[4] *Somasundaram, Sutharsan & Vathshalyan, Nishanthi & Srikrishnah, Shanmugalingam. (2014). Effects of Foliar Application of Seaweed (Sargassum crassifolium) Liquid Extract on the Performance of Lycopersicon esculentum Mill. In Sandy Regosol of Batticaloa District Sri Lanka. American-Eurasian J. Agric. & Environ. Sci.. 14. 1386-1396. 10.5829/idosi.aejaes.2014.14.12.1828.*

[5] *Farghali, M., Mohamed, I.M.A., Osman, A.I. et al. Seaweed for climate mitigation, wastewater treatment, bioenergy, bioplastic, biochar, food, pharmaceuticals, and cosmetics: a review. Environ Chem Lett 21, 97–152 (2023). https://doi.org/10.1007/s10311-022-01520-y*

[6] *CBI, The European market potential for seaweed, 2022; CBI, Growing appetite for seaweed, 2022*

[7] *"World Bank. 2023. Global Seaweed: New and Emerging Markets Report, 2023. © Washington, DC: World Bank. http://hdl.handle.net/10986/40187 License: CC BY-NC 3.0 IGO."*

[8] *R. Pereira, C. Yarish, 2008, Mass Production of Marine Macroalgae, 2236-2247, ISBN 9780080454054, https://doi.org/10.1016/B978-008045405-4.00066-5. (https://www.sciencedirect.com/science/article/pii/B9780080454054000665)*

are used to produce food additives. (Andrade et *al.,* 2018; Batista et *al.,* 2017; Martelli et *al.,* 2020; Somasundaram et *al.*,2014). They have been identified as a good source of carotenoids and bio-active compounds such as iodine, bromine, vitamins, and pigments, and may be used as a medicine for cancer patients. This is mainly practiced by Chinese cancer patients who use extracts of *Laminaria* and *Sargassum* species (Kariyawasam, 2016).

With regard to the culture of fish and shrimp, Danish researchers are reportedly planning to utilize residual nutrients and CO_2 from land-based shrimp and fish farming to produce sea lettuce, a green protein and valuable high-fibre seaweed species for human consumption (INFOFISH, 2023)[9]. The project aims to use the sea lettuce to absorb and convert emissions from land-based aquaculture into a high-value product. Among other things, the seaweed will be used for dietary supplements that can prevent diabetes and for sustainable foodstuffs innovations. In addition to capturing emissions that would have otherwise been emitted into the atmosphere and aquatic environment, the seaweed produced is both healthy and rich in umami flavour. Seaweeds are also a cost-effective source for the synthesis of metallic nanoparticles; in this regard, silver nanoparticles (AgNPs) may be used as prophylactics and therapeutic agents against bacteria and viruses affecting cultured shrimp.[10] Meanwhile, some findings suggest that seaweed extracts may enhance the nutritional content, production, and growth of plants (Durairatnam, 1961[11]; Somasundaram et *al.,* 2014).

In addition, seaweed has a significant impact on global carbon, oxygen, and nutrient cycles through photosynthesis (Chung et *al.*,2013, 2017). Balancing CO_2, and facilitating, fossil energy and decreased eutrophication are other major contributions of seaweed. (Krause-Jensen et *al.,* 2016; Jagtap et *al.,* 2023[12]).

Seaweed cultivation in Sri Lanka

Over the past years and by the end of 2023, remarkable growth in the sector has been reported with the assistance of relevant authorities, encouraged by increasing global demand, and there is clear potential for more expansion. The cultivation of seaweed is gaining popularity as a sustainable livelihood activity in the coastal areas of Sri Lanka, where around 320 species are being cultivated (Durairatnam, 1961; Somasundaram et *al.,* 2014). The seaweed industry also acts as a catalyst for generating employment opportunities and improving the living standards, particularly for women, in coastal regions (Crawford, 2002; Narayanakumar et *al.,* 2011[13]; Ginigaddara et *al.,* 2018[14]).

According to the National Aquatic Resources and Development Authority (NAQDA), there are 191 recorded seaweed farms in Mannar, 72 in Jaffna, and 28 in Mannar. However, the seaweed production in the northern region experienced a slight decline in 2021 and 2022 due to the global COVID-19 pandemic and economic setbacks in the country. In 2023, production is expected to rebound with the active involvement of NAQDA, which is conducting continuous training, monitoring, water quality management, and disease management.

Northern seaweed annual production (tonnes)			
2020	2021	2022	2023 (up to October)
422	218	200.6	1410

(Source: NAQDA)

Gracilaria edulis and *G. verrucose,* commonly referred to as Ceylon moss, are predominantly found in the Northern region, specifically in Kalpitiya, Trincomalee, and Mannar. (Durairatnam, et *al.,* 1955; Ginigaddara, 2018); in addition to other species and seaweed beds which have been identified around the island. FAO reports that the seaweed is collected from Mannar, Kalpitiya, Trincomalee and Puttalam for commercial purposes and various locations in Sri Lanka have been identified as commercial seaweed beds, including Mannar in the Northern Province, Kalpitiya in the North-Western Province, Negombo and Beruwala in the Western Province, Hikkaduwa and Hambantota in the Southern Province, and Trincomalee in the Eastern Province (FAO, 1990)[15]. The seaweed included *Ulva spp., Enteromorpha spp, Caulerpa spp, Sargassum spp, Padina spp, Gracilaria spp, Laurencia spp, Gelidiella spp, Hypnea museiformis, Padina spp, Gracilaria edulis, Caulpera spp, Codium spp, Acanthophora delile, Noospora spp, Cheaetomorpha spp* and *Lorencia spp.*

The seaweed is cultured mainly through the single rope method, raft method, and pond culture (Kariyawasam, 2016[16]).

Due to a lack of essential and comprehensive scientific data on seawater salinity, temperature, biodiversity, tides, wave action, currents, and geographic conditions, Sri Lankan commercial seaweed cultivation is still considered to be in the pilot stage and experimental initiatives are still being conducted (FAO, 2021). Research in 2018 indicates that the availability of information about employment opportunities, financial viability, personal satisfaction of stakeholders, and product viability is vital when developing seaweed cultivation as a sustainable industry to uplift livelihoods.

Rising trend in seaweed exports

Sri Lanka primarily exports seaweed-related products to the European region, with Sweden being the largest export destination, followed by Germany, Belgium, Lithuania, France, and Denmark. As an individual nation, India is the primary importer of Sri Lankan seaweed products, together with several non-EU countries, including Hong Kong, the United Kingdom, Switzerland, the United States, New Zealand, the Maldives, and Norway, which maintain a good trade relationship with Sri Lanka.

[9] *INFOFISH, 2023, Fishing Technology Digest, A newsletter on Fishing Technology, Gear and Methods, Vessels and Equipment, April-June 2023*

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Despite the presence of identified seaweed beds in Sri Lanka, export quantities of seaweed and related products remain relatively low. Insufficient production levels, lack of proper processing technologies and a limited range of value-added products have led to diminished export values.

Table 1: Value of seaweed exports (various forms) from Sri Lanka (in USD)

Code	2019	2020	2021	2022	2023
H.12122900				11 020	164 444
H.12129900	34	2 741	98 792	96 541	114 535
H.12122100	88 595	60 275	71 153	62 775	94 231
H.12122990		23 566	39 971	51 102	18 143
H.12122910		3			1 799
H.26219090	1 020	979	93	7	
H.26219010			44		
Total	**88 629**	**86 585**	**209 916**	**221 439**	**393 151**

Source : Sri Lanka Customs

In early 2023, approximately 600 000 kg of seaweed were recorded as exported, with this figure showing an upward trend over the past five years, as indicated by Customs records (Table 2).

Table 2. Volume of seaweed exports from Sri Lanka, 2019 -2023 (in kg)

Year	2019	2020	2021	2022	2023
Quantity	61 829	149 963	197 990	270 128	594 307

Source : Sri Lanka Customs

Currently, only a few exporters are engaging in seaweed cultivation and exportation. Most of their farms and establishments are based in the northern areas. According to the 2023 Customs records, around USD 165 thousand worth of seaweed was exported in the year up to September, mainly to India (USD 43.52 thousand) followed by Hong Kong for manufacturing fertilizers. The Republic of South Korea is a major destination for seaweed meant for human consumption; exports to that market were valued at USD 50.71 thousand in 2023 up to September (Table 3).

Processed seaweed *Credit: Global Seafood (Pvt) Ltd*

Constraints for seaweed cultivation in Sri Lanka

A scientific survey conducted in the northern region in 2018 revealed that seaweed cultivation is a good option to address unemployment in coastal communities. However, the absence of a well-established buying and selling system and the significant impact of predator attacks are crucial obstacles for seaweed farmers, in addition to other factors affecting the industry (Ginigaddara et *al.*, 2018). Overuse of the existing seaweed stock is one of these major constraints in the industry, creating raw materials with low biodiversity and vigour (Kariyawasam, 2016).

Since seaweed cultivation takes place in an uncontrolled environmental setting, unexpected weather conditions may affect seaweed cultivation. As mentioned above, the current practice of the industry is to use planting materials from previous generations which has led to the gradual deterioration of their genomic quality. Furthermore, any transition from traditional to commercial cultivation is severely affected by the lack of technological knowledge at the nursery stage, reduction of post-harvest losses, appropriate drying techniques, and value-added production to meet international standards. A general lack of awareness regarding the potential value of the industry among officials also leads to unexpected delays in the processing and export process.

The way forward

Due to over-harvesting of Gracilaria spp in Chile, Buschmann et *al*[17] proposed in their report to shift from captured seaweed to cultured seaweed. In Sri Lanka, which similarly sees a lack of captured seaweed, cultivation practices assume more importance in meeting rising world market demand. However, seaweed cultivation is still an under-tapped area in Sri Lanka (Sunjoyo, 2023).

Most of the farm activities are conducted by family members and through contracts with nearby farmers. These arrangements often provide additional socio-economic benefits, reflecting the potential for the Sri Lankan seaweed industry to be a financially viable livelihood option for coastal communities. The expansion of seaweed cultivation will also create more opportunities for Sri Lankan women to uplift their lifestyles and reduce financial difficulties.

Despite the presence of abundant seaweed beds in Sri Lanka's marine areas, various natural and logistical constraints affect seaweed production. Enhancing technical know-how and implementing effective monitoring throughout the cultivation and post-harvest processes, are critical for the success of commercial seaweed cultivation. In comparison to other aquaculture industries, seaweed farming is relatively straightforward from a technical perspective, allowing farmers to learn through practical experience to improve their practices.

[17] *Alejandro H. Buschmann, Carolina Camus, Javier Infante, Amir Neori, Álvaro Israel, María C. Hernández-González, Sandra V. Pereda, Juan Luis Gomez-Pinchetti, Alexander Golberg, Niva Tadmor-Shalev & Alan T. Critchley (2017) Seaweed production: overview of the global state of exploitation, farming and emerging research activity, European Journal of Phycology, 52:4, 391-406, DOI: 10.1080/09670262.2017.1365175*

Table 3. Volume and value of seaweed exports from Sri Lanka to major markets, 2021 – September 2023 (in USD & kg)

Code	Description	2021		2022		2023 (January To September)	
		Quantity	Value	Quantity	Value	Quantity	Value
H.12122900					**11.02**		**164.44**
	India			30 146	11.02	423 940	164.43
	Hong Kong					3	0.01
H.12129900			**98.79**		**96.54**		**114.54**
	United Kingdom	43 824	72.46	46 536	50.21	33 780	61.38
	Sweden	6	0.03			1 579	33.64
	Belgium			16 000	35.71	9 040	19.26
	Germany			12	0.17	36	0.14
	Switzerland			4	0.06	14	0.12
	Saudi Arabia	1241	3.9	2 975	10.4		
	Lithuania	2 398	21.71				
	Italy	216	0.46				
	United States	32	0.24				
H.12122100			**71.15**		**62.78**		**94.23**
	Republic of Korea	16 000	20.25	8 000	23.63	32 000	50.71
	India			9 500	9.54	38 830	43.52
	Japan	24 553	50.9	18 587	29.6		
H.12122990			**39.97**		**51.1**		**18.14**
	India	109 582	39.85	138 340	51.1	48 985	18.14
	China	8	0.12				
H.12122910							**1.8**
	India					6 100	1.8
H.12129300			**0.03**				**0.82**
	Maldives					1 000	0.82
	UAE	40	0.03			10	...
H.26219090			**0.09**		**0.01**		
	Australia	15	0.01	11	0.01		
	China			17	...		
	New Zealand	50	0.06				
	Denmark	5	0.02				
H.26219010			**0.04**				
	Viet Nam	20	0.04				
H.26211000							
	Total :		**210.08**		**221.45**		**393.97**

Source: Sri Lanka Customs

More women should be encouraged to culture and process seaweed as a means to strengthen their incomes

The introduction of new value-added technology and greater availability of investment opportunities for the seaweed sector in Sri Lanka is a must, particularly during this current economic depression. In this regard, a one-stop approval process for potential investors, including from overseas, may lead to revitalization of the sector. In addition, as financial difficulties in the initial stages and during cultivation are critical limiting factors, Government intervention and assistance is important.

Government and stakeholder interventions are also important in:

- identifying culture sites. Seaweed has a super adaptability to grow under a diverse range of environmental conditions even in the desert (Zhang et al., 2022); thus it is crucial to identify the optimal locations for cultivation in Sri Lanka and to execute the cultivation accordingly;
- establishing a proper purchasing system is imperative to support existing farmers. This is because research findings from the study on "Seaweed farming as a sustainable livelihood option for Northern coastal communities in Sri Lanka" in 2018 have highlighted the challenges related to the purchasing system for seaweed in the northern area of Sri Lanka;
- the introduction of advanced technological approaches to industrial-scale cultivation, seed production using tissue culture, integrated aquaculture systems, automated harvesting techniques, and post-harvest technologies; and
- enhancing knowledge on seaweed and related activities. Currently not many officials and communities know enough about the sector, which may create difficulties for the smooth production of seaweed pertaining to approvals and investments. A series of steps should be taken by the government and other responsible organizations to further develop the seaweed industry including awareness workshops, seminars, extension services, demonstration projects, pilot-scale farms, and processing units targeting university students, farmers, processors, investors, and exporters.

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18th INFOFISH WORLD TUNA TRADE CONFERENCE & EXHIBITION

20-22 MAY 2024
Shangri-La Hotel,
Bangkok, Thailand

Advancing Blue Transformation, Sustainable Development and Innovation through the Global Tuna Industry

Jointly organized by: INFOFISH TTIA

DECEMBER 2023

PRESS RELEASE

JOIN US in Bangkok, Thailand, at the prestigious Shangri La Hotel from 20-22nd May 2024, as we convene the biggest global tuna gathering in the world: the **18th INFOFISH World Tuna Trade Conference and Exhibition (TUNA 2024).**

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Visit http://tuna.infofish.org for the programme highlights and further information on TUNA 2024.

18th INFOFISH WORLD TUNA TRADE CONFERENCE & EXHIBITION

Advancing Blue Transformation, Sustainable Development and Innovation through the Global Tuna Industry

20-22 MAY 2024

Shangri-La Hotel,
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Jointly organized by:

INFOFISH

Department of Fisheries
Ministry of Agriculture and Cooperatives

TTIA
สมาคมอุตสาหกรรมทูน่าไทย
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- **US$ 1100** *(After 25 March 2024)*

Other Countries

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- **US$ 1350** *(After 25 March 2024)*

BENEFITS

- Full access to the Conference Sessions
- Access to the Exhibition
- Access to Conference Presentations
- Conference Kit
- Face to face networking opportunities
- AM/PM Breaks and Lunches

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THE CONFERENCE

Under the theme ***'Advancing Blue Transformation, Sustainable Development and Innovation through the Global Tuna Industry',*** the 18th INFOFISH World Tuna Trade Conference & Exhibition (TUNA 2024) to be held in Bangkok, Thailand, from 20-22nd May 2024, will bring together leading speakers, experts and representatives from the global tuna industry, including the world's major producers, processors and marketers, policymakers, industry experts, RFMOs, NGOs, community groups, as well as leading scientists and researchers to speak, share and shine a light on industry developments and innovation that are not just addressing sector challenges, but are also putting the tuna industry at the fore in addressing wider global challenges and advancing sustainable solutions for the global common good and our planet's future prosperity.

Continuing the tradition in past biennial INFOFISH World Tuna Trade Conference and Exhibitions, TUNA 2024 will be a significant platform for industry partners and stakeholders from across the Asia-Pacific region and globally to come together on the latest trade and market trends, technological developments and the ongoing efforts for greater sustainability in an industry that remains ever so dynamic and resilient. As always, participants will be able to discuss the state of play in the industry, the latest industry trends and the trajectory of sustainable development that the industry continues to effectively embrace, support and contribute to.

With over 500 participants anticipated and representation from across the globe, TUNA 2024 is an opportunity for global tuna industry players to be informed; to share insights and experiences; engage with industry leaders, experts and policy makers; expand business connections and to add to the very vibrant conversations, transformational fora and advocacy for sustainable development that constitutes the global tuna industry going forward.

THE INDUSTRY

The global tuna industry is a highly valued and dynamic industry, the value of which was estimated at USD 41.06 billion in 2022 and projected to grow to USD 51.25 billion by 2030. Tuna is considered a most important resource and is an essential part of marine ecosystems, with stock harvesting and sustainability remaining critical to the long-term vitality, viability and prosperity of the industry. The global tuna industry is also a livelihood, a source of income, a job, an industry and a critical sector in many countries the world over, as it is also a significant source of sustenance and nutrition for many families, households and communities across the globe. Commercial tuna fisheries today as such form a key part of the blue economy and its sustainable development.

The TUNA 2024 theme ***'Advancing Blue Transformation, Sustainable Development and Innovation through the Global Tuna Industry'*** provides a critical reflection point for the industry as a whole, in terms of bringing together all actors from government, industry, institutions and communities the world over. This is especially opportune, as pressing industry and global issues continue to become more intertwined, calling for sustainable industry solutions to become part of the fabric for the global common good. The time is now, in addressing the key issues of today's world: alleviating poverty; enhancing food security, equity and inclusiveness, better health and education, human rights, labour protections; combating IUU; improving sustainability; advancing clean energy and addressing climate change; which are all global development issues and critical industry endeavours. This of course, is relative to the very real efforts that the global tuna industry continues to make towards greater sustainability; better standards; monitoring and compliance; research and development; and embracing technology and innovation in contributing to a more sustainable industry, sustainable communities and a sustainable globe. At the core of this endeavour is an emphasis on greater collaboration, cooperation and partnerships, where TUNA 2024 serves as a significant and rare opportunity to learn from each other, share, engage and to be inspired.

PROGRAMME HIGHLIGHTS

TUNA 2024 gathers the pressing topical matters and conversations at the forefront of the global tuna industry, under the theme "Advancing Blue Transformation, Sustainable Development and Innovation through the Global Tuna Industry". The following session overviews provide a glimpse of the salient issues that will be discussed.

DAY 1: Monday, 20 May 2024

Session 1 - An overview of Blue Transformation, sustainability & innovation in the tuna industry

What is 'Blue Transformation, Sustainability & Innovation' and how important is this to the global tuna industry? This session will speak to how the industry continues to leverage these core values and strengths, in addressing industry challenges and in contributing to global development issues. Greater efficiency, productivity, innovation and sustainability are critical for all tuna fisheries, both commercial and small-scale, and Blue Transformation may well continue to be a big part of this going forward.

Session 2 - Global tuna industry efforts and actions towards sustainability and innovation

How comprehensive are industry's efforts and actions towards sustainability and innovation in tuna management? This session will feature industry leaders that are leading from the front in terms of advancing Blue Transformation, global food security and innovation in a disruptive industry environment.

DAY 2: Tuesday, 21 May 2024

Session 3 - Blue Transformation and sustainable supply chains

'Blue Transformation and Sustainable Supply Chains' are critical to the industry going forward. Emphasis on 'sustainable' raw material sourcing, benefit-sharing and value-adding, better integration, regional and global policies; as well as actions and initiatives that work to enhance this from end-to-end, is vitally important. This session will also touch on issues such as clean energy in the tuna fishing industry; reusable raw materials for packing; and advances in waste management; which are also important industry considerations regarding a sustainable future for the industry and for the planet.

Session 4 – The global tuna market and improving production, market promotion, access, trade and investment, innovation and sustainable tuna industry growth

Focused on the global tuna market and on initiatives in improving production; market access; trade and investment; and innovation and sustainable tuna industry growth, this session looks at the current trends in the markets, production and trade as well as investment in regional and global markets. It would also look to highlight innovation in production, marketing and pricing mechanisms, with an emphasis on driving the value of tuna as a sustainable, irreplaceable and nutritious source of protein.

Session 5 - Advancing global food security and livelihoods for healthier communities

How critical is the global tuna industry as an actor and participant in addressing global challenges and sustainable development issues? This session will take a hard look at the global tuna industry and consider to what extent it is effectively contributing to world food security, health and nutrition, better communities, sustainability and prosperity.

Session 6 - Blue Transformation, innovation, research, science & technology

The application of research & development; science & technology; and innovation are changing the face of the industry from food safety to innovative fishing technology, data collection and management, as well as surveillance and certification. With the integration of new technologies as a critical enabler, the global tuna industry of today and tomorrow will be safer, smarter and more sustainable.

DAY 3: Wednesday, 22 May 2024

Session 7 - Blue Transformation and the future of certification, social accountability and sustainability in contributing to a safer, cleaner and responsible global tuna industry and planet

As an industry, how does certification, social accountability and sustainability contribute to a safer, cleaner and responsible global tuna industry; and therefore, to the sustainability and prosperity of the planet? These continue to be some of the most pressing questions for the industry and its role and responsibility in being stewards for a resource and an industry that benefits many livelihoods, many communities and many futures.

THE VENUE & ACCOMMODATION

The 5-star luxury Shangri-La Hotel will again be the venue of TUNA 2024. Ideally located on the bank of the Chao Phraya River and adjacent to the sky train, it takes about 30 minutes to arrive at the hotel from the Suvarnabhumi International Airport. Rooms at reduced rates have been blocked at the Shangri-La and at several other satellite hotels nearby.

Shangri-La Hotel, Bangkok

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E-mail: slbk_reservation@shangri-la.com, Web: www.shangri-la.com

For hotel reservations, delegates are requested to submit the hotel registration form provided, directly to Shangri-La Hotel or to the satellite hotels. Hotel registration forms are available from our TUNA 2024 event website: **www.tuna.infofish.org**

THE EXHIBITION

An exhibition will also be held concurrently at the same venue. A total of 41 booths are available for companies and organizations to display and promote their products, equipment, machineries and services related to the industry. Reservation of booths is on a first-come, first-served basis.

SPONSORSHIP

Companies and organizations are invited to be a partner of this prestigious event by signing up for the sponsorship packages - Platinum, Gold, Silver or Bronze - which offer attractive and real benefits to sponsors.

SIMULTANEOUS INTERPRETATION

Simultaneous interpretation of presentations from English to Spanish as well as English to Mandarin will be provided throughout the event for the benefit of Spanish and Mandarin speaking delegates.

EXHIBITION FACT SHEET

HALL A

US$ 3,500 *(Booking by 31 January 2024)* / **US$ 3,900** *(Booking after 31 January 2024)*

- A standard shell scheme stand (3m x 3m)
- 1/2 page colour advertisement in INFOFISH International
- 1/2 page colour advertisement in conference programme booklet
- Free banner advertisement on INFOFISH website for 6 months
- 50% discount on registration fee applicable to one delegate only

HALL B

US$ 2,900 *(Booking by 31 January 2024)* / **US$ 3,300** *(Booking after 31 January 2024)*

- A standard shell scheme stand (3m x 3m)
- 50% discount on registration fee applicable to one delegate only
- Free banner advertisement on INFOFISH website for 3 months

STANDARD SHELL SCHEME (3m X 3m)

- Lettering on 350mm facia board with fluorescent tube behind
- 3mm thickness white laminated panel
- 13A 230V power outlet
- Pifex system aluminium frame section
- Carpet
- Information counter
- Chairs

RESERVATION INFORMATION:

A total of **41 booths** are available and alloted on a first come - first served basis. Make your booking by **31 JANUARY 2024** and enjoy an early booking rate of **US$ 3,500** under **HALL A** or **US$ 2,900** under **HALL B.**

Once booking is made, an application form will be forwarded with the general information to be endorsed and signed for booking confirmation.

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For enquiries, please contact: **Mr Mohd Syahir**, Tel: (603)80668112, E-mail: **syahir@infofish.org/info@infofish.org**

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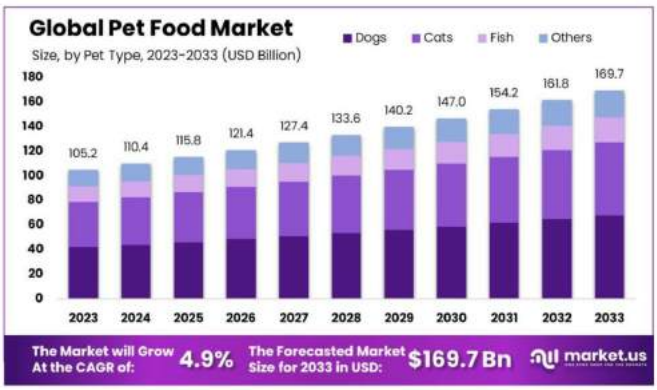
Pet Food (Feed) Quality Control with Digitalization tools

The world after pandemic have been changing in almost every field as well as fish industry.

In 2020, FAO have mentioned that the most consumed fish in the world is Tuna[1]. Until now, tuna product consumption seems to be expanding and nonstop growing. Especially tuna product for Pet consumption. Due to rising up of the pet's adoption during and after pandemic.



Source: https://market.us/report/pet-food-market/

As we can see now the quality of pet food is improving more than before because of the pet's owner awareness. Pet's owner would like to ensure the food quality and food safety for their lovely pet.

Pet food producers and processor are developing the formula and nutrition ingredients for ensure and fulfils the demand of the pet food variety. Although, in terms of regulation of Pet food and human food is not the same. But one of the key parameters that could affect to the health of human and pet is "Histamine or Scombrotoxin"

An important factor in the processing of tuna for international markets is to ensure that the product does not cause scombrotoxin poisoning due to the elevated level of histamine generated by bacterial degradation of substances in the muscle protein. The levels of poisoning increase due to high temperature, exposure to oxygen and inappropriate sanitary conditions. Scombrotoxin poisoning is one of the most common causes of intoxication caused by the ingestion of fish and fishery products, and the potential toxins are not destroyed by freezing, cooking, smoking, curing or canning. Fish most commonly involved are members of the Scombridae family (tunas and mackerels).

There are an increasing number of new digital tools on the market which are useful in assessing the levels of histamine and other contaminants in fish and fishery products. Documents of interest in this aspect include the FAO's Blue Transformation Road Map[2] and the US FDA's New Era of Smarter Food Safety[3]. These tools provide connectivity and accessibility to key data for early detection and monitoring; an example of such a tool is BIOLAN's range of histamine assessment devices which help to ensure the quality of the fish before and after receiving raw material.

In the other hand, producer can use digitalization tools to enhance and show up the quality added value to their product with the transparence data. Aimed at ensuring quality control as well as providing readily accessible and accurate data to the critical decision-makers. Furthermore, as this food safety data is saved on to secure digital platforms, its transparency is assured.

[1] https://www.atuna.com/pages/tuna-world-s-2nd-most-consumed-fish-2

[2] https://www.fao.org/3/cc0459en/cc0459en.pdf

[3] https://www.fda.gov/food/new-era-smarter-food-safety

AQUACULTURE

Complete farming of eels

The cost of producing glass eels and the number of glass eels that can be produced are still at a stage where they cannot be compared with natural ones, explained Professor Hideki Tanaka, Kindai University Fisheries Research Institute

Japan – On 26 October 2023, Kindai University announced that it has succeeded in complete farming of Japanese eels, in what it describes as the world's first feat of its kind by a university (in 2010, the Japan Fisheries Research and Education Agency became the world's first body to achieve the feat). Complete farming involves hatching fish larvae from eggs and sperm collected from adult fish that were artificially hatched. Kindai University has so far developed farming technology for bluefin tuna and red sea bream.

However in practical terms, the cost issue poses a challenge. According to the Fisheries Agency, it cost 3 026 yen (about USD 20) to artificially breed one young fish as of fiscal 2020. While this is a sharp drop from the 27 750 yen (USD 185) it cost in fiscal 2016, natural young fish remain cheaper, at 180 to 600 yen each (approximately USD 1.20 – 4). This significant price difference makes it difficult for completely artificially-bred fish to make it onto dinner tables.

World's first integrated power fish farm

China – Longyuan, a subsidiary of the world's largest power producer China Energy Investment Corp (CEIC) and turbine-maker Shanghai Electric Wind Power Group (a subsidiary of Shanghai Electric) have launched what they claim is the world's first integrated floating wind, solar and fish farming system. Located off Nanri Island in Fujian Province, the floating farm includes a three-column, semi-submersible platform, wind turbines and a central hexagonal deep-sea aquaculture zone. "The pioneering convergence of wind power, photovoltaics, and aquaculture presents a new horizon for the industry," claimed a statement from the project partners.

The next steps will be research on choosing the right seafood breeds, the impacts of turbine noise on fish farms, as well as the impact of subsea fish cages on the performance of the turbines themselves. Once operational, the farming system can generate 96 000 kWh of electricity daily at full capacity, equivalent to the daily energy consumption of 42 500 people, according to Shanghai Electric.


Credit: Shanghai Electric

Naked clam culture

UK – Researchers have developed a fully-enclosed aquaculture system for shipworms, traditionally considered to be a marine pest because they bore through any wood immersed in seawater, including ships, piers and docks. Renaming the shipworms "naked clams", the researchers say that the modular design means that its culture can be carried out on-land, far from the sea.

This photo shows shipworms which have burrowed into wood.

These long, white saltwater clams are the world's fastest-growing bivalve and can reach 30 cm long in just six months. Scientifically named *Teredinids,* they have no shell, but are classed as bivalve shellfish and related to oysters and mussels. Because the naked clams don't put energy into growing shells, they grow much faster than mussels and oysters which can take two years to reach a harvestable size. The levels of Vitamin B12 in the clams were found to be higher than in most other bivalves – and almost twice the amount found in blue mussels. And with the addition of an algae-based feed to the system, the naked clams can be fortified with omega-3 polyunsaturated fatty acids.

Wild shipworms are eaten in the Philippines either raw, or battered and fried like calamari. But for British consumers, the researchers think naked clams will be more popular as a 'white meat' substitute in processed foods like fish fingers and fishcakes. "We urgently need alternative food sources that provide the micronutrient-rich profile of meat and fish but without the environmental cost, and our system offers a sustainable solution," said Dr Reuben Shipway at the University of Plymouth's School of Biological & Marine Sciences, senior author of the report.

FISHING

Ministry to amend tough fisheries law

Thailand – According to the Bangkok Post, the Ministry of Agriculture and Cooperatives plans to have the fisheries law amended to help solve economic problems faced by fishermen who say their livelihoods are hurt by tough regulations. Minister Thammanat Prompow said that a committee has been set up to look into the matter, particularly the regulation meant to prevent IUU fishing and which brings stiff penalties for breaking the rules. At the same time, the committee will also discuss the issue with international bodies such as FAO in order to ensure that the country's commitment to combat IUU fishing is not affected.

Thammanat emphasised the significance of the fisheries sector in propelling economic growth, citing its contribution of approximately 130.3 billion baht to the Gross Domestic Product (GDP) in the previous year. This was partly attributed to the Department of Fisheries' efforts to augment fish stocks and collaborate with local communities to conserve marine life.

Study indicates ongoing human rights abuse

Pacific Islands – The Pacific Community (SPC) reports that very little attention has been given to addressing human rights violations within the fishing industry in the Pacific. This is according to new research unveiled at a first-of-its-kind ocean science meeting in Nadi, Fiji recently. A study titled, *'Fishing Practices in Pacific Island Countries: A human rights perspective'* is currently in review stage but academics from the Solomon Islands used the inaugural Pacific Islands Conference on Ocean Science and Ocean Management to highlight the issue that "permeates the multi-billion-dollar tuna industry".

One of the report's co-authors, Kezyiah Lusa Saepioh said that the research addressed 18 reported cases of human rights violations in the fishing industry in Papua New Guinea, Fiji, the Federated States of Micronesia, and others. The information was collected with the help of international human rights organisations including the International Organization for Migration (IOM) in Honiara.

Saepioh said the research recommends "the need for international commitment, particularly ratification, and implementation of some of the international instruments. For example, the International Labour Organization C188 to address forced labour in the industry". She said the Solomon Islands and other Pacific Island countries have yet to ratify the agreement. "There's also a need for the establishment of a coordinating framework to detect and ensure improved regional equitable access to social services, particularly for the victims, whether they are locals or foreigners."

To champion this human rights issue on a broader scale, Saepioh said that the "Western and Central Pacific Fisheries Commission (WCPFC) should be the leading organization and of course, with important support and contribution at the sub-regional level including Parties to the Nauru Agreement (PNA), Forum Fisheries Agency (FFA) and others".

MARKETS/MARKETING

First Russian king crab shipment flies into Qingdao

China/Russia – On 22 September 2023, the first Russian king crab shipment (slightly over 8 tonnes in weight) landed at the Qingdao airport. Specially trained staff ensured fast customs clearance and transportation and the importer reported that the crabs arrived "as alive as caught."

Some of the crabs were reported to have been sent to Beijing and Shanghai due to high demand. Imports of Russian crab into China in 2023 are thought to have increased significantly, as prices were down by 20% compared to 2022, according to a Shanghai importer. September

marked the start of the king crab harvesting season in Russia, coinciding with Chinese national holidays that drive demand for crabs.

Air-flown live crab shipments from Russia into China are expected to rise further with the recent announcement by China Eastern Airline that it had signed an order of king crab worth USD 1 billion with Russia's Antry Group. The deal was announced at the 6th China International Import Expo (CIIE) in November 2023. The carrier also said that it had concluded more than USD 2.5 billion in other deals at the event, including an order of USD 500 million with Aquachile (Chile) for salmon.

GAPP explores new pollock markets in Southeast Asia

USA/Malaysia – As part of a US Department of Agriculture (USDA)-sponsored trade mission to Southeast Asia, Alaska pollock was showcased in Malaysia at the end of October 2023. The Association of Genuine Alaska Pollock Producers (GAPP) Chief Executive Craig Morris, USDA Under-Secretary for Trade Alexis Taylor, and other commodity marketing association leaders "will work to explore new opportunities for wild Alaska pollock in these critical Southeast Asian markets and forge relationships, generating new demand with buyers in the region," GAPP said in a press release.


Credit: GAPP

GAPP CEO Craig Morris in the Pasar Harian Selayang Daily Market in Kuala Lumpur, Malaysia

Morris said that the trade mission will benefit GAPP by giving it a chance to learn more about what it can do for its members to build demand in Southeast Asia. Malaysia was identified in a GAPP study as a "very favourable" market for Alaska pollock. The study found that Malaysia has "avid fish eaters, an increasing demand for imported fish, [and] a growing population that is mostly urban and a large middle/upper class," – all factors which ranked it more favourably compared to 20 export markets ranked in the study. Malaysia also had the highest per-capita seafood consumption among countries in the study, the study found.

The GAPP delegation also travelled to Singapore to visit the Agri-Tech Food Expo Asia and participated in the US-Association of Southeast Asian Nations (ASEAN) Business Council Roundtable on 3 November 2023.

Digital campaigns to sell Norwegian salmon

Republic of Korea/Norway – The Norwegian Seafood Council (NSC) is capitalizing on online shopping, digital trends, and influencers to increase recognition and sales of Norwegian mackerel in the South Korean market. NSC said in a release that it has been testing the use of interactive digital campaigns about Norwegian mackerel to increase awareness of the species. Research, the NSC showed, has determined that Korean shopping habits have changed, and many consumers in the country are using online broadcasts and e-commerce to purchase food. "Koreans do not shop as frequently in physical stores as in the past. Instead, they have started buying food and drinks online," the NSC said.

E-commerce sites are now offering next-day delivery for products in Seoul and other cities, and online shopping has become an increasing part of South Koreans' grocery shopping habits, NSC said. Live broadcasts by Amazon, IKEA, and TikTok featuring influencers or celebrities promoting products have also gained traction, and live chat features with audiences have given potential buyers new avenues of learning more about products. The result, the NSC found, is that its mackerel is increasingly sold online, with approximately 25 percent of the product now sold through such online channels. "This has proven to be an effective way of reaching new consumers and maintaining interest in mackerel in South Korea – especially among the youth" the NSC said.

Meanwhile, China has surpassed Japan and the Republic of Korea as the biggest destination for chilled Norwegian salmon in Asia for the first time ever. From January to August 2023, Norway exported NOK5.6 billion (USD 501.5 million) worth of marine products to the Chinese market, up by 10 percent from the previous year, said the NSC.

SUSTAINABILITY/TRACEABILITY

Maruha Nichiro invests in cell-cultivated seafood

Japan/Singapore – Maruha Nichiro (Japan) has invested in Umami Bioworks, a food-tech start-up in Singapore, to develop and commercialize cell-cultivated seafood. Nikkei Asia reports that Umami uses artificial intelligence to calculate optimal conditions, such as the ratio of nutrients and culture temperature, to efficiently increase the number of cells. It is working to cultivate several species of fish, and development has progressed to the stage where grouper, for example, can be taste-tested.

MARUHA NICHIRO

UMAMI BIOWORKS

Cultured fish meat is a paste at the cell-growth stage. Umami is making prototypes of products formed like fillets using a 3D printer by mixing soy protein and other ingredients as a binding agent. The production cost of the food is estimated to be around USD 200 per 100 grams. Maruha Nichiro plans to develop a cost-effective method of processing fish paste products using

Credit: NSC

cultured fish meat produced by Umami as a raw material. "We hope to increase the pace of technological development and establish mass-production technology by 2026 that can compete with the supply of commercial products," the company said. Maruha Nichiro may either build its own production line or bear some of Umami's investment in a manufacturing facility in Japan.

Japanese eco-label approved by GSSI

Japan – On 12 December 2019, The Global Sustainable Seafood Initiative (GSSI) had provided formal recognition of the Marine Eco-Label Japan (MEL) scheme for the scope of aquaculture and fisheries. On 21 September 2023, their Aquaculture Management Standard (version 2.0, 2022) and Fisheries Management Standard (version 2.0, 2018) were re-benchmarked under version 2.0 of the Global Benchmark Tool.

MEL Council President Naoya Kakizoe said that "Today marks an important step for Japan's seafood sector and for the Japanese aquaculture and fisheries industry. Since February 2017, the MEL Council, in collaboration with Japanese stakeholders, has continuously improved our scheme governance and operational management to harmonize Japan's rich diversity of nature, culture, and fishing industries with the FAO guidelines as outlined in the GSSI Benchmark Tool."

The MEL certification was created in 2007 to promote its recognition in the Japanese market, with the aim to gain wider acceptance and to respond to the needs of foreign markets to promote the export of sustainable Japanese seafood. More than 70 Japanese operators, including CGC Japan, Sojitz, Nissui, Nicherei, Marubeni, and Mitsubishi have MEL certification, with a dozen holding certification for both fisheries and distribution and processing. The certification and its label are not used outside of Japan, though MEL leadership has stated its intention to expand into the broader Asian market in the future.

Approval to export to the EU

Malaysia/EU – Veolia Bioconversion Malaysia, one of the largest insect protein producers in Asia, with a production capacity of 3 000 tonnes of insect products per year, has been approved to export its insect meal and oil exports to the European Union. On 13 October 2023, the company announced it had received approval from the Malaysian Ministry of Agriculture in Malaysia to export its Entomeal insect meal product and Entolipid, its insect oil product, to European markets for use in pet food, aquafeed, and livestock feed.

The Trade Control and Expert System (TRACES) approval means the company's products are produced to EU industrial standards and are fully compliant with EU regulations to be used in animal feed applications, the company said. Veolia Bioconversion Malaysia General Manager Fabrice Latchoumanin said his firm has found "optimal conditions" for growing black soldier fly larvae in Malaysia."

Possible resumption in export of lobster larvae

Hundreds of thousands of lobster larvae confiscated from a foiled smuggling attempt

Indonesia – According to a Mongabay report, the Indonesian fisheries ministry is considering once again allowing exports of lobster larvae, a controversial policy that landed the former minister in jail for corruption. The ministry says resuming exports will be important for boosting the livelihood of fishers across the country. Exports were halted in 2016 to prevent the overharvesting of wild lobster stocks from Indonesian waters. However, a decree currently being drafted by the ministry indicates they could soon resume, catering to demands for a resumption made by fishers at a parliamentary hearing in August.

The decree says exporters buying wild-caught larvae from local fishers would have to sign a partnership agreement with fish farmers and commit to release 2% of their harvest back into the wild. Those same requirements were notably included when then-minister Edhy Prabowo lifted the export ban in May 2020. That experiment lasted only briefly, however, after Edhy was arrested and jailed for taking bribes to award export licenses. This time around, the ministry says it will be stricter about ensuring that exporters comply with the rules.

Proponents of resuming lobster larvae exports argue that not harvesting them would be a waste, as the individual larvae have low survival rates in the wild. They also say the ban has been ineffective against larvae smuggling, despite several smuggling attempts being foiled by authorities. The larvae are typically sold to buyers in Vietnam, Singapore and China, where they can be raised and sold at much higher prices as fully grown lobsters.

WORLD

Pacific nations warn about climate change

The Republic of the Marshall Islands Climate Change Envoy Kathy Jetnil-Kijiner at the International Tribunal for the Law of the Sea (ITLOS)

On 21 September 2023, the Pacific Community (SPC) presented compelling science to the International Tribunal for the Law of the Sea (ITLOS) that shows the existential threat climate change is having on the marine environments of Pacific communities, which is predicted to continue if rapid decarbonization and greenhouse gas emissions are not urgently curbed.

The SPC Statement was co-presented by the Republic of the Marshall Islands Climate Change Envoy Kathy Jetnil-Kijiner and Director of SPC's Geoscience, Energy and Maritime Division Ms Rhonda Robinson in Hamburg, Germany in front of the 21 judges of the ITLOS Tribunal. This representation is a critical step towards ensuring the best available science and information is informing the decision-making on the realities Pacific communities are facing, as emphasized by Jetnil-Kijiner: "If we do not act with sufficient urgency and ambition within this decade, within these next 7 years our people will suffer for thousands of years." Jetnil-Kijiner also highlighted the need to listen to the science and realities of communities on the ground, noting that Marshallese communities are already facing the impacts of climate change on their homes and families.

SPC's Director Robinson spoke to the science on ocean warming, acidification and what the predicted sea level rise impacts are as a result of greenhouse gas emissions and their impact. "The impacts of sea level rise have forced many communities to abandon their ancestral lands and relocate to safer areas, often resulting in the loss of traditional food sources, cultural heritage, identity, practices, traditional knowledge, social cohesion as well as economic stability and security."

The opinion on the ITLOS oral statements is expected in the coming months and will be instrumental for Pacific countries in their work towards presenting a case at the International Court of Justice in 2024.

Vegan sashimi market to reach a valuation of USD 218.8 million by 2033

According to Future Market Insights, the global vegan sashimi market is expected to be valued at USD 104.9 million in 2023 and to reach a valuation of USD 218.8 million by 2033. The demand for vegan sashimi is estimated to grow at a steady 8.5% CAGR, with the UK, the US, China and India emerging as key producers.

In recent years, there has been a growing interest in vegan and plant-based alternatives to traditional meat and seafood products. This has led to the development of various plant-based seafood substitutes, including vegan sashimi. These products are typically made

Future Market Insights

Attributes	Details
Vegan Sashimi Market CAGR (2023 to 2033)	8.5%
Vegan Sashimi Market Size (2023)	US$ 104.9 million
Vegan Sashimi Market Size (2033)	US$ 218.8 million

from plant-based ingredients such as konjac, soy, mushrooms, and seaweed, which are shaped and flavoured to resemble traditional sashimi. Increasing awareness and concern for the environment, animal welfare and a growing number of health-conscious consumers are driving the growth of the vegan sashimi market.

New organization for alternative foods

Future Ocean Foods, a new global seafood association dedicated to supporting and accelerating the alternative seafood industry, was launched in November 2023 with a membership base of 36 companies across 14 countries, including the United States, Canada, the UK and Singapore. Spanning plant-based, fermentation and cultivated food and technology, Future Ocean Foods members are "united in their mission to promote food security, human health, environmental sustainability and ocean conservation".

There have been enormous recent developments in advancing the taste, texture, nutrition and price of seafood alternatives. Invested capital into the space grew 92% from 2021 to 2022 and US retail sales grew 42% over a similar period. The worldwide plant-based food market is expected to surpass USD 100 billion by 2030.

Big drop in fishmeal and fishoil supplies

Based on a list of countries considered by the Marine Ingredients Organisation (IFFO) – Peru, Chile, Denmark, Norway, Iceland, UK, Ireland and Faroe Islands, USA, South Africa, Ivory Coast and Mauritius, and Spain - cumulative total fishmeal production during the first nine months of 2023 was down by approximately 26% compared to the cumulative production reported through September 2022. The predominant factor behind this is the 70% year-on-year production decrease in Peru. As for fish oil's total cumulative output in the period under review, it was down by 21% year-on-year. Chile remained the only country to report an increase year-on-year, thanks to healthier catches and higher-than-average oil yields in the South of the country.

Cumulative imports of fishmeal by China through September dropped by 8.7% on a yearly basis, reflecting both a weaker domestic demand from aqua- and piglet feed producers and a lower supply worldwide.

New WWF platform to assess climate impact

The World Wildlife Fund (WWF) has launched a new platform intended to identify areas that are likely to experience maritime conflict or food insecurity due to climate-driven fisheries migration.

The Ocean Futures program is a response to a 20-fold increase in fisheries conflict over the last four decades and a projected 23 percent of global fish stocks migrating due to climate change, according to the WWF. Oceans Futures has already identified seascapes that are expected to experience increased fisheries conflict as a result of climate change, including the Arctic Ocean, the Gulf of Guinea, the Eastern Mediterranean, the Eastern Tropical Pacific, and the Central Pacific, along with 20 regions of the world that will likely see conflict, food insecurity, or geopolitical tensions over fisheries by 2030.

Besides countries bordering Arctic waters, Cameroonian, Syrian, Ecuadorian, Indonesian, and Micronesian waters are included in the regions identified. These hotspots were pinpointed by combining data on fisheries movement with socioeconomic and security information, including nutrition profiles, economic levels, the presence of foreign fishing vessels, and contested maritime borders.

The Gambia, UK formally accept WTO Agreement

The World Trade Organization announced that the Republic of the Gambia and the United Kingdom had deposited their instruments of acceptance of the Agreement on Fisheries Subsidies on 13 December 2023. This brings the total number of WTO members that have formally accepted the Agreement to 55, which is half of what is needed for the Agreement to come into effect (two-thirds of the WTO membership).

Seyaka Sonko, Minister of Interior of the Gambia, and Andrew Mitchell, Minister of State (Development and Africa) of the UK presented the instruments of acceptance to Director-General Ngozi Okonjo-Iweala. The UK also announced its pledge to donate up to GBP 1 million (approximately CHF 1.11 million) to the WTO Fisheries Funding Mechanism.

DG Okonjo-Iweala said: "I am delighted to receive the formal acceptance of the Agreement on Fisheries Subsidies by the Gambia, the first least-developed country to do so. I also heartily welcome the UK's formal acceptance of the Agreement on Fisheries Subsidies, and am grateful for its pledge to the Fisheries Funding Mechanism."

REGULATORY CHALLENGES IN SEAFOOD INNOVATION: THE THAI UNION EXPERIENCE

By Sirilak Suwanrangsi

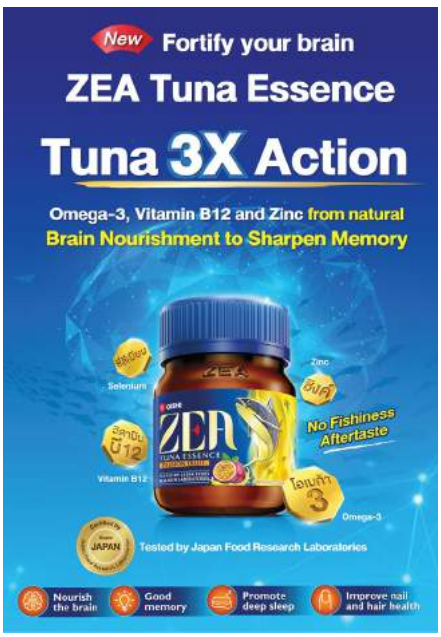
Innovations in the seafood industry hold great promise for addressing overfishing, reducing environmental impact, and meeting the rising global demand for protein-rich foods. Highlighting the crucial fact that such innovations enable companies to remain relevant to consumers and customers, this article gives an insight into the portfolio of the biggest tuna business in the world, Thai Union PCL, where the company's stated mission is to develop game-changing solutions for enhanced consumer satisfaction, shared value, and sustainability. However, these innovations are not without their regulatory challenges. The author examines the complex regulatory landscape surrounding seafood innovations and discusses the implications of these rules for sustainable growth and responsible development.

ZEAVITA, Thai Union's flagship supplement brand, continued strengthening its product portfolio in 2022. Strong momentum was noted in the new product launches, especially with regard to tuna collagen products.

The role of food nowadays is not only to provide basic nutritional needs to consumers but also to support both physical and mental health in a sustainable way. Accordingly, the seafood industry is undergoing a transformative phase driven by technological advancements, sustainability concerns, and changing consumer preferences.

In line with this global momentum, Bangkok-based Thai Union PLC invested in seafood innovation by establishing the Global Innovation Incubator in 2015, with the emphasis being on the full utilization of the company's core raw material, tuna, using new and novel technology. The Incubator evolved into the Global Innovation Center which focuses on developing game-changing solutions for enhanced consumer satisfaction, shared value, and sustainability. Successful innovated products have been produced, which are commercialized in different regions of the world. These products, which contain marine ingredients (tuna head fish oil, tuna bone calcium, collagen and protein hydrolysate), include food supplements, tuna essence, calcium-rich canned tuna products, all of which reach consumers in user-friendly and environmentally-friendly packaging. In fact, sustainable packaging plays a key role in supporting SeaChange®, Thai Union's sustainability strategy, along with the company's goal of 'Healthy Living, Healthy Oceans.' The company is committed to achieving 100 percent reusability, recyclability, or compostability of our branded packaging by 2025.

The OMG brand launched in June 2022 is an example of a line of commercial products that make use of Thai Union's plant-based shrimp technology



ZEA Tuna Essence is a functional nutrient beverage enriched with Vitamin B, zinc, selenium and Omega-3. The product comes in two flavours: original and passion fruit. It was launched in Thailand across modern trade channels in Q4 2021

Lisa DHA Shot is a milk-based drink high in DHA, EPA and Vitamin B

Regulatory challenges

Some of the main challenges with regard to product regulations are as follows:

- **Regulations applicable to novel ingredients and products**

  The emergence of alternative seafood products derived from plant-based, cellular agriculture, or microbial sources poses labeling and safety challenges. Regulatory agencies must determine the appropriate terminology and establish safety standards for these novel products. Ensuring that these products are accurately-labeled and meet nutritional requirements is vital to prevent consumer confusion and protect public health;

The high-pressure processed tuna slice is a ready-to-eat product which comes in two flavours: smoked and paprika

- **Novel technology**

  The development and use of novel thermal and non-thermal technologies and 3D printing to process foods are on the increase worldwide. For the food manufacturing industry, this means that the use of novel technologies ultimately must result in the production of nutritious, safe and high-quality foods at a reasonable cost for the consumer. Yet considerable work remains to be done to validate the safety and efficacy of many of the novel technologies, in order to achieve food safety assurance required by regulatory authorities. So far, only high-pressure processing (HPP), irradiation and pulsed electric field technologies are being used commercially.

- **Laboratory-grown seafood**

  Cellular agriculture has enabled the cultivation of seafood without the need for traditional fishing or aquaculture. However, the regulatory framework for laboratory-grown seafood is still evolving. Questions surrounding food safety assessment, labeling, and traceability need to be addressed. Collaborative

Tuna bone calcium is utilized in the protein and calcium-rich tuna product line of John West Australia, a brand under Thai Union (www.johnwest.com.au/ourrange/tuna/protein-calciumriched-tuna)

efforts between regulators, scientists, and manufacturers are essential to establish guidelines that ensure the safety and quality of laboratory-grown seafood.

- **Labeling issues**

  The food industry faces many challenges that include adhering to an increasingly complex set of global regulations, maintaining supply chain visibility and meeting localization requirements such as language. New ingredients, flavouring agents, enzyme-added water, for example, should be included in the list of ingredients on the products. The claims to be made on packaging are regulated but they are somewhat in a grey area of interpretation. Uses of terms such as natural, vegan, gluten-free, plant-based, culture meat or seafood are yet to be regulated. Permitted health claims i.e. Omega3, EPA and DHA in products are still limited and approval requires humongous scientific support beyond the ability of a single food company.

- **Environmental impact**

  Global environment sustainability requirements are ambitious. Sustainable seafood production methods such as recirculating aquaculture systems (RAS) and closed-containment systems, aim to minimize environmental impact. Regulatory agencies must balance encouraging these practices with ensuring compliance with environmental regulations. Striking the right balance requires ongoing assessment of the ecological effects of new production methods and adapting regulations accordingly.

- **Traceability and fraud prevention**

  Seafood traceability systems are complex, but monitoring is attainable through electronic data systems and big data systems which identify catch or production to products throughout the supply chain. Regulatory requirements should be clearer with regard to what information to maintain, the records to be kept, and what should be labelled. Regulatory bodies also need to promote the adoption of traceability systems and to establish protocols for their integration into seafood supply chains. Seafood fraud, including mislabeling and misrepresentation of products, remains a significant concern. Regulations to prevent fraud to-date are still based on existing food safety and labeling regulations, making implementation to prevent fraud and enforcement inaccurate and liable for misinterpretation. For example, the use of phosphate and added water in seafood remain unsolved fraud issues. Clearer regulations and continued development of advanced traceability technologies, such as blockchain, can enhance transparency and combat fraud.

- **International trade**

  The global nature of the seafood industry requires harmonization of regulations across borders to facilitate trade. Differing regulatory approaches can lead to barriers to market entry for innovative seafood products. Establishing international standards and agreements can streamline the utilization of fishery by-products and movement of seafood innovations while ensuring consistent safety and quality controls.

Implications and future directions

- **Collaboration and education**

  Regulatory agencies, industry stakeholders, and researchers need to collaborate closely to develop informed regulations that foster innovation while safeguarding consumer interests and environmental sustainability. Education and information-sharing are crucial to ensure that all parties are well-informed about the latest advancements and regulatory expectations.

- **Adaptive regulations**

  The regulatory framework must be flexible enough to accommodate rapidly-evolving technologies and production methods. Regular updates and revisions are necessary to address emerging challenges effectively. Consultation among experts, regulatory authorities and industry is essential.

- **Public engagement**

  Involving consumers in discussions about seafood innovations and regulatory decisions can enhance transparency and build public trust. Public input can influence the direction of regulations and contribute to responsible development.

Summary

Seafood innovations have the potential to revolutionize the industry, addressing critical issues such as sustainability and food security. While regulatory challenges are inevitable, they also present opportunities to create a supportive environment for responsible and impactful advancements. By addressing these challenges collaboratively, regulatory agencies can pave the way for a future in which seafood innovations benefit both consumers and the planet.

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EMPOWERING FISHERWOMEN IN PAPUA NEW GUINEA BY INTRODUCING INNOVATIVE TECHNOLOGY (FAO THIAROYE TECHNOLOGY-FTT)

By Amir Khaleghiyan, Muhammad Atif Nasim and Patu Jume Shang

The Food and Agriculture Organization (FAO) has introduced the FAO-Thiaroye Technology (FTT) in Papua New Guinea to address the challenges of post-harvest losses within the fisheries sector and to provide better market opportunities. To determine the financial and economic viability, FAO established two demonstration sites and conducted a Financial and Economic Analysis (FEA) to compare traditional smoking practices with the FTT smoking technique. The results showed that the incremental benefit is 59% IRR, and the analysis also identified the sensitive parameters of the business. Moreover, FTT empowers fish operators by solving cold chain, market access, and transport constraints in remote areas. It boosts fish production and quality, reduces losses, and extends shelf life by 5-6 months.

The FAO-Thiaroye Technology is an innovative technology that empowers fisherwomen to own and operate profitable fish businesses

Papua New Guinea, an archipelago nation, is deeply influenced by its surrounding Pacific waters, rivers, and lakes, shaping the livelihood of its communities. Approximately 30% of the population resides along the 10 000 km coastline, heavily reliant on marine fishing for sustenance and livelihood. Additionally, the country hosts over 5 000 freshwater lakes, supporting communities in floodplains and extensive water bodies.

Fishing and aquatic life are vital for a significant part of the populace, impacting the nation's culinary practices, cultural traditions, and social dynamics. Fish, a dietary staple, plays a key role in providing protein and ensuring food security for both marine and freshwater communities.

Despite their abundant aquatic resources, these communities face significant challenges in effectively using the resources to enhance their well-being. These challenges, such as limited market access and underdeveloped post-harvest processing, prevent communities and the nation from benefiting from the vast fisheries resources.

Poor road infrastructure is also a major bottleneck, hindering the transport of goods from rural areas to markets. This particularly affects fishing communities as fresh fish spoil quickly, thus making it difficult to reach distant markets. Moreover, with most households engaged in fishing, local markets become oversaturated, especially during peak fishing seasons. The combination of poor roads, scarce vehicles, and high transport costs impede intermediaries from collecting fish, often leaving communities with unsold catches.

The above challenges are compounded by the fact that only 13% of the country's population has access to electricity, severely impacting fishing communities. The absence of reliable refrigeration and ice-making

facilities, which need a reliable energy supply, hampers the preservation of fresh fish, crucial for consistent market supply.

In Papua New Guinea, fish drying offers a viable preservation method for seafood, yet its widespread adoption is hindered by several factors. High humidity, frequent overcast conditions, and persistent rainfall challenge the wider adoption and effectiveness of this practice.

Despite the potential benefits, the country has seen limited technological advancement in enhancing artisanal fish smoking quality. Fishing communities often lack the necessary resources and know-how for efficient fish-drying techniques. Typically, rudimentary methods are used, such as steel meshes balanced on sticks or stones.

Traditional open-fire smoking methods, prevalent in the country, primarily use firewood from untouched forests or coastal mangroves, leading to environmental degradation. These methods are not only energy-inefficient and time-consuming but also emit harmful pollutants, posing health risks. Moreover, these labour-intensive practices disproportionately burden women, who are central to fish drying processes, often resulting in poorly-smoked fish unsuitable for commercial sale.

Innovative technology

FAO, as part of the European Union-funded STREIT PNG Programme, introduced the FAO-Thiaroye Technology (FTT) in Papua New Guinea. This innovative technology aims to revolutionize fish processing, quality, safety, and marketability, ultimately enhancing the income of fishers and other stakeholders in the fisheries value chain.

FTT represents a significant advancement, addressing the inefficiencies of traditional fish smoking and drying methods. Developed collaboratively by FAO and Senegal's National Training Center for Fisheries and Aquaculture Technicians (CNFTPA), FTT targets enhancing food safety, efficiency, and working conditions in small-scale fish smoking and drying operations across developing nations.

Adopted in over 20 countries across Africa, Asia, and Latin America, FTT has proven its value in enhancing fish product quality, safety, and marketability, contributing to sustainable fisheries development.

FTT, introduced in the 1990s, has undergone iterative evolution driven by experiential insights. This evolution emphasizes reduced construction timelines and enhanced component functionality and usability, adapting to diverse social, cultural and economic contexts (Nyemah, 2021)[1]. In Papua New Guinea, the FTT implemented in the country comprises a masonry-made kiln, housing four metal components: (i) Lid: used to cover the top of the FTT kiln; (ii) Smoking racks: used to place fish for smoking; (iii) Fat collection tray: serves to collect fat/fish oil while the fish is being cooked and preventing direct flames; and (iv) Furnace: holds firewood that generates heat for cooking fish (Mindjimba, 2020[2]; Rotawewa, 2023[3]). Figures 1 – 5 depict these various components.

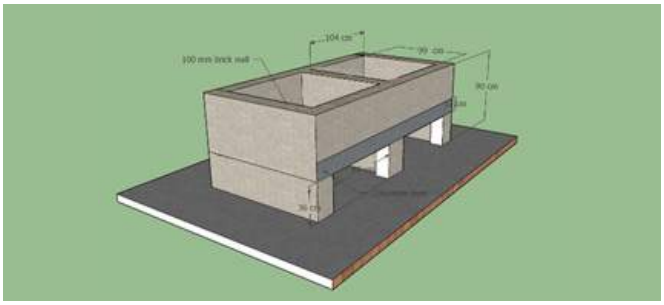


Figure 1- FTT Kiln design

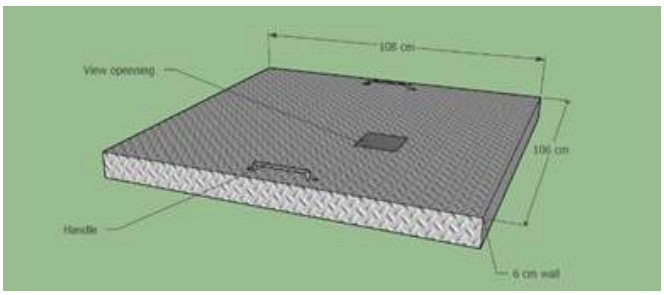


Figure 2 - Lid

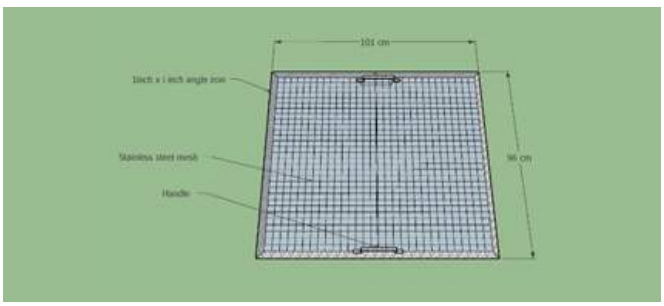


Figure 3 - Metal Rocks

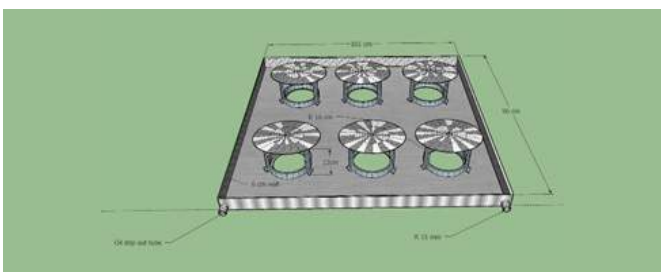


Figure 4 - Fat Collection Tray

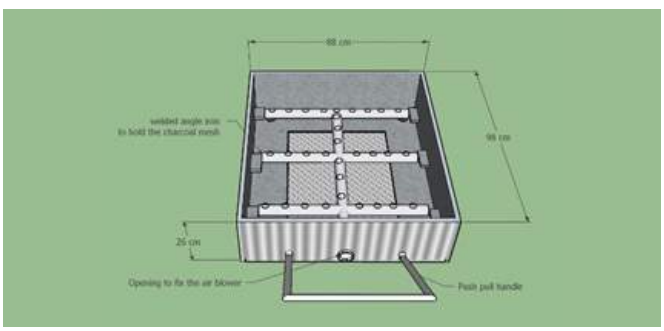


Figure 5 - Furnace

1 Nyemah, J. N. (2021). The FAO-Thiaroye Processing Technique (FTT). Apia, Samoa: FAO.
2 Mindjimba, K. (2020). Study on the profitability of fish smoking with FTT-Thiaroye kilns in Côte d'Ivoire (FAO Fisheries and Aquaculture Circular). ROme, Italy: FAO.
3 Rotawewa, B. (2023). Training on construction of FAO-Thiaroye Processing Techniques (FTT) fish smoking unit. Wewak, Papua New Guinea: FAO (unpublished training module).

To ensure the sustainability of FTT in Papua New Guinea, FAO trained and empowered national entrepreneurs to build and run FTT facilities on their own. This involved engaging experts, fish processors, and community leaders throughout the process, encompassing construction, operation, maintenance, and quality control of fish products. Furthermore, FAO developed adaptable training modules on FTT, catering to the varied needs of different beneficiaries.

The final product in the Papua New Guinea site: the FTT kiln, variations of which have been constructed in small-scale fish smoking and drying operations across over 20 developing nations

This approach has made FTT a replicable technology across Papua New Guinea. Collaborating with local stakeholders, FAO identified optimal sites for FTT facilities and strategized their construction and management. For instance, under the EU-STREIT PNG Programme, FAO, with partner consultation, planned 30 FTT sites in the Sepik region, demonstrating its commitment to widespread and sustainable implementation.

Financial and economic analysis

FAO has set up two FTT sites in Papua New Guinea's Sepik region, one in the marine-rich Karawap Community, Wewak, near the Bismarck Sea; and another in Angoram, by the fish-abundant Sepik River.

A Financial-Economic Analysis (FEA) was conducted to determine the economic feasibility of these sites. FEA, a method for evaluating financial and economic factors of a program or investment, employs cost-benefit analysis to gauge the viability of FTT businesses by contrasting scenarios with and without the FTT, considering intervention costs and outreach.

A 10-year cash flow analysis was conducted to calculate the Net Present Value (NPV) and Internal Rate of Return (IRR) of the FTT business (Table 1). In this analysis, the FAO is considered as a stakeholder because it is contributing resources, including capital investment and other related costs, to the business. Data for this analysis were gathered from beneficiary farmers, local input suppliers, and stakeholders involved in FTT implementation.

Table 1. FTT operating parameters and financial model

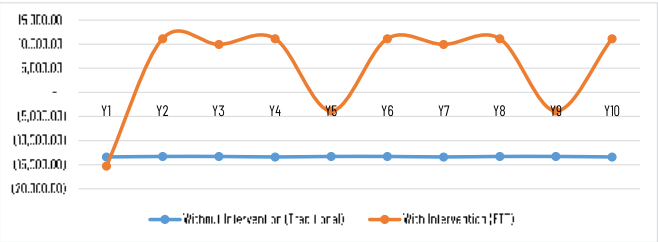
Description	Unit of measurement	Without FTT	With FTT	Remarks
Capital investment for the establishment of FTT	**Kina**	**0**	**15,000**	**4 years of economic life**
Processing capacity per cycle	Kg	15	50	
Smoking cycle (per year)	No	104	104	Twice a week
Wastage	%	10%	5%	Proper smoking method reduces the amount of wastage
Fresh to smoked ratio	%	33%	33%	The average weight of the fish is reduced to one-third after smoking.
Prices				
Price of fresh fish	Kina per kg	7.0	7.0	
Price of smoked fish	Kina per kg	30.0	35.0	The price increases by 5 Kina because of the improved quality.
Cost per cycle				
Labour	Kina	42	84	More labour is needed to manage the FTT business as the fish processing volume has grown by nearly four times. Comparatively, the labour decreases per unit.
Transportation	Kina	15	25	The transportation cost is directly proportional to the quantity.
Other Inputs (firewood, cleaning)	Kina	110	77	FTT is an efficient way of smoking fish, as it saves 30% of firewood.
Revenue				
Average annual revenue	Kina	13 900	55 916	
Average production costs	Kina	21 268	42 588	FTT doubles the processing cost; however, at the same time, FTT smokes four times more in quantity
Average annual net profit	Kina	-ve	10 000	
Profitability				
Net Present Value (NPV)	Kina	-ve	24 050	
Internal Rate of Return (IRR)	%	-ve	59.28%	

Findings

The implementation of FTT is projected to increase fish processing volumes from 15 kg to 50 kg per batch, reduce wastage from 10% to 5%, and raise prices by 5 kina per kg due to improved fish quality. The intervention is expected to yield an annual net profit of PGK 10 000 for FTT, with an incremental NPV of PGK 24 050 and an IRR of 59.28%.

The cash flow reveals initial negative cash flow in the first year due to upfront investments, turning positive mid-year (Figure 6). However, in the fifth and ninth years, cash flow drops to zero, correlating with the FTT's four-year economic life and the need for replacements.

Figure 6. Annual cash flow of FTT



The analysis incorporates labour costs, which are traditionally performed as household labour, primarily by women, in fish smoking. However, when using the Programme-supported FTT to process 50 kg of fish, extra labour is required.

Sensitivity analysis

To gain a deeper understanding of the model's profitability, a sensitivity analysis was conducted to assess the impact of variations. The sensitivity analysis showed that the model's Internal Rate of Return (IRR) is stable against smoked fish price changes but sensitive to fresh fish price fluctuations. A significant rise in fresh fish price (above PGK 8 per kg) combined with a smoked fish price drop to PGK 32.5 per kg could jeopardize financial viability. Green cells indicate a viable IRR range, while yellow cells suggest potential unfeasibility (Table 2).

Table 2. Sensitivity analysis for the IRR of FTT (fresh fish and smoked fish price)

		Price of Fresh Fish/KG in Kina						
		4	5	6	7	8	9	10
Price of Smoked Fish/kg in Kina	30.0	248%	96%	27%				
	32.5	585%	188%	76%	16%			
	35.0	5760%	384%	147%	59%	4%		
	37.5		1174%	279%	117%	46%	-9%	
	40.0			631%	214%	94%	34%	-32%

Source: Rotawewa, 2023

Another analysis assessed the impact of changes in smoked fish quantity and price on viability. A 100 kg yearly reduction in smoked fish quantity, coupled with a price drop to 32.5 kina per kg, risks the model's financial sustainability. Green cells represent an acceptable IRR range, while yellow indicates potential unviability (Table 3).

Table 3. Sensitivity analysis for the IRR of FTT (Quantity of smoked fish per year and price)

		Smoked Fish (KG/Year)						
		1,330	1,430	1,530	1,630	1,730	1,830	1,930
Price of Smoked Fish (kg) in Kina	30.0					3%	36%	69%
	32.5				15%	50%	91%	148%
	35.0			22%	59%	107%	180%	309%
	37.5		22%	63%	117%	203%	372%	873%
	40.0	18%	61%	118%	213%	414%	1154%	

Developing FTT capacity of women

FTT necessitates SME-scale operations for its viability and sustainability. Consequently, FAO is dedicated to fostering SME development among fish farming groups, with a particular focus on women-led business groups that play a pivotal role in the post-harvest stages of the fish value chain.

Key efforts by FAO include enhancing the capabilities and knowledge of these groups in various business aspects. This encompasses training in group dynamics, leadership, effective communication, conflict resolution in business settings, enterprise management, financial literacy, and promoting gender and youth participation. Additionally, FAO linked the groups to development partners (UN Agencies and private sector bodies) to access finance, market opportunities, ICT services and transport infrastructure. It will provide a conducive environment to business groups for the implementation of FTT businesses.

In Papua New Guinea (PNG), women are integral to the fish sector, traditionally dominating fish processing and local market sales. However, they often face limitations in resources and knowledge necessary for enhancing and managing their practices and business growth.

Recognizing this, FAO is actively working on empowering women's business groups. This involves training on utilizing FTT for producing high-quality, safe smoked fish; accessing and connecting with markets; and effectively managing and expanding their collective enterprises. Additionally, FAO encourages the formation and operation of women-led businesses that can capitalize on FTT for the production and marketing of superior fish products, thereby reinforcing women's pivotal role in the sector.

Women in Karawap and Angoram have been trained to operationalize the FTT, and are now producing high quality smoked seafood

Prospective transformative change

FTT has brought about profound improvements in the livelihoods and quality of life for fish operators. Its benefits extend beyond economic gains:

- Better production: FTT markedly improves fish product quality, ensuring consistency in appearance, texture, and taste, which boosts consumer satisfaction and demand. It effectively reduces post-harvest losses and food waste, functioning well in various weather conditions and simplifying processing to save time and labour;
- Better nutrition: FTT contributes significantly to food and nutrition security by extending the shelf life of fish products up to 5-6 months (Ndiaye, Komivi, & Ouadi, 2015[4]), under proper handling and monitoring, thereby enhancing food security;
- Better environment: FTT promotes environmental sustainability with improved fuel efficiency and lower wood or charcoal usage. This conservation effort helps preserve forests, cut greenhouse gas emissions, and combat climate change;
- Better life: By increasing income and reducing smoke exposure and workload, especially for women, FTT facilitates opportunities for fish post-harvest operators to diversify income and engage in community activities. Overall this contributes to comprehensive personal development. Moreover, FTT reduces the risk of harmful contamination, such as exposure to polycyclic aromatic hydrocarbons (PAHs) from traditional smoking methods, which can negatively impact human and animal health;
- In Papua New Guinea, where women are central to fish processing and marketing, FTT offers significant potential for business and personal development. This technology is especially advantageous for women, who typically manage both reproductive roles (like family and household duties, childcare, and domestic chores) and productive work. FTT not only improves their work quality but also lessens their time burden, enabling women to assume a leading role in the fisheries industry;
- Enhanced decision-making influence: Women's involvement in income-generating activities through FTT boosts their influence in household decisions, promoting gender equality and empowerment within families and communities;
- Expanded market access: Producing superior smoked fish through the FTT opens new market avenues for women, enabling them to create unique brands. This leads to increased market presence and financial autonomy;
- Diversified entrepreneurial pathways: Skills acquired from FTT training empower women to pursue various entrepreneurial opportunities beyond fish processing, such as value-added products or related businesses, contributing to their long-term economic resilience; and
- Elevated standing: Women's active participation in economic activities like FTT enhances their social standing and visibility in their communities, garnering increased respect, agency, and acknowledgement of their contributions.

[4] *Ndiaye, O., Komivi, B. S., & Ouadi, Y. D. (2015). Refer to: Guide for developing and using the FAO-Thiaroye Processing Technique (FTT-Thiaroye). Rome: FAO.*

Discussion

The two demonstration FTT sites in Angoram and Karawa built by the FAO have been met with open arms by the local beneficiaries. The enthusiastic adoption of this technology by beneficiary groups illustrates the crucial role of such initiatives in empowering local communities, especially women, by providing them with the tools and knowledge to thrive in their endeavours.

The Financial and Economic Analysis affirms the benefits of investing in FTT kilns over traditional methods. The resilience of FTT, as shown in the sensitivity analysis, highlights its adaptability to changing circumstances and underscores the need for strategic decision-making based on fluctuations in prices and quantities to ensure its ongoing effectiveness.

Furthermore, the advancement in fish smoking technology offered by FTT not only improves the quality and safety of smoked fish products but also lessens environmental impacts and betters the livelihoods of fish operators. With reduced wood or charcoal use; lower emissions of smoke and harmful substances; and prolonged shelf-life of fish products, FTT contributes to increased consumer satisfaction and demand. These advantages are particularly impactful in elevating the income and quality of life for fish operators, notably women. Hence, FTT's contribution to food security, nutrition, health, and sustainable development is substantial, embodying its intended outcomes.

There have been some challenges encountered during the implementation of the FTT, offering guidance for future interventions:

- A pivotal lesson is the need for a paradigm shift from subsistence to commercial fishing among local communities. The transition is not straightforward, as many communities are accustomed to fishing for sustenance, selling only surplus catches. The lack of experience in commercial or SME-scale operations presents a significant hurdle. Future initiatives must, therefore, focus on nurturing a business-oriented mindset, providing comprehensive training and resources to facilitate this transition from subsistence to profitable fishing enterprises;
- Another critical insight relates to asset management, particularly regarding the FTT. Communities often show limited prowess in valuing such assets, optimizing their use for sustained profits, effective maintenance, and financial planning for future reinvestment. It becomes imperative for implementers to impart knowledge on the economic value of FTT; guide its proper usage and maintenance; and educate on financial strategies for long-term asset sustainability; and
- The concept of community organization for larger-scale operations poses its own set of challenges. The inherent unfamiliarity among fisher communities with operating collectively at a larger scale suggests a more pragmatic approach: starting with smaller, family sized FTT units. These are likely to be more successful initially, as families tend to be more committed to the success and upkeep of their businesses. For larger groups, addressing the complexities of labour division and collective responsibility is crucial. This phased approach, beginning with smaller models and gradually scaling-up, can build a strong foundation for more extensive collaborative ventures.

In conclusion, the lessons learned from FTT implementation emphasize the importance of training and extension programs focused on business management, financial literacy, and cooperative operations, tailored to align with the unique needs and customary practices of the local fishing communities. Such an approach will bridge the gap between traditional subsistence fishing methods and modern, sustainable commercial practices.

The FTT model also improves household nutrition by increasing protein intake and adhering to international smoked fish standards, thereby contributing to environmental sustainability. FTT has also been shown to boost fishers' incomes, reduce exposure to smoke, lighten workloads, and promote community participation, thus improving living standards.

Note: *This article, based on an intervention by FAO under the EU-STREIT Programme in Papua New Guinea, presents the authors' views. These views do not necessarily represent the official stance of FAO or any other entity. The article is for informational purposes and is not endorsed by FAO for other purposes.*

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THE IMPORTANCE OF MONITORING SHRIMP UNIFORMITY FOR BETTER PERFORMANCE IN THE PRODUCTION CYCLE

By Diego Maia Rocha and Ana Paula G. Teixeira

Uniformity of size in shrimp culture is an indication of good farm management, contributing towards increased productivity, predictability, consistency, and also importantly, better prices at the point of sale. Assessment of uniformity involves looking at the coefficient of variation (CV); percentage of uniformity; and class distribution in terms of length and weight. These assessments can be performed manually as well as using artificial intelligence, as outlined in this article which bases its observations on data extracted from production results recorded by a high-efficiency farm in Brazil.

Animal sampling for biometry

Shrimp uniformity is one of the main considerations when it comes to characteristics related to product quality, from the beginning to the end of the production process. It is a measured trait with big influence at the hatchery stage, during the grow-out phase, and at the end of a cycle when harvesting the pond.

According to Newman (2023)[1], determining the size variability of a population along, and at the end of a cycle, is one of the most valuable tools for a farmer, as it can, in general, indicate how healthy the shrimp are.

Understanding concepts about uniformity, monitoring the animal's behaviour in relation to size distribution throughout the cycle and working towards enhancing better uniformity throughout the crop, can contribute greatly to its nutritional management and consequently result in a better product.

The uniformity of a sample can be assessed by the length and weight of the animals. There are three indicators that facilitate a broad reading of the condition of a batch: (i) coefficient of variation (CV); (ii) percentage of uniformity; and (iii) class distribution in terms of length and weight. These assessments can be performed manually as well as using artificial intelligence.

Coefficient of variation

In shrimp culture, especially in the post-larvae stage, the coefficient of variation is the most used mathematical indicator. It allows one to analyze the characteristic distribution of the sizes in a selected batch.

The first step to quantify the distribution of a batch is to measure the size of each animal in a sample and then calculate the sample´s mean and standard deviation for that trait. To calculate the CV, the following equation is used:

CV=S/X*100 (where: CV=coefficient of variation, S = standard deviation and X= mean weight or length of the same population).

Uniformity rate

For some producers, the CV may seem abstract and its information not easily interpreted. As an alternative way to read it, there is the Uniformity Rate (U%), an indicator that clearly shows, both in length and weight, the

[1] *Newman, Stephen. Cuáles son algunos parámetros que los camaroneros deberían monitorear regularmente? www.panoramaacuicola.com, june. 2023.*

Individual weighing for uniformity

situation of uniformity of a lot, in percentage. The Uniformity Rate is the coefficient of variation decrease, by 100%; i.e.:

U% = 100% -CV (where CV is the coefficient of variation of the population for size, in length or weight).

With this information, the producer or person in charge of the grow-out will be able to have a technical and strategic approach to monitor and specifically quantify the development of the batch throughout the production process.

Class distribution

A third indicator of uniformity is the class distribution, which stands for the distribution of the animals of a specific population in groups (classes) of size (length or weight). Individual biometric analysis of a sample is carried out and the data is divided into groups of size (which are the classes) and at the end, the percentage of animals in each class is calculated. It can be carried out at any stage of cultivation. In the initial stages (hatcheries and nurseries) it is usually read by classes of length (in cm), but for grow-out it is more common to be done by weight. In some cases, the sizes are already distributed in the processing classification. Having knowledge about the class distribution from the early stages allows for efficient and gradual nutritional management in relation to pellet size, making it possible for smaller animals to have access to food according to their size.

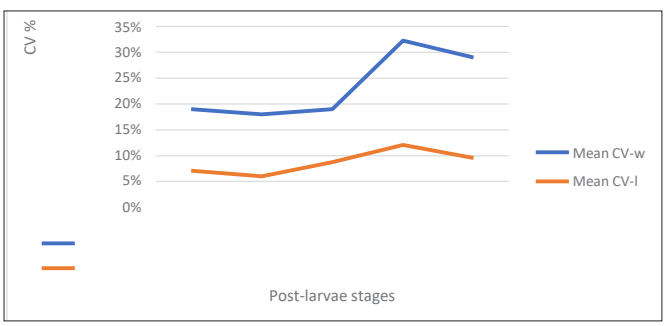
The impact of uniformity in the production cycle

Starting from the perspective of the post-larvae stocked in a pond, uniformity could be considered an indicator of the quality of the animals that are entering the culture cycle, as it can reflect genetic traits, previous feeding management, occasional management fails during hatchery, and possible presence of diseases. An example of the latter is in the case of animals infected with IHHNV (infectious hypodermal and hematopoietic necrosis virus), which in *vannamei*, causes mainly reduced, irregular growth, leading to extremely uneven populations.

Historically, in hatcheries and nurseries, the coefficient of variation is used with length, which allows a partial reading of the uniformity of a batch. Field experience shows that the CV of the length is more related to the visual perception of uniformity of a population of post-larvae, which will affect the commercial acceptance of the post-larvae, for example. However, the CV of the weight will correlate more with this same population´s performance further on.

Currently, with the possibility of the use of artificial intelligence applications, it is possible to achieve a broader indication of uniformity, once it can be performed completely both by length and weight. As an example, in Figure 1 we can see clearly, how the CV for length (CV-l) and weight (CV-w) are very different for the different commercial post-larvae stages:

Figure 1. CV evolution through post-larvae ages for weight (CV-w) and length (CV-l).



	9	13	14	18	20
Mean CV-w	19%	18%	19%	32%	29%
Mean CV-l	7%	6%	9%	12%	10%

During the grow-out phase

Moving on through the production cycle, the CV/uniformity for weight becomes greatly important and monitoring of uniformity becomes a fundamental indicator of the development of the animals. As Souza (2019) cites, a large variation in body size during grow-out can cause competition among shrimp (dominance hierarchies), which negatively affects growth rate, mortality, and feed efficiency .

Figure 2. Evolution of CV during the shrimp production cycle

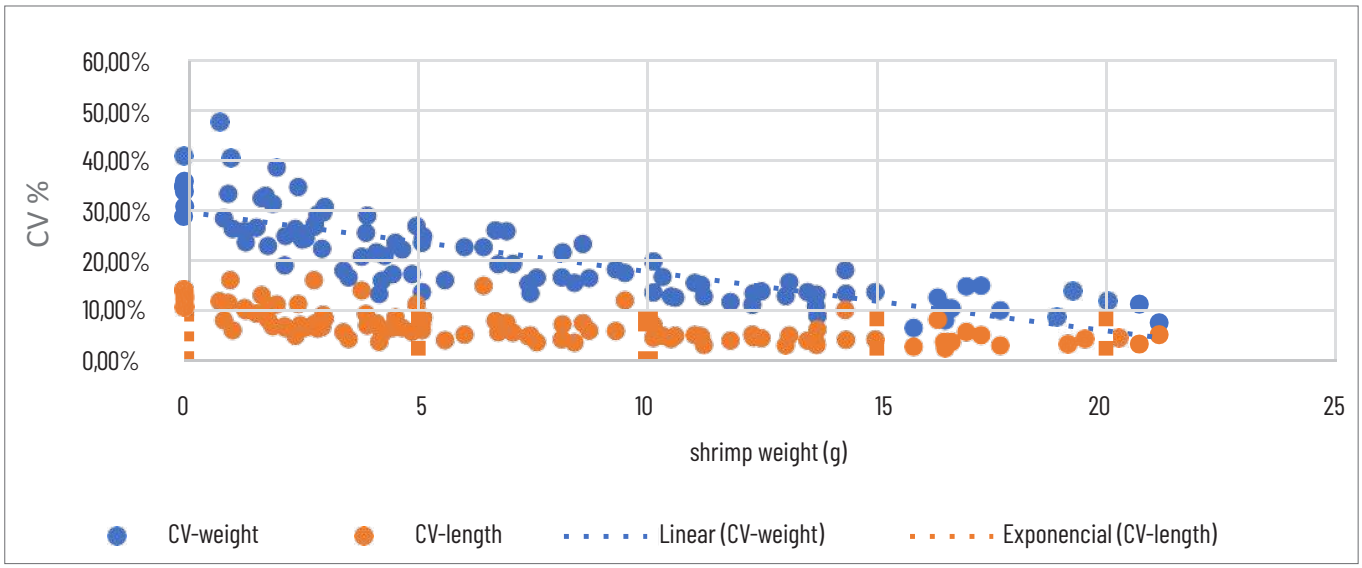
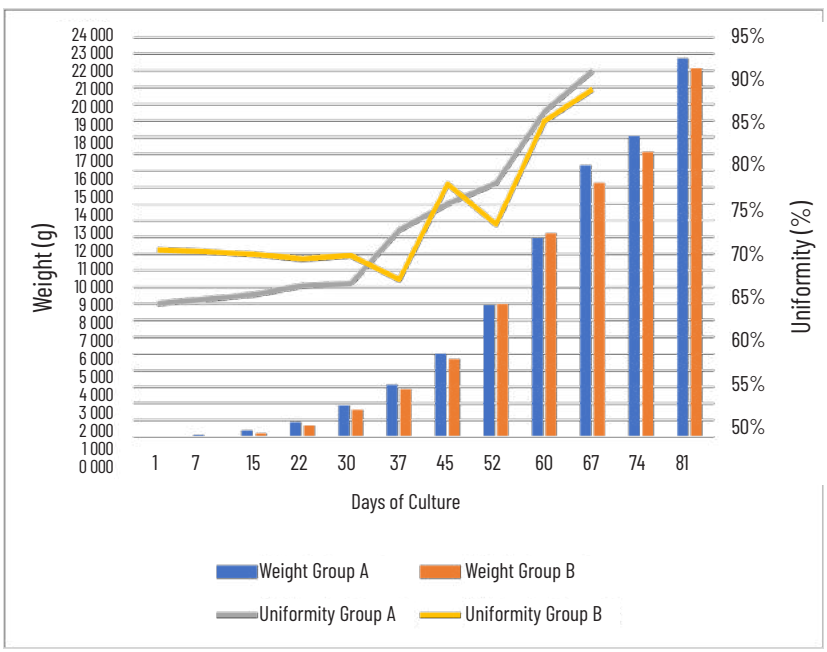


Figure 2 shows the progress of CV along a production cycle. Monitoring a batch weekly allows for the evolution or involution of the percentage of uniformity to be observed; and with this updated information, it can be used as a tool to give direction on the feeding management and thereby move towards the most optimally uniform population. It is the lack of uniformity that is responsible for lengthening the cycle while contibuting towards a decrease in the average weight of the shrimp.

It is important to know that a batch that has initial unevenness is not always doomed to failure at the end of the cycle. Rather, it is vital that the appropriate strategies should be adopted to address the lack of uniformity.

Regarding nutritional management, understanding the size distribution behaviour of the animals throughout the cycle allows one to have greater confidence in the mix and adjustment of feed pellets. The correct pellet size leads to less competition for food, increasing the possibility of recovery for smaller animals.

Figure 3. Uniformity recovery during grow-out



In Figure 3 we can observe the results of two groups of ponds stocked with different uniformities and how, through proper management, they became similar in terms of performance and uniformity.

Some other actions may be involved in a batch recovery process such as checking the health status of the animals through macroscopic evaluations, microscopic monitoring, and PCR tests. Also, it is important to monitor the environmental parameters in the ponds to make sure that they are within the ideal ranges for each factor. These data will allow for deeper understanding of the cultivation expectations which can be placed on the batch in question.

Gracia et *al*[2] describes how complex is the influence of different factors on uniformity, stating that "Weight uniformity depends on the sensitivity of an individual to macro-and micro-environmental factors. Macro-environmental factors are measurable factors such as temperature, seasonality, diet, and management, whereas micro-environmental factors are non-measurable animal-specific factors within a given macro-environment. A necessary condition to increase weight uniformity is the existence of genetic variance for response to such micro-environmental factors".

[2] *García-Ballesteros, S., Villanueva, B., Fernández, J. et al. Genetic parameters for uniformity of harvest weight in Pacific white shrimp (Litopenaeus vannamei). Genet Sel Evol 53, 26 (2021). https://doi.org/10.1186/s12711-021-00621-6*

Figure 4. Report on shrimp measurements done by AI using specific software

At the point of harvest

When it comes to the impact on the final product, uniformity of size (or otherwise) is a primary determinant in sale negotiations, especially when the shrimp is delivered for processing. In other words, the lack of uniformity in a harvested crop can directly affect the financial viability of the production process.

Shrimp are graded according to their size and count per unit of weight. Prices between size categories vary widely, and a larger number of shrimp per weight unit (i.e., of smaller sizes) results in a price reduction, post-harvest. Analysis of class distribution may therefore be an interesting strategy for farmers to be able to make the best decision on how to work with their crops.

Note: *The data used in this article was extracted from production results recorded by SynbiAqua Cultivos Aquáticos Ltda (Brazil).*

Aerial view of the SynbiAqua farm

Part of the SynbiAqua culture ponds

Ana Paula G. Teixeira *is Co-founder of SynbiAqua Cultivos Aquáticos Ltda (www.synbiaqua.com.br), a high-efficiency shrimp farm located in Rio Grande do Norte / Brazil.*

Diego Maia Rocha *is Co-founder of SynbiAqua Cultivos Aquáticos Ltda (www.synbiaqua.com.br), a high-efficiency shrimp farm located in Rio Grande do Norte / Brazil.*

INFOPESCA

INFOPESCA PARTICIPATED IN THE WORLD SEAFOOD CONGRESS 2023

Group photo of the participants

INFOPESCA participated in the World Seafood Congress 2023 (WSC2023) that took place in Peniche, Portugal, in September 2023. According to the organization, the objective was to explore how to optimize the contribution of fisheries and aquaculture production and distribution to sustainable development, reflecting the interests of different stakeholders, particularly consumers.

The Congress brought together companies and stakeholders working in the global trade in seafood products and their supply chain. A key point discussed was how the sector can adapt to the challenging dynamics of the physical, biological, informational and socio-economic environment to ensure that companies deliver safe, sustainable and equitable products and services in the second half of the 21st century.

The event was divided into three blocks: a first day with three simultaneous workshops on developing countries in the Latin American, Asian and African regions; then the three days of the Congress; and finally technical and cultural visits, including to a cannery, fish markets, fish processing facilities and a bivalve hatchery and nursery.

INFOPESCA was part of the workshop on developing countries in Latin America, discussing current challenges and opportunities in the international fish market. Some of the points mentioned were that aquaculture is a high priority for many governments in the region, mainly to produce a product of high value for the population; promote equitable development in rural areas; and catalyze the optimal use of water resources and vessels of the countries. It was also highlighted that capture fisheries production is decreasing due to resource problems. Regarding the opportunities of the sector, the role of fish in food security and school meals was highlighted, as well as improvements in small-scale fisheries, including the development of fishermen's capacities in hygiene and fish handling, with special emphasis on vendors and processors.

During the Congress, INFOPESCA was part of the session "Advances in safety, science, technology and use of aquatic products" with the presentation on "Development of strategies for the inclusion of fish and fishery products in school meals", where the main conclusions of the TCP/INT/3605 (D) Project with the same name were shared, in which our organization provided technical support.

The project was framed within the objectives of helping to eliminate hunger, food insecurity and malnutrition; and improving the capacities of governments to develop regulatory frameworks, investment plans and programs for food security and nutrition.

The beneficiary countries of the project were Angola, Honduras and Peru, while the study country was Uruguay. Some of the main products were: development of national strategies for the inclusion of fish in school meals; strengthening the technical capacities of the three countries to promote a healthy diet in school meals, with a focus on child nutrition; and pilot tests of fishery products prepared, especially for children.

More information about the project is available at:
https://www.infopesca.org/node/2426

INFOFISH

NEW INFOFISH ACTING DIRECTOR

Gemma Meermans Matainaho (left); Shirlene Maria Anthonysamy (right)

At a Special Meeting of the INFOFISH Governing Council in December 2023, representatives of INFOFISH Member Countries approved the appointment of Gemma Meermans Matainaho as Acting Director with immediate effect. The main functions of the Council are to determine the policy of INFOFISH and approve its programme of work and its budget for the upcoming year, giving due consideration to the conclusions and recommendations of the Technical and Advisory Board.

Within this capacity as Acting Director, Gemma brings to bear over 15 years in the fisheries sector as a trade and marketing specialist. At the time of her assumption to the position, Gemma was a serving INFOFISH staff member, as a Trade Promotion Officer. Gemma has a Masters in International Business from Monash University (Melbourne, Australia) and brings to the fore years of experience with a focus in industry development, trade and marketing, organizational management and strategic planning, working with both INFOFISH and with the Papua New Guinea National Fisheries Authority (NFA), a government statutory agency and Competent Authority, that manages, controls and regulates the fisheries industry and sector of Papua New Guinea. In her tenure with NFA, Gemma also served as the PNG National Liaison Officer (NLO) for INFOFISH for seven years, attributing to her long-standing association with INFOFISH even prior to substantively joining INFOFISH.

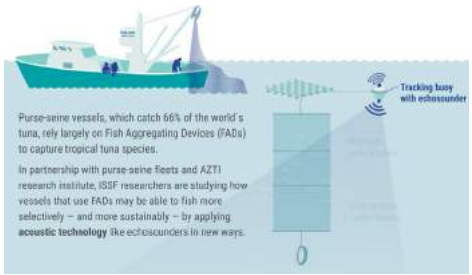
Gemma is a strong believer in the shared responsibility of sustainable fisheries management and growth, and she is looking forward to supporting the Member Countries towards this endeavour. Immediate priorities for her include the strengthening of good governance mechanisms and policy frameworks, and a renewed commitment to INFOFISH's strategic intent in continuing to deliver for all Member Countries.

Gemma replaces Shirlene Maria Anthonysamy, who had joined INFOFISH as Trade Promotion Officer in 2000, and thereafter appointed as Acting Director in May 2016 and Director of INFOFISH in December 2018. She left in September 2023 to take up a position as Fisheries Officer (Trade and Markets) at FAO, Rome. Shirlene has more than 20 years of experience in monitoring and reviewing the Asia-Pacific fishery industry and trade; carrying out consultancies related to international fishery trade for private companies and national bodies; publishing articles related to international fishery trade and markets; conducting training and facilitation on trade promotion, marketing and databases; and coordinating national and international workshops and conferences. She holds a Masters in Food Biochemistry and Bachelors in Biochemistry and Microbiology from University Putra Malaysia.

Shirlene is honoured to have been part of INFOFISH and enjoyed her 23 years of service with the organization. She remains grateful for the support to INFOFISH from all INFOFISH Member Countries, Council Members, the Fisheries Development Authority of Malaysia (LKIM), the Government of Malaysia as hosting agency of INFOFISH in Malaysia and FAO. She considers herself privileged to have earned great mentors, valuable friends and colleagues in the process.

In her new role with FAO Globefish, she coordinates the GLOBEFISH project with the Fisheries and Aquaculture Division (NFI) – Markets and Trade team, and provides assistance with fisheries and aquaculture market analysis throughout NFI and other FAO areas. Among these responsibilities are the supervision of the GLOBEFISH Highlights, the European Price Report, and the Chinese Price Report, as well as the coordination of publication of market information and analysis on the GLOBEFISH website.

ISSF exploring technology to support selective fishing



In partnership with purse-seine fleets and AZTI research institute, International Seafood Sustainability Foundation (ISSF) scientists are exploring innovative ways to use acoustic equipment at sea as a tool to prevent overfishing – and reduce bycatch – in purse-seine tuna fisheries. One current challenge to fishing selectively is that FADs can attract a mix of tuna and other marine species as well as fish of different sizes, making it difficult to catch only the tuna species that are being targeted.

The ISSF is studying how echosounder buoys near fish aggregating devices (FADs) can detect the distinctive "sound signatures" of different tuna species – and transmit that information to vessels before fishers travel to a FAD to make a set. If fishers can harness acoustic technology to "pre-emptively" estimate the type and amount of fish gathered at a particular FAD, they can choose to fish only on FADs with higher proportions of tuna species for which stocks are in healthy condition – and avoid those that have attracted larger groups of non-target species. This approach can reduce overfishing and bycatch – and also save fuel and reduce emissions from fishing operations.

Underwater communications sector is expanding

An Italian aquatech company, WSense, is developing an underwater wireless communications system that can deliver real-time information delivery and communication exchange for underwater environments. In a recent fundraising round, it received an investment of EUR 9 million (USD 9.8 million). WSense Co-Founder and CEO Chiara Petrioli said. "…….we are building partnerships that will strengthen us in emerging areas such as marine renewable energy, autonomous underwater robotics, and infrastructure security and surveillance.'"

WSense holds patents for both software and hardware that allow for underwater, cloud-based communication without the use of cables. The company claims its system works reliably and cost-effectively at depths of up to 3 000 meters below the ocean's surface. The company said the global underwater communications sector will be valued at EUR 7.3 billion (USD 8 billion) by 2030, up from EUR 3.3 billion (USD 3.6 billion) in 2022.

Credit: WSense

Quality monitoring using AI

An AI-powered sensor that is able to adapt to assess any type of water sample and its quality, has been developed. This low-cost system harnesses artificial intelligence to model various physicochemical parameters that indicate the presence of organic matter that poses a risk to water quality in aquaculture sites. To assess the amount of organic matter contained within a water sample, the technology measures the amount of absorbent and fluorescent spectra. That data is then passed to a planktoscope microfluidic slide, which takes images of the water sample before sending them to the cloud for further analysis.

The sensor is one of seven technologies developed by researchers contributing to ASTRAL (All Atlantic Ocean Sustainable, Profitable and Resilient Aquaculture), a €7.93 million (£6.93m), 48-month project supported by EU Horizon 2020 funding. Its core aim is to define, support and promote IMTA production in the Atlantic area. Elisa Ravagnan, ASTRAL project coordinator, stated in a press release: "The AI Quality Water Sensor is an effective tool to avoid environmental risks and promote consistent and high-quality sustainable production processes that operate within ecological limits."

Developments in edible biofilm food wrapping

The most common technique in the world of food packaging is single-use plastic films. Supported by the European Maritime and Fisheries Fund, the SeaFilm food packaging project aims to create a substitute for single-use plastic film in conserving frozen fish. As the name indicates, the new packaging film comes from the sea and is based on bioactive seaweed *(Grateloupia turuturu)* extracts and edible algae which is claimed to help to conserve frozen seafood for longer while maintaining the quality.

Developed by researchers from the Polytechnic University of Leiria in Portugal, the concept of edible biofilm for frozen fish came about as a solution that was in line with the European Union's commitment to ban the use of single-use plastics. After the frozen fish is defrosted, the biodegradable film can either be disposed of or eaten along with the fish. The film could even include seasonings for the fish.

Sponging up plastic pollution

According to Hakkai Magazine, Chinese scientists have created some experimental sponges out of starch and gelatin that can soak up microplastics which could be adopted in various places to reduce plastic pollution from entering the oceans.

The sponges are literally as light as a feather, and inside their pores, not only microplastics, but nanoplastic particles of less than one micron in size—or 1 millionth of a meter—can become trapped. In tests, the sponges were able to remove around 90% of micro- and nano-plastic particles from environmental and food matrices, including seawater, tap water, soil surfactant, and even take-out lunch soup. The sponges are also biodegradable. However, the chemical process used to make them includes formaldehyde, which the authors admit is a serious environmental drawback.

Research will be continued to find an alternative to formaldehyde.

Cell-cultivated cat food

US company CULT Food Science Corp. a pioneer in the investment, development, and commercialization of cellular agriculture technologies and products; and Singapore's Umami Bioworks (formerly Umamai Meats) are collaborating in the production of Marina Cat, a hybrid cell-cultivated pet food brand for cats. This is a blend of ocean snapper which is enriched, resulting in a high-protein, low-calorie snack with umami flavours. The companies claim that Marina Cat has "all the animal-derived nutrition of caught or farmed fish, but none of the harmful environmental impacts of commercial fishing."

Production has just begun, with widespread availability anticipated in 2024. This ground-breaking release represents a world first for the pet food industry, which has an estimated worth of USD 150 billion on the global market. In 2008 it was estimated that the amount of raw fishery products directly used by the cat food industry equates to 2.48 million metric tonnes per year.

This is the "Ship of the Year" for 2023

A fuel-efficient propulsion system and a revolutionary solution for taking fish on board are two of the innovations in the ECOFIVE trawler

Bluewild, Ulstein Design & Solutions AS and Westcon have been awarded Ship of the Year 2023 in Norway for the innovative factory trawler ECOFIVE, under construction at Westcon for fishing company Bluewild. The vessel and the solutions on board will ensure environmentally friendly, gentle and efficient fishing, a safer working environment and increased quota and resource utilisation. The ship's name, "Ecofive", comes from the concept of eco-friendly-fishing vessel.

The ship will have a low average fuel consumption and emissions. Especially during trawling at low speed, it will be able to achieve a reduction of CO_2 emissions of up to 40 percent, and a NOx reduction of up to 70 percent. There will also be zero emissions of residual raw materials from catches.

The shipping company has placed great emphasis on good fish welfare, and a high-quality standard for the raw material. They achieve this through a handling system for the trawl that guides the fish into a catch reception in the vessel below the waterline. The fish are then taken alive by pipe transport to water-filled reception tanks, which reduce crushing injuries and stress for the fish.

Creative ways to eat seafood

The innovative food focus in this January/February 2024 issue is on crispy seaweed sticks produced by French company, ZALG.

Seaweed sticks

The seaweed sticks are composed of a blend of locally-grown seaweed and macroalgae coated with a thin layer of breadcrumbs. "We are creating a new realm of possibilities in the use of seaweed in cooking to meet the current demands for a healthy, delicious, and sustainable diet," ZALG Co-Founder Tanguy Gestin said. The seaweed sticks are made intended for use in commercial foodservice, and can be ready in as little as 90 seconds using a fryer. Another seaweed offering from the company is "sea tofu". These products can be stored for up to 24 months in a freezer at about -18°C, and can be served as is, in a burger, as part of a vegetable dish, or poké.

" Sea tofu" *Credit: ZALG (France)*

Gender-sorting of salmon smolts

The gender-sorting machine in use at Mowi

Machines manufactured by several Norwegian companies for automatic sex sorting of salmon smolts are making a name both domestically as well as in Chile, where more than 50% of all farmed salmon is sexed manually, which means more than 100 million fish a year

The machine designed by GreenFox Marine uses ultrasound and has had its patent application approved in Norway. According to general manager Erling Aspen, "fish in sex-separated cages grow faster, have lower mortality and fewer wounds. At the same time, farms can optimize production for each sex through differentiated harvest times, light management, localization, and other such measures. "You will also be able to reduce the time the fish spend in the sea, which in turn will have positive effects with fewer lice on the fish. A more uniform size of the fish will also simplify production, at the hatchery, in the cage and at the slaughterhouse," he explained. The GreenFox Marine model can also be integrated into vaccination machines, so that the fish are sexed at the same time as they are vaccinated. In the long term, GreenFox will also adapt the machine to more fish species.

Similar to the machine above, the SORTpro machine, created by Norway-based Aquaticode, is designed to categorize up to 10 000 juvenile salmon per hour based on gender and other performance traits. The artificial intelligence (AI)-powered solution achieved a verified gender classification accuracy exceeding 97%, and didn't increase mortality rates, Aquaticode said in a press release. It is being assessed over time and at scale by Chilean fish farming company, Salmones Camanchaca. Salmones Camanchaca is Chile's seventh largest salmon farmer by volume, and expects to harvest between 55 000 and 59 000 tonnes of Atlantic and coho salmon in 2023.

Aquaticode's SORTpro can separate 10 000 smolts per hour into male and female cohorts

Credit: Aquaticode

Further information: GreenFox Marine, Norway (https://www.greenfoxmarine.no/)

Further information: Aquaticode, Norway (https://aquaticode.com/)

A hundred shrimp peeled per minute

Shrimp processing giant Gregor Jonsson has, over the decades, manufactured many types of equipment, among them being shrimp peeling machines which are said to be able to peel up to one hundred shrimp per minute, any species, any size, any style. Labour costs are lowered and the shrimp are peeled uniformly.

One of the best selling equipment in the range is Model 61, which can peel shrimp tail-on round style, tail-on butterfly split, tail-on gradual cut, completely peeled and deveined (tail off), completely peeled and deveined split, E-Z peel style; and raw, headless shrimp as large as 10/15 to as small as 71/90 count (number per pound).

Further information: Gregor Johnsson Inc, USA (https://jonsson.com/)

"Disappearing" packaging

Notpla's food containers are engineered so that they are biodegradable: where conventional containers have petrol-based coatings that do not disintegrate, these have a 100% natural seaweed coating. The construction is said to be robust, with leakproof coating, resistant to water and oil; and once finished, the whole package can be composted and disappears without a trace, eaten by worms, fungi and microbes.

Green Cell Foam is another company which is marketing environmentally-sustainable packaging material. Made from corn, these containers are said to be able to dissolve in sinks for safe and easy disposal. In fact, customers are reminded that the containers are not recyclable; rather, they are encouraged to "water it (submerge the Green Cell Foam panels in water and watch them disappear); compost it (the panels will compost in 60 days or less); or plant it".

Several companies around the world also use bagasse or plant wastes (such as sugarcane, corn and bamboo), to manufacture seafood trays and containers which degrade naturally within a few months of being discarded. They are also said to take up seven times less volume (storage) than polystyrene trays.

Further information: Notpla, UK (notpla.com)

Further information: Green Cell Foam, USA (greencellfoam.com)

ECOSYSTEM RESTORATION AND INLAND FOOD FISHERIES IN DEVELOPING COUNTRIES

Coates, D. 2023. Ecosystem restoration and inland food fisheries in developing countries – opportunities for the United Nations Decade on Ecosystem Restoration (2021–2030). FAO Fisheries and Aquaculture Circular No. 1231. Rome, FAO.

The review presents the strong business case for inland food fisheries in developing countries to be either a co-benefit, or very often the main benefit, of ecosystem restoration. In view of the current state of inland water aquatic habitats the potential for restoration is high. Realizing this potential requires concerted action to overcome current challenges, foremost of which is the invisibility of inland fisheries in many policy arenas as well as technical and scientific fora. The drivers of ecosystem degradation, ecosystem services valuation frameworks and the main technical tools for implementing interventions are presented. Experiences in developed countries dominate the literature but are not necessarily applicable to developing country inland food fisheries. Local communities that have high dependency on inland fisheries and live in close association with inland water fisheries habitats not only provide much higher fisheries values but a management asset that is unavailable in developed countries and the mainstay of many successful restoration programmes.

Ten case studies, representing effective restoration of food fisheries from local to basin scale are used to illustrate what can be achieved. The prospects of inland fisheries benefiting from, or contributing to, the UN Decade on Ecosystem Restoration (2021–2030) are good but upscaling the existing progress will require increased and sustained efforts to mainstream the values of inland fisheries including their co-benefits for biodiversity conservation.

This publication can be downloaded at no cost from: https://doi.org/10.4060/cc7082en

ELIMINATING GOVERNMENT SUPPORT TO ILLEGAL, UNREPORTED AND UNREGULATED FISHING

Claire Delpeuch, Emanuela Migliaccio, and Will Symes. OECD Food, Agriculture and Fisheries Paper, June 2022 No. 78

This report assesses how to stop illegal, unreported and unregulated (IUU) fishing benefitting from government support. Based on a survey of OECD countries and partner economies participating in the work of the OECD Fisheries Committee, it recommends actions that can be undertaken by countries to maximize the chances of excluding individuals and companies with links to IUU fishing from government support, and to minimize the risk that such support benefits IUU fishing ex-ante, given the inherent difficulty to take action ex-post. Eight specific recommendations are presented.

This publication can be downloaded at no cost from: https://doi.org/10.1787/f09ab3a0-en

GOOD PRACTICES FOR PREPROCESSING AND COOKING FARMED FISH

Zakar A, Salah I, Rashad M, Mosbah M and Nasr-Allah A. 2023. Good practices for preprocessing and cooking farmed fish. Penang, Malaysia: WorldFish. Guidelines: 2023-07.

Fish is an important food for human consumption. Because of its high nutritional value, it can treat diseases caused by malnutrition, and it is especially suitable for children, pregnant women and breastfeeding mothers. More than one billion people around the world get their animal protein requirements from fish, which also contains minerals like phosphorous, iodine, calcium, magnesium and sulphur. In addition, there are a number of important fat-soluble vitamins in fish oil, including vitamins A and D. Fish oils are high in unsaturated fatty acids, especially omega-3, which helps reduce cholesterol. Yet despite being highly nutritious, fish is difficult to process and spoils easily. This is why proper processing methods are so important, as they help preserve fish, prolong its shelf life and produce new products that consumers prefer. Fish processing also engages more women and youths in aquaculture activities, which improves their income.

This manual was prepared through the Advancing Climate Smart Aquaculture Technologies (ACliSAT) project, funded by the International Fund for Agricultural Development. WorldFish is implementing the project in partnership with the Central Laboratory for Aquaculture Research in Egypt, Bahir Dar University in Ethiopia and the Ministry of Marine Resources in Eritrea.

This publication can be downloaded at no cost from: https://hdl.handle.net/20.500.12348/5546

LEAN MANAGEMENT IN AQUACULTURE: A PRACTICAL GUIDE FOR SMALLHOLDER FISH FARMERS

Lawrence TK, Steensma JT, Oyebola OO, Akuwa EI, Rhea CL, Subasinghe RP, Nukpezah J and Siriwardena SN. 2023. Lean management in aquaculture: A practical guide for smallholder fish farmers. Penang, Malaysia: WorldFish. Manual: 2023-18.

Lean management is a powerful approach that can significantly benefit the aquaculture industry. By minimizing waste and maximizing value, businesses can improve the quality of their products and increase their profits while reducing their environmental impact. The practical guide will help solve the problem of inefficient processes, wasteful practices and low profitability in your aquaculture business.

This publication can be downloaded at no cost from: https://hdl.handle.net/20.500.12348/5551

2024

FEBRUARY

15-17
AquaIndia 2024
Chennai, India
http://aquaprofessional.org/

19-23
FISHFORUM
Türkiye
https://www.fao.org/gfcm/fishforum2024/en/

21-22
21st Seafood Show Osaka
Osaka, Japan
https://seafoodshow-japan.com/osaka/

MARCH

10-12
Seafood Expo North America (SENA)
Boston, USA
www.seafoodexpo.com/north-america/

20-22
VietShrimp 2024
Ca Mau city, Vietnam
https://vietshrimp.net/

APRIL

23-25
Seafood Expo Global (SEG)
Barcelona, Spain
https://www.seafoodexpo.com/global/

MAY

8-11
International Indonesia Seafood & Meat (IISM)
Jakarta, Indonesia
https://iism-expo.com//

20-22
18th INFOFISH World Tuna Trade Conference & Exhibition
Bangkok, Thailand
www.tuna.infofish.org

JULY

2-5
Asian Pacific Aquaculture (APA2)
Surabaya, Indonesia
https://www.was.org/meeting/code/APA2024

AUGUST

21-23
26th Japan International Seafood & Technology Expo
Tokyo, Japan
https://seafoodshow-japan.com/tokyo/

21-23
Vietnam Fisheries International Exhibition
Ho Chi Minh, Vietnam
https://vietfish.com.vn/

28-30
18th Shanghai International Fisheries and Seafood Exhibition
Shanghai, China
www.worldseafoodshanghai.com/en

SEPTEMBER

4-6
Seafood Expo Asia 2024
Singapore
www.seafoodexpo.com/asia/

17-19
Global Fishery Forum & Seafood Expo Russia 2024
Saint Petersburg, Russia
https://seafoodexporussia.com/en/

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EDITORIAL PLAN 2024

INFOFISH

ISSUE	FISHERIES & AQUACULTURE	PROCESSING & MARKETING	EQUIPMENT & TECHNOLOGY	SUSTAINABLE DEVELOPMENT GOALS
1/2024 (Jan/Feb) **Deadline: 15 Nov 2023**	• The importance of monitoring shrimp uniformity for better performance during production	• Women in Papua New Guinea embrace new technology in fish processing • Sri Lanka: Seaweed production, trade and marketing	• Supporting sustainable fisheries with satellite technology and open data	• Translating the SSF Guidelines into practice • Promoting community engagement and partnership: Lessons learnt from the FishFAD Tuna Project in the Pacific
2/2024 (Mar/Apr) **Deadline: 15 Jan 2024**	• Bringing fishing vessels into the fold: why an agreement on fishing vessel safety is big news • The increasing role of RFMO's in addressing sustainability and broader regional prosperity	• Canned tuna, regulatory challenges and seafood innovation	• Smart technologies towards a new era in sustainable tuna fishing • Supercooling for seafood preservation	• Empowering workers: understanding and addressing fairwashing challenges in the seafood industry • Tuna sustainability, solidarity and communities
3/2024 (May/June) **Deadline: 15 March 2024**	• Restorative aquaculture for people and oceans	• Seaweed-based nutraceuticals/ Seaweed processing for non-food-based products • Tuna hubs & spokes in the Pacific: Where are we now and where are we going in the tuna Industry in the Blue Pacific Continent?	• Innovations in packaging of seafood	• Blue Transformation: What does it really mean for the global tuna Industry? • Financing innovations for sustainable small-scale fisheries • Powerful Women in Seafood - Leading responsible tuna supply chains
4/2024 (July/Aug) **Deadline: 15 May 2024**	• Illegal, unreported and unregulated fishing costs the industry billions of dollars: where does that money go?	• How is growing competition from "China in Latin America" undermining Ecuador's supremacy? • Canned tuna and consumer behaviour in Papua New Guinea	• Application of SNP Genomic tools to revolutionize breeding, enhancing productivity and boosting sustainability • Managing seafood safety risks in a changing global environment	• The life of responsible tuna fishers in the Madives • Fisheries leadership and governance in the Pacific
5/2024 (Sep/Oct) **Deadline: 15 July 2024**	• How can Pacific island countries/states take greater ownership of their tuna resources?	• Fish byproduct utilization in Asia: status and prospects • Bioprospecting of marine natural products	• Shipping seafood safely • Recirculating aquaculture equipment	• Collective action for sustainability and efficiency- A fisheries perspective • AI and small-scale fisheries development
6/2024 (Nov/Dec) **Deadline: 15 September 2024**	• Moving beyond the stalemate: how a clear mechanism for how to allocate fishing opportunities should save time and money in fishery negotiations	• What's trending in the global seafood market: A wrap-up of 2024 • Emergence of cool chain management in the seafood industry	• IoT-based aquaculture monitoring and control system • Innovations along the seafood value chains: Policy recommendations	• On tuna RFMOs and the road to 2030: Improvement implementations necessary in science and management to achieve the SDGs

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