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INFOFISH International

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Hermasus sapiens

We are no longer alone: a new intelligent species, capable of evolving, will accompany mankind

A new generation of canning machinery with Artificial Intelligence

*The father of the Theory of Evolution, Charles Darwin, meets face to face with the new machines, capable of evolving all by themselves

Hermasa
Canning technology

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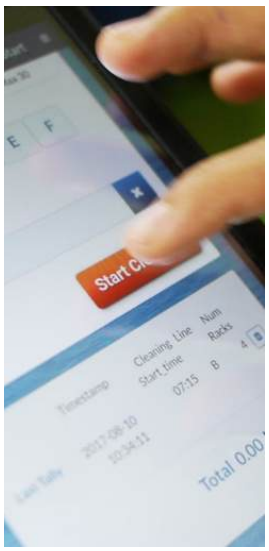

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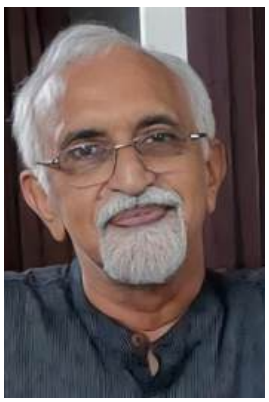
Retired Professor, Centre for Development Studies, Trivandrum, India; and Founder Member of the International Collective in Support of Fishworkers (ICSF)



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Cover image : 18th INFOFISH World Tuna Trade Conference & Exhibition

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Canned Tuna

Tuna Pouches

Frozen Tuna

Caught & Packed in **The Maldives.**

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Gemma Meermans Matainaho
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Editorial Assistants
Norezah Ismail, Aszryn Nur Ain Desnawi

Advertisement, Promotion and Circulation
Mohd Syahir Zahardin

Web Administrator
Mohd Aftar Aris

EDITORIAL OFFICE:
INFOFISH
1st Floor, Wisma LKIM
Jalan Desaria
Pulau Meranti
47120 Puchong, Selangor DE
Malaysia
Tel: (603)80668112 (603)80603734 • 80603738
Fax: (603)80603697
E-mail: info@infofish.org
Website: www.infofish.org

REGIONAL OFFICES:

Latin America, Caribbean
INFOPESCA, Casilla de Correo 7086,
Julio Herrea y Obes 1296, 11200 Montevideo, Uruguay
Tel: (598) 2 9028701/29028702 • Fax: (598) 2 9030501
E-mail: infopesca@infopesca.org
Website: www.infopesca.org

Africa
INFOPECHE, BP 1747 Abidjan 01, Côte d'Ivoire,
Tél (225) 20 21 31 98/ 20 .21 .57.75
Fax (+225) 20 21 80.54
Email: infopeche@aviso.ci / infopech@gmail.com
Website: www.infopeche.ci

Arab Countries
INFOSAMAK, 71, Boulevard Rahal, El Meskini
Casablanca 20 000, Morocco.
Tel: (212)522540856 • Fax: (212)522540855.
E-mail: info@infosamak.org / infosamak@infosamak.org
Website: www.infosamak.org

Eastern Europe
Eurofish International Organization,
H.C. Andersens Boulevard 44-46,
1553 Copenhagen V , Denmark
Tel: (+45) 33377755 • Fax: (+45) 33377756
E-mail: info@eurofish.dk
Website: www.eurofish.dk

China
INFOYU, Room 901, No 18, Maizidian street, Chaoyang District, Beijing 100125, China.
Tel (86) 01059195186 • fax: (86) 01059195186.
E-mail: infoyu@agri.gov.cn.
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The 18th INFOFISH Tuna Trade Conference and Exhibition was successfully held in May in the vibrant tuna capital of Bangkok. Delegates from over 40 countries were present, together with 36 global companies and organisations exhibiting cutting-edge products and services which are unique to the tuna industry. INFOFISH deeply appreciates the support of our collaborating partners and co-organisers: Department of Fisheries, Thailand and Thai Tuna Industry Association (TTIA); the Food and Agriculture Organization (FAO) of the United Nations; three RFMOs (WCPFC, IATTC, IOTC); ANFACO; Atuna.com; and Undercurrent News. We also thank the Platinum Sponsors: Marine Instruments and Maldives Industrial Fisheries Companies (MIFCO); Gold Sponsor BIOLAN; and Silver Sponsor Arcadia Chemical and Organic Ingredients for their invaluable support of the event. We look forward to meeting everyone again at the next Tuna Conference in 2026, when we will unveil our new exciting format.

With that said, welcome to another very exciting and informative issue of our INFOFISH International, packaged to present opinions and updates from industry leaders, practitioners and experts. Join us as they analyse and delve more into current industry practices and trends, as well as look more closely into transformative initiatives and endeavours for a more sustainable industry in our INFOFISH Member Countries and across the globe.

In this issue, we present five articles, two of which focus on sustainability in fishing. In 'Equity and sustainability in transboundary tuna fisheries', the authors highlight that the long-term sustainability of tuna fisheries depends on the effective cooperation of numerous coastal and distant-water fishing States through the Western and Central Pacific Fisheries Commission (WCPFC) and the Indian Ocean Tuna Commission (IOTC). The various measures and mechanisms that both regional organisations adopt, or even opt out of, will have consequential effects on these fisheries and achievement of the UN Sustainable Development Goals.The other, titled 'One key to ending IUU fishing: holding vessel owners accountable', highlights that those who are apprehended for illegal, unreported and unregulated (IUU) fishing tend to be a few members of the crew, while the real perpetrators — the ultimate beneficial owners of these vessels — remain faceless. The authors contend that, as with any crime, the way to stop large-scale IUU fishing is to ensure that the risk and costs to these owners outweigh the benefits of being involved in such unlawful activities.

Innovative technology is the premise for two articles, one focusing on artificial intelligence (AI) and the other on genetic improvement of tilapia. Three types of AI are described: machine learning, computer vision and generative AI; as well as how AI is currently being deployed in seafood supply chains, from computer vision onboard fishing vessels to automated inspection and demand forecasting in supply chains. The other article summarises the transformative impact of genomics and precision breeding on tilapia breeding lines; and recent innovations in genomic selection and line breeding. These innovations pave the way for farmers to harness superior performance, leading to increased profitability and a sustainable tilapia industry.

Shifting from a global to the equally important local focus, an article on the 'Dried fish industry in Bangladesh: issues and concerns' highlights the importance of sun-dried fish as a source of low-cost protein for communities; however, these products tend to be under-valued and poorly understood. This article addresses the key challenges and issues in the industry, including specific recommendations to enable market access and which may be useful in the formulation of national policy for the sustainable development of the industry.

The Industry Profile in this issue features John Kurien, retired Professor and Founder Member of the International Collective in Support of Fishworkers (ICSF). Included in this fascinating interview are his recollections of the evolution of global discussions regarding the small-scale fisheries and aquaculture sector, leading to (among others) a seminal document which became known as the Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries in the Context of Food Security and Poverty Alleviation (SSF Guidelines). He also presents his frank opinions on a number of issues such as fisheries subsidies, and ends with a tribute to fishing communities.

Under our FishBytes category, we have an article by the International Pole and Line Foundation (IPNLF) which focuses on elevating livelihoods of women in the Maldives through the development of an exclusive digital market platform. Through the use of the platform, women processors have full autonomy over their businesses, including being able to sell their tuna products without middlemen, and conduct financial transactions online.

Apart from all the above, please take some time to read though the other sections, including industry news, innovations, and equipment notes. Thank you all so much and enjoy this edition of the INFOFISH International.

Gemma Meermans Matainaho
Acting Director

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Resúmenes de los principales artículos

Equidad y sostenibilidad en las pesquerías atuneras transfronterizas 8
Por Quentin Hanich, Ina Tessnow-von Wysocki y Bianca Haas

La mayor parte del atún del mundo se captura en el Indo-Pacífico, que aporta contribuciones fundamentales a los mercados mundiales, la seguridad alimentaria, los medios de vida, los ingresos y el desarrollo económico de numerosos estados costeros y pesqueros en desarrollo. La sostenibilidad a largo plazo de estas pesquerías depende de la cooperación efectiva de numerosos estados pesqueros costeros y de aguas distantes a través de la Comisión de Pesca del Pacífico Occidental y Central (WCPFC) y la Comisión del Atún del Océano Índico (IOTC). Si bien ambas organizaciones han adoptado varias medidas de conservación y gestión, la integridad y eficacia de estas medidas se ven socavadas por las opciones de exclusión voluntaria y exenciones que se han aplicado debido a preocupaciones de equidad. Es fundamental que la IOTC y la WCPFC consideren estrategias futuras para abordar de manera transparente las preocupaciones de equidad, permitiendo una amplia participación y cumplimiento, al mismo tiempo que se logran los Objetivos de Desarrollo Sostenible de las Naciones Unidas y se garantiza el uso sostenible a largo plazo de estas pesquerías.

Una clave para ponerle fin a la pesca INDNR: responsabilizar a los armadores 26
Por Peter Horn y Gina Fiore

La pesca comercial está valorada en USD 141 mil millones al año, por lo que no sorprende que esta industria atraiga a infractores de la ley, en particular a aquellos que se dedican a la pesca ilegal, no declarada y no reglamentada (INDNR), una actividad que, según los expertos, representa hasta USD 36 mil millones al año en productos pesqueros. Normalmente, los detenidos por pesca INDNR son unos pocos miembros de la tripulación, mientras que los verdaderos perpetradores (los propietarios finales de estos buques) permanecen anónimos. Los autores sostienen que, como ocurre con cualquier delito, la forma de detener la pesca INDNR a gran escala es garantizar que el riesgo y los costos para estos propietarios superen los beneficios de participar en actividades ilegales.

Industria del pescado seco en Bangladesh: problemas y preocupaciones 38
Por Sujit Krishna Das

La producción de pescado secado al sol ofrece un medio de generación de ingresos en Bangladesh (particularmente para las mujeres) y reduce el volumen de materia prima que de otro modo se descartaría o se perdería. También es una fuente importante de proteínas de bajo costo para las comunidades. Sin embargo, la escala y la importancia de la producción, el comercio y el consumo de pescado seco rara vez se reconocen y se comprenden poco. Este artículo aborda los desafíos y problemas clave en la industria, incluyendo algunas recomendaciones específicas para permitir el acceso al mercado y que pueden ser útiles en la formulación de una política nacional para el desarrollo sostenible de la industria.

Desbloquear una mejora genética más rápida en tilapia a través de la genómica y la cría de precisión 42
Por Rajesh Joshi

Este artículo resume el impacto transformador de la genómica y la cría de precisión en las líneas de cría de tilapia por parte de investigadores del Grupo GenoMar Genetics con sede en Noruega, destacando el aumento en el rendimiento de producción alcanzable en las nuevas generaciones de alevines. Innovaciones recientes en la selección genómica y la cría de líneas han amplificado las ganancias genéticas en el núcleo de cría de GenoMar. El resultado es un triple aumento en la ganancia genética en las últimas siete generaciones de tilapia. Estas innovaciones abren el camino para que los acuicultores aprovechen un rendimiento superior de las últimas iteraciones de productos de la empresa, lo que conduce a una mayor rentabilidad y una industria de tilapia sostenible.

Cómo la IA va a transformar la industria pesquera 46
Por Eric Enno Tamm

La inteligencia artificial (IA) puede ayudar a que la industria pesquera sea más predecible y rentable. Este artículo explica tres tipos de IA: aprendizaje automático, visión por computadora e IA generativa; pasando a cómo se está implementando actualmente la IA en las cadenas de suministro de productos pesqueros, desde la visión por computadora a bordo de los buques pesqueros hasta la inspección automatizada y el pronóstico de la demanda en las cadenas de suministro. Luego explora sobre cómo se puede utilizar la IA en el sector de procesamiento de productos pesqueros, incluida la predicción del rendimiento, la predicción del peso escurrido para las fábricas de conservas de atún, las pruebas rápidas de salinidad, la inspección visual automatizada con cámaras inteligentes, la detección de anomalías y la previsión de la demanda. El artículo concluye que existen muchas oportunidades para implementar IA para optimizar y automatizar procesos con el fin de mejorar la rentabilidad y sostenibilidad del sector de procesamiento de productos pesqueros.

Rodrigo Misa

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Résumés des articles de fond

Équité et durabilité dans les pêches transfrontalières de thon 8

Par Quentin Hanich, Ina Tessnow-von Wysocki et Bianca Haas

La majeure partie du thon mondial est pêchée dans la région indo-pacifique, apportant une contribution essentielle aux marchés mondiaux, à la sécurité alimentaire, aux moyens de subsistance, aux revenus et au développement économique de nombreux États côtiers en développement pratiquant la pêche. La viabilité à long terme de ces pêches dépend de la coopération efficace de ces États pratiquant la pêche hauturière dans le cadre de la Commission des Pêches du Pacifique Centre- ouest (WCPFC/CPPCO) et de la Commission des Thons de l'Océan Indien (CTOI). Bien que ces deux organisations aient adopté diverses mesures de conservation et de gestion, l'intégrité et l'efficacité de ces mesures sont compromises par des dérogations et des exemptions qui ont été appliquées pour des raisons d'équité. Il est essentiel que la CTOI et la CPPCO envisagent des stratégies futures pour traiter de manière transparente les questions d'équité, en permettant une large participation et le respect des règles, tout en atteignant les objectifs de développement durable des Nations Unies et en garantissant l'utilisation durable à long terme de ces pêches.

Une des clés pour mettre fin à la pêche INN : Responsabiliser les propriétaires de navires 26

Par Peter Horn et Gina Fiore

La pêche commerciale représente 141 milliards de $EU par an. Il n'est donc pas surprenant que ce secteur attire les contrevenants, notamment ceux qui pratiquent la pêche illicite, non déclarée et non réglementée (INN), une activité qui, selon les experts, représente jusqu'à 36 milliards de $EU générés par l'exploitation de fruits de mer chaque année. En général, les personnes appréhendées pour la pêche INN sont quelques membres de l'équipage, tandis que les véritables coupables - les réels propriétaires de ces navires - restent anonymes. Les auteurs affirment que, comme pour tout crime, le moyen de mettre fin à la pêche INN à grande échelle est de s'assurer que les risques et les coûts pour ces propriétaires dépassent les avantages qu'ils retirent d'une implication dans des activités illégales.

L'industrie du poisson séché au Bangladesh : Problèmes et préoccupations 38

Par Sujit Krishna Das

La production de poisson séché au soleil constitue un moyen de générer des revenus au Bangladesh (en particulier pour les femmes) et de réduire le volume de matières premières qui seraient autrement jetées ou perdues. Elle constitue également une source importante de protéines à faible coût pour les communautés. Cependant, l'ampleur et l'importance de la production, du commerce et de la consommation de poisson séché sont rarement reconnues et mal comprises. Cet article aborde les principaux défis et problèmes de l'industrie, y compris certaines recommandations spécifiques pour permettre l'accès au marché et qui peuvent être utiles dans la formulation d'une politique nationale pour le développement durable de l'industrie.

Accélérer l'amélioration génétique du tilapia grâce à la génomique et à la sélection de précision 42

Par Rajesh Joshi

Cet article résume l'impact transformateur de la génomique et de la sélection de précision sur les lignées de tilapia par les chercheurs du GenoMar Genetics Group, basé en Norvège, en soulignant l'augmentation des performances de production réalisables dans les nouvelles générations d'alevins. Les récentes innovations en matière de sélection génomique et d'élevage en ligne ont amplifié les gains génétiques dans le noyau d'élevage de GenoMar. Le résultat est un triplement du gain génétique sur les sept dernières générations de tilapia. Ces innovations ouvrent la voie aux éleveurs pour exploiter les performances optimales des dernières itérations de produits de l'entreprise, ce qui se traduit par une rentabilité elevée et une industrie du tilapia durable.

Comment l'IA va transformer l'industrie des fruits de mer 46

Par Eric Enno Tamm

L'Intelligence Artificielle (IA) peut aider l'industrie de fruits de mer à devenir plus prévisible et plus rentable. Cet article explique trois types d'IA : l'apprentissage automatique, la vision par ordinateur et l'IA générative. Il explique ensuite comment l'IA est actuellement déployée dans les chaînes d'approvisionnement en fruits de mer, depuis la vision par ordinateur à bord des navires de pêche jusqu'à l'inspection automatisée et la prévision de la demande dans les chaînes d'approvisionnement.

Il explore ensuite la recherche sur la manière dont l'IA peut être utilisée dans le secteur de la transformation des fruits de mer, notamment la prédiction du rendement, la prédiction du poids d'égouttage pour les conserveries de thon, les tests rapides de salinité, l'inspection visuelle automatisée avec des caméras intelligentes, la détection d'anomalies et la prévision de la demande. L'article conclut qu'il existe de nombreuses possibilités de déployer l'IA pour optimiser et automatiser les processus afin d'améliorer la rentabilité et la durabilité du secteur de la transformation de fruits de mer.

DIGRÉ Arriko Calice

Pour plus amples informations et pour la traduction des articles contenus dans cette revue, veuillez vous addresses à INFOPÊCHE ,
BP 1747 Abidjan 01, Côte d'Ivoire
Tél (225) 20 21 31 98/ 20 .21 .57.75 / Fax (+225) 20 21 80.54
Email: infopeche@aviso.ci / infopech@gmail.com

Website : www.infopeche.ci

文 章 摘 要

跨境金枪鱼渔业的公平性和可持续性.....8
作者 Quentin Hanich, Ina Tessnow-von Wysocki and Bianca Haas

世界上大部分金枪鱼都在印度-太平洋地区捕捞，为全球市场、粮食安全、生计、收入和众多发展中沿海渔业国家的经济发展做出了重要贡献。这些渔业的长期可持续性取决于诸多沿海和远洋捕鱼国通过中西部太平洋渔业委员会（WCPFC）和印度洋金枪鱼委员会（IOTC）所进行的有效合作。尽管两个机构都采取了各种保护和管理措施，但出于公平考虑，这些措施所实行的退出权和豁免权却逐渐影响了其完整性和有效性。至关重要的是，IOTC和WCPFC应考虑其未来战略，从而显著地解决公平问题，促进广泛参与和遵守，同时实现联合国可持续发展目标，并确保长期可持续利用这些渔业的。

终止IUU捕捞活动的关键:追究船只所有者的责任 26
作者 Peter Horn and Gina Fiore

商业捕捞每年产值约1410亿美元，因此该产业引来不法分子也就不足为奇了，尤其是那些从事非法、未报告和无管制(IUU)捕捞活动的常违规者。专家表示，该活动导致每年海产品的损失价值高达360亿美元。通常情况下，因IUU捕捞活动而被抓捕的只是全体成员中的少数人，而真正的罪魁祸首——最终受益于这些船只的所有者们——始终没有露面。作者认为，同任何犯罪行为一样，制止大规模IUU捕捞活动的解决办法就是使这些船只所有者们承担的风险和成本超过其参与非法活动的利益。

孟加拉干鱼产业的相关问题.....38
作者 Sujit Krishna Das

生产加工晒干鱼为孟加拉国(尤其对女性)提供了一种创收途径，并减少了本将被丢弃或损失的原材料数量。对社区而言，这也是一个低成本获得蛋白质的重要来源。然而，干鱼的生产、贸易和消费的规模与重要性却鲜少为人所承认与了解。本文探讨了该产业面临的的主要挑战和问题，并提出了一些具体建议，从而促进市场准入，以及助力制定使该产业可持续发展的国家政策。

通过基因组和精准育种，推动罗非鱼的遗传改良 42
作者Rajesh Joshi

本文概括了由挪威遗传育种公司GenoMar Genetics(吉诺玛)的科研人员进行的基因组和精确育种对罗非鱼育种系的变革性影响，强调了提高新一代鱼苗生产效率的可行性。近期在基因组选择和品系育种方面的创新技术极大提高了GenoMar核心育种系统的遗传增益。结果显示，罗非鱼的遗传增益相比过去七代增加了三倍。这些创新技术为养殖户提供了运用公司最新迭代产品优异性能的机会，从而提高了盈利能力，促进了罗非鱼产业的可持续发展。

人工智能将如何转变海鲜产业 46
作者 Eric Enno Tamm

人工智能（AI）可以助力海鲜产业提高可预测性和盈利能力。本文介绍了三种类型的人工智能（AI）：机器学习、计算机视觉和生成式人工智能，并通过对目前渔船上的计算机视觉到供应链中的自动检查和需求预测进行讲解，介绍了人工智能（AI）目前在海鲜供应链中的应用。同时，进一步探讨了人工智能（AI）在海鲜加工领域的应用研究，包括产量预测、金枪鱼罐头厂的排水重量预测、快速盐度测试、智能摄像头的自动视觉检测、异常检测和需求预测。本文指出，在很多情况下都可以应用人工智能来（AI）优化流程并使之自动化，从而提高海鲜加工业的盈利能力和可持续性。


Wang Beiyang

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EQUITY AND SUSTAINABILITY IN TRANSBOUNDARY TUNA FISHERIES

By Quentin Hanich, Ina Tessnow-von Wysocki and Bianca Haas

Most of the world's tuna is caught in the Indo-Pacific, providing critical contributions to global markets, food security, livelihoods, revenue and economic development for numerous developing coastal and fishing States. The long-term sustainability of these fisheries depends on the effective cooperation of numerous coastal and distant-water fishing States through the Western and Central Pacific Fisheries Commission (WCPFC) and the Indian Ocean Tuna Commission (IOTC). While both organisations have adopted various conservation and management measures, the integrity and effectiveness of these measures are undermined by opt-outs and exemptions that have been applied due to equity concerns. It It is critical that the IOTC and WCPFC consider future strategies to transparently address equity concerns, enabling broad participation and compliance, while achieving UN Sustainable Development Goals and ensuring the long-term sustainable use of these fisheries.

PNG Purse-seiner in Pohnpei

Tuna fisheries include some of the most valuable fisheries globally.[1] Their migratory nature requires cooperation between numerous coastal and distant-water fishing States in order to sustainably manage them throughout the transboundary range of the tuna stocks. Tuna pay little attention to national boundaries; thus, cooperation is required. This cooperation must balance numerous national and regional interests, and engage sufficient political will to support implementation through all relevant national jurisdictions in waters under national jurisdiction and the high seas.

[1] *PEW, Netting Billions 2020: A Global Tuna Valuation. 11 September 2023, https://www.pewtrusts.org/-/media/assets/2020/10/nettingbillions2020.pdf*

A narrowly focused short-term view of national interest will jeopardise such cooperation. All parties must look towards long-term, shared interests and explore collective and innovative solutions that avoid a disproportionate burden on developing States and minimise disruption, while ensuring long-term sustainability. The international legal framework, and global commitments toward sustainable development, require that sustainability and equity be considered together.

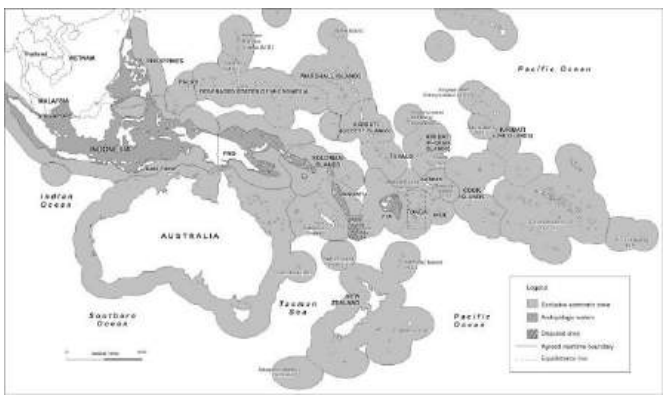
This article discusses the international legal framework for transboundary fisheries, sustainable development commitments, and the need to find new equitable pathways to sustainability. An inequitable conservation

and management measure contradicts international commitments, and is unsustainable in practice, while unsustainable exploitation similarly contradicts international commitments and is inequitable for current and future generations.

Ocean governance

The "constitution for the ocean" is provided by the United Nations Convention on the Law of the Sea.[2] This is one of the landmark successes of international cooperation, and an inspiring treaty for global governance. A total of 119 States signed the Law of the Sea when it was opened for signature on 10 December 1982, and while some developed States, such as the United States of America (USA), United Kingdom (UK) and Germany initially opposed the Convention's principled "common heritage of mankind"[3], it has since been ratified or acceded by 169 States, including both the UK and Germany (but not the USA).[4]

The Law of the Sea applied a zone-based order, dividing the oceans into areas *within* and *beyond* national jurisdiction, each zone being characterised by a different set of rights and responsibilities. In internal waters and territorial seas out to 12 nautical miles, coastal States hold sole jurisdiction to authorise and undertake activities, free of external interference within internationally agreed limits.[5]



Beyond 12 nautical miles, coastal States may claim an exclusive economic zone (EEZ) out to a maximum of 200 nautical miles, within which they hold sovereign rights for the purpose of exploring, exploiting, conserving, and managing natural resources (i.e., living, and non-living resources) and a responsibility to protect the marine environment.[6] Coastal States hold exclusive rights to determine who can access their EEZ resources, and under what conditions.[7] While they must promote the objective of optimum utilisation and provide foreign access to any surplus allowable catch, they are given exclusive discretion in determining the level of surplus, if any, and any conditions and fees.

Beyond 200 nautical miles are the high seas, which are considered to be a global commons and cannot be claimed by any State. The Law of the Sea recognises the "freedom of the sea" for the high seas,[8] subject to conditions, including the requirement that States cooperate with each other, conserve and manage marine living resources, and protect and preserve the marine environment.[9]

In the early 1990s, it became increasingly apparent that the Law of the Sea was insufficient to address increasing threats posed by overfishing, overcapacity, and destructive fishing practices.[10] Subsequently, the global community negotiated new initiatives to strengthen the global framework for fisheries management, including the United Nations Fish Stocks Agreement (UNFSA) [11], and the Food and Agriculture Organization's (FAO) Code of Conduct for Responsible Fisheries [12].

UNFSA is the most significant of these supplementary agreements regarding straddling and highly migratory fisheries and is an implementation agreement of the Law of the Sea. It institutionalises the duty to cooperate and explicitly requires all UNFSA parties to apply all conservation and management measures established by existing Regional Fisheries Management Organisations (RFMOs). It also limits access to these fisheries to parties that participate in RFMOs, or at the very least, agree to implement the relevant RFMO's measures.

UNFSA is often cited for modernising fisheries management and strengthening the duty to cooperate. But it also includes important provisions that recognise the special needs, rights and aspirations of developing States, particularly the need to avoid adverse impacts on, and ensure access to fisheries by, subsistence, small-scale and artisanal fishers, women fishworkers, and Indigenous Peoples. It also explicitly requires parties to ensure that conservation measures do not result in transferring, directly or indirectly, a disproportionate burden of conservation action onto developing States. It is important to note that this requirement only applies to developing States, as its scope has sometimes been confused during RFMO negotiations.

The FAO Code of Conduct for Responsible Fisheries also similarly recognised development concerns, noting that the capacity of developing countries to implement fisheries management should be duly taken into account. Paragraph 5.2 of the Code of Conduct states:

"In order to achieve the objectives of this Code and to support its effective implementation, countries, relevant international' organizations, whether governmental or non-governmental, and financial institutions should give full recognition to the special circumstances and requirements of developing countries, including in particular the least-developed

[2] *Tommy T. B. Koh, "Constitution for the Oceans" in United Nations Convention on the Law of the Sea 1982: A Commentary ed. Myron H. Nordquist, (Netherlands: Martinus Nijhoff Publishers, 1985).*
[3] *Philippe Sands, Lawless World: America and the Making and Breaking of Global Rules (London, United Kingdom: Penguin, 2005).*
[4] *As of 7th September 2023; United Nations, United Nations Treaty Collection – Chapter XXI Law of the Sea, 7 September 2023, https://treaties.un.org/pages/ViewDetailsIII.aspx?src=TREATY&mtdsg_no=XXI-6&chapter=21&Temp=mtdsg3&clang=_en*
[5] *Articles 2, 19, 21, 49, 52 of UNCLOS*
[6] *Article 56(1)(b)(i-iii) of UNCLOS*
[7] *Art 56 of UNCLOS: "In the exclusive economic zone, the coastal State has: (a) sovereign rights for the purpose of exploring and exploiting, conserving and managing the natural resources, whether living or non-living, of the waters superjacent to the seabed and of the seabed and its subsoil, and with regard to other activities for the economic exploitation and exploration of the zone, such as the production of energy from the water, currents and winds […]"*
[8] *Part VII of UNCLOS*
[9] *Articles 117, 118, 119, 192 of UNCLOS*
[10] *Rosemary Rayfuse, "The Interrelationship Between the Global Instruments of International Fisheries Law" in Developments in International Law, ed. Ellen Hey, 107-158, (Netherlands: Kluwer Law International, 1999).*
[11] *UNFSA, Agreement for the Implementation of the Provisions of the United Nations Convention of the Law of the Sea 10 December 1982, Relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks. (New York, USA. International Legal Materials, vol. 34. 1995).*
[12] *FAO. Code of Conduct for Responsible Fisheries. 1995. https://openknowledge.fao.org/server/api/core/bitstreams/4a456053-db08-4362-875a-2fdc723c1346/content*

among them, and small island developing countries. States, relevant intergovernmental and non-governmental organizations and financial institutions should work for the adoption of measures to address the needs of developing countries, especially in the areas of financial and technical assistance, technology transfer, training and scientific cooperation and in enhancing their ability to develop their own fisheries as well as to participate in high seas fisheries, including access to such fisheries."

Artisanal fishers in Betio, Kiribati

Meanwhile, the United Nations Sustainable Development Goals (SDGs) includes SDG 14, which aims to "conserve and sustainably use the oceans, seas and marine resources for sustainable development", through seven targets:

- Reducing pollution
- Restoring ecosystems
- Minimising ocean acidification
- Ending overfishing
- Conserving coastal and marine areas
- Reforming fisheries subsidies
- Increasing benefits to Small Island Developing States

Sustainable development

Most of the world's tuna is caught in the Indo-Pacific, within the jurisdiction of the Western and Central Pacific Fisheries Commission (WCPFC) and the Indian Ocean Tuna Commission (IOTC). While the two RFMOs are very different in structure and fishing operations, coastal States in both regions, particularly small island developing States, share a high dependence on fisheries for food security, livelihoods, revenue and employment. Artisanal fisheries maintain and feed communities, and provide important livelihoods. Industrial fisheries, ports and processing factories all provide development opportunities, while access fees from foreign fishing vessels provide critical revenue to fund schools and hospitals, infrastructure and technology. But they all depend on a productive and sustainable fishery, and the exclusive sovereign rights of the coastal State to determine management, development and access.

The sovereign rights create immediate and long-term value for the coastal States, both financially and in other terms (e.g. food security, livelihoods, etc). Fishing licenses and access agreements are mechanisms through which governments earn revenue and manage activity. The access fees are calculated, in part, based on the likely catch in the specified period of the access agreement, and the value of that catch, informed by historical and current data. A recent study determined that access arrangements pay for access – not future rights or catch history[13] - and highlighted the importance of accurate reporting and catch attribution for sustainable development.

Longliners at rest, Solomon Islands

High seas fisheries are also critically important, particularly in the Indian Ocean. The FAO Code of Conduct notes the need for measures that enhance the ability of developing States to develop their own fisheries and "... participate in high seas fisheries, including access to such fisheries."

RFMOs have mandates to consider the best available science and adopt appropriate conservation and management measures. For both the IOTC and WCPFC, conservation measures must be compatible across both EEZs and high seas and apply across the range of the stock. Therefore, negotiations over potential proposals must consider the impact of each proposal on the interests of diverse coastal and fishing State members, and ensure that the chosen approach achieves sustainability objectives while avoiding a disproportionate burden on developing States. This is not to say that RFMOs must avoid applying any conservation burden onto developing States, but that it must not be disproportionate.

This is often a difficult challenge, particularly when data is limited, or in circumstances where developing States have not had the opportunity to develop their own fisheries aspirations. For example, applying a conservation limit for an overfished stock that is primarily based on historical catch may inadvertently lock out developing States that have not had fishing opportunities, while rewarding flag States with

[13] *Andriamahefazafy, M., Haas, B., Campling, L., Le Manach, F., Goodman, C., Adams, T. and Hanich, Q. Advancing tuna catch allocation negotiations: an analysis of sovereign rights and fisheries access arrangements. npj Ocean Sustain 3, 16 (2024). https://doi.org/10.1038/s44183-024-00055-9*

vessels that overfished the stock. Such an outcome would contradict international equity commitments noted previously, and might also be considered to contradict the "polluter pays principle", rewarding the polluting (overfishing) activity.[14]

Within the IOTC, members can opt out of measures that they oppose. These opt-out procedures have been commonly used and have limited the effectiveness of conservation and management measures, with six members currently having opted out of the current yellowfin tuna measure.[15] While this might address equity concerns, it directly undermines sustainability goals and prevents the rebuilding of a key stock.

The WCPFC does not allow for opt-outs, but has adopted measures that ensure that the Commission must explicitly consider the special requirements of developing States and avoid a disproportionate burden.[16] For example, the WCPFC conservation and management measure for tropical tuna includes measures that exempt small island developing States from some provisions so as to avoid a disproportionate burden.[17] While such exemptions are important to address equity concerns, they undermine the integrity of conservation and management measures and may inadvertently create further equity concerns for other members.[18]

Balancing interests

Both the IOTC and WCPFC need to consider future strategies to transparently address equity concerns while achieving sustainability goals. Both organisations have initiated allocation processes that could meaningfully implement these goals and balance diverse interests, but both are struggling to negotiate an agreement. Meanwhile, climate change is accelerating and likely to further exacerbate equity concerns as it impacts on the productivity and distribution of fish stocks.[19]

RFMOs generally apply a consensus-based decision-making approach, even when they have the option to vote. While the consensus-focused approach is often criticised for resulting in weak outcomes, consensus is important as decisions can only be implemented through domestic jurisdictions; as flag States, coastal States, port States and market States. If a State objects to a proposed measure, or does not have the capacity to implement it, then that State is unlikely to comply.[20]

Win-win solutions are needed that recognise the sovereign rights of coastal States, and allow for innovative compatible management across EEZs and high seas. This requires creative negotiations that explore package deals that provide benefits for all, capacity-building programs and funding that ensure all parties can effectively participate and implement any decision; and allocations that enable development aspirations, minimise disruption, and ensure long-term sustainability goals.

Conclusion

The sustainability of transboundary fish stocks, such as tuna, depends on more than just science-based decision-making. It fundamentally depends on effective cooperation between sovereign States and their subsequent implementation of conservation and management decisions. This requires that all parties have the capacity and agency to determine their own national interest, and participate effectively in a negotiation.

Cooperation must consider history and context when negotiating conservation and management proposals. International relations occur within a geo-political, institutional, economic and trade context that has been formed by centuries of colonialism, capitalism and power disparities. Ignoring this does not make it go away. Failure to consider this history and context ignores ongoing inequities, marginalises development aspirations, undermines legitimacy, deters participation and subsequent implementation, and contradicts international development commitments.

Professor Quentin Hanich *leads the Fisheries Governance Research Program and is a Nippon Foundation Ocean Nexus Research Chair. He works throughout the Indo-Pacific region in various international research partnerships focusing on ocean governance and equity, marine conservation, and the sustainable and equitable management of transboundary fisheries. He is particularly interested in strategic research and capacity-building projects that support equitable ocean outcomes for coastal developing States. With this goal in mind, he engages closely with governments, stakeholders and international fora, and develops collaborative studies and courses that address current and future ocean governance and policy challenges.*

Dr Ina Tessnow-von Wysocki *is an Ocean Nexus Postdoctoral Research Fellow at the Australian National Centre for Ocean Resources and Security (ANCORS), based at the University of Wollongong. Her research on international ocean governance in areas beyond national jurisdiction focuses on ocean equity with regards to multi-jurisdictional coherence of fisheries, deep-sea mining and marine biodiversity governance. She cares about humans' relationship with nature to recognise the environment and future generations in governance decisions.*

Dr Bianca Haas *is a Research Fellow at ANCORS and works on equity issues in transboundary fisheries management, focusing on tuna fisheries in the Indian and Western and Central Pacific Oceans. She is especially interested in the issue of disproportionate burden, allocation, and the availability of science and data. Additionally, she works on crew labour issues in fisheries.*

[14] *Kok-Chor Tan , "Climate reparations: Why the polluter pays principle is neither unfair nor unreasonable," WIREs Climate Change 14 (2023):e827.*
[15] *Resolution 21/01 on an interim plan for rebuilding the Indian Ocean yellowfin tuna stock in the IOTC area of competence*
[16] *CMM 2013-06 on the criteria for the consideration of conservation and management proposals.*
[17] *CMM 2023001 for Bigeye, Yellowfin and Skipjack Tuna in the Western and Central Pacific Ocean*
[18] *Bianca Haas, Kamal Azmi and Quentin Hanich, "The unintended consequences of exemptions in conservation and management measures for fisheries management," Ocean & Coastal Management 237 (2023): 106544.*
[19] *Johann D. Bell et al., "Pathways to sustaining tuna-dependent Pacific Island economies during climate change," nature sustainability, 4 (2021): 900-910.*
[20] *Quentin Hanich, Feleti Teo and Martin Tsamenyi, "A collective approach to Pacific islands fisheries management: Moving beyond regional agreements," Marine Policy 34 (2010): 85-91.*

SHRIMP

Global supply: From China to India, farmed shrimp prices reached record low levels during the first half of 2024, while shrimp imports in the top two markets (China and the United States of America) during January–April 2024 declined year-on-year.

Nearly 95% of the shrimp farmers in India's Gujarat state, the second largest area for shrimp aquaculture in the country, have opted to produce black tiger shrimp in 2024 because of better business returns. Overall production of *vannamei* in India in 2024 is thus anticipated to fall.

Current imports of frozen raw material from Ecuador and India into Vietnam were lower than last year's first quarter period, suggesting a recovery in the domestic production of farmed shrimp in 2024. Despite the weakening in ex-farm prices, Vietnam has reported increased exports during the first quarter of this year.

Farmed shrimp supply in Bangladesh will be low this year, as most of the aquaculture farms in the southern region were destroyed and washed away by the strong cyclone in June; black tiger shrimp is the main species farmed in Bangladesh.

Ecuador continues to see increased production of farmed shrimp despite the low ex-farm and export prices.

Exports

According to revised export data in the first quarter of 2024, shrimp exports declined from Ecuador (-7.2% at 276 760 tonnes) and Indonesia (-9.4% at 51 155 tonnes) but increased from India (+4.1 % at 155 624 tonnes), Vietnam (+26.35 at 61 470 tonnes) and China (+4.3% at 34 710 tonnes) in comparison with the same period in 2023. Exports from Indonesia declined by 19% to 51 153 tonnes during this period. Cumulative exports from Ecuador during January–April 2024 were 1% lower year-on-year at 388 562 tonnes.

Global import trends in January–April 2024

China: The world's leading importer of shrimp posted a 5.8% decline in shrimp imports during January-April 2024 with waning monthly supplies from February to April 2024 against the same period a year ago.

US/Canada: During the first quarter of 2024, total imports of shrimp in the US increased by 1.25% against the same period in 2023.

However, by April, the market reverted to its previous negative growth trend as cumulative imports fell by 2% at 233 693 tonnes. Market analysts relate this negative trend to the initial assessments of the Countervailing Duty (CVD) applicable on certain exporting countries.

In Canada, the positive import trends seen in January–March 2024 continued in April as monthly imports increased significantly by 39% at 5 066 tonnes, making a cumulative total of nearly 20 000 tonnes during January–April 2024.

European Union: Shrimp imports into the European Union shrimp during January–March rose by 3.5%, which could be credited to increased supplies of farmed shrimp from Ecuador, Vietnam and China, as well as sea-caught shrimp from Argentina.

Preliminary data in April also indicated higher imports in Spain, France, and Germany.

Asia/Pacific: Japan and the Republic of Korea, the two non-producing countries in the Asia Far East, imported more shrimp during January–April 2024. In comparison with 2023, shrimp imports in Japan and the Republic of Korea increased by 4.7% at 62 644 tonnes and 33 000 tonnes, respectively, associated with the Lunar New Year and Spring Festival celebrations during February–May.

Meanwhile, most of the shrimp producing countries in Southeast Asia and the Far East enjoy good demand for fresh shrimp in their domestic markets, where demand for medium to small sizes remains stable almost round the year in the retail and catering trade.

TUNA

Sashimi and non-canned tuna trade

Japan: With the beginning of the summer season in June, overall demand and supply of fresh and frozen tuna in Japan's sashimi trade has reduced significantly along with weakening in prices. The warmer seawater has also affected the quality of domestic tuna upon landing. Meanwhile, the overall price rises of household items (including seafood) since April have continued to impact household disposable incomes for food, including tuna, across the country.

During the first quarter of 2024, imports of all types of frozen tuna (including fillets) increased in Japan but declined for air-flown fresh tuna as demand for locally-caught fish rose. This trend may be linked to improved seasonal demand during the cherry blossom and Golden Week celebrations in April and May, in comparison with the last three years.

There was a significant rise in imports of the popular ultra-frozen tuna fillets during the first quarter of 2024, while imports of whole frozen dressed tuna also increased significantly. The 45% jump in tuna fillet imports comprised 8 136 tonnes bluefin, 3 832 tonnes of yellowfin and 4 512 tonnes of bigeye, for which the main exporters were Malta, China, Republic of Korea, Spain, Morocco, and Indonesia.

USA: The overall import trend for fresh and frozen tuna in the United States, the second largest non-canned tuna market, remained flat during January–March 2023 as well as in the same period in 2024. Supplies continued to be dominated by frozen tuna fillets/steaks, which comprised 45% of total imports.

Raw materials for canning and other uses

Western Pacific: According to FAO-Globefish, tuna catches in the Western and Central Pacific (WCP) have been inconsistent since late May; some vessels are reporting moderate catches while others say that fishing is poor. Meanwhile, the delivery price of frozen skipjack from the WCP to Thailand increased by USD 100/tonne to USD 1 400–1 450/tonne in June in comparison with May 2024.

Southeast Asia and Europe: Demand for frozen raw material has increased in Thailand. Year-on-year imports during January–April 2024 were 12.2% higher at 266 530 tonnes and 25% more for cooked frozen loins at 16 600 tonnes. China and Indonesia were the main suppliers of cooked loins to Thai canners. In Europe, imports of whole frozen skipjack, yellowfin and cooked frozen loins also increased during the first quarter of 2024.

Japan: At the Yaizu port in Japan, landings of frozen skipjack and yellowfin were stable, with slight weakening in ex-vessel prices.

Canned and processed tuna

World: Global exports of canned and processed tuna (HS 160414) recovered during the first quarter of 2024 in comparison with the same period in the previous four years. Exports of this product group from the top five producers/suppliers, namely Thailand, Ecuador, China, Spain, and the Philippines, increased year-on-year during January–March 2024.

Thailand and Spain generally export ready-to-eat products, whereas supplies from Ecuador, China and the Philippines mainly consist of semi-processed cooked frozen loins and end-products. With a 16.5% increase in exports, Thailand, the top supplier, had an estimated share of 35% in the global exports of canned and processed tuna during the review period.

Exports from Ecuador were 26.6% higher against the first quarter of 2023 as supplies of semi-processed cooked loins and canned tuna increased to Europe (European Union, United Kingdom and the Russian Federation) and Latin American markets (Colombia, Chile, Uruguay, Peru, and others) during January–March 2024.

For China, Thailand was the top market (31% in total exports, mostly consisting of cooked frozen tuna loins and semi-processed loins). Exports to Mexico, Ecuador, and Vietnam also increased.

For Spain, gains in the inter-EU trade were positive, but small.

Meanwhile, with over 50% increase in exports (mostly cooked loins), Thailand was the number one export market for Indonesia during the first quarter of this year. However, exports of end-products (canned tuna) declined to Saudi Arabia, Japan, and the United States with a 1% decline in the total exports year-on year.

LIVE, FRESH, CHILLED FISH AND SEAFOOD

Salmon

Asia: Asian markets for fresh/chilled Atlantic salmon accounted for 10% market share of the total global imports (1 825 600 tonnes). In 2023, the total imports of fresh/chilled Atlantic salmon in Asia increased by 10.6% at 180 809 tonnes in volume and 7.4% at USD 2 267 350 in value, compared to the previous year. Among the main markets in Asia, an increase in China compensated for the overall decrease recorded in almost all other Asian countries.

In terms of supply, the top five main suppliers for fresh/chilled Atlantic salmon to Asia are Norway, Australia, Chile, the Faroe Islands and the United Kingdom. In 2023, Norway dominated the Asian market with a 72% market share due to a growth in exports by 5.7% at 130 121 tonnes, against 2022. Greater demand was recorded for China. Among the main suppliers (except for the Faroe Islands), increases were recorded particularly for Chile with +156.5% at 18 137 tonnes from 7 070 tonnes in 2022. The increased demand from China has been the major contributor to the growth of fresh/chilled salmon exports from Chile in Asia, taking into consideration the agreement between Chile and China aimed at increasing the export of aquaculture products in line with a new protocol for inspection, quarantine and veterinary health requirements *(Source: Globefish Highlights 1/2024).*

Fresh/chilled tilapia fillets

Global: During the first quarter of 2024, fresh/chilled tilapia fillet imports in the United States decreased by 14.8% at 6 405 tonnes compared to the same period in 2023. Nevertheless, the United States continues to be the top global importer of the product, with a 79% market share. Among the other leading importers in ranking were Canada, Guatemala, Hong Kong, Qatar, and Colombia. Notable increases in imports have been recorded in Guatemala (207%), Hong Kong (192%), and Qatar (97%). The other markets in Asia were Singapore and Japan, which reported nominal imports (two tonnes each).

In terms of supply, during January–March 2024, Colombia, Brazil, Costa Rica, and Honduras were the top exporters. However, Honduras recorded a huge decrease in export volume by 70%.

USA: The country's imports of fresh/chilled tilapia fillets during the first quarter in 2024 declined by 20% at 5 071 tonnes compared to the same period in 2023. Fresh/chilled tilapia fillet sales in the United States have declined largely due to their higher prices in comparison with cheaper frozen fillets. Among the major suppliers, only Colombia and Brazil recorded increases, while significant decreases were seen in Costa Rica (-23%), Honduras (-72%), and Mexico (-88%).

FROZEN FISH & FILLETS

Frozen tilapia

During the January–March 2024 period, global imports of frozen tilapia increased by 11.4% at 103 255 tonnes compared to the same period in 2023. Both frozen fillets and whole tilapia products recorded increases of 3.4% and 24.8% respectively. Major market destinations for frozen tilapia fillets were Mexico, United States, Costa Rica, and Colombia while those for frozen whole product are Cote d 'Ivoire, United States, Mexico, South Africa, and Saudi Arabia.

Mexico has surpassed the United States as the top market for frozen tilapia fillet. Its imports of 25 964 tonnes were 27.9% higher than the same period a year ago, while imports in the USA decreased by 12.8%. For the whole frozen tilapia category, Cote d'Ivoire dominated the market with a 33.4% share, followed by the United States and Mexico. In Asia, Malaysia was the largest importer of whole frozen tilapia and fillets with a 33% rise in imports year-on-year. The other importers in Asia were Thailand, Singapore, Japan and Republic of Korea.

Meanwhile, the top suppliers in the first quarter of 2024 were China, Indonesia, and the Netherlands for frozen tilapia fillets, while for whole frozen fish, the suppliers were China, Taiwan, and India. China continues to dominate the supplies of whole frozen tilapia and frozen fillets; exports of whole fish increased during this period but declined for frozen fillets.

In China, demand for tilapia has increased in line with reduced consumer disposable income. Following expansion of casual dining chains and e-commerce offering lower-priced products, low-cost whitefish like tilapia have become increasingly popular. However, Vietnamese pangasius are still preferred due to their lower price as compared to tilapia. Domestic producers of tilapia are therefore forced to reduce prices despite the rising costs of fish feed.

The United States remains the top importer of total frozen tilapia when combined (fillet and whole product categories) despite an overall decline in the import volume. During the first quarter of 2024, total frozen tilapia imports decreased by 5.4% at 34 151 tonnes compared to the same period the previous year. Imports of frozen tilapia fillets comprising 64.8% share in the total frozen tilapia imports, declined by 12.8%, while frozen whole tilapia imports increased by 12.4%. The lower US imports, specifically for frozen fillets, are due to China's efforts to reduce its dependency on the export market by selling more fish in its domestic market.

FROZEN LOBSTER AND CRAB

Cuba/China: Cuban lobster exports have established a small, yet solid presence in the Chinese market following the continued ban on Australian lobster. Compared to lobster from Boston, Cuban lobsters are considered more premium as it is more expensive in China. During the recent Chinese New Year, one Cuban lobster was sold for USD 42 against USD 32 for a Boston lobster.

FROZEN CEPHALOPODS AND MOLLUSCS

Global: In 2023, global imports of frozen squid and cuttlefish increased marginally by 2.6% at 1.7 million tonnes against the previous year. Among the major market destinations, China and the Republic of Korea posted increases in imports by 32.5% and 12.9% respectively, while imports declined in Spain (-3.7%), Thailand (-2.4%) and Italy (-2.4%). Suppliers to China, which continues to be the top market in a 4-year review period, are Peru, Indonesia, United States, Malaysia, and India. Peru had a huge increase in exports (+688.8%) to China surpassing Indonesia as the top supplier. However, according to *Globefish Highlights 1/2024,* the domestic consumption of squid in China did not improve as expected, which created problems for traders who were left with high inventories. Meanwhile, Spain in the second spot among the top importers, procured supplies from the Falkland Islands, Peru, Morocco, India, and China. In Asia, Japan, Vietnam, Malaysia, Taiwan, and the Philippines were also good markets for frozen squid and cuttlefish, where part of these imports was meant for export processing.

FISHMEAL

Peru: According to The Marine Ingredients Organisation (IFFO), the Total Allowable Catch (TAC) of anchovies in Peru is highly important to the global seafood industry as the country is responsible for about 20% of the global fishmeal production in an average year. Peru's first anchovy fishing season was reported to have already reached its 82% TAC, exceeding two million tonnes in just over 40 days. With the TAC of 2.48 million tonnes, these catches are significantly higher than those from the north-central zone's two seasons in 2023. Given that the TAC is nearly reaching its limit, the fishing industry is now preparing for slow production.

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Tilapia

Promising outlook: Tilapia prices set to rebound amid tight supply

During the first nine months of 2023, global tilapia trade saw a slight downtrend due to tight supply and increased production costs. However, the market is expected to remain positive in terms of trade and supply, and the outlook for a recovery in prices in 2024 is optimistic.

Production

In the third quarter of 2023, tilapia production in China has been considerably affected by increased raw material costs, partly due to a decline in Peruvian fishmeal production. Consequently, tilapia supplies tightened, causing farmgate prices to surge by over 30 percent compared to the previous year. Processors are now faced with the dilemma of either delaying contracts or breaking them to mitigate losses. To offset the expensive feed costs, Chinese farmers have adopted high-density farming techniques, raising concerns about the quality of the tilapia produced.

Elsewhere, Indonesia is emerging as the second-largest tilapia producer in Asia. African countries are also investing more in tilapia production, aiming to increase their contribution to the global tilapia supply. Farmers in Kenya and Zimbabwe are making strides in enhancing fingerling production, and launching programs to increase the output of higher-quality tilapia as well as stimulate domestic fish consumption. Meanwhile, Egyptian production is anticipated to exhibit a positive supply outlook for the upcoming year. In Latin America, tilapia supplies in Brazil and Honduras during the third quarter of 2023 were lower than envisaged due to fish mortality problems that could be linked to the impact of climate change or diseases in different regions.

Market and trade

According to the National Oceanic and Atmospheric Administration (NOAA), tilapia imports in the United States for the first nine months of 2023 amounted to 129 678 tonnes, valued at USD 489 million. This represents declines of three percent in terms of volume and 13.7 percent in value compared to the same period in the previous year. Additionally, fresh tilapia sales in the US market in the third quarter fell by around 10 percent, largely due to the higher prices.

China, the leading exporter of tilapia to the United States, saw a seven percent year-on-year decrease in the volume of frozen tilapia fillet exports but a 59 percent increase in frozen whole tilapia exports in the third quarter of 2023. It is predicted that by the end of 2023, Chinese market share in tilapia imports to the United States will likely drop by approximately 50 percent due to significant price increases, leading US customers to explore alternative seafood options. However, tilapia prices are expected to stabilize in 2024 as customers continue to seek more competitively priced alternatives.

In China, the domestic seafood distribution channel has undergone changes, with live streaming and short videos gaining popularity. However, tilapia sales have not seen significant growth through this specific distribution channel despite its prevalence in the seafood industry. Additionally, although there is growing demand for ready-meal items in restaurants, tilapia convenience products are in small supply, with limited purchases. Holiday seasons are likely to drive the domestic tilapia market in the country, but the low re-purchase rate for this species indicates that demand is sluggish. This decreased consumer demand for tilapia has resulted in a decline in prices at restaurants serving the fish.

In the third quarter of 2023, Brazilian exports of farmed tilapia reached 1 578 tonnes valued at USD 6.8 million. Despite an 11 percent volume drop, there was a notable 48 percent increase in value. The rise was driven by surging sales of fresh and chilled tilapia fillets, with a remarkable growth of 276 percent and 365 percent, respectively. Whole fresh and chilled tilapia sales also saw significant growth, with a 515 percent increase in volume and an astounding 1 094 percent increase in value. Average sales value rose across all tilapia products during Q3. Although tilapia exports to Japan declined by 27 percent in volume, the export value rose by 25 percent. Meanwhile, exports to Canada, ranking third by value in the third quarter, amounted to USD 143 991.

Elsewhere in Latin America, Colombia has further established itself as the second-largest tilapia supplier to the United States, exporting 13 020 tonnes of tilapia, valued at USD 86.2 million during the first nine months of 2023. This represents a 2.8 percent increase in volume and a 16.8 percent increase in value compared to the same period the previous year. Fresh chilled fillets continue to be in high demand as the preferred product.

Prices

In the third quarter of 2023, Chinese tilapia prices rose, reaching the highest levels seen in the corresponding review period in previous years. During July and September, whole live tilapia (300–500g in size) in Guangdong province (DAP, Guangdong) were sold at CNY 6.65 (USD 0.92) per kg, reflecting an 11 percent increase from the previous quarter and a 12 percent increase year-on-year. Import prices in the United States for frozen fillets decreased by 16 percent, while fresh fillets increased three percent year-on- year in the third quarter of 2023. During the same period, average prices of tilapia products in Brazil increased sharply. Fresh whole tilapia saw a remarkable 93 percent increase, while fresh and frozen fillets both rose by 23 percent. This rise can be attributed to decreased production in key Latin American supplying countries like Colombia and Honduras.

Outlook

The global tilapia market has encountered difficulties, including disease outbreaks and climate change challenges, resulting in a sluggish period (January – September 2023). Despite inflation and high input costs driving up tilapia prices, global trade can be characterized as having positive prospects. China and major tilapia suppliers in Latin America faced production constraints and slower growth in the first nine months of 2023, leading to tight global tilapia supply. Efforts are underway for price recovery, with these key suppliers expecting production rebounds in addition to increased supply from African countries. With consumers having a wide range of seafood choices, it may lead to increased competition and potentially lower prices for tilapia in 2024.

China exports of frozen whole tilapia
January–September, 2021–2023 (1 000 tonnes)

Frozen tilapia	2021	2022	2023
Côte d'Ivoire	38.71	34.19	44.47
United States of America	20.34	14.32	22.73
Mexico	11.08	5.40	6.55
Other countries	27.33	27.33	27.33
Total exports	97.46	81.24	101.08

Source: Author's own elaboration based on GTT 2024, Global Trade Tracker, [Cited 5 January 2024] www.globaltradetracker.com

United States of America imports of chilled tilapia fillets,
January–September, 2021–2023 (1 000 tonnes)

Chilled fillets	2021	2022	2023
Colombia	5.87	7.50	8.24
Honduras	6.26	6.64	3.98
Costa Rica	2.55	2.65	3.11
Other countries	2.89	1.57	2.23
Total imports	17.57	18.36	17.57

Source: Author's own elaboration based on GTT 2024, Global Trade Tracker, [Cited 5 January 2024] www.globaltradetracker.com

United States of America imports of frozen tilapia fillets,
January–September, 2021–2023 (1 000 tonnes)

Frozen fillets	2021	2022	2023
China	64.29	67.82	63.23
Indonesia	3.88	5.15	4.91
Taiwan Province of China	1.07	1.03	0.94
Other countries	3.66	1.57	2.23
Total imports	72.89	75.57	71.31

Source: Author's own elaboration based on GTT 2024, Global Trade Tracker, [Cited 5 January 2024] www.globaltradetracker.com

United States of America imports of frozen whole tilapia, January–September, 2021–2023 (1 000 tonnes)

Frozen whole	2021	2022	2023
China	20.34	14.32	22.73
Taiwan Province of China	9.32	8.12	7.19
Brazil	0.97	2.26	1.91
Other countries	1.99	4.07	4.80
Total imports	32.63	28.77	36.63

Source: Author's own elaboration based on GTT 2024, Global Trade Tracker, [Cited 5 January 2024] www.globaltradetracker.com

(Source: Globefish Highlights Issue 1, 2024)

Celebrating a decade of dedication to a holistic sustainability approach, Seafoodmatter marks its **10th anniversary** with pride and reflection. What began as a vision to drive positive change has now blossomed into a global force for environmental responsibility and social impact in each client who requested our technical support and advice.

SEAFOOD MATTER
Celebrating 10th Anniversary

Our Global Impact on Numbers

- **51 Countries** – worked
- **More than 100 MSC Chain of Custody Assessment**
- **More than 150 Aquaculture Stewardship Council Farm Assessments** *(Seriola, Shrimp, Oysters, Tilapia, Salmon, and Trout fish)*
- **5 Fisheries assisted in obtaining the Marine Stewardship Council MSC certification**
- **More than 90 Fishing vessels assessed against ILOC 188, IMO, and Human Rights** *(Purse seiners, trawlers, and long liners)*
- **More than 1000 Crew members were interviewed on Social Accountability aspects, and more than 600 interviews on Labor rights in the Aquaculture Sector.**
- **Speaker 54 Seafood conferences and events**
- **27 Clients Globally**
- **48 Workshops delivered**
- **10 Technical advisory member**
- **2 Steering board member**
- **4 associated technical partners**

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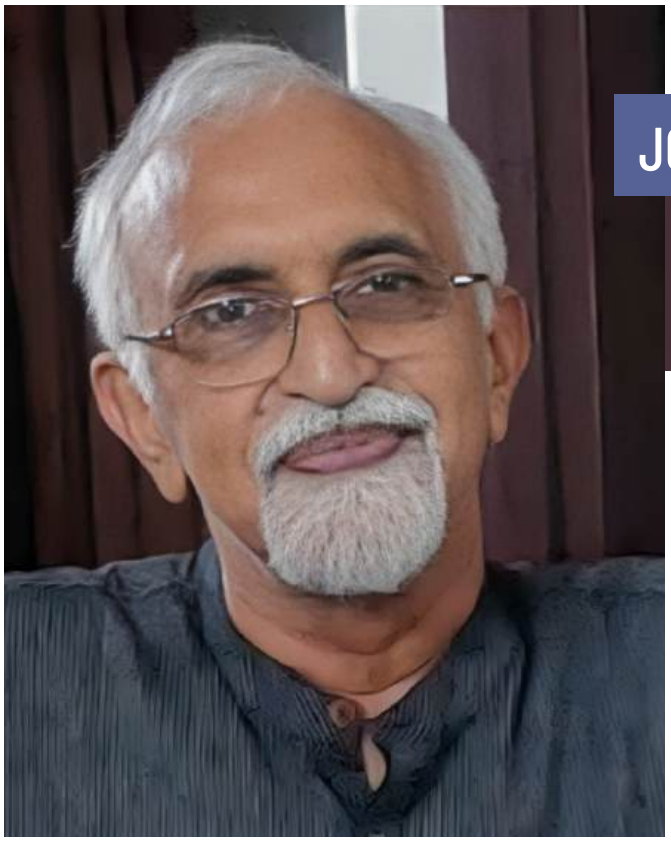

JOHN KURIEN

Retired Professor, Centre for Development Studies, Trivandrum, India; and Founder Member of the International Collective in Support of Fishworkers (ICSF)

Q: *In your capacity as Founder Member of the International Collective in Support of Fishworkers (ICSF), could you provide readers with some historical context of the organisation, including the organisation's involvement in seminal documents such as The Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries in the Context of Food Security and Poverty Eradication (the SSF Guidelines), adopted in June 2014?*

A: The founding of the ICSF in 1986 is linked to the first *International Conference of Fishworkers and their Supporters* held at Rome in July 1984 – now referred to, in the circles of small-scale fishers and activists, as the "Rome Conference[1]".

As Secretary-General of this initiative, collaborating with individuals worldwide, we organised a unique gathering where sixty fishworkers and forty activists representing 34 countries from all the continents, convened in Rome. They first discussed their common concerns, then deliberated appropriate ways to progress an agenda for sustainable fisheries where fishworkers matter as much as the natural resource. This event overlapped with the FAO/UN's first World Conference on Fisheries Management and Development.

The Rome Conference also popularised the term "fishworker," now widely used in fishery circles and international documents. The term encompasses anyone involved in the labour process of fish harvesting, processing, and marketing, including small-scale fishers and workers in industrial fishing vessels, processing plants, and marketing chains. Additionally, the Conference prompted supporters to explore concrete expressions of solidarity for global fishworker-related issues.

It was in November 1986, when at an international workshop at the Centre for Development Studies (CDS) in Trivandrum, India, supporters who had attended the Rome Conference, decided to establish the International Collective in Support of Fishworkers (ICSF)[2].

Comprising community activists, academics, and organizers, the ICSF network focused on advocating for the rights of small-scale fishworkers. The common denominator was that all members were in some manner connected to small-scale fishworkers in their respective countries. From its inception, ICSF emphasised the economic, ecological, social, and cultural importance of the small-scale fishing sector, undertaking various initiatives such as workshops, conferences, and publications like the SAMUDRA Journal, Yemaya newsletter and provided daily fishery news alerts.

In 2008, a meeting in Bangkok, spurred by an FAO/UN initiative, and together with global fishworker and civil society organisations, established the initial agenda for formulating broad guidelines to support small-scale fisheries. ICSF, along with other organisations, took on the task of drafting guidelines to valorise small-scale fisheries, building on the recommendations of the Rome Conference and the extensive knowledge and contacts already accumulated through ICSF's global activities.

Ms Chandrika Sharma, then Executive Secretary of ICSF, and my former student at CDS, played a pivotal role in spearheading a global bottom-up approach to formulate guidelines for small-scale fisheries. She travelled extensively, engaging with small-scale fishworkers to incorporate their concerns into the document. Tragically, she was aboard the ill-fated MH370 in March 2014 en route to a meeting to discuss details about the Guidelines. In an exceptional gesture for a UN document, the *Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries in the Context of Food Security and Poverty Alleviation* (SSF Guidelines) adopted in June 2014 was dedicated to her memory, recognising her tireless efforts in improving the lives of fishworkers worldwide and her invaluable contribution to the formulation of these Guidelines.

[1] *https://www.icsf.net/resources/report-of-the-international-conference-of-fishworkers-and-their-supporters-rome-july-4-8-1984/*

[2] *http://www.icsf.net*

Q: *In a thought-provoking article that you wrote for the INFOFISH International at the beginning of this year[3], one clear message was that post-adoption of the SSF Guidelines (and other international guidelines), States often lack clear strategies for national implementation. At the same time, local communities remain unaware and uninvolved in the implementation processes. As quoted in your article, it is important to "democratise the implementation and monitoring of voluntary guidelines, making it a process by, for, and of the community"? What are some major steps that could be taken by both parties that might be useful in this democratisation process?*

A: To my mind, for any international agreement to effectively serve its purpose, it must undergo a process of democratisation. This involves making the agreement accessible and understandable, particularly for those who will be affected by it. When representatives of States agree to collaborate at international fora, it is because they see alignment with the contents of a concerned agreement. So, they vote that the agreement be adopted. Thereafter, national ratification is crucial, requiring efforts to raise awareness about the agreement's contents and implications among various sections of society. Governments, media and civil society should collaborate to ensure that the message reaches citizens, fostering a sense of commitment and purpose in implementing the agreement.

Applying a similar democratisation process to the SSF Guidelines implies advocating for the involvement of national fisheries ministries/departments/institutions in raising awareness and popularising the Guidelines. This includes translating them into languages spoken by fishworkers and simplifying their core contents.[4] Additionally, producing informational materials in various media formats is recommended. Prioritising the involvement of local government governance structures is paramount, as they are closest to small-scale fisheries and can effectively recognise their benefits such as engendering employment, income, food, appropriate technologies, local culture, taxes and so on. States should integrate the SSF Guidelines into their policy documents and ensure that relevant themes such as tenure, fisheries management, social development, and gender parity are addressed at the appropriate government departments.

Similarly, small-scale fishworkers and their associations must understand the implications of the core contents of the SSF Guidelines. Vibrant civil society supporters should facilitate this process, as has been seen in various initiatives worldwide over the last decade. This grassroots engagement is crucial for generating pressure for implementation. Given the wide and participative nature of the SSF Guidelines' creation, it is only natural that the very same level of zeal and enthusiasm should drive commitment toward their implementation.

Achieving effective democratisation of awareness and implementation of the Guidelines resembles the dynamic of clapping—it requires both hands. Similarly, this process necessitates participatory actions from grassroots levels and obligatory commitments from higher authorities. This dual commitment, especially in the context of any voluntary guidelines document, often yields surprisingly more effective outcomes than relying solely on legal mandates.

Q: *One can argue that in theory, democratisation is entirely achievable. But in the increasing context of commercial fisheries, big businesses, and other sectors (mining, tourism, etc) encroaching upon the spaces traditionally occupied by the SSF sector, how can we ensure that ocean governance is just, as well as within the framework of the Blue Economy defined by the World Bank as "the sustainable use of ocean resources for economic growth, improved livelihoods and ocean ecosystem health".*

A: I cannot agree more with you about the risks and limitations inherent in the fast evolving and competing interests which are casting their eyes on the oceans and the coasts, posing a huge challenge for the survival of small-scale fisheries world over and to the real sustainability of the oceans.

We need to change our perspective from "what more can we get from the ocean" to "what value does the ocean offer to us." The framework of the World Bank about the Blue Economy continues to focus on the former materialist perspective. Our human relationships with the ocean represent a plurality of values – material, monetary, emotional, and spiritual – that must be respected and fostered.

Blue Justice will prevail only if we give priority to all these values. And only those who have an intimate relationship with the oceans – ocean citizens so to speak – can spearhead this. I believe the many millions of small-scale fishers of the world, for whom the sea is "Mother", should take the lead. They are the true ocean citizens, who, while they depend for their livelihoods on its living material resources, foster the values of care, cooperation, mutual assistance, and the ethic of sufficiency. These values are foundational to create a more just, sustainable, participatory, and self-reliant ocean economy.

Q: *Could you cite some examples from the work of ICSF where fishing communities, either on their own or through discussions with the authorities, have been successful in strengthening the coherence between overarching policy and implementation at grassroots level?*

A: Since the commencement of the ICSF in 1986, in hindsight, I see two broad phases of its work.

The first two decades focused on facilitating existing fishworker organisations and where appropriate, facilitating the formation of new ones, in different parts of the world. In this phase, I can recall the activities which have taken place with the Maritime Fishers Union in Canada; the National Collective of Fishers of Senegal; the National Fishworker Forum of India; and the Network of Fishers of Laguna, Philippines; to name a few across the globe. Such initiatives were combined with training and exchange programs; campaigning for different issues of concern for fishworkers; organisation of multi-stakeholder workshops dealing with a variety of issues such as work on distant-water vessels; the role of

[3] *John Kurien. 2024. Democratizing the Implementation of the Small-Scale Fisheries Guidelines. INFOFISH International January/February 2024 (https://infofish.org/v4/media/attachments/2024/01/08/article-democratizing-the-implementation-of-the-small-scale-fisheries-guidelines.pdf)*

[4] *https://www.icsf.net/resources/ssf-guidelines-summary-john-kurien/*

customary organisations in management; collaboration in the Indian Ocean; a feminist perspective in fisheries; and others.

The second phase was the period after 2008 which can be described as focusing more on small-scale fisheries issues. ICSF members were joined by many other NGOs and CSOs which were starting to take interest in fishworker issues. During this period, members first facilitated the articulation of what was needed to secure sustainable small-scale fisheries, holding local meetings and discussions with communities. It was these processes which led to the bottom-up articulation of themes for inclusion in what finally became the SSF Guidelines. Thereafter, particularly after the adoption of the SSF Guidelines, contemporaneous national-to-local and local-to-national facilitation and action has taken place in Tanzania, Ghana, Costa Rica and Thailand. Members, and the fishworker organisations with which they associate, have engaged in multiple activities. These include translation of the Guidelines to local dialects; undertaking analysis of national social development programs and budgets, pointing out their agrarian and urban bias; and then indicating the realms for providing the kind of social support which is required for the fisheries sector; and setting up networks of fishers from indigenous communities across national territories.

Q: *Still on the SSF Guidelines, what would you identify as being the top three global priorities for action leading up to 2030?*

A: To me the three top priorities within the SSF Guidelines are human capacity development for youth (Ch.12); collective action for (re)securing tenure and fisheries management (Ch 5); and social development (Ch.7). It is my considered opinion – based on my five decades of field experience, research, and reflection – that if these three priorities are given global and local attention, then the rest of the vital elements needed for securing sustainable small-scale fisheries will quickly fall into place.

Q: *Moving on to a very topical matter, in 2006, you authored a paper titled "Untangling subsidies, supporting fisheries: The WTO fisheries subsidies debate and developing-country priorities"[5]. You had said then that banning all subsidies is unfair for developing countries, particularly since the level of support given to the fisheries industries in developed countries often far exceeds that in less developed countries. Moreover, that State support is essential for fishing communities to enhance human development aspects such as poverty alleviation and increasing food security. In view of the recent discussions at the WTO's MC13 conference, has your opinion changed substantially?*

A: My opinion on the need for developing countries to subsidise their fisheries remains the same. It must be continued and enhanced. Though the adoption of the WTO Fisheries Subsidies Agreement remains incomplete, my position is that developing States should plan to utilise it importantly to support their fisheries towards implementing sound management practices within their EEZs – with special focus on their small-scale fisheries.

Observers well-versed in the global issue of fisheries subsidies are acutely aware that developed maritime nations have consistently and generously subsidised both their small-scale and industrial fisheries sectors. However, it is the support directed towards the industrial sector that has predominantly contributed to the worldwide over-exploitation of fishery resources.

Hence, the utilisation of WTO regulations by developed nations to halt or challenge subsidies granted by developing coastal States for their fisheries, smacks of hypocrisy. It resembles employing a ladder to ascend and then dismantling it when others seek to utilise it as well—a contradiction in action and principle.

What we need to understand is that, when States provide subsidies, the considerations are not exclusively economic, nor are they related only to the issues exclusively to the sector in question. The decision to provide any subsidy is importantly socio-political. This applies to the fisheries sector as well.

Take the example of Norway. Since the mid-1900s, it has given direct income support to its coastal fishing communities. Based on costs and earnings data provided by Norway's Directorate of Fisheries, if the income of fishers, in any year, fell below that of the oil-rig workers of the country, their incomes were topped-up to that extent. This practice was even opposed by well-known Norwegian fishery economists as being a "market distortion". However, one crucial socio-political and strategic reason for this levelling of incomes was that, during the Cold-War era, it was paramount to support coastal fishers' livelihoods in the cold northern provinces of Norway which were close to the erstwhile USSR, and thus prevent migration to the more climate-friendly southern provinces and to the capital, Oslo. As a result, the fisheries of Norway, have over time, transitioned from small-scale into middle and large-scale operations primarily due to this long-sustained State support and their own strong professional organisational strength.

Why should developing countries be denied a similar course of action today, by scare-mongering about global overcapacity and overfishing which, in the first place, is essentially the result of unbridled investment and destructive fishing originally subsidised by developed fishing nations?

For developing coastal States, small-scale fishing communities are increasingly being recognised as providers of local, decentralised employment, food security, coastal protection, and promoters of coastal tourism. These factors alone justify support. Fishing communities, whose political influence have grown in many countries, also often happen to be "outliers" on the scales of human development in many countries. For all these socio-cultural, political, and economic concerns; and for important fishery reasons as well; it is both a historical right and a matter of global justice for developing States to continue/increase financial support to their marine fisheries – including for large-scale industrial operations, if and where they consider it necessary and appropriate.

[5] *https://www.icsf.net/wp-content/uploads/2006/09/930.ICSF112.pdf*

Despite their political stance at the WTO, developing countries must still make prudent decisions regarding the forms of support they provide to their fisheries. Should they prioritise subsidising fuel for vessels; or should they promote the adoption of science-intensive innovations to incentivise fishers to transition to multiple energy sources? Alternatively, should support focus solely on fishery infrastructure; or should it also encompass secure coastal land tenure, adequate housing, healthcare and education facilities; and parametric insurance against extreme weather events and unemployment due to meteorological conditions? These are crucial questions that require careful consideration to ensure effective and sustainable support for fishing communities and broader socio-economic development.

My sole plea would be for developing countries that advocate staunchly for their fishing sectors and fishworkers at the WTO, often challenging the negotiating positions of developed nations, to exhibit equal vigour and dedication in implementing these policies at their national level.

Q: *Are you optimistic that this dissonance between the developed and developing countries can be resolved to achieve a compromise on subsidies which will be acceptable to all?*

A: The global discourse surrounding fisheries subsidies traces back to the GATT era and has remained a contentious issue within the WTO framework for decades. Discussions on fisheries have often been sidelined in WTO negotiations, receiving insufficient attention compared to other priorities of developed nations. However, with developing countries becoming more assertive and unwilling to be sidelined, there is growing discomfort within the WTO, where the veto power cannot be applied. My speculation is that this shift in the political balance among nations will ultimately result in a more equitable agreement. It may take time to reach such a consensus.

Q: *Also, in your opinion, what are some approaches that governments in developing countries today could use to strike a balance between subsidizing their small-scale fisheries sector, fostering a large-scale fishery, and ensuring the conservation of resources?*

A: To fully address this question, it is crucial to consider both historical context and the unique characteristics of tropical ecosystems.

In the 1950s, many tropical developing countries rushed to modernise their fisheries by adopting the large-scale, industrial model prevalent in temperate regions. This decision was partly influenced by the pressures of development assistance and technical aid aimed at modernising their fisheries infrastructure. Unfortunately, little consideration was given to the inherent value and sustainable practices of existing small-scale fisheries. These traditional fisheries, often dismissed as "primitive" and in decline, were overlooked in favour of industrialisation.

Another crucial consideration, often overlooked but of significant importance, is the inherent bias towards, and logical rationale behind, supporting small-scale fisheries in the tropical world. Approximately sixty percent of fishery resources are concentrated within the 12- nautical mile limit of most tropical developing countries. These resources encompass a vast array of species, each with relatively smaller biomass and significant inter-species interactions. Therefore, advocating for spatially decentralised and appropriate forms of small-scale fish harvesting, processing, and marketing becomes imperative. This approach is intricately linked to conserving fishery resources and achieving optimal sustainable and economic yields; as well as maximising employment opportunities within tropical coastal fisheries.

Therefore, does it not seem more prudent to allocate financial resources towards supporting small-scale fisheries rather than investing in centralised, capital-intensive industrial fisheries? The historical errors made by many developing countries in initially favouring large-scale fisheries—accompanied by large-scale technology, temperate water science, and centralized administration—underscore the need for course correction. A wiser approach to fisheries development would have been to enhance the capabilities of the existing small-scale sector before considering the establishment of a large-scale industrial sector. The latter should ideally complement small-scale operations by targeting areas beyond their reach.

When you know you are on the wrong road, it is never too late to turn back!

Q: *And a final personal question: as a researcher and grassroots activist for global small-scale fisheries over many decades, what are some special memories of events that stand out for you? These could be personal stories or moments in history which have altered the course of development in a positive way for artisanal fishers, fish workers, and communities.*

A: As I look back over my career, I recall several such decisive and precious moments.

Fifty years ago, I found myself in a fishing village in Kerala State, India. In my early twenties, with a management degree and a corporate job, my knowledge of beaches was limited to places of relaxation. However, this visit exposed me to a vibrant and bustling scene of occupational beach life. Log kattumarams were being brought ashore, while fishermen, their sun-kissed bodies gleaming, swiftly unloaded their catch for lively auctions. The coast buzzed with activity as buyers hurried to purchase fish for market.

I was introduced to Nelson, the President of a newly formed cooperative in the village. His genuine warmth and simple faith resonated with me, prompting me to accept his spontaneous invitation to stay and assist in organising the cooperative's fish marketing efforts. This encounter ignited something within me, leading me to commit to dedicating one year to this cause. Little did I know then that this serendipitous moment would mark the beginning of a lifelong journey living among, and learning from, small-scale fishing communities worldwide for the next five decades. It is a journey I have never regretted.

The successful conclusion of the Rome Conference in 1984 marked another pivotal moment. It illuminated the shared challenges faced by fishing communities worldwide and demonstrated their readiness to collaborate for collective action, supported by larger civil society. The subsequent emergence of numerous organisations and movements; shifts in governmental and international organisation agendas; and the evolving attitudes of civil society toward the realities of fishing communities were unexpected, but welcomed, outcomes. These developments reinforced my belief that sincere collective commitment to a just cause, such as elevating the status of small-scale fisheries, sets into motion virtuous cycles of events that lead to positive actions and greater achievements. For me, the adoption of the SSF Guidelines stands as a prime example of this phenomenon.

A third event, set in the Aceh province of Indonesia after the 2004 tsunami, deeply reinforced my admiration for, and understanding of, fishing communities, adding to what I perceive as the realistic optimism of small-scale fishers in this era of unprecedented climate change.

During a preliminary visit to the province, which had gained political autonomy almost as a "gift of the tsunami", I was contemplating undertaking a long-term assignment to facilitate new fisheries co-management arrangements in Aceh. It was during this time that I encountered Pak Shaiffudin, a fisherman from Patek village, at a makeshift coffee shop. Their village had been nearly obliterated by the tsunami, with only a handful of male survivors who were fortunately at sea during the catastrophe. Our conversation spanned from Bollywood movies to the Free Aceh Movement's 30-year war, the post-tsunami fishery recovery efforts, and the devastating day of the tsunami itself, which claimed around 180 000 lives in Aceh in just 30 minutes.

Surprisingly, when discussing the tsunami, which claimed about 200 000 lives, there was no distinct sense of grief or remorse. It seemed that for these survivors, the universality of the losses provided mutual solace. I inquired about the aid they received and whether it brought comfort for their loss. Pak Shaiffudin shared that while he had received a new home from an aid agency, he had not yet decided what to do with it, as the monstrous wave had taken his entire family. Despite enduring such profound loss and facing the challenge of a drastically changed sea yielding fewer catches in familiar areas, he spoke with remarkable equanimity and concluded with a momentous statement: "The tsunami was not God's punishment but God's training!"

Amid scientists and climate activists convening in major international conferences to discuss the daunting effects of climate change and the foreboding implications of a predicted 1-meter rise in sea levels, Pak Shaiffudin's perspective on a real 15-meter wave that engulfed everything he held dear as "God's training" stands as a stark contrast—devoid of fear or bitterness.

His unwavering faith and hope left me profoundly humbled and inspired, prompting me to embrace a four-year assignment in Aceh focused on enhancing human capacity among the young women and men of coastal communities, as well as fostering collaboration between fishers' customary organisations and State officials.

As I look back over the years, it is my conviction that the future of small-scale fishing and coastal communities in the developing world will depend significantly on the nature and quality of capacity development initiatives they collectively undertake to safeguard their human rights. This endeavour will cultivate a sense of collective spirit and resilience that refuses to succumb to despair.

Credit: ICSF

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GENDER EQUALITY AND EQUITY: HOW IPNLF MALDIVES HELPS WOMEN FISH PROCESSORS TURN FISH INTO MONEY

In the Maldives, women are the ones who "turn the fish into money." However, women fisherfolk often struggle with delayed and unfair payment conditions, unreliable buyers and middlemen, and poor access to financial information, tools, and training. IPNLF-Maldives developed an innovative solution connecting women fisherfolk in the Maldives to an exclusive digital market platform. This platform will allow them to account for their own production and sales data, receive payments directly without middlemen, conduct financial transactions online, build credit histories, and access financial tools, giving them autonomy over their small-scale businesses.

In the Maldives, traditional one-by-one tuna fishing is predominantly a male-dominated industry. However, the women are also capable of transforming the fish into money, playing a crucial role in supporting household finances and significantly contributing to the fisheries sector. In the Maldivian fishery, while a significant percentage of the tuna harvests are exported (as raw materials, as well as in value-added products which are exported to developed markets), the rest is consumed locally, serving as the primary source of protein for the population.

Women largely undertake the role of selling and/or processing the locally-consumed tuna through various post-harvest activities such as drying, thus ensuring the economic viability of their communities. Despite their importance, women fisherfolk face numerous challenges that hinder the growth of their small-scale businesses and limit their economic benefits. These challenges include poor access to market information and credit, delayed and unfair payment conditions, unreliable buyers and middlemen, and limited financial assistance and training.

Empowerment through technology: eDhumashi

Recognising the vital role of women in the fisheries sector, the International Pole and Line Foundation (IPNLF) is committed to empowering them and bridging the gender gap in fishing communities. IPNLF's "Baseline Survey Report: Increasing Economic Benefit to Women Fish Processors in the Maldives" outlines the current context, obstacles, and potential solutions for supporting these women. The report highlights the need for targeted interventions to enhance market access, improve financial literacy, and provide technical training to empower women fisherfolk.

A significant outcome of IPNLF's efforts on gender equality and equity in fisheries is the development of the eDhumashi (short for

Locally-consumed tuna is processed by women, but they face numerous challenges that hinder the growth of their small-scale businesses and limit their economic benefits.

"electronicDhumashi") e-commerce platform which functions as an exclusive online marketplace to uplift women socio-economically. This platform was named after the word "dhumashi," which is a traditional fish rack used for smoking and drying fish in household kitchens. It was developed in consultation with women from Ga. Gemanafushi, one of the Maldives' largest fishing islands, with the aim of providing locals access to broader markets by centralising various locally made fish products.

eDhumashi is the first e-commerce platform to feature a complete Dhivehi version, eliminating language barriers and making digital trade more accessible through a user-friendly mobile application. This platform allows women to market their products directly to consumers, bypassing the traditional middlemen who often impose unfair conditions. By doing so, women gain greater control over pricing and distribution, enhancing their economic stability.

The eDhumashi IPNLF-Maldives project was one of the innovations selected by the United Nations Development Programme (UNDP), through its Ocean Innovation Challenge (OIC) initiative which (since 2020) aims to accelerate progress on SDG 14 targets. Chosen out of 300 proposals, the project will receive incubation and financial support until summer 2024. The OIC, funded by the Swedish International Development Cooperation Agency (SIDA) and the Norwegian Agency for Development Cooperation (NORAD), was created on the basis that between overfishing, pollution, habitat loss and the multiple impacts of climate change on ocean ecosystems, the ocean has never faced such diverse threats.

Enhanced consumer experience: transparency and confidence in locally sourced fish products

Navigating the local market for fish products in the Maldives can be challenging for consumers, as there is limited information on product details and standards. eDhumashi aims to change this narrative by empowering producers to showcase their products with full production details and inspiring stories of the women behind the processing. Through eDhumashi, consumers can access detailed product information, including the woman who processed the fish, the originating island, and potentially how the fish was caught using sustainable methods. The platform, which will be accessible on mobile, will therefore support transparency and traceability in the fisheries value chain and give consumers access to product imformation, aligning with IPNLF"s commitment to responsible fishing and consumption.

IPNLF's vision to bridge fishing and tourism

As the Maldives seeks to diversify its economy beyond traditional sectors, there is a growing recognition of the untapped potential at the intersection of fishing and tourism. IPNLF envisions a future where local women in the fisheries sector play a central role in providing authentic cultural experiences to tourists. By integrating fishing and tourism activities, and engaging women in culinary experiences and other tourism-related ventures, there's an opportunity to unlock new economic opportunities and enrich the visitor experience. This approach will also allow women

to contribute to the local economy, enabling income generation from the comfort of their homes and more fair distribution of revenue across the population.

IPNLF Maldives is now collaborating with software developers, local women, and key stakeholders to enhance the eDhumashi platform. The goal is to provide comprehensive information for local and international tourists about island activities, particularly culinary experiences offered by women in fisheries. This initiative expands market access through digital means and offers opportunities to contribute to tourism from domestic settings.

IPNLF's holistic approach to empowering women in Maldivian fisheries is not just about economic empowerment; it's about fostering resilience, promoting sustainability, and preserving cultural heritage. By leveraging technology, bridging sectors, and fostering transparency, IPNLF supports women's economic empowerment and contributes to a more sustainable and transparent fishing industry in the Maldives. Through initiatives like eDhumashi, the Foundation is paving the way for a future where women are not just beneficiaries, but active participants in shaping the future of fisheries and coastal communities.

About IPNLF-Maldives

The International Pole and Line Foundation (IPNLF) and its branch organisation IPNLF-Maldives, promote the sustainable management of the world's responsible pole-and-line, handline and troll (collectively known as 'one-by-one') tuna fisheries while also recognising the importance of safeguarding the livelihoods they support. IPNLF's work to develop, support, and promote one-by-one tuna fisheries is subsequently fully aligned with the 2030 Agenda for Sustainable Development. Effective and equitable global governance is essential to protecting and restoring the ocean, and this should be achieved by ensuring the participation of local and coastal communities in decision-making processes.

The work of IPNLF-Maldives focuses on data collection, specifically on the social aspects of the national fishery and exploring future opportunities for the use of livebait to conduct a livebait survey and developing best practices for catching, storing and the use of livebait in one-by-one fisheries. Through these projects, we establish a replicable model for improvements in fisheries management worldwide.

Furthermore, in the fight against ocean plastic pollution, the IPNLF-Maldives team has begun to develop a similar project on Lhohi Island, Noonu Atoll, following IPNLF's successful Ghost Gear Removal Project in Gemanafushi. The Lhohi project will train fishers to retrieve and safely dispose of ghost gear and, if necessary, safely release entangled turtles that need to be rehabilitated.

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ONE KEY TO ENDING IUU FISHING: HOLDING VESSEL OWNERS ACCOUNTABLE

By Peter Horn and Gina Fiore

Commercial fishing is worth USD 141 billion a year. So it's no surprise that this industry attracts scofflaws, most notably those engaged in illegal, unreported and unregulated (IUU) fishing, an activity that experts say accounts for up to USD 36 billion worth of seafood every year. Typically, those who are apprehended for IUU fishing are a few members of the crew, while the real perpetrators — the ultimate beneficial owners of these vessels — remain faceless. The authors contend that, as with any crime, the way to stop large-scale IUU fishing is to ensure that the risk and costs for these owners outweigh the benefits of being involved in unlawful activities.

Credit: Pew Charitable Trusts

Illegal, unreported and unregulated (IUU) fishing is not a victimless crime. It depletes fish populations; because it's not recorded, it throws off scientific assessments of fish stocks; and it often damages ocean ecosystems and habitat because most illegal fishers don't hesitate to use banned gear or fish in closed or restricted areas. Illicit fishing puts wildlife, including endangered marine mammals and other species, at risk. And this environmental damage is not confined to small or isolated areas of the ocean; it occurs across the globe and by boats of all sizes, from artisanal canoes to industrial trawlers.

IUU fishing is also a significant threat to people, especially residents of coastal communities, because IUU fishers raid the waters that law-abiding commercial fishers depend on for their livelihoods. As a result, the fishers who play by the rules end up casting their nets for scraps in areas depleted by IUU activity. This happens most commonly in places where people can least afford to lose income or their ready access to seafood; these are often the same locales where governments lack the resources they need to adequately patrol their countries' exclusive economic zones (EEZs), which extend 200 nautical miles from each country's coast.

One of the major problems in stopping IUU fishing is the difficulty authorities face in knowing who ultimately profits from the illicit activity. This issue extends throughout the commercial fishing industry, including those vessels that operate fully within the law. The true financial beneficiaries of fishing—referred to as ultimate beneficial owners (UBOs)—own the vessels and reap most of the financial gain but can be very hard to locate for several reasons. They sometimes conceal their identity behind a tangled web of flags of convenience, shell companies, ever-shifting vessel names and hard-to-trace registrations; these are all legal maneuvers that are often exploited by fishers or UBOs who have something to hide.

In one of the more infamous cases of IUU fishing, the non-governmental advocacy group Sea Shephard pursued an IUU vessel named the Thunder. The pursuit started in the Southern Ocean, and when it ended off the west coast of Africa more than 110 days later in April 2015, the boat sank, destroying potential evidence. The captain then relied on the conservationists who had trailed him for three months to rescue him and his crew.

In the end, the captain and two of his crew were sentenced to three years in prison. Although the prison sentence was overturned on appeal, related entities were ordered to pay EUR 25 million, a rare legal victory in the global fight against IUU fishing, although probably not enough to dissuade

the Thunder's owner. Experts estimate that the owner reaped some USD 60 million in the nine years that the Thunder plundered toothfish (marketed and sold as Chilean sea bass) from the Southern Ocean and faced no legal case or indemnity for the pollution caused when the vessel sank.

A tangled, murky web

In theory, finding and prosecuting owners of IUU vessels shouldn't be difficult. The ships are, after all, very large objects that are constructed, sold and deployed for very specific purposes. So it might appear easy for authorities to check paperwork and arrest vessel owners when crimes are suspected.

But it's much more complicated than that. For one, the vessel owner behind the illegal activities is rarely present when they occur, making it difficult to find evidence linking the owner directly to the crime. And the crimes themselves are often committed in one country's waters with a vessel flagged to another country, or owned by someone in a third country, and often under the control of a captain hailing from yet another nation. This alone makes policing and legal proceedings challenging at best.

What's more, all fishing vessels have a registered owner and a beneficial owner, and sometimes they aren't the same person or entity. In fact, in the world of IUU fishing, the registered owner could be a shell company or other decoy. Further, some countries maintain "closed" vessel registries, meaning owners can't register boats there unless they have clear ties to the country. To evade this prohibition, they often set up a shell or front company, registered to a local, to circumvent what is meant to be a protective effort.

In addition to the legal maneuvers that UBOs use to hide their identity, the true owner can also be difficult to determine because no international rules or requirements ensure full transparency. This is especially true for vessels that fish in areas beyond the national jurisdiction of their home country, which is increasingly the case as growing pressure on fish stocks is driving many vessels farther out to sea to bring in catch and profits. Oversight in these distant high-seas areas is even patchier than in the most under-resourced nation's waters.

And even when someone is held accountable for IUU fishing, it is typically one or more members of the crew, not those who orchestrate, organise and profit from the illegal activity. Because ownership is often obfuscated and regulatory structures are weak, the owners escape sanctions and fines. This is analogous to police arresting drug users and small-time dealers on the streets while the cartels behind the drug trafficking go unpunished.

With ocean health and global fisheries straining under increasing pressure from overfishing, climate change and other challenges, ensuring that all fishing activity is sustainable, transparent and operating with effective oversight, including holding illegal operators accountable, is more important than ever. To that end, flag States to which vessels are registered; port States that accept the catch; coastal States and regional fisheries management organisations (RFMOs); and other stakeholders must all do their part to clarify the true ownership of vessels. They also need to establish an internationally agreed-upon definition of ultimate beneficial ownership, strong company data collection mechanisms, and appropriate penalties for those who benefit most from IUU fishing.

There is no international consensus regarding who or what qualifies as a UBO. According to the Financial Action Task Force (FATF)—an intergovernmental watchdog group that sets standards for nations and financial institutions to counter money laundering and the financing of terrorism—a UBO should always be a human being, rather than a company, and the threshold for ownership or control should be no higher than 25% of said company. But not all countries use this definition. Some set a higher threshold—as much as 50% of ownership or control. This lack of standardisation makes coordination difficult, especially at the RFMO level where Member States may have different definitions of a beneficial owner.

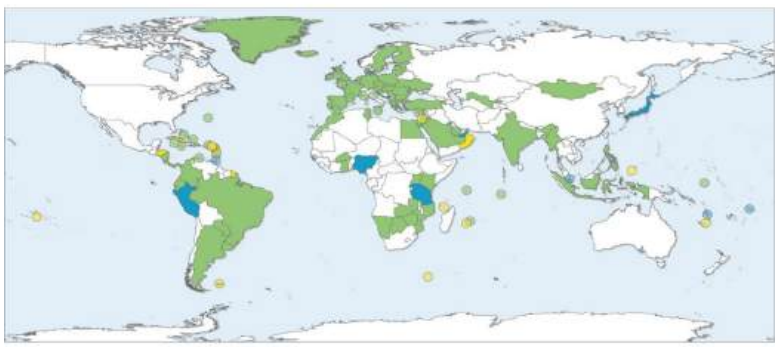
Financial transparency watchdog groups, such as the FATF and the Organization for Economic Cooperation and Development (OECD), strongly recommend that countries develop a mechanism for obtaining documentation on beneficial owners, particularly the UBO, either through the banking system's due diligence process or by mandating that corporations keep and promptly provide the ownership information upon the government's request.

Alternatively, FATF recommends that countries collect UBO information in a national-level registry, similar to how fishing vessels are supposed to be registered at the country and RFMO levels. As of 2022, 97 countries have some sort of UBO registry. But these registries vary in their levels of transparency, how they define UBOs, and whether they allow corporations to be listed as the UBO or require that the UBOs be listed as individuals.

Figure 1

Fewer Than Half of Countries Worldwide Have Laws Requiring Transparency of Ultimate Beneficial Owners

National laws on UBO disclosure



Note: "Complete" means a nation's UBO law requires data collection for all companies and in all parts of the country. "Incomplete" means a nation's law does not include all of those requirements.

Source: Tax Justice Network, "Financial Secrecy Index 2022," https://fsi.taxjustice.net/; Pew's analysis of publicly available information

These inconsistencies limit the registries' value, even when the data is publicly available, because they make compiling comprehensive global information difficult. Additionally, legal challenges related to privacy may force changes to the availability of registry information to the wider public, allowing only specific government officials to access the data and further limiting a registry's usefulness.

For example, in November 2022, the European Court of Justice cited privacy concerns in invalidating public access to UBO registries in the European Union. Although the current registry system has its flaws, rolling back public access would hinder efforts by watchdog and other civil society groups to locate and track beneficial owners and ensure that companies are complying with local and global rules.

Knowing a fishing vessel's UBO can help enforcement officials shine a light on an issue that can be difficult to detect and ultimately prosecute. In some cases, countries maintain distant-water fishing fleets that work as teams to carry out IUU fishing, with some bad actors hiding within larger groups of vessels, making it very difficult for authorities to track and verify all fishing activity. And because modern fleets can freeze fish immediately, transfer catch to carrier ships and refuel from bunker vessels in the middle of the ocean, many can stay at sea for months, compounding the damage they do to fish populations and the ecosystem. This activity, known as transshipment of catch—when one vessel offloads its catch at sea to another vessel—can often hide illegal transfers.

Often, IUU fishers hover near the outer boundaries of EEZs—for example, off the coast of West Africa or South America, where this type of behaviour is so common that it is called the 201-mile marker. In such cases, vessels loiter close to the 200-mile EEZ line and often cross it to fish illegally before quickly retreating into international waters to avoid prosecution. IUU fishers frequently do the same around marine protected areas and other sanctuaries, darting in to steal fish at opportune moments but spending most of their time outside the boundaries.

Moreover, many IUU fishers are committing crimes beyond stealing fish. As detailed in a 2023 report by Earth League International and the John Jay College of Criminal Justice, international syndicates use IUU vessels to carry out a wide range of crimes, including human trafficking, drug and wildlife smuggling, money laundering and more.

For example, the report documents a phenomenon called "crime convergence" in which a syndicate that operated in China, Peru and South Africa smuggled shark fins, rhinoceros horns, Galapagos turtles, jaguar fangs and more to various countries in Asia. Aside from IUU fishing, the syndicate also was reported to have engaged in corruption, money laundering and human smuggling.

Labour abuse is an issue even among otherwise law-abiding vessels, but it's far worse on IUU ships. Cases abound of forced labour on illegal fishing boats, with documented incidents of captains using children as crew and keeping workers at sea for months or years at a time in hazardous and inhumane working conditions. In an infamous case, an IUU captain kept some of his crew in cages on an island to guard against them escaping when the ship wasn't at sea.

Similarly, the Indonesian crew of a notorious IUU vessel, the STS-50, toiled at sea for months without pay as the captain maneuvered to evade authorities. Fortunately, Indonesian authorities intercepted the boat in 2018 after an odyssey during which authorities from numerous countries tracked the ship virtually. But even though the crew was released, the vessel seized and the captain detained, the trail on the UBO went cold. Analysts at Interpol estimated that the boat had poached upwards of USD 50 million worth of toothfish over the years, and whomever profited from that, faced no punishment.

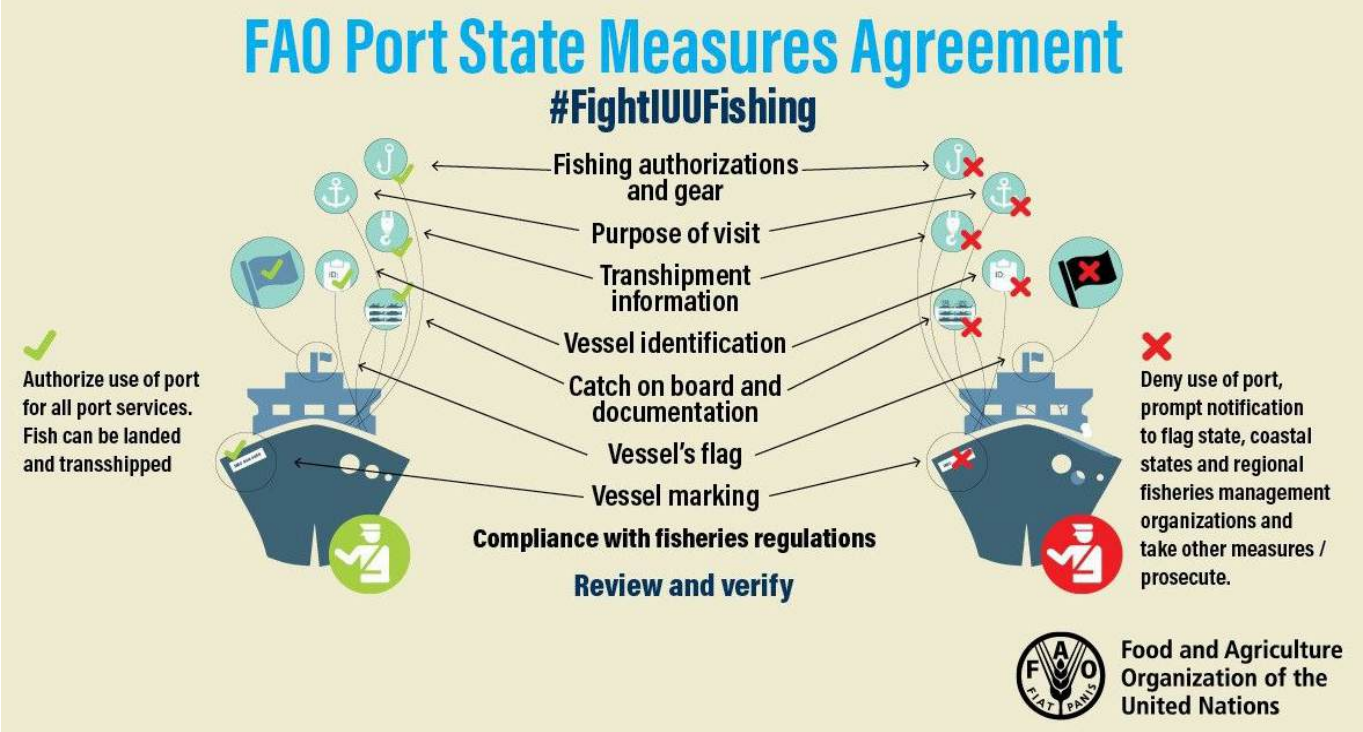
The solution to this problem of corporate transparency in fisheries isn't complicated, but will take cooperation and coordination among multiple players. First, all governments should maintain UBO registries and share that information with fisheries ministries and maritime law enforcement officials of their own and other countries. When a motor vehicle or aircraft is used in a suspected crime, authorities can quickly act to make public not only the name of the owner of the vehicle but also his or her likely whereabouts; the same should happen in suspected IUU cases.

Next, flag States already have a responsibility to ensure that vessels flagged to them obey the laws of the waters in which they fish. These States should do a better job of enforcing that policy, monitoring activity and adding a mandate that no boat gets a flag State authorization without full clarity on who owns the vessel and profits from its operation. More precisely, flag States should collect UBO information when flagging vessels, or when issuing a fishing license or signing a fishing agreement. They can use Taiwan as a guide: there, companies that plan to fish in foreign waters must register with, and gain approval from, the government before they begin fishing in another country's EEZ. Failure to comply with this mandate can result in financial penalties.

Coastal States should also join and implement the Port State Measures Agreement (PSMA), a treaty adopted by the United Nations Food and Agriculture Organization (FAO) in 2009. The PSMA entered into force in 2016 and is now legally binding in over 100 States, all of which are legally bound to strengthen port controls for foreign-flagged vessels offloading catch. The agreement aims to prevent, deter and eliminate IUU fishing by strengthening and harmonising port controls around the world, thus making it much harder for IUU fishers to search for an amenable port when seeking to offload catch.

The PSMA's success hinges on port officials, both within and among States, sharing information. Fortunately, FAO created two tools to do precisely that: The Global Information Exchange System (GIES) and the Global Record of Fishing Vessels, Refrigerated Transport Vessels and Supply Vessels (Global Record). According to FAO, the GIES is the first global system for exchanging compliance information and "permits the sharing of vital information between port, flag and coastal States, as well as other relevant organisations."

Although the Global Record is not directly linked to the PSMA, FAO maintains it as a collaborative initiative to certify data and information about fishing vessels and their activities, specifically to help fight IUU through greater transparency and traceability. The organisation does not currently mandate that UBO information be entered into this database but is beginning to explore how to do so.



The Agreement on Port State Measures is the first binding international agreement that specifically targets illegal, unreported and unregulated (IUU) fishing.

Credit: FAO

Further, RFMOs, which set policies for fishing of much of the world's shared fished stocks in both coastal and international waters, should insist on UBO information for every vessel authorised to fish in their areas. It should not be a big step for RFMOs and other fisheries bodies to require this information before authorising vessels to fish, but to date only one RFMO—the Indian Ocean Tuna Commission—collects UBO information; even then, vessel owners reportedly have an easy time skirting supplying that information simply by claiming UBO information is "not available." Other organisations, such as the Commission for the Conservation of Antarctic Marine Living Resources, do collect data, but don't make it public.

Lastly, governments should penalise citizens engaged in IUU fishing—even in foreign waters—especially the UBOs and others who reap the bulk of the profits from the illegal activity. Given the amount of money UBOs make from illicit fishing and the damage the activity causes to the environment and other people, governments should pursue significant fines and potentially prison terms for those found culpable, instead of "slap-on-the-wrist" punishments that do little to dissuade further crimes. An example of such a regulation is the European Council Regulation 1005/2008, which the European Union implemented to curb such behavior, although it hasn't yet been used much by its Member States.

Encouragingly, signs of progress are emerging. In January, a United Nations Joint Working Group—comprising Member States from FAO, the International Maritime Organization and the International Labour Organization—met in Geneva in January 2024, where delegates agreed to hold an expert roundtable on collecting beneficial ownership data for the Global Record, which would be essential to stop those orchestrating the systematic plunder of the ocean.

Conclusion

As with any crime, the way to stop large-scale IUU fishing is to ensure that the risk and costs for UBOs outweigh the benefits of being involved in unlawful activities. Until now, wealthy developed countries have not borne the brunt of the impact of these crimes and have not effectively clamped down on them. However, because the depletion of fish populations and habitat damage from IUU fishing will have repercussions far beyond where the crimes occur, all governments and international fisheries bodies should be collaborating now to stop this pervasive activity. A clear and effective move in that direction would be to take the necessary steps to ensure that UBOs can be promptly identified—and that people or organisations implicated in IUU fishing are held accountable, no matter where the activity occurs.

Peter Horn is a project director with the Pew Charitable Trusts' international fisheries program. He directs Pew's work on ending illegal fishing, bringing together policy, technology, and enforcement initiatives to legislate against this practice and prevent or stop it at sea.

Gina Fiore is an officer with the Pew Charitable Trusts' international fisheries program. She leads Pew's efforts on beneficial ownership and financial transparency in the fisheries industry. She also manages work related to the convergence of illegal fishing, criminal activity and maritime security and acts as a liaison between Pew and the military and national security communities.

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AQUACULTURE

Probiotics for aquaculture sector

Indonesia – Jala, a shrimp industry startup, has formed a strategic partnership with Luminis Water Technologies, integrating the Luminis-developed NGS-guided precision probiotics and solutions into Jala's farmer platform.

The collaboration will allow Jala to bring Luminis Water Technologies' expertise in microbiome intelligence and molecular solutions, to shrimp farmers, in a bid to boost production, eliminate disease events and promote environmental stewardship.

"We are thrilled to join forces with Luminis Water Technologies in our mission to strengthen the shrimp farming industry. "This partnership represents a significant milestone in our journey to provide innovative solutions for shrimp farmers that drive sustainable yields and ensure food security. By integrating Luminis Water Technologies' cutting-edge tools into our farmer platform, we are eager to enhance productivity, reduce environmental impact, and elevate the overall performance of shrimp farms across Indonesia", said Liris Maduningtyas, CEO of Jala.

Fast-growing new tilapia strain

Brazil –The GenoMar Genetics Group has introduced a new tilapia strain called GenoMar 1000 in the Brazilian market. It has a fast growth rate, combined with robustness, resistance to specific pathogens and a competitive fillet yield. In pre-launch tests carried out under commercial farming conditions in Brazilian waters, the GenoMar 1000 fish grew from approximately 20 to 1 000 grams in 114 days in cages and 121 days in ponds. The fish was compared with high-performing Brazilian genetics, showing 30% faster growth than the local genetics.

This genetically-selected tilapia has been continuously developed for more than 30 years and has, until now, been only present in Asia. This milestone follows years of planning and substantial investments including the establishment of a cutting-edge, biosecure breeding centre in Tocantins, Brazil, and the importation of the strain into the country. Brazil is the fourth largest producer of tilapia in the world and the industry is poised for strong growth due to its natural resources and strong domestic consumption. More on GenoMar initiatives regarding the new tilapia strain can be seen from pages 42 to 44.

FISHING

At UN conference, States call for ratification of High Seas Treaty

World –Several Small Island Developing States have issued a call for the ratification and implementation of the High Seas Treaty, which would prioritise action against climate change related biodiversity loss. The call was issued during a high-level event, "SIDS leadership in the Race for Ratification – action to protect marine biodiversity in areas beyond national jurisdiction," held at the United Nations Fourth International Conference on Small Island Developing States.

The High Seas - the areas of the world's oceans which lie outside of national jurisdictions - covers a vast area of the globe and contains a significant portion of global marine biodiversity. Despite this, less than two percent of the global High Seas is fully protected under current legislation. These ecosystems provide a broad range of functions and services, and their collapse may have wide and devastating impacts on the fisheries and aquaculture sectors.

Currently five States have ratified the Treaty, with three of these being SIDS. Once 60 countries have ratified the Treaty, it will become the first international law to mandate the conservation and management of biodiversity beyond national jurisdiction.

The implementation of the Treaty would mark a significant step towards achieving the goal of the Kunming-Montreal Global Biodiversity Framework to protect 30 percent of global oceans by 2030. This is because it will provide the world's first international legal framework to create marine protected areas (MPAs) on the High Seas and require comprehensive environmental impact assessments of potentially harmful activities in this vast ocean area. One of the key features of the High Seas Treaty is the inclusion of Indigenous Peoples and local communities (IPLC) and their traditional knowledge in the decision and policy-making process.

RMI ratifies Agreement on Port State Measures to Combat Illegal Fishing

Republic of the Marshall Islands – In April, the Republic of the Marshall Islands (RMI) ratified the FAO Agreement on Port State Measures (PSMA) to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated (IUU) Fishing.

The Agreement aims to prevent vessels engaged in IUU fishing from using ports and landing their catches.

Majuro is the most important tuna transhipment port in the world. As such, the Marshall Islands Marine Resources Authority (MIMRA), supported by New Zealand's Ministry of Foreign Affairs and Trade (NZ MFAT), has been actively implementing Port State Measures (PSM) best practices since 2018. As a direct result, in 2023, the International MCS Network Organization presented MIMRA with the "Stop IUU Fishing Meritorious Achievement Award".

RMI also intends to combat IUU fishing through its own IUU-Free Pacific project, which aims to eradicate IUU fishing from the Pacific by 2023. Meanwhile, the practical implementation of the PSMA will strengthen the RMI's efforts to protect its fisheries and ensure its marine resources' economic and environmental sustainability.

Fishpath technology for octopus management

Tanzania – Limitations in data and capacity can present major challenges to effective fisheries management. The government, together with The Nature Conservancy, has introduced the FishPath approach, a technology it says will help in sustainable management and harvesting measures regarding octopus. The framework was developed during a Science for Nature and People Partnership (SNAPP) working group (2014-2016), drawing on the expertise of global experts from eight countries and over 10 organisations.

FISHPATH

In brief, FishPath is a specialised online tool designed to enable effective fisheries management based on data such as the amount of the catch, the size and age structure of the population, and much more, hence empowering decision-makers with the technical expertise needed to design tailored harvesting strategies for their fisheries. The tool will simplify stock assessment and management measures, to address existing gaps in assessing and harvesting octopus stocks, enhancing conservation efforts while supporting vital exports and local markets. According to statistics from the Food and Agriculture Organization of the United Nations, Tanzania's octopus catches have increased from 482 tonnes in 1990 to more than 3 400 tonnes in 2023 and its main challenges are from illegal fishing practices to post-harvest losses.

MARKETS/MARKETING

Collaborative effort to make Indonesia the world's largest ornamental fish exporter

Indonesia – Nusantara Aquatic (NUSATIC), held annually in Indonesia, is billed as the world's biggest international ornamental fish exhibition and aquatic show. Envisioned as a hub for all parties involved in advancing Indonesia's ornamental fish market and industry, the

annual event brings together ornamental fish enthusiasts; micro-, small- and medium-enterprises (MSMEs); and major traders and breeders. These stakeholders contribute towards fostering valuable communication and collaboration in the industry in order to boost its competitiveness.

This year, NUSATIC 2024 was held for three days, from June 7 to 9, 2024, at the ICE BSD Exhibition hall in Serpong, South Tangerang, Indonesia. More than 20 000 ornamental fish were showcased, surpassing the previous year's figure of 16 129. The event was organised by the Ministry of Marine Affairs and Fisheries (MMAF) and NUSATIC with support from related ministries.

Indonesia is currently second in the world for ornamental fish exports: from 2018 to 2023, these exports experienced an average annual growth of 4.1%. In fact, Ornamental Fish International (OFI) has acknowledged Indonesia's potential to become the world's top ornamental fish exporter in the coming years. To achieve this goal, MMAF has emphasised the need for collaboration with NUSATIC, which can serve as a platform for marketing Indonesian ornamental fish to the global market.

Cuban lobsters expand share in Chinese market

China – Cuban lobster exports have established a small, yet consistent foothold in the Chinese market, where the product has started to compete with lobster from the United States and where consumers have highlighted the product's high quality and taste, according to a vendor at the large Jingshen Seafood wholesale market in Beijing (source: FAO GLOBEFISH).

"It's a premium product and more expensive than lobster from Boston," Liu, the manager of the International Seafood Store, said, adding that she wholesaled Cuban lobster during Chinese New Year at CNY 3,000 (USD 420; EUR 390) per 10 lobsters. "The quantities of Cuban lobsters are still low, however, compared to Boston lobster," she said. A wholesale price of CNY 300 (USD 42; EUR 39) per lobster, as quoted by Liu, compared to the CNY 239 (USD 32; EUR 30) per lobster being sold at 7 Fresh supermarkets in Beijing operated by JD.com, suggests that Cuban lobster is considered a premium product in the country.

In 2020, Cuban lobsters averaging 900 to 1 100 grams were selling for CNY 568 (USD 78; EUR 73) on the Yu Xian Xuan store on Tmall.com. Cuban lobsters have an opening to grab an even stronger market share, particularly because Australian lobster have been banned in the country since 2020.

Antidumping duties on shrimp

USA/Ecuador/Indonesia – The US Department of Commerce (DOC) has unveiled its preliminary determinations on antidumping duties for Ecuador and Indonesia, with most companies in Ecuador facing an additional charge of over

10 percent. The DOC launched the investigation in November 2023 in response to trade petitions filed by the American Shrimp Processors Association (ASPA), targeting India and Vietnam with countervailing duties and Ecuador and Indonesia with both countervailing and antidumping duties.

The countervailing duty for Ecuadorian shrimp industry was set at 2.89 percent, while it was determined that Indonesia did not subsidise its shrimp industry enough to require countervailing duties. At the same time as the DOC was investigating whether to apply countervailing duties, it was also determining whether Indonesia and Ecuador qualify for an additional antidumping duty. Ecuadorian company Sociedad Nacional de Galapagos (SONGA) was hit with a 10.58 percent dumping margin and cast deposit rate. The rest of Ecuador's shrimp industry was also hit with a 10.58 percent dumping margin and a 10.18 percent cash deposit rate. Combined with the countervailing duties, Ecuador's shrimp industry – aside from SONGA and another company, Industrial Pesquera Santa Priscila – now faces a 13.47 percent duty on all shrimp exports to the U.S.

The DOC's preliminary determination for Indonesia is similar to its findings on Ecuador, in that one company managed to avoid any additional duty while the rest of the industry did not. PT Bahari Makmur Sejati was given no duty after the investigation, while PT Khom Foods was dealt a 6.3 percent dumping margin, along with the rest of the Indonesian shrimp industry.

Rise in pufferfish imports

Japan/Singapore – A recent regulatory adjustment by Singapore, enacted in August 2022, has significantly expanded the import parameters for Japanese pufferfish. This change permits not only the muscle meat but also additional parts such as muscles, skin, fins, and milt of farmed pufferfish to enter the Singapore market, diversifying the offerings available to consumers.

Pufferfish imports are banned by most countries because wild pufferfish contain a potent poison that can cause numbness, paralysis, and death. However, farmed pufferfish are toxin-free because they do not produce the toxin themselves; instead, they accumulate it from the food they eat in the wild. The main export markets for Japanese pufferfish are Australia, Singapore, and Malaysia, though in Singapore, there are several restrictions: the pufferfish must have been prepared in Singapore-accredited establishments by expert chefs, each import consignment must come with a health certificate from the Japanese authorities, and Singapore officials also test the imported pufferfish as part of its food surveillance program.

Rising consumer demand for whitefish

China – Lower-cost whitefish such as pangasius and catfish are seeing a spike in demand from both informal dining chains in the country and due to promotion by e-commerce services. Snakehead has also emerged as a popular whitefish alternative, though it is priced at a higher level compared to the two other species.

Another reason why restaurants are finding now a good time to expand is that sales in China's dine-out sector have skyrocketed since Covid-19 regulations were lifted in the country. Sales in the sector totaled CNY 5.2 trillion (USD 728 billion, EUR 676 billion) in 2023, up 20.1 percent year over year, according to the National Bureau of Statistics.

Meanwhile, the rise of Chinese e-commerce, on the back of huge user numbers and low-priced goods, has enabled key players like Alibaba and Temu to expand into other Asian markets.

Resumption of lobster larvae exports

Indonesia – According to Mongabay, the Indonesian government is resuming a controversial policy of exporting lobster larvae – the latest chapter in an eight-year saga that began over concerns for wild lobster stocks and led to a fisheries minister being jailed for corruption. The country's current fisheries minister, Sakti Wahyu Trenggono, said recently that the decision to reinstate the export policy was to capitalise on the global multimillion-dollar lobster trade. The government initially banned exports of lobster larvae in 2016 to prevent the overharvesting of wild stocks from the country's rich waters.

For now, exports are permitted only to Vietnam, whose lobster-farming industry produces around 1 600 tonnes a year of premium-grade lobster grown from mostly imported larvae. Sakti previously suggested that much of the wild-caught lobster larvae supplied to Vietnam was most likely smuggled out of Indonesian waters. He said legalising lobster larvae exports would both undercut the smugglers and generate revenue for Indonesia. He added that the partnership with Vietnam included the latter investing in developing Indonesia's aquaculture sector through sharing of technology and knowledge.

Lobsters are among Indonesia's top fisheries commodities, but the illegal export of larvae cost the country 900 billion rupiah (USD 62 million at the time) in lost revenue in 2019 alone, according to the PPATK, the government's anti-money-laundering watchdog. A key destination is nearby Singapore, from where the larvae are often reexported to third countries like Vietnam and China, where they're raised to maturity in fish farms and tanks and sold at much higher prices.

PROCESSING

MSMEs benefit from support by the Ministry

Indonesia– The Ministry of Marine Affairs and Fisheries (MMAF) is making a significant push to empower potential micro-, small-, and medium-scale enterprises (MSMEs) which are interested in operating Fish Processing Units across Indonesia. This initiative aims to propel these businesses to the next level by fostering growth in both production and marketing capabilities.

A selection of products from several MSMEs: Pangasius fillets from CV. Kirana Bahari, East Jawa; fish crackers – UD. Mekar (East Jawa); and fish nuggets from Jaladri Food (East Jawa)

The MMAF commitment extends beyond a one-time intervention. The program is designed for long-term impact, with ongoing assistance provided to ensure the continued development of these MSMEs. Since March 2024, MMAF has been meticulously assessing the needs of 376 MSMEs. This in-depth evaluation allows the Ministry to tailor its support programs to address the specific challenges and opportunities faced by each business.

Beyond the initial curation process, MMAF offers a multifaceted support system. This includes equipping MSMEs with technical guidance to enhance their human resource capabilities, and encouraging them to embrace digitalisation. Additionally, MMAF provides assistance in expanding market access, both domestically and internationally, ultimately paving the way for export success and contributing to a more robust and competitive national fisheries industry.

SUSTAINABILITY

John West tuna now traceable using GDST protocol

Australia – Australia's tuna market leader, J.R. Simplot Company's John West brand, and the leading Pacific tuna supply chain traceability and verification company, Pacifical, have achieved a historic milestone with the successful exchange of data using the GDST (Global Dialogue on Seafood Traceability) protocol.

This groundbreaking achievement sets a new standard for transparency and sustainability

within the tuna industry. The successful completion of the beta testing phase witnessed the transmission of 105 critical tracking events—ranging from fishing and transshipment to discharge and processing—via Pacifical SmarTuna platform to John West's internal "Trace Our Tuna" site.

"Over the years Simplot, in partnership with Pacifical, has made great progress on our commitment to responsible seafood sourcing practices, to the point that 100% of our skipjack tuna range is certified to the highest standard of sustainability for seafood," said Phoebe Dowling, head of Simplot Global Food sustainability. "Leading the GDST initiative as part of our long-term collaboration with Pacifical is a logical and beneficial next step in our pioneering approach to sustainability, and we are proud to be part of this pivotal moment in the seafood industry.

Henk Brus, Pacifical CEO, stated, "The successful beta testing phase of SmarTuna demonstrates our commitment to excellence in traceability. Through our real-time platform, we have facilitated the smooth transmission of verified critical tracking events, ensuring 100% compliance with GDST protocols and data interoperability across systems."

WORLD

Framework for restorative aquaculture

Not only can aquaculture provide a low-impact source of food and raw material, but it can also accelerate ecosystem restoration. The Nature Conservancy is promoting a global monitoring, evaluation, and learning framework for regenerative and restorative aquaculture which "creates a shared language and supportive network that will help farmers, researchers, government, and non-government organisations come together to understand, value, and communicate these benefits".

The framework:

- Helps farmers identify and measure the environmental benefits they may be providing on their farm;
- Provides a consistent approach to measuring environmental benefits from similar species, systems, and/or practices across locations and over time;
- Aligns a quantitative understanding of the contributions to broader environmental goals around ecosystem resilience, protection, or repair; and
- Recognises key socioeconomic benefits that are associated with these environmental benefits.

It applies specifically to three overarching aquaculture sectors and farming in marine (including coastal) or estuarine environments: (i) seaweed (macroalgae); (ii) molluscs and echinoderms—including bivalves and gastropods but excluding cephalopods; and (iii) finfish. It is intended that future versions of the framework will be developed for other sectors, farming practices, and ecosystems.

Increased salmon supply in 2023

A Kontali report stated that the global supply of salmonids increased by 7% year-over-year in 2023 to 5.2 million tonnes whole fish equivalent (WFE), due to the rise to solid wild catch in North America and Russia, rather than larger aquaculture. Farmed production decreases were seen in Norway, the Faroe Islands, the United Kingdom and Canada, while Chile was the only producer with an increase.

Extenuating circumstances in some countries impacted upon farmed salmon figures; as did biological challenges related to climate change, exceptionally high sea temperatures, and rising sea lice levels, among others. In Norway, the imposition of the new tax system slowed down investments in the industry, impacting production. It was also a challenging year for main salmon farms in Scotland, exacerbated by exceptionally high water temperatures which affected the average harvest size. The situation improved as the year progressed, especially in the last quarter, due to mitigation measures taken by the farmers. Chile increased its harvest volume compared to 2022 but according to analysts, the industry is expanding at very moderate levels as it grapples with low international prices and higher cost of inputs.

Nevertheless, global farmed salmon supply is projected to grow in the first two quarters of 2024 after two years of almost uninterrupted decline.

Fisheries subsidy talks to continue in June

World Trade Organization (WTO) members are expected to reconvene in June to negotiate a deal that eliminates harmful fishery subsidies. Icelandic WTO Ambassador Einar Gunnarsson, who is chairing the talks, recently approached WTO member delegations in Geneva, Switzerland, asking to continue negotiations.

The 2022 agreement banned subsidies that supported illegal, unreported, and unregulated fishing, as well as subsidies that supported the fishing of overfished stocks that have no management measures in place. In order for enforcement to take place, the agreement must be ratified by 110 WTO members, but only 71 had ratified the agreement as of early March. Under a sunset clause in the agreement, it must be ratified by 2026 or will become void.

Though negotiations have so far failed to reach an agreement, Gunnarson has remained upbeat upon reflection of the most recent round of negotiations, which took place in Abu Dhabi in March.

"Progress was made on limiting subsidies that go toward distant-water fishing activities", he said; however, WTO members remain deadlocked on the extent and phase-in periods of exemptions for developing nations that wish to pay subsidies to artisanal fisheries.

Some developing countries object to any deal that limits payments to subsistence fishing, arguing that leading industrialized fishing nations are the chief culprits of overfishing globally and should be the primary targets of the ban on subsidies. Leading the charge among these developing nations is India, which pays out USD 300 million (EUR 276 million) annually to its fishing fleet, well behind China, which pays USD 7.4 billion (EUR 6.8 billion) a year in subsidies to its fleet, the EU at USD 3.8 billion (EUR 3.5 billion), and the US at USD 3.4 billion (EUR 3.1 billion).

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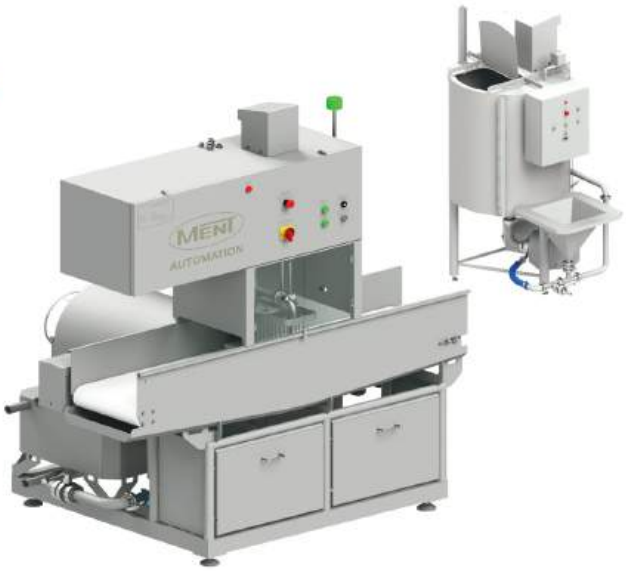

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DRIED FISH INDUSTRY IN BANGLADESH: ISSUES AND CONCERNS

By Sujit Krishna Das, Technical Officer, INFOFISH

The production of sun-dried fish offers a means of income generation in Bangladesh (particularly for women) and reduces the volume of raw material that would otherwise be discarded or lost. It is also an important source of low-cost protein for communities. However, the scale and significance of dried fish production, trade and consumption is rarely acknowledged and poorly understood. This article addresses the key challenges and issues in the industry, including some specific recommendations to enable market access and which may be useful in the formulation of national policy for the sustainable development of the industry.

Photo 1: Freshwater fish drying in the Chalan beel area, Natore district

The role of fisheries and aquaculture in the national economy, food security and nutrition of Bangladesh is enormous. The sector contributes 2.43% to the GDP, 22.14% to the agricultural GDP and 1.05% to the total national exports; some 5.74% of the GDP growth was achieved from the fisheries sub-sector (Bangladesh Economic Review 2023)[1]. Per capita fish consumption has increased from 60 g/day to 67.80 g/day (Household Income and Expenditure Survey 2022)[2] and around 12% of the total population (19.5 million) of the country is directly or indirectly dependent upon the fisheries sector, of whom 1.4 million are women (Department of Fisheries, DoF 2023)[3].

Bangladesh has achieved tremendous progress in the fisheries sector due to the adoption of agriculturally-friendly policies and strategies at national and local level by the government. The Ministry of Fisheries and Livestock (MoFL) is working to build a sustainable, safe, and profitable agricultural system to ensure food security in light of Vision 2041, the 8th Five Year Plan, National Agricultural Policy 2018, the UN Sustainable Development Goals (SDGs), Deltaplan-2100 and other policy documents. As a result, the country has become self-reliant in aquaculture production since the 2016–17 Fiscal Year (FY), for the first time since the country's independence.

In FY 2021–22, total fish production was recorded as 4.75 million tonnes whereas it was 3.06 million tonnes during 2010–11 FY, representing a growth of 55.42% over the last decade. The country's achievement in the fisheries sector has also been recognised internationally. According to SOFIA 2022 (State of World Fisheries and Aquaculture published by the UN FAO), Bangladesh ranked 3rd globally in inland freshwater capture fish production and 5th in inland closed water fish production in 2020. Moreover, the country took 8th and 12th position respectively for crustacean and marine fish production under the marine and coastal aquaculture category. Bangladesh also leads in hilsa shad production among the 11 hilsa producing countries in the world, and ranks 4th in tilapia production globally (DoF 2023)[4].

Dried fish (locally known as *shutki*) comprise one of the traditional delicacies in Bengali cuisine due to its mouth-watering taste and high nutritional value, as well as being readily available in the market. It plays a vital role as a low-cost, high protein source of food; as an income-generating activity for women; and in contributing to the food value chains by reducing fish loss and waste. In Bangladesh, significant amounts of marine and freshwater fishes are being processed through the traditional sun-drying method.

Dried fishes are rich in high nutritional content and are of great food value. About 2–5 kg of fresh fish is required to make one kg of dried fish; hence the nutritional content per kg is always 2–3 times higher than the raw fish. Thus, dried fish has become a preferred source of high-quality protein for most consumers. In the countryside, especially in the hill tracts and remote areas, dried fish is still considered as one of the key sources of high-quality protein for pregnant women and people recovering from illness. People from different regions like different forms of dried fish

[1] *Bangladesh Economic Review 2023 (BER 2023).*
[2] *Household Income and Expenditure Survey 2022 (BIES 2022).*
[3&4] *DoF 2023. National Fish Week 2023 Compendium (in Bengali). Department of Fisheries (DoF), Ministry of Fisheries and Livestock, Bangladesh. 160p.*

e.g. *nga-pi* (roasted small shrimp paste) is widely consumed by the tribal communities in Rangamati, Khagrachhori and Bandarbans. *Shidol* and *chepa* (fermented freshwater barb and marine hairfin anchovy) are also extensively consumed in the Mymensingh, Kishoreganj, Sylhet and Natore areas. Roasted Bombay duck, large head-hairtail or small shrimp (*loittya*, *chhuri* and *icha shutki*) paste mixed with chopped onion, green/roasted chili, salt, mustard oil and green coriander leaves comprise the traditional recipe in the Chittagong and Cox's Bazar areas.

Dried fish has a rich amino acid profile, and is low in cholesterol and saturated fatty acids. It is also full of vitamins (B1, B2, B12 and Vit A) and minerals (calcium, iron, iodine, phosphorus, zinc, copper and antioxidants). The omega-3 (ω3) fatty acids in dry fish play a vital role by reducing the risks of heart diseases and obesity and enhancing the intellectual development of children, as well as increasing metabolic activity and immunity. Thus, dried fish is not only important for its nutritional value but also as part of Bengali culinary tradition and heritage.

However, the scale and significance of dried fish production, trade and consumption is rarely acknowledged and poorly understood, in part because of a tendency for fisheries research to focus on fishers, thereby overlooking actors and processes in mid- and downstream value chain segments (Belton et al., 2017)[5]. This article addresses the key challenges and issues in the industry, including some specific recommendations to enable market access and formulate national policy for the sustainable development of the industry.

2

3

Credit: Sujit Krishna Das/INFOFISH

Photo 2&3: Traditional fish drying in Nazirartek, Cox's Bazar, Bangladesh

[5] *Belton et al., 2017. Labour, Identity and Wellbeing in Bangladesh's Dried Fish Value Chains. In: Johnson, D., Acott, T.G, Stacey, N., Urquhart, J., (Eds.). Social Wellbeing and the Values of Small-Scale Fisheries. New York: Springer: 1-23.*

Major producing areas

Defined broadly as aquatic animals preserved using simple techniques (such as sun-drying, salting, fermentation and smoking) that permit storage as foods at ambient temperature for extended periods without specialised packaging, dried fish have received little direct attention in fisheries research. This lack of visibility belies their historical and contemporary importance. Prior to the introduction of refrigeration, dried fish were the main form in which fisheries catches were traded and consumed. Dried fish products remain a core component of production, trade, diets, and cuisines across the world, particularly in the global south (Belton et al., 2022)[6].

The large-scale fish drying, and fermentation activities are concentrated in the Chittagong and Cox's Bazar areas; as well as the Sylhet-Mymensingh-Comilla and Khulna-Barisal-Patuakhali regions. Dublar Char (The Island of Dubla) in the Sundarbans (the largest mangrove forest in the world and a UNESCO heritage site), Khulna, Nazirar Tek and Sonadia in Cox's Bazar are the largest marine fish drying facilities in the country. Freshwater fishes are mainly dried in the Sylhet-Mymensingh-Comilla region; smaller quantities are dried in the Chalan Beel area in north-central Bangladesh, in Faridpur and Kaptai Lake (Hossain et al. 2015)[7].

Major marine water fish species use for drying

Last year, the author visited Nazirar Tek, Cox's Bazar, the prime marine dried fish production facility in Bangladesh, also known as the "dried fish processing capital" (*shutki palli*), to look at production value chains and market potential. Some 26-27 types of marine fish were recorded (Table 1), most of which are commercially important. These fish are being dried and processed, targeting both domestic and export markets. Fish drying activities continue round the year; however, the peak season is mainly August to April, focusing on the winter season.

Drying methods and distribution channel

The raw fish received by the dried fish yards are generally washed, sorted, degutted and salted (especially for high-value fishes like hilsa shad) before going for traditional sun-drying on vertical and horizontal bamboo racks. After two to three days in the sun, the dried fish are stored before packing. The drying process depends on the size of the fish, available sunshine and weather conditions. The packed dried fish are ready for human consumption and distributed to the wholesalers and retailers. The price of the dried fish varies with the species, size, taste and moisture content of the fish. In addition, certain low-value species, spoiled fish, discarded offal, viscera and others are stored to produce fish meal.

[6] *Belton et al., 2022. Dried fish at the intersection of food science, economy, and culture: A global survey. Online Library (Willey) Fish and Fisheries: 942-962.*

[7] *Hossain et al., 2015. Dried fish value chain in Bangladesh. World Fish, Bangladesh and South Asia Office, Dhaka, Bangladesh. 122 p.*

Major freshwater fish species used for drying

During the winter season when most of the open water bodies (ponds, flood plains, oxbow lakes, and seasonally-cultured water bodies, etc.) become dry and fish are harvested in bountiful amounts, the villagers preserve them by sun-drying to be used as a source of protein for harder times (rainy season). Small-scale entrepreneurs also sun-dry several freshwater fish species, mostly for domestic trade and local consumption, as well as for export to countries with Bangladeshi diaspora. The freshwater fish drying season generally lies between September to March, varying with the location. The list of the major freshwater fish species used for drying is provided here.

Methods used for freshwater fishes

The drying technique for freshwater fish is sometimes different from the marine species. The head, viscera, gut and air bladder of big fish are removed; the fish is washed and sometimes salted and seasoned with turmeric powder; rewashed, and then sun-dried for 2–3 days on bamboo mats. Smaller fish, especially freshwater barb (*punti*), are processed by fermentation. Except for some species, the dried freshwater fish mainly go to local markets. Their price varies with the species, size and quality. Usually there are a small number of discards which are used to produce fishmeal.

Issues and concerns associated with the industry

Although dried fish has become a vital source of food and nutrition, and it contributes to the national economy, it has been criticised for pesticide contamination. Sometimes pesticides are utilised in the drying and storage process, especially during the rainy season to prevent the outbreak and growth of flies, maggots and other insects. Thus, it might create adverse health implications for consumers who eat dried fish for a sustained period of time.


4


5
Credit: Dr. Md. Enamul Hoq, BFRI.

Photo 4&5: Improved solar fish drying techniques and with help of exhaust fans

Advanced (solar/mechanical) fish drying methods (Photo 4 & 5) can be adopted to ensure food safety and to preserve public health by upholding hygienic production. The Marine Station of the Bangladesh Fisheries Research Institute (BFRI) at Cox's Bazar has taken up this issue and developed improved fish drying devices (solar and mechanical) to help processors. Some stakeholders are applying advanced drying techniques developed by BFRI with some modifications. Collaborative and long-term research is the way forward for the sustainability of this important small-scale fisheries sector.

Trade and markets for dried fish

According to the Bangladesh Fisheries Statistics Yearbook (2021–22), in that financial year, the country exported 3 301.54 tonnes of dried fish worth USD 4.4 million (4 691.47 tonnes worth USD 5.7 million in FY 2020-21; 1 USD = BDT 117.36) (Graph 1)[8]. The major export destinations for dried marine fish were the Middle East, Pakistan, the United States, the United Kingdom, China, Hong Kong, Vietnam, Malaysia and Sri Lanka. In 2023, Bangladesh produced 0.71 million tonnes of dried fish (about 15 % of the total fish production of 4.76 million tonnes), comprising 85% marine and 15% freshwater.

The domestic market for marine dried fish is mainly positioned in Chittagong, Cox's Bazar, Patuakhali, Barisal and Khulna Sundarbans whereas the freshwater dried fish market is primarily located in Mymensingh, Kishoreganj, Comilla, Sylhet, Natore, Syedpur and Dhaka. Major products derived from marine fishes are: dried fish, salted fish (hilsa shad), fermented fish (*phaisa*), *nga-pi* (roasted small shrimp paste), fish meal, fish oil, by-products (head, viscera, gut, tail, spine, etc.) and others like fish maws and fish scales. Similarly, dried fish, fermented fish (*shidol, chepa*), fish meal, fish oil and other by-products and co-products are the major freshwater fish products. The dried fish value chain comprises a complex combination of multiple intermediaries which starts with the (i) fish boat owners/fresh fish collectors/fishermen; followed by (ii) dried fish processors; (iii) transporters; and (iv) wholesalers/distributors; (v) retailers; and (vi) consumers.

[8]*Yearbook of Fisheries Statistics of Bangladesh, 2021-2022, Department of Fisheries, Ministry of Fisheries and Livestock, Bangladesh. 79 p.*

Photo 6&7: Dried fish products available in traditional shops and supermarkets in different packing modes.

Income generating activity for women

Women participation along the dried fish value chain is highly significant as something like 50% of the workers in the fish drying yards are women. Their operation starts with the sorting and washing of fish when the fresh harvest arrives at the coast or fish landing centre. The fish are transported to a drying yard where the women work together with men in sorting and then placing them onto different horizontal and vertical bamboo structures for the next two to three days. The dried fish are packed and transported to a depot from where they are sent to different domestic and international trade destinations. The finished products are available at dried fish shops and supermarkets, where they may be packed and branded as organic dried fish.

Most women work part-time in the fish drying yard to generate income for their families. However it should be noted that the environmental features in the fish drying yard like the waste management system, water and sanitation system, and health and occupational safety, are usually inadequate. The overall wellbeing of the women workers is yet to be addressed.

Labour issues and well being

Although men and women have clear segregation of work, both are casual laborers in the fish drying yards. While the women sort the fish, the men transport them from the boat to the yard, unloading and loading the raw and dried fishes to and from the truck. Labour demand climbs high during the peak season. Most of the labourers in the Cox's Bazar region are Rohingyas (refugees from Myanmar) and seasonal workers from different parts of the country.

As most of the labourers are contractual, their working hours vary (6 a.m.–6 p.m.), salaries differ, recruiters neither maintain a leave policy, nor the workers have access to medical assistance or recreational facilities. They do not maintain practices linked to Standard Operating Procedure (SOP) such as washing hands with soap and clean water, wearing aprons, hand gloves, face masks, gum boots and other security measures to avoid any contamination.

Conclusions and recommendations

The following specific recommendations are part of a strategic plan which may be useful in developing the "Small in scale, Big in nutrition" dried fish industry of Bangladesh:

- A long-term, inclusive and gender-focused development approach should be taken to improve the dried fish industry in Bangladesh;
- The Ministry of Fisheries and Livestock (MoFL) should assess the supply and demand, market prospects, food safety and public health issues to exploit the maximum benefit from this industry;
- The Ministry of Commerce (MoC) should declare a special 'Export Processing Zone' to ensure the supply of safe and hygienic dried fish products by enabling appropriate infrastructure and facilitating market access;
- Advanced (solar and mechanical) fish drying methods should be introduced to reduce fish loss and waste and to ensure public health and safety;
- Application of unauthorised chemicals and pesticides along the dried fish value chains should be monitored closely by the Fish Inspection and Quality Control Division (FIQC) of the Department of Fisheries (DoF); and
- Financial institutions should facilitate interest-free loans for dried fish processors to ensure the sustainability of this small-scale fisheries sector.

Sujit Krishna Das *has more than 18 years of experience in fisheries and aquaculture development at regional and international level. His areas of expertise include commercial breeding of shrimp, intensive nursing and farming protocols, formulated species-specific feed, managed nutrition, and biosecurity of aquatic animal health. Following completion of his postgraduate degree in Aquaculture, he worked closely with the private sector and DFID-UK funded SUFER project. Being the Technical Officer at INFOFISH, Malaysia, since 2019, he is responsible for providing Technical and Policy Advisory Support to the INFOFISH Member Countries, keeping abreast of technological developments. He passionately advocates responsible "blue food" production and "circular economy" to achieve the SDGs.*

UNLOCKING FASTER GENETIC IMPROVEMENT IN TILAPIA THROUGH GENOMICS AND PRECISION BREEDING

By Rajesh Joshi

This article summarises the transformative impact of genomics and precision breeding on tilapia breeding lines by researchers at the Norway-based GenoMar Genetics Group, highlighting the increased production performance achievable in newer generations of fingerlings. Recent innovations in genomic selection and line breeding have amplified the genetic gains in GenoMar's breeding nucleus. The result is a tripling of the genetic gain over the last seven generations of tilapia. These innovations pave the way for farmers to harness superior performance from the company's latest product iterations, leading to increased profitability and a sustainable tilapia industry.

Nile tilapia, reared commercially in more than 120 countries worldwide, had an annual production of 5.3 million tonnes in 2022, making it the fourth most produced aquaculture species in that year[1]. Genetic selection is pivotal in further enhancing this productivity and sustainability of tilapia farming systems[2]. By selectively breeding individuals with desirable traits such as faster growth rates, higher fillet yield, and enhanced survival and disease resistance, genetic programs aim to optimise production outcomes and indirectly mitigate environmental impacts. Over the last 35 years, genetic selection has significantly advanced, resulting in faster-growing tilapia breeds that vastly outperform their wild ancestors, thus enhancing profitability in tilapia production.

The importance of accelerating genetic gain

GenoMar's selective breeding initiatives have resulted in significant milestones in tilapia breeding, driving the evolution of the global tilapia industry over the past three decades[3]. This progress has led to the development of tilapia strains and products with superior growth rates compared to the competitors. Field trials have demonstrated that GenoMar fingerlings can help farmers increase both production and profitability by over 30%[4].

Each generation in selective breeding brings about remarkable growth enhancements, illustrating the continuous improvement in GenoMar tilapia strains. Since the late 1980s, the company's breeding program has prioritised fast growth in Asian farming conditions. Leveraging cutting-edge technologies and global expertise, it has established the GenoMar brand as a hallmark of growth performance, benefiting countless farmers worldwide.

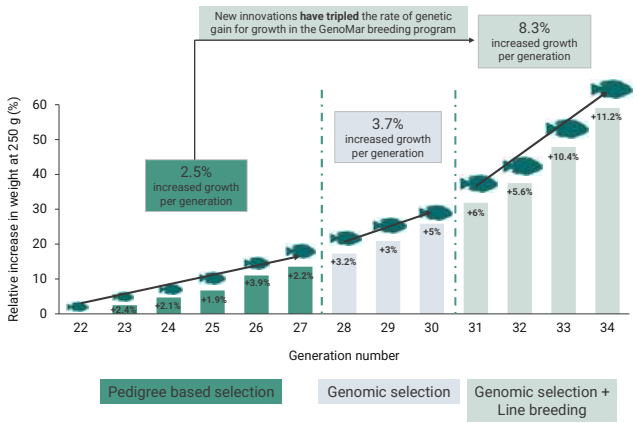
Innovations in selective breeding

The rate of genetic progress for a trait is contingent upon several factors, including the number of generations under selection and the precision of selection methods. In GenoMar's breeding program, early generations focused primarily on fast growth, resulting in substantial advancements with each iteration. As the program matured, additional traits were integrated, such as fillet yield and disease resistance, into the selection criteria[5].

In the last eight generations, two key innovations have been implemented in the breeding programs (Figure 1). GenoMar is currently harvesting and collecting phenotypes from generation 35 of the breeding population. Genomic selection was fully implemented in Generation 28 and, from generation 31 onwards, combined genomic selection with precision breeding via line breeding. Results have demonstrated tripling of the genetic gain in the last seven generations by implementing these two innovations (Figure 1). Thus, this focused approach increases accuracy and expedites generational turnover, driving rapid advancements and ensuring the continued success of the company's breeding initiatives.

[1] *FAO. The State of World Fisheries and Aquaculture 2024. Blue Transformation in action. Rome; 2024.*
[2] *Joshi R, Skaarud A, Mariussen A. 30 years of tilapia breeding programs: The effect of traditional and novel selection methods. Aqua Cult Asia Pacific. 2022;18.*
[3] *Joshi R, Skaarud A, Mariussen A. 30 years of tilapia breeding programs: An essential contribution for a healthy and profitable industry. Aqua Cult Asia Pacific. 2021;17:20–4.*
[4] *Joshi R, Fernandes T, Skaarud A, Almeida D, Gil T, Mariussen AV, et al. Impact of genetics in tilapia production – A comparative trial between two strains in Brazil [Internet]. Oslo; 2024. Available from: https://genomar.com/wp-content/uploads/2024/06/Impact-of-genetics-in-tilapia-production.pdf*
[5] *Joshi R, Skaarud A, Mariussen A. 30 years of tilapia breeding programs: An essential contribution for a healthy and profitable industry. Aqua Cult Asia Pacific. 2021;17:20–4*

Figure 1. Relative increase in the estimated breeding values (EBVs) of the trait, weight at 250g, for the last twelve generations of GenoMar tilapia nucleus broodstock[6]



Note: The 22nd generation is used as the base line for calculating the increased weight per generation succeeding. Genomic selection was implemented in Generation 28. These recent innovations in genomic selection and line breeding have amplified the genetic gains, with the relative percentage increase in the EBVs for weight at 250g of the GenoMar 250 breeding line more than tripling in the last seven generations. Besides this, the generation interval has reduced by 36%.

Genomic selection in tilapia breeding programs

Full genomic selection was implemented in the GenoMar strain in early 2019. The process involves dividing offspring into a reference population and selection candidates. The reference population, tested in various environments and for disease resistance, provides phenotype data. Both groups are genotyped, and genomic breeding values are calculated using single nucleotide polymorphism (SNP) effects derived from the reference population. This method ensures precise ranking and selection of the best candidates.

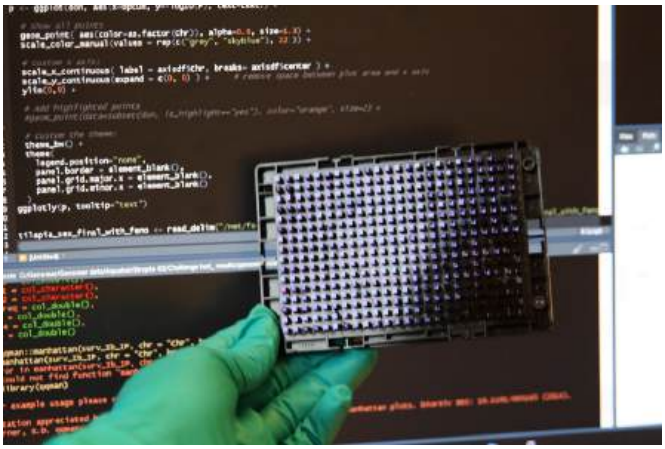
Genotyping tool: high-density SNP chip

Substantial resources have been invested in developing innovative genetic tools aimed at increasing the predictive capabilities in GenoMar breeding programs, ultimately benefiting farmers with superior products. The company's journey with using DNA information in selective breeding began as early as 2000, culminating in the development of the first high-density SNP array for Nile tilapia (Onil50) in 2016[7], comprising approximately 58 000 SNPs from the tilapia genome.

Using Onli50 SNP array in the breeding programs for almost six years and testing it on nearly 300 000 tilapia fish, extensive data and insights have been accumulated regarding the performance of various SNPs of the array for the breeding populations. This wealth of information has allowed for the identification and removal of SNPs that are not functioning effectively, while incorporating other important SNPs. As a result, we have updated this to the new version of commercial SNP array, known as the Onil_70 array, for the company's breeding programs.

[6] *Joshi,R. Interview: Shaping the future of the tilapia industry through genetics. Hatchery Feed & Management. 2024;12:2:36-41*

[7] *Joshi R, Arnyasi M, Lien S, Gjoen HM, Alvarez AT, Kent M. Development and validation of 58K SNP-array and high-density linkage map in Nile tilapia (O. niloticus). Front Genet. 2018;9:472.*



The updated chip includes 40 000 existing high-quality markers from the previous Onil50 array, alongside approximately 30 000 new SNPs. The SNPs were selected using the in-house reference genome assembly of GenoMar fish developed using both long-read and short-read sequences. This approach provided researchers with the tailored genetic markers specific to the GenoMar strains, ensuring more precision and accuracy in the breeding programs.

Strategic line breeding

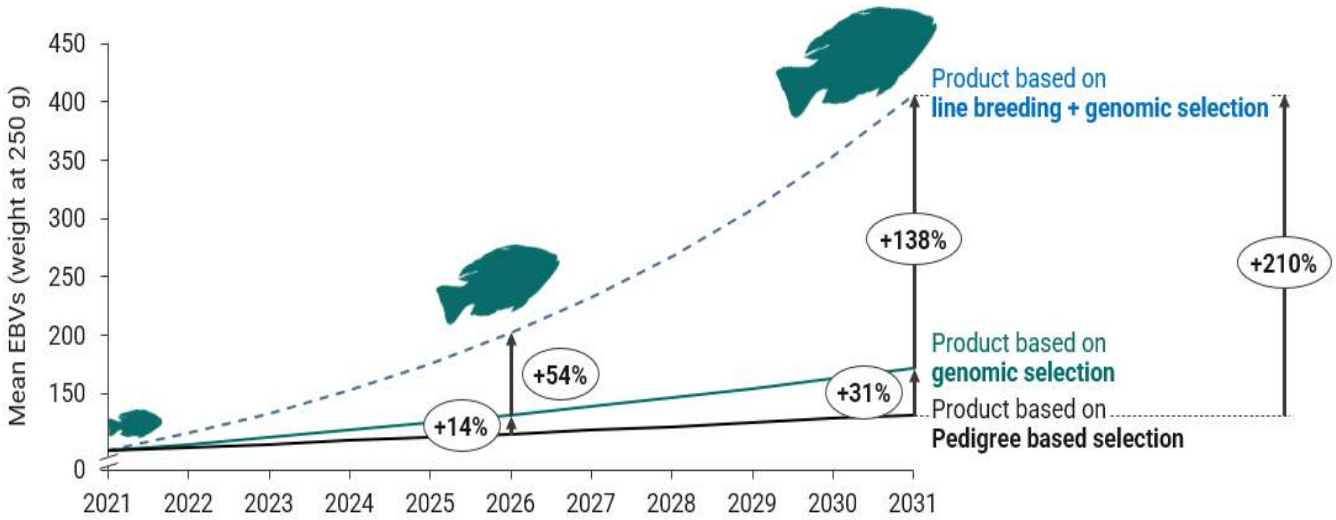
To elevate tilapia to the level of "modern aquatic chicken", GenoMar adopted line breeding techniques, drawing from the poultry industry. Multiple breeding lines align with product portfolios, each focusing on specific traits to meet the global market demands. Strategic crossbreeding of different breeding lines for commercial fingerling production balances performance, combining complementary traits and enhancing productivity beyond parental lines (Table 1). Simulations indicate that line breeding combined with genomic selection will yield an additional 210% genetic gain for GenoMar 250 over the next ten years, positioning GenoMar to become the "aquatic chicken."

Table 1. Global product strategy based on different breeding lines for various markets in Asia and Latin America

Product	Weighting of traits		Table fish	Medium to large-sized fish
	Survival	Growth and yield		
GenoMar STRONG	75%	25%	Asia	Asia
GenoMar 250	50%	50%	Asia	
GenoMar 1000	50%	50%		Asia Latin America
Aquabel	50%	50%		Latin America

Note: In the tilapia market, "table fish" refers to smaller fish weighing around 300 grams suitable for retail consumers, while "medium to large-sized fish" refers to larger fish weighing 800 grams to 1 kilogram or more, preferred by the processing industry and regions favouring larger portions. Details on each product is available at www.genomar.com.

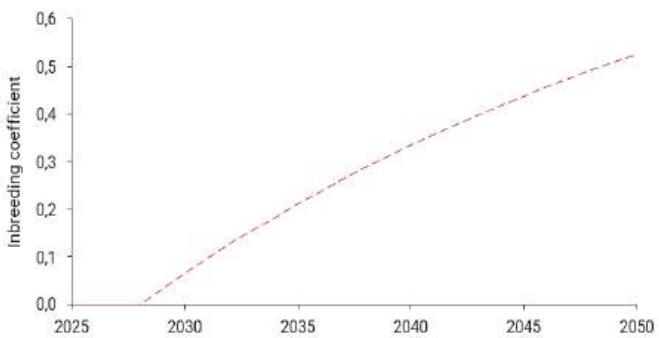
Figure 2. Simulation illustrating the relative genetic gain by incorporating the two new innovations: genomic selection and line breeding into the breeding program



Note: Estimated breeding value (EBV) is a calculation based on the parents' performance for a trait and the estimation of their offspring performance for the same trait. Figure shows that our new strategy of combining genomic selection and line breeding yields an additional 210% genetic gain for GenoMar 250 over ten-year period.

Moreover, the strategic approach to commercial fingerling production using line breeding is designed to elevate the inbreeding levels significantly if competitors incorporate GenoMar commercial fingerlings into their breeding programs (Figure 3). Excessive inbreeding within a fish breeding population can result in inbreeding depression, leading to adverse impacts on growth, fitness, and overall health. This leads to an increased expression of deleterious traits, diminished reproductive success, and a compromised immune system. Such conditions will impact the viability of hatchery operations.

Figure 3: Simulations showing the increase in the inbreeding level within a population resulting from the unauthorised breeding of GenoMar commercial products by competitors



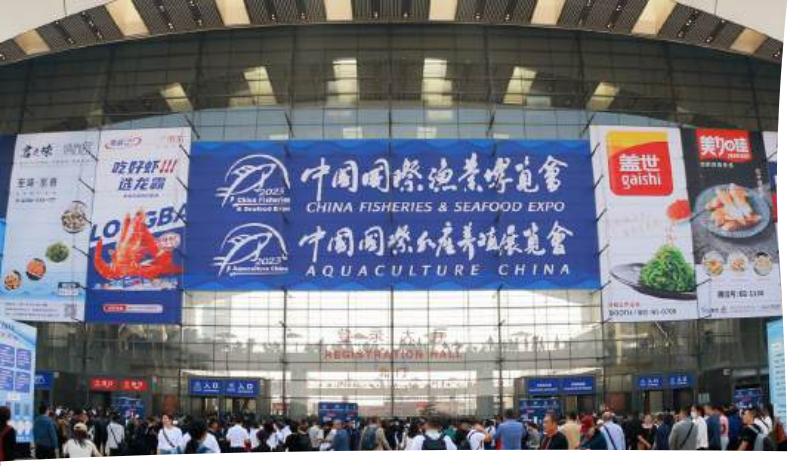
Note: There is a widespread trend in Nile tilapia aquaculture where backyard hatcheries buy female breeders from different strains (with or without any breeding program), and "steals" male commercial fingerlings in order to create a new product.

The Food and Agriculture Organization (FAO) recommends that the rate of inbreeding in a population should not exceed 1-3% per generation to maintain the viability of the population. The simulation illustrates that utilising our commercial population for breeding significantly accelerates the inbreeding rate, rendering the breeding nucleus of such competitors non-viable in just a few generations due to the accumulated inbreeding coefficient.

Future prospects and conclusion

The future of tilapia breeding holds significant potential for genetic improvements, enhancing margins for farmers. Selective breeding technologies have evolved significantly over the last century. These technologies require substantial resource investment, which might not be possible for everyone in the market. By leveraging these new technologies, we aim to substantially improve the accuracy of breeding decisions, translating into better products and a more profitable and sustainable tilapia industry. GenoMar's breeding objective is to supply top-quality fingerlings, supporting healthy, profitable production and value-added products. The goal is to position tilapia as a sustainable alternate protein source, meeting global food demands responsibly and sustainably.

Dr. Rajesh Joshi *serves as the Senior Researcher in the R & D department at GenoMar Genetics Group, Norway. His role encompasses overseeing the planning and execution of various activities within the breeding nucleus and multiplication facilities of tilapia, located in both the Philippines and Brazil. He is additionally responsible for product planning and the coordination of benchmarking, documentation and performance evaluation efforts across various countries in Asia and Latin America. Furthermore, Dr. Joshi actively engages in academia as a visiting professor at several universities worldwide, including CLSU in the Philippines.*



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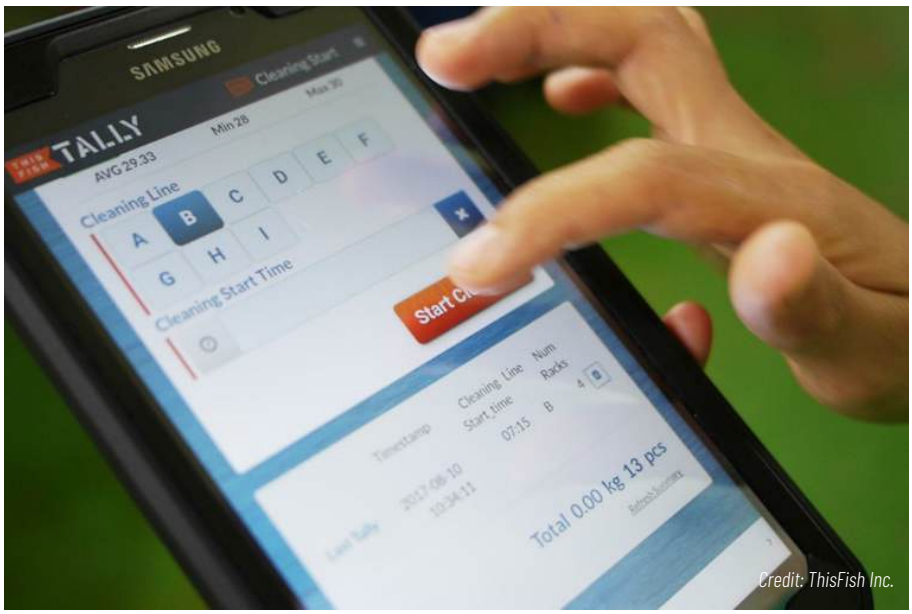
South Road Dongsanhuan
Beijing 100022 P.R. China
Tel: +86 10 58672620
info@seafarechina.com

HOW AI CAN TRANSFORM THE SEAFOOD INDUSTRY

By Eric Enno Tamm

Artificial intelligence (AI) can help the seafood industry become more predictable and profitable. This article explains three types of AI: machine learning, computer vision and generative AI; moving on to how AI is currently being deployed in seafood supply chains, from computer vision onboard fishing vessels to automated inspection and demand forecasting in supply chains. It then explores research in how AI can be used in the seafood processing sector including yield prediction, drain weight prediction for tuna canneries, rapid salinity testing, automated visual inspection with smart cameras, anomaly detection and demand forecasting. The article concludes that there are many opportunities to deploy AI to optimise and automate processes in order to improve the profitability and sustainability of the seafood processing sector.



Technology optimises processes in aquaculture at various points of the supply chain, including processing plants

The authors—all business professors at the University of Toronto—argue that AI enables us to make better predictions faster and cheaper. That, in short, is driving profits and the adoption of AI across industries: seafood included.

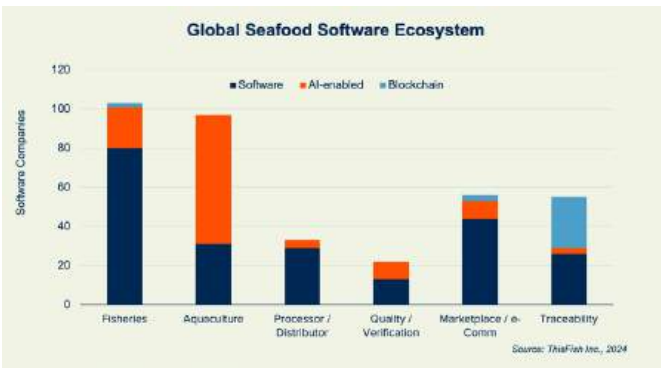
In this article, I provide readers first with an overview of the different types of AI, how they work and their applications. Second, I analyse how AI is currently being used in seafood supply chains, based on a survey of some 365 software applications. Third, I'll explore how AI can be used in seafood processing, a sector that is currently being under-serviced by AI. I'll also share cutting-edge research we (ThisFish Inc.) are currently doing to bring AI into the processing sector. Finally, I'll conclude with some thoughts on how seafood companies can begin to prepare themselves for the AI revolution, ensuring they won't be left behind.

The seafood industry is extremely unpredictable. Weather, sea temperatures, fish stock levels, migration patterns, climate change—all these factors impact fishing operations, trigging gluts and shortages of supply. Quality is unpredictable too, often dependent on environmental factors, catch methods, seasonality, handling at sea, cold chain, and more. Aquaculture also experiences natural variability. Uncontrollable environmental conditions – such as water quality issues caused by weather or pollution and disease outbreaks – affect production and quality in fish and shrimp farms. In short, it's a risky business.

For these reasons, artificial intelligence (AI) – described as "prediction machines" – holds the promise to make the seafood industry more predictable and therefore more profitable.

"Prediction is the process of filling in missing information," write the authors of *Prediction Machines: The Simple Economics of Artificial Intelligence.* "Prediction takes information you have, often called 'data,' and uses it to generate information you don't have. In addition to generating information about the future, prediction can generate information about the present and the past. This happens when prediction classifies credit card transactions as fraudulent, a tumor in an image as malignant, or whether a person holding an iPhone is the owner."[1]

[1] *Ajay Agrawal, Avi Goldfarb and Joshua Gans Prediction Machines: The Simple Economics of Artificial Intelligence. Harvard Business Review Press, Boston, 2028, pp. 29-30*



What is AI and how does it work

Artificial intelligence is often referred to as the Fourth Industrial Revolution. The original revolution was driven by steam power and mechanisation in the 1780s; the second centered on electrification and mass production in the 1870s; and the third began in 1969 with computer electronics. AI is now at the heart of the fourth Industrial Revolution, often called Industry 4.0. Many of the new technologies such as cloud computing, the Internet of Things (IoT), smart sensors and computer chips are enabling AI through

advances in data collection, data storage and computational power. AI is itself also enabling many new technologies such as autonomous robots, self-driving cars, augmented reality, and cognitive computing.

What exactly is AI? At its core, AI is about simulating human intelligence in machines and falls within the general field of data science. Machine learning is a subset of AI in which machines make decisions without being programmed. We basically train machines using data. In general, more, and better quality data makes AI smarter. You can "supervise" the learning of AI by labelling data, meaning the input comes with a corresponding output label. For example, you might label an image of a fish (the input) with its proper species (the output). Unsupervised learning involves an algorithm that tries to uncover hidden patterns in data such as detecting anomalies or errors. The US Food and Drug Administration (FDA), for instance, is using AI to see patterns in seafood import data to identify possible illegality. A third type of learning is "reinforced" which occurs when AI interacts with its environment, receiving positive or negative feedback. Chatbots for customer support which ask you to rate its answers is a common example of reinforced learning.

A subset of machine learning is called "deep learning" which uses neural networks inspired by the human brain's structure and function. This technology is often used to discover hidden patterns in enormously large, complex or multi-dimensional datasets. The most common technologies include computer vision and natural language processing.

Computer vision is a field of AI that enables machines to interpret and make decisions based on visual data from the world. Each pixel in an image is given a number, and then algorithms find patterns that, for example, will differentiate a yellowfin from a bigeye tuna in an image. Computers can classify an image, detect an object, segment an image into components and recognise faces. Computer vision technologies use a type of neural network to achieve high accuracy.

The final technology is generative AI such as the wildly popular ChatGPT or DALL-E for generating images. This technology also uses neural networks to learn patterns from large datasets of images or texts to generate new content. Large language models are trained on millions of pages of text which make them sound human.

How can all this AI technology be applied to the seafood industry? One helpful tool is called the P.A.C Framework, developed by entrepreneur and AI expert Rob May. P.A.C. stands for Predict, Automatic and Classify, which are the core functions of AI. May suggests creating a simple table to see how AI can apply to your business. "To make your first grid, make three columns, one for Predict, one for Automate, and one for Classify. Then on the rows, list key areas of your business. For example, you could list: Customers, Product, and Operations. Then in each box you can figure out how that specific A.I. approach could apply to that area of your business", May writes.[2]

I have created such a grid (Table 1) looking at different sectors of the seafood value chain including fishing, farming, planning, production and quality control. While not an exhaustive list, it is meant as a brainstorm on how AI might apply to your business. As we'll see in the next section, AI is now being broadly adopted across the seafood sector.

Table 1: P.A.C. Framework, adapted to the seafood industry

P.A.C. FRAMEWORK

The three functions of AI — Predict, Automate and Classify — and potential uses cases in the seafood industry.

	PREDICT	AUTOMATE	CLASSIFY
FISHING	• By-catch levels • Fish stock size • Migration patterns • Fish weight and size • Weather • Ocean conditions	• E-log books • Electronic monitoring video review • Route optimization	• Illegal fishing activity • Species recognition • Bycatch • Fish size
FARMING	• Growth forecasting • Disease outbreaks • Health status • Biomass estimates • Feeding time	• Fish & lice counting • Water quality • Weighing by photo • Anomaly Alerts • Feed optimization • Remote sensing	• Fish size • Appetite detection • Fish quality
PLANNING	• Production outcomes • Raw material costing and yields	• Worker allocations by fish size, cleaning, species • Warehouse optimization	• Worker productivity
PRODUCTION	• Can drained weights • Yields / recovery • Optimized cooking • Worker productivity	• Cost accounting • Calculations and reporting • Material use • Counting cans, cases, fish	• Image recognition for species and size • Defect detection • Color classification
QUALITY CONTROL	• Quality • Error or outlier detection • Histamine levels • Salinity levels on vessels	• Image collection • Continuous sampling • Reporting • Compliance checks	• Image recognition for grade, color, size • Defect detection

Source: ThisFish Inc., 2024

Credit: Eric Enno Tamm

The explosive growth of AI in seafood

AI is now everywhere in our daily lives: in our smartphones, virtual assistants, cars, music recommendations, food deliveries, facial recognition, and so on. The growth has been driven by three factors. First, the volume of digital data has grown in the past 10 years by some 30-fold. AI needs data to learn, and so the growth of digital technologies—especially cloud computing and smartphones—is generating the data to

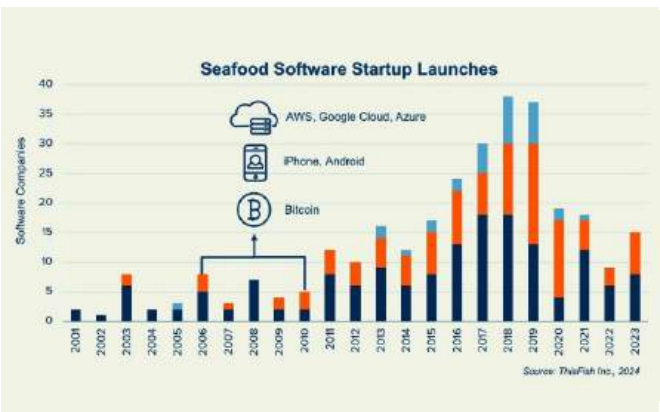
train AI. Second, AI algorithms have become more powerful. For example, ImageNet was a large-scale visual recognition challenge held once a year for the past decade. In 2015, the best AI system beat human performance for the first time. AI can now recognise photos with higher accuracy than humans. And third, computer chips are becoming more powerful and cheaper. They are critical for processing larger amounts of data with more complex algorithms.

As for seafood, I've identified a "meta-trend" which helps to explain why AI is being widely adopted in the industry. I call it the Fish n' Chips Index. Since 1990, the FAO Fish Price Index has increased by 60 percent while the price of semi-conductors or computer chips as declined by more than 50 percent. Today about a third of the software—more than 120 apps—being used in the seafood industry employ AI.

In fact, I've analysed more than 365 software apps being used in the seafood industry and published them in an online directory on ThisFish's website[2]. There has been an explosion in new tech startups servicing the seafood sector, which peaked in 2018-2019. However, AI is being applied unevenly in the seafood industry.

There are about 100 software apps being used in wild capture fisheries and an additional 100 in aquaculture. Almost 70 percent of aquaculture tech uses AI compared to only 20 percent in fisheries. The reason for the divergence is two-fold: incentives and regulations. In aquaculture, AI is driving down two of the industry's largest costs: optimisation of feeding and reducing mortalities. Farmers are motivated to adopt AI since it makes business sense. In fisheries, most technology is being driven not by market dynamics, but regulatory compliance to better monitor catches. Fishermen are reluctant to adopt technologies that increase surveillance, with the exception, perhaps, of improved safety at sea. A significant amount of the AI in fisheries is focused on using computer vision to automate the reviewing of video from electronic monitoring systems onboard fishing vessels.

We'll likely see this gap in AI adoption widen. According to Crunchbase, aquaculture tech companies have raised about USD 632 million in investments, compared to only USD 19 million by fisheries tech companies. In fact, Crunchbase reported that in 2022 alone, 45 aquaculture startups raised USD 292 million.



[2] *Visit https://this.fish/software-directory.*

AI use cases for seafood processing

The seafood processing sector has lagged in both digital transformation and the adoption of AI. Paper record keeping is the predominant method of data collection, causing numerous problems such as human errors, no real-time analytics, slow reporting and poor traceability. There are 29 software products targeting this sector and yet only four feature AI capabilities. For quality testing and verification, there are 13 software products for seafood. More than 50 percent are using AI including computer vision, DNA testing, and chemometrics.

Despite low levels of digitisation and AI adoption, seafood processors are critical nodes in supply chains, aggregating supply, maintaining food safety and enabling global trade. Estimates suggest that about 23 000 companies are involved in seafood processing globally. They represent a bottleneck between the millions of primary producers and billions of consumers.

Despite its critical commercial importance, the processing sector suffers from low profitability. Planet Tracker analysed 89 publicly-listed seafood processing companies to determine that their earnings margin before interest and tax (EBIT) on average was only 3.4 percent.[3] Artificial intelligence could potentially improve these margins through automation and optimisation while meeting sustainability goals.

Based on our work digitising seafood processing plants, ThisFish Inc. estimates that an average tuna cannery, processing 100 metric tonnes of raw material per day, generates more than four gigabytes of digital data a year, equal to about 2.7 million pages of text. Fresh-frozen processors of tuna and salmon generate about one gigabyte of data or 680 000 pages. This enormous volume of data could prove to be valuable to the seafood processing sector. Historic data could be used to train machine-learning algorithms to predict quality and production outcomes. In the next section, I'll share some of the innovative AI research we've conducted over the years.

Machine learning

In 2021, data scientists at ThisFish Inc. developed a proof of concept to predict yields in a tuna cannery in Thailand. The data used for analysis came from approximately 22 months of production for skipjack, albacore, and yellowfin tuna. The data consisted of 8 818 unique datapoints for which yields were calculated. A single unit of raw material for which the yields were calculated was a production lot. The yield was calculated as the following:

We divide the variables into two categories: raw material variables and process variables. Raw material variables are those that are inherent properties such as fish species, fish size, harvest method, etc. Process variables are those that are collected as part of the canning process, such as cold storage duration, thawing time, thawing temperatures, cooking time, cooking temperatures, etc. We studied the impact of these variables and tried to determine ways in which these variables can be adjusted to potentially increase yields.

[3] *François Mosnier, John Willis, Matt McLuckie. Traceable Returns. Planet Tracker. October 2020.*

In summary, the primary variables that were found to influence yields were fish size, fish species, time in cold storage, cooking temperature, and cooking time. However, the more interesting finding was the impact of cold storage duration on yields, which impacted recoveries by up to three percent. About 85 percent of the variation in yields was explained by the variables in the model and the AI had a confidence level of 95 percent. Since raw material is the largest cost in production, a yield prediction model could help a cannery in predicting gross margins in production.

Another machine learning project focused on the drained weight in tuna canning. Drained weight is declared on cans and represents the minimum amount of meat weight that remains in a can once its liquid medium—typically oil, brine or spring water—is drained. It's difficult to predict the drained weight because the tuna in the can absorbs some of the liquid, known as "pick-up." Many variables can impact the amount of "pick-up" including species, liquid type, meat quality, packing density, can size, flake-to-chunk ratio and others. Most canneries have developed drained weight tables which help production managers determine the fill weight of the cans. However, these tables are simplistic with only a couple variables. They don't consider all the relevant variables and how these variables interact with each other. As a result, canneries are often surprised when results come back from the drained weight lab.

Furthermore, there are regulatory limits on how many cans are allowed to be underfilled which is called the tolerable negative error. For example, the threshold on a 102-gram drained weight means you can't have more than 2.5 percent of cans underfilled by 4.5 grams and there's zero tolerance for extreme underfilling of more than 9 grams. Since the process is unpredictable, canneries purposefully overfill cans from 3–6 grams on average to ensure they don't break underfilling rules.

In 2023 and 2024, ThisFish Inc. worked with two tuna canneries in Manta, Ecuador to develop a drain weight prediction model. We received more than 100 000 drained weight samples and related variables from Eurofish S.A. and Tri Marine's SEAFMAN cannery. We trained two separate AI models, one for each cannery, keeping the data separate given confidentiality requirements.

The preliminary results were promising. In general, the AI reduced the standard deviation in the drained weights, pointing to stronger process control. The results also suggest that up to three grams per can could potentially be saved, depending on the benchmark performance of the cannery. One gram of skipjack is equal to about USD 500 000 in raw material costs each year for a 100-metric-tonne-per-day cannery. There are 150 canneries worldwide averaging 100-metric tonnes, meaning AI could potentially save the sector USD 75 million to USD 225 million in raw material costs each year. Once performance is improved, the AI model could then be retrained on the better data, hopefully squeezing out even more savings and strengthening control.

Computer vision

There is a lot of visual inspection in the seafood industry, on raw material, semi-finished and finished products. In general, if humans can see something then we can program AI to see it as well.

At ThisFish Inc., we've developed several computer vision algorithms for counting and measuring fish fillets, classifying salmon fillets based on the SalmoFan color scale and detecting five different types of defects on salmon fillets including gaping, trenching, softness, bruising and inoculation scarring (on farmed fish). We're also working on an algorithm to estimate the weight of a salmon based on an image. Future models could also be trained on whitefish or shrimp.

In the tuna industry, a Japanese tech company has developed Tuna Scope to use computer vision to rate the quality of fresh tuna. ThisFish Inc. has also experimented with using computer vision to estimate the salinity level in frozen skipjack, a research project that is ongoing. Other applications include visual inspection of can seams or detection of dents and other defects on cans. Most seafood processors also do label inspection of finished product, a task that could be automated by a smart camera.

Computer vision could potentially make quality inspection cheaper and better. Currently, most quality inspection involves human inspectors taking random samples to check quality. With computer vision comes automated reducing labour costs and inspection is continuous instead of random sampling. Seafood companies would generate enormous volumes of inspection data which could be used to make better decisions and reduce frivolous claims, since processing plants would have enormous amounts of data to prove they've met customer requirements.

Conclusion

In the past, many seafood companies believed a competitive advance could be gained by hiding data and not being transparent about their production process or supply chain. With growing market demands for transparency and responsible sourcing, these attitudes are becoming more anachronistic with each passing day. In the Information Age, lasting competitive advantage will come to those companies that discover hidden insights and patterns in their data through artificial intelligence.

My advice to companies that want to start their AI journey is simple: digitise, prioritise and learn. First, digitise your data. Without data, you'll have no AI. Second, prioritise by focusing on early wins and cost reductions through automation and optimisations. And third, learn as you go. Take a phased approach in introducing new digital technologies.

While AI can make the industry more profitable, it could also prove valuable for sustainability, especially helping to detect and eliminate seafood fraud in supply chains. Since AI requires clean, comprehensive and complete data for accurate predictions, there will be growing commercial incentives to collect quality data on provenance and traceability.

Stanford professor and AI expert Andrew Ng has stated, "It's not who has the best algorithm that wins. It's who has the most data." One could also say it is those who have the *best* data that will win.

Eric Enno Tamm *is the Co-Founder and CEO of ThisFish Inc., a Vancouver-based company providing software and artificial intelligence solutions to the seafood industry. With over 20 years of experience in commercial fisheries and 15 years in technology development, he possesses extensive expertise and insight in the industry.*

INFOFISH

Vacant Position

INFOFISH is an inter-governmental organization that was set up by the Food and Agriculture Organization of the United Nations (FAO) to provide marketing information and technical advisory services for fishery products in the Asia-Pacific Region and beyond. It is based in Kuala Lumpur and hosted by Malaysia since its inception in 1981. In this regard, INFOFISH is currently seeking suitably qualified and interested applicants for the role as highlighted below.

TRADE PROMOTION OFFICER

Trade Promotion Division

Working under the over-arching supervision of the Acting Director/Director, INFOFISH, the Trade Promotion Officer shall be responsible for the following:

- Monitor and review fishery trade in the Asia-Pacific region and beyond;
- Collect and analyze price and market information on specific fishery products for the 'INFOFISH Trade News', a monthly bulletin;
- Attend to queries on supply, marketing and trade of fishery products worldwide;
- Work on identification and export promotion of fishery products from the region;
- Maintain regular contact with institutions, market news correspondents and organizations relevant to the fish marketing information network;
- Write and review articles pertaining to marketing and international trade of fishery products for the INFOFISH International magazine and other publications; and
- Undertake other activities as assigned by the Supervisor or the Acting Director/Director.

Interested applicants should also have the following necessary qualifications:

- Post-graduate degree in Fisheries Economics, Economics, Marketing, Trade, Business Management, International Business or related fields;
- Experience in international trade and marketing; experience in a fisheries-related work environment would be viewed very favourably;
- Proven ability to understand, analyze and report on trade data, statistics and trends;
- Proven ability to draft, edit or write trade reports, articles and/or contribute to trade news;
- Very good inter-personal and communication skills in English;
- Excellent written English skills;
- Very good ability to plan, prioritize and multi-task;
- Strong ability to work in a diverse work environment;
- Proficiency in Microsoft Office; and
- National of a Member Country* of INFOFISH.

Duty station:

This position is based in Kuala Lumpur, Malaysia. Applicants must be willing to relocate.

Emoluments:

Salary will be consistent with the INFOFISH terms and conditions for this position, details of which will be clarified to the successful candidate.

Should you be interested in making an application for this position as advertized, please email: info@infofish.org for an **Application Form**. All **Application Forms** should be completed in full and submitted with the necessary supporting documentation by 16th August 2024 to the following address;

The Acting Director,
INFOFISH, 1st Floor, Wisma LKIM, Jalan Desaria, Pulau Meranti, 47120 Puchong, Selangor Darul Ehsan, Malaysia
Email: info@infofish.org

Closing date: 16th August 2024

for the receipt of applications at INFOFISH. Only short-listed candidates will be notified.

**Bangladesh, Cambodia, Fiji, Kiribati, Malaysia, Maldives, Papua New Guinea, Philippines and Thailand.*

Training of Trainers on onboard tuna handling, preservation and transport

27-28 May 2024, Samut Prakan, Thailand

In collaboration with SEAFDEC Training Department (SEAFDEC/TD), INFOFISH organised a training course entitled *"Training of Trainers on Onboard Tuna Handling Preservation and Transport"* during 27-28 May 2024 at Samut Prakan, Thailand. The training aimed at providing technical knowledge on onboard tuna handling techniques applicable to various fishing operations in the ASEAN and Asia-Pacific regions. Some 13 participants representing competent authorities and the tuna industries of six INFOFISH Member Countries namely: Kiribati, Malaysia, Maldives, Papua New Guinea, Philippines and Thailand were present. The training was part of INFOFISH's Work Plan and mandate to provide marketing information and technical advisory services for fishery products in the Asia and Pacific Region.

SEAFDEC Secretary-General and Chief of the Training Department, Dr Suttinee Limthamahisorn, opened the two-day long training course. Mr Thaweesak Thimkrap, Head of Marine Engineering Section; Mr. Khunthawat Manomayidthikarn, Training and Research Support Division, SEFDEC/TD; Mr. Pawared Inthuserdha, Food Technologist, Senior Professional Level; Dr Walai Kleechaya, Fisheries Industrial Technology and Development Division, Department of Fisheries, Thailand; and Mr Pramuan Rugjai, Adviser, Fish Marketing Organization and Public Warehouse Organization, Thailand, conducted the technical session. The session comprised technical presentations on the *"Importance of Fish Handling; Cold Chain Logistic Management; Modern Technologies for Tuna Preservation Onboard; Different Methods for Onboard Tuna Preservation; Tuna Loading and Unloading Techniques"* aimed at better understanding of fish handling tools, facilities, and handling of problems in tuna handling in the Asia-Pacific region.

On Day 2, a field observation of tuna handling, loading and unloading techniques was conducted at the Fish Quarantine and Inspection Regional Centre 3, Department of Fisheries, Bangkok led by Mr. Khunthawat Manomayidthikarn, Training and Research Supporting Division, SEFDEC/TD. The participants gained knowledge and experience on the basics of onboard tuna handling, preservation, and transportation methods, which will enable them to guarantee quality for significant export destinations.

The acquired knowledge is expected to be disseminated among the tuna post-harvest and quality assurance officers working at field level in INFOFISH Member Countries. On closing, INFOFISH representative and Technical Officer, Mr Sujit Krishna Das, acknowledged SEAFDEC/TD and the Department of Thailand's technical and logistic support in organising the training course. The trainees were each awarded a Certificate of Attendance.

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Photo 1, 2 & 3: Resource persons (Dr Walai Kleechaya, DOF Thailand, Mr. Pawared Inthuserdha, DOF, Thailand and Mr Thaweesak Thimkrap, SEAFDEC/TD) explaining the basics of Onboard Tuna Handling.

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Photo 4 & 5: Trainees from INFOFISH Member Countries and observation of slurry ice preparation.

Philippine seafood industry exhibits at SEG 2024

INFOFISH participated in the Seafood Expo Global (SEG2024) held in Barcelona, sharing a booth together with the following 15 seafood-based industry partners from the Philippines: Agri-Aquatic Care Enterprise, Inc, Bluefin Seafood Export Inc, Bohol Agro-Marine Development Corporation, D & L Seafoods, Department of Agriculture - Bureau of Fisheries and Aquatic Resources, E.M. Buenaventura Trading, FFSAPI-SARGEN HANDLINE Fisheries Improvement Project, Fisher Farms Inc., FRI Seafood Trading, Jam Seafoods, Inc., Jarla Trading, Joel N Mercado Seafood Export Supply, Meliomar, Inc., Nuevo Fresco Marine Trading Corporation, Philippine Cinmic Industrial Corporation, RGE Agridev Corp., Seatrade Canning Corporation and Super Royale Seafoods Int'l, Inc. These companies were present as exhibitors under the auspices of the Bureau of Fisheries and Aquatic Resources (BFAR), with the majority being from the tuna-based sector.

The delegation from the Philippines was led by Ms Amor G. Diaz, Chief of Fisheries Industry Development and Support Services Division. Representing INFOFISH were Mohd Hazmadi Zakaria, INFOFISH Technical and Event Officer, and Mohd Syahir Zahardin, Advertising Officer.

The representatives of the Philippine industry expressed their desire to introduce and further highlight their products more widely, especially to the European market to obtain better prices and to benefit from the high exchange rate between the Euro and local currency. Aside from supplying to their local market, most of the exhibitors were seasoned producers and exporters of seafood products to other countries such as Japan.

Based on the statements from the organiser, Diversified Communications USA, there were 2 244 exhibiting seafood and seafood processing equipment companies from 87 different countries, and 67 national and regional pavilions within 51 248 square meters of exhibit space. The expo also featured educational sessions, tasting demonstrations, and networking events for attendees to learn and connect with others in the industry. It is considered one of the largest and most important seafood trade shows in the world.

Participating in the Seafood Expo Global (SEG) provided a platform for industry from the Philippines to expand market networks and industry trade partners in the world of seafood production, innovation, technology and others. The collaboration between BFAR and the Government of the Philippines is therefore crucial in supporting and promoting the country's fishing industry and its seafood products. In line with its focus on supporting Member Countries to develop their fisheries and aquaculture sectors, INFOFISH is privileged to be able to assist the Philippines in this process.

Some key points about the Philippines seafood industry include:

- The Philippines is one of the top fish-producing countries in the world, with a diverse range of seafood products such as tuna, shrimp, bangus (milkfish), tilapia, and seaweed.
- The industry is a significant source of employment for millions of Filipinos, particularly in coastal communities where fishing and aquaculture are the main livelihoods.
- Small-scale fishers and fish farmers make up a large portion of the industry, but there are also commercial fishing operations and seafood processing companies in the country.
- The Philippines is a major exporter of seafood products, with countries such as the United States, Japan, and China being key markets for Philippine seafood.
- The industry faces challenges such as overfishing, habitat destruction, climate change, and illegal, unreported, and unregulated fishing (IUU). Sustainable management practices and conservation efforts are being implemented to address these issues.

Credit: Hazmadi Zakaria

Credit: Fisher Farms Inc.


Credit: Hazmadi Zakaria

INFOFISH and BFAR representatives at the Philippines Pavilion

TRAINING ON "INTERNATIONAL FISH TRADE, GLOBAL APPLICABLE FRAMEWORK AND MARKET ACCESS", 4–6 JUNE 2024, JAKARTA, INDONESIA

INFOFISH, in collaboration with the Food and Agriculture Organization of the United Nations (FAO), the Ministry of Foreign Affairs (KEMLU), and the Ministry of Marine Affairs and Fisheries (MMAF) of the Republic of Indonesia, together with the Government of Norway, organised a training on "International Fish Trade, Global Applicable Framework, and Market Access".

Hosted by Indonesia, one of the core objectives of the training was to provide a basic understanding of import regulations and the international regulatory framework involving fisheries and aquaculture trade, aimed at facilitating market access and enhancing competitiveness for fisheries and aquaculture products. Participants were also expected to gain foundational knowledge of current trade regulatory frameworks and trends. Another objective was to establish a platform for initiating further discussions on future frameworks applicable to these products.

In the broader context, the training aligned with the Programme Priority Areas (PPAs) of "Blue Transformation", "Equitable Access to Resources for Small-scale Producers", and "Transparent Markets and Trade". It also supported the realisation of Sustainable Development Goal (SDG) 14, which focuses on conserving and sustainably using oceans, seas, and marine resources for sustainable development. Furthermore, it aimed to advance the implementation of Article 11 of the Code of Conduct for Responsible Fisheries, particularly in relation to post-harvest activities and trade.

The training took place over three days from 4–6 June, 2024, at the JS Luwansa Hotel in the city of Jakarta. It was attended by over 47 participants, including government officials from KEMLU and MMAF, industry stakeholders, and key actors in the fisheries and aquaculture value chains. Representatives from various associations participated, including APIKI (Indonesian Fish Canning Association); AP5I (Association of Indonesian Fish Processing and Marketing Producers); APRI (Indonesian Crab Processing Association); AP2HI (Indonesian Pole & Line and Handline Fisheries Association); ASTUIN (Indonesian Tuna Association); INOFE (Indonesian Ornamental Fish Exporters Association); and ADI (Indonesian Demersal Association); as well as observers from the Directorate of Europe II.

The training began with welcoming remarks from INFOFISH Acting Director, Ms Gemma Meermans Matainaho, followed by speeches delivered by Ms Afina Burhanuddin, Deputy Director of the Directorate of American and European Intra-regional Affairs at the Ministry of Foreign Affairs; and Mr Marcio Castro de Souza, Senior Fishery Officer.

As the training was conducted in a hybrid mode, it was facilitated in person by Mr Marcio de Souza and Ms Bhakti Anand, Fish Consultant, as well as in remote mode by other FAO experts in international trade and markets, alongside interactive sessions. Technical and secretarial support was provided by INFOFISH. Interpretation services from English to Indonesian were available throughout the training, fostering active participant engagement through questions posed to the facilitators.

Press release

TUNA 2024

On the occasion of the successful hosting of the 18th INFOFISH World Tuna Trade Conference & Exhibition (TUNA 2024), under the theme ***"Advancing Blue Transformation, Sustainable Development and Innovation through the Global Tuna Industry"***, in Bangkok, Thailand from 20–22nd May 2024, INFOFISH would like to take this opportunity to extend our sincere appreciation and gratitude to all our co-organisers, collaborators, sponsors and partners. INFOFISH acknowledges your partnership and support at all levels and in all forms, as integral to an engaging and vibrant experience for our participants at TUNA 2024 and a wonderfully successful program overall. Thank you and we look forward to meeting again in 2026.

TUNA 2024 Co-organisers

Department of Fisheries, Thailand

Thai Tuna Industry Association (TTIA)

Inter-American Tropical Tuna Commission (IATTC)

Indian Ocean Tuna Commission (IOTC)

Western and Central Pacific Fisheries Commission (WCPFC)

In collaboration with

The Food and Agriculture Organization of the United Nations

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SUMMARY OF THE 18TH INFOFISH WORLD TUNA TRADE CONFERENCE & EXHIBITION

20-22 May 2024. Bangkok, Thailand

The 18th INFOFISH World Tuna Trade Conference & Exhibition or TUNA 2024, was held under the theme 'Advancing Blue Transformation, Sustainability and Innovation through the Global Tuna Industry' and was convened from 20-22 May 2024 at the Shangri-La Hotel in Bangkok, Thailand. There were over 300 delegates in attendance from over 40 countries and a total of 41 booths representing 36 companies and organisations, promoting proven and cutting-edge products, equipment, machinery and services, all of which were very relevant and unique to the tuna industry.

The Chairperson of the Conference was **Ms Rhea Moss-Christian,** Executive Director of the Western and Central Pacific Fisheries Commission (WCPFC), with **Dr Chanintr Chalisarapong**, President of the Thai Tuna Industry Association (TTIA), serving as the co-Chair. The co-organizers of the event included the Department of Fisheries, Thailand and Thai Tuna Industry Association (TTIA); the Food and Agriculture Organization (FAO) of the United Nations; three RFMOs (WCPFC, IATTC, IOTC); ANFACO; Atuna.com; and the TUNA 2024 media partner, Undercurrent News. TUNA 2024 was also supported by Platinum Sponsors Marine Instruments and Maldives Industrial Fisheries Companies (MIFCO); Gold Sponsor BIOLAN; and the Silver Sponsor Arcadia Chemical and Organic Ingredients. The opening ceremony and conference began with a Welcome Address by **Gemma Meermans Matainaho**, Acting Director of INFOFISH, followed by the Keynote Address by Ms Rhea Moss-Christian, and Special Addresses by the Hon. Fisheries Ministers or delegate from several INFOFISH Member Countries: HE Kalaveti Ravu from Fiji, represented by **Rovereto Nayacalevu** (Acting Permanent Secretary of the Ministry); **HE Ribanataake Tiwau** (Kiribati); **HE Ahmed Shiyam** (Maldives) and **HE Jelta Wong** (Papua New Guinea).

Ms Matainaho put forward that the industry was at a critical juncture and this was an opportune moment for it to reflect on how it continues to be a significant player in responding to global challenges, including addressing food security, poverty alleviation, employment opportunities, marine conservation, climate change mitigation, disruptive markets and supply chains, and challenges to sustainable development. She added that how the industry contributes to advancing Blue Transformation, Sustainability and Innovation in line with the theme, may well be important to the industry's vitality and footprint, going forward. Ms Rhea Moss-Christian in her Keynote Address, highlighted that the theme of 'Blue Transformation' is a buzzword and implies that the industry has a significant role to play in this regard. As stated by Ms Moss-Christian, over the next three days, "we will hear how the industry is contributing to real sustainability initiatives". She further stated that it is our collective responsibility to contribute to food security in a challenging world, and that this Conference was an opportunity for the industry as a whole to discuss these issues, and more.

A common theme in the addresses of the Honourable Fisheries Ministers or delegate from Fiji, Kiribati, Maldives and Papua New Guinea, was just how important the tuna industry is for the food security and livelihoods of these nations, and how activities like IUU fishing are so detrimental to the fulfilment of national objectives ("the ocean is our life"). The shared sentiments were that sustainable development, innovation, and collaboration with all stakeholders are therefore crucial for all peoples and the planet. There was also the view put forward that tuna marketed from the Pacific Islands region should have a premium label attached to it and that the tuna, certified as sustainable through methods such as pole-and-line fishing, is able to access international markets. Good governance and

policy reforms are necessary for the industry to respond to international requirements such as the Port State Measures Agreement. A connected and cooperative Pacific can ensure benefits throughout the region, and therefore programmes such as the East New Britain Initiative in Papua New Guinea are of great importance. The Guest of Honour was **Mr Buncha Sukkeow**, Director-General of the Department of Fisheries, Thailand, on behalf of the Minister of Agriculture and Cooperatives, Thailand. With that, the TUNA 2024 Conference and Exhibition was officially declared open by Mr Buncha Sukkeow, following his Welcome Address.

Session-by-session overview

Session 1 – 'An overview of Blue Transformation, sustainability & innovation in the tuna industry', was moderated by **Mr Phil Roberts**, Board Director-Tri Marine International. **Mr Marcio Castro de Souza** (Senior Fishery Officer, International Trade, FAO and Secretary of the FAO Sub-Committee on Fish Trade) presented on the topic *'Blue Transformation Roadmap 2022-2030'*. He explained 'Blue Transformation' as a multi-stakeholder, collaborative approach to enhance the role of aquatic food systems in meeting food security and nutrition needs for all populations in a sustainable manner; and to open the doors for secure market access. **Dr Manumatavai Tupou-Roosen** [Director General, Pacific Islands Forum Fisheries Agency (FFA)], followed with a presentation on 'Our People, Our Fisheries, Our Future'. Her key messages were that: "our Pacific home is 96% ocean; our ocean and our fisheries are a lifeline for our people, who are custodians of the world's largest and healthiest tuna fisheries. In advancing Blue Transformation in our Blue Pacific Continent, we safeguard our future, and when we talk about our oceans, we talk about unity". She added that Pacific leaders look to the 2050 Strategy for the Blue Pacific Continent and the Regional Roadmap for Sustainable Pacific Fisheries as frameworks for peace and prosperity. **Ms Rhea Moss-Christian** (Executive Director of the Western and Central Pacific Fisheries Commission (WCPFC)), highlighted that the Commission oversees the world's largest tuna fishery, valuable not only in terms of biological wealth but also due to its significant socio-economic impact to small island nations in the region. Her key message was that the WCPFC is engaging with various stakeholders to enhance efficiency in the way it manages Pacific tuna fisheries. This is seen in its efforts to develop harvest strategies; bycatch mitigation, and incorporate technology to support data collection, such as electronic reporting and electronic monitoring; and streamlining of reporting requirements. She surmised that "without good data, we cannot have good management". **Dr Paul de Bruyn** [Executive Secretary of the Indian Ocean Tuna Commission (IOTC)], said that the IOTC's focus continues to be on sustainability issues such as catch allocations, Fish Aggregating Devices (FAD) management, catch limits for key tropical tuna species, improved data for neritic tuna species as well as socio- economic considerations when developing management measures. Further, the IOTC has made strides in its science management and compliance processes and there is also a Technical Committee on Management Procedures. **Professor Dr Quentin Hanich** [Fisheries Governance Program Leader at the Australian National Centre for Ocean Resources and Security (ANCORS) at the University of Wollongong], said that despite the adoption of various conservation and management measures by the WCPFC and the IOTC, a major challenge lies in struggling to achieve equity; for without this as a basis, there would likely be no sustainability. Of crucial importance is the possession of exclusive sovereign rights to determine management and access. **Mr Steven Adolf** (Senior Advisor, High Seas Alliance), highlighted last year's adoption of the United Nations Agreement on the Conservation and Sustainable Use of Marine Biological Diversity of Areas Beyond National Jurisdiction Treaty (known as the High Seas or BBNJ Agreement) as a crucial moment in global sustainable governance of the biodiversity in our oceans. Particularly for the tuna Regional Fisheries Management Organisations (t-RFMOs), BBNJ policy decisions will have important consequences at RFMO level. In his opinion too, the BBNJ brings new hybrid sustainability claims to the market, and that a biodiverse certified tuna label on cans may be a part of the future.

Session 2 – Global tuna industry effort and actions towards sustainability and innovation and Sub-Session 2.1 – Tuna industry efforts and actions towards a resilient and sustainable industry, was moderated by **Mr Marcio Castro De Souza,** Senior Fishery Officer, FAO. **Mr Luciano Pirovano** (Chief Sustainability Officer, Bolton Food and Tri Marine/ Chairman, AIPCE-CEP Sustainability Working Group, Italy) presented on the topic 'European industry as positive agents of change'. He said that the AIPCE-CEP (EU Fish Processors Associations) through its Sustainability Working Group, is working on a manifesto by the end of 2024, which (i) can serve as a common statement which policymakers can refer to, with full confidence of representing the entire European seafood sector; (ii) will be a roadmap to approach sustainable practices throughout the supply chain; (iii) will position fish and seafood as food with a unique nutritional profile. **Mr Thue Barfod** (Gobal Director of the Fish and Seafood Vertical, Maersk, Singapore), stated that shipping currently accounts for approximately 3% of greenhouse gas emissions (GHG), according to the International Maritime Association. In addressing the issue of GHG, he said that Maersk is decarbonising its operations in partnerships with customers and suppliers as well as investing in technology. However, he cautioned that the defining issues of our time are climate and nature in crisis, as well as political or natural upheaval. **Ms Janice Molloy** (Trust Convenor, Southern Seabirds Trust, New Zealand) stated that in 2006, she established the Southern Seabirds Trust, made up of the New Zealand fishing industry, WWF New Zealand, indigenous fishing interests, and the New Zealand Government. A Seabird-Safe Fishing Toolkit is being developed with guidance from a range of tuna companies and organisations, bringing together information on practical measures to reduce seabird bycatch and ways for companies to demonstrate the measures in use. She

ended by saying "what is good for the birds, is good for business". In his presentation on a case study regarding an assurance model for mitigating risks on tuna sourcing and meeting market requirements, **Mr Marcelo Hidalgo** (Sustainability & CSR Director, Fishing Industry Association of Papua New Guinea), said that in 2018, the Fishing Industry Association of Papua New Guinea (FIA PNG) had committed to the Responsible Sourcing Policy (RSP). This is a due diligence Assurance Model based on four pillars addressing market requirements and in working together with the National Fisheries Authority (NFA). Some of its outcomes are: (i) that it prioritises stakeholder engagement at all stages of development and implementation; (ii) it prioritises transparency and accessibility of data related to fisheries management, monitoring and evaluation; and (iii) it promotes a culture of continuous learning within the fishing industry.

Session 2 – Global tuna industry effort and actions towards sustainability and innovation' and Sub-session 2.2– Strengthening industry commitments, partnerships and innovation towards sustainability' was moderated by **Mr Neil Bohannon,** Group Procurement Director-Princes Group United Kingdom. In this session **Dr Chanintr Chalisarapong** [President, Thai Tuna Industry Association (TTIA)], spoke on *'Leading by example: The TTIA experience'*. He stated that the Association, the largest company in the world for tuna procurement, supports ILO C188 - Work in Fishing Convention and has set guidelines for its Members and the supply chains to implement these standards, including those related to labour recruitment practices. TTIA is also collaborating with the International Labour Organization in the Ship to Shore Rights Project to develop better working conditions in the seafood industry. Other key areas of focus are global warming, reduction of carbon emission, plastic pollution, and effective utilisation of tuna raw material to reduce loss and wastes. "Partnership is our leadership", said **Mr Luciano Pirovano** (Chief Sustainability Officer, Bolton Food and Tri Marine/Chairman, AIPCE-CEP Sustainability Working Group, Italy). The company manages the issue of sustainability by working together with global strategic partners in full compliance with Goal 17 (Partnership for the Goals) of the Sustainable Goals of the UN 2030 Agenda. He added that Bolton Food works on four pillars: sustainable fishing and ocean health; human rights and community support; sustainable production; and health and nutrition. The company also has a clear focus on human rights, with one such initiative being its 'Speak Up' policy developed under the European Whistleblowing Directive, and which contains grievance mechanisms.

Mr Ahmed Shamaah Rasheed [CEO, Maldives Industrial Fisheries Company Limited MIFCO)] presented on the topic *'Maldives Industrial Fisheries Company Limited's role in modernising the Maldives fishing industry and promoting sustainability'*. Since its establishment in 1993, MIFCO has focused on modernisation of the Maldives' fisheries sector. The company's dedication to sustainability is founded upon the traditional pole-and-line fishing technique, under the theme of environmental stewardship and sustainable living. MIFCO tuna products meet the requirements of certification schemes such as Marine Stewardship Council, Dolphin Safe, and ISO 22000. **Dr Toni Ruchimat (**Policy Advisor, Indonesia Tuna Consortium) under the topic *'One step forward: Tuna Harvest Strategy in Indonesian archipelagic waters'* said that the Ministry of Marine Affairs and Fisheries unveiled a Harvest Strategy, focused on expanding Indonesian tuna production while promoting sustainability. Through the Strategy and collaboration with international organisations in the Tuna Consortium (MDPI, IPNLF, Marine Change, Fair Trade USA, and Konservasi Alam Nusantara, with the Implementing partner being Resonance Global), Indonesia is positioned to secure the future of its tuna fisheries while ensuring the long-term health of its marine ecosystems. On the topic *'Sustainability and the consumer in the Australian and New Zealand markets'*, **Mr Tim Anastasopoulos (**Procurement Senior Category Manager, Simplot Food Group APAC) put forward that 'greenshouting' (as opposed to 'greenhushing') could be useful going forward. He pointed to the fact that the tuna industry has made enormous progress in resource sustainability. However, results of recent studies in Australia and New Zealand indicate that whilst sustainability is a factor considered when purchasing canned tuna, it ranks below other factors such as price, quality or brand name. The industry needs to simplify the sustainability message for consumers, who are bombarded by many labels on cans like MSC-certified, FAD-free, Responsibly Sourced, and 100% pole-and-line.

Session 3 – Blue Transformation and Sustainable Supply Chains was moderated by **Mr Henk Brus,** Managing Director-Pacifical, Netherlands. In this session **Mr Daniel Suddaby** [Executive Director, Global Tuna Alliance (GTA)] said that the GTA has evolved from working on transforming tuna management and the supply chain, to new focus areas in its Phase II: (i) deepening the trust and relationship with its partners; (ii) disruptive RFMO impact (highly collaborative, bespoke partnership engagement plans); and (iii) transforming into a diligent/professional organisation. **Dr Hilario Murua** [Senior Scientist at the International Seafood Sustainability Foundation (ISSF)] highlighted how effective collaboration between industry, science, and the conservation community, is driving transformative vessel to-plate transparency. The ISSF favours a multifaceted approach, including the adoption of tools such as the ISSF

ProActive Vessel Register (PVR) and the Vessels in Other Sustainability Initiatives (VOSI) list. In conjunction with ISSF conservation measures for participating seafood companies, these tools jointly offer a comprehensive assessment of supply chain sustainability pledges. On the topic *'Global dialogue in seafood traceability'*, **Mr Huw Thomas** [Asia Pacific Market Development Lead at the Global Dialogue on Seafood Traceability (GDST)], presented on the development of the GDST Standards and Guidelines for interoperable Seafood Traceability Systems. In effect, GDST enables a global seafood trade where seafood buyers use a common language when talking about the seafood they catch, farm, buy or sell and can capture the information in a standardised way so that when digitised, it can be used seamlessly for traceability, transparency, enforcement, and validation. The Standard is updated through an annual dialogue process involving partner companies and stakeholders. **Mr Henk Brus** (Managing Director, Pacifical) warned against the dangers of "greenwashing" and that the industry must be careful to ensure that the sustainability label on a can is an accurate reflection of what is inside. He added that current tuna certifications and traceability systems are almost all based on mass balance, administrative data reporting, and periodic random verification on land or in port, but not at sea. He also spoke about using the Global Dialogue on Seafood Traceability (GDST) data exchange protocol, and said that Pacifical is the first in the world to have a realtime GDST data exchange between an information provider and the end-market (i.e. the just-announced collaboration between Australian company J.R. Simplot Company's John West brand, and Pacifical).

Session 4 – Sub-Session 4.1-Global tuna market trends from across major regional markets was moderated by **Mr Luciano Pirovano,** Chief Sustainability Officer-Bolton Food and Tri Marine, Italy. In this Session, **Mr Roberto C. Alonso,** Secretary General of ANFACO-CECOPESCA presented on the European Union's canned fish market and also gave an analysis of current market trends, highlighting key players and drivers of trade flows. Noticeably, 'being safe to eat' has risen to be a top motivator of purchase across most product types; and being 'wild-caught' is an increasingly important motivator for fresh fish purchase. Of importance to the trade is the EU's expansive and extensive legislative landscape and how to navigate its complexities. **Mr Dario Chemerinski** (Senior Business Director, SSP- Selecting Strategic Partners) spoke about *'How growing competition from China and IUU undermine Ecuador's tuna supremacy in Latin America: Lessons for the global industry'*. An indicator of this impact is that between 2015 and 2022, Ecuador's share of the tuna market fell from 32% to 26%, while China's grew from 9% to 24%. Also, some 27% of Ecuador exports normally go to markets in Latin America, particularly Brazil, Argentina and Colombia but this figure has declined in recent years. In the meantime, Ecuador has signed a Free Trade Agreement with China that excludes tuna and maintains a zero-tolerance approach to IUU. On the topic *'Canned tuna and innovation in the Middle East: adapting to a changing world and ensuring a sustainable future'*, **Mr Arnab Sengupta** [Deputy CEO, J.M.B. International (Thailand) Co. Ltd] said that the Middle East and Africa region has been accepting of many European national brands, and products such as tuna salad and other value-added products. Rio Mare and John West, in particular, are carving a niche in the premium segment. It is also a market of interest for value-added brands from the Philippines, with primary focus on their own diaspora. He presented his analysis of the size of the market region for canned tuna (worth about USD 800 million), adding that it is crucial to target Generations Y and Z in order to expand the market for tuna in the region. **Mr Amornphan Aramwatananont** [Director, Thai Tuna Industry Association (TTIA)] spoke to the topic *'Asia and the Pacific: Thailand Tuna Industry Experience'*, stating that the Asia-Pacific region is home to a huge chunk of the global tuna industry. Some 56% of frozen whole tuna exports comes from the region, and Thailand holds the highest share of 30% of global exports, producing approximately 500 000 tonnes of canned tuna per year. The Thai industry prioritises sustainable growth through the three core policies of Food Safety, Sustainability and Ethical Standards. An opportunity for tariff relief comprises the TH-EU FTA and IPEF negotiations.

Session 4 – Sub-Session 4.2 – Improving production, market promotion, access, trade & investment, innovation and sustainable tuna industry growth, was moderated by **Mr Juan Corrales,** CEO-Tri Marine International, USA. **Mr Neil Bohannon** (Group Procurement Director, Princes Group United Kingdom) spoke to the topic *'Communicating Tuna Through the Ages'* and reflected on the question 'why is it so hard for the industry to communicate about sustainability?'. The global tuna industry is of course highly complex; it is managed by government bodies and organisations, who have their own national interests and priorities. He pointed to the proliferation of eco-labels, of which the MSC label has a clear edge in consumer recognition and trust. He concluded that brands and retailers need to support FIPs and recognise MSC certification as a shared end-goal; tuna RFMOs need to go further and faster in improving measures across all gear types; and fishing nations need to put sustainability first while putting politics aside. The presentation on *"Fluctuating tuna prices: Uplifting the value of tuna"* by **Mr Matthew Owens** (Sustainability Director,

Tri-Marine Group) highlighted several positive trends: a fairly stable global tuna supply annually; and increasing consumer demand. However, short-term variation in supply is significant across species, regions and time periods, causing sizeable price fluctuations. Some degree of market balance may be achieved through value-added innovation. Strategies for uplifting value include: (i) emerging economies could shift to more premium products, e.g., from flake to chunk; (ii) growth of ecolabeling; and (iii) product innovation focused on convenience (pouches), or tuna as an ingredient (salads, snack kits). **Dr Magnus Bergkvist,** Head of Science & Research, Global Innovation Center, Thai Union Group PCL, under the topic *'Valorisation of wastes in tuna processing',* highlighted some of the research-to-market work within the Thai Union structure related to the utilisation and valorisation of by-products from tuna processing. Most recently, a state-of-the art collagen and peptide processing plant is manufacturing products like UniQDHA (tuna oil), other Omega-3 oils (algal oil, cod liver oil, salmon oil), UniQBONE (tuna bone powder), and UniQPEP (protein hydrolysate in liquid form). Other interesting products from Thai Union include ZEA Tuna Essence (a nutritional drink containing tuna hydrolysate).

Session 5 – Advancing global food security and livelihoods for healthier communities, was moderated by **Dr Adisorn Promthep** (former Director General-Department of Fisheries, Thailand and current advisor to TTIA). **Mr Martin Purves,** Managing Director at the International Pole & Line Foundation (IPNLF) spoke on *"Enhancing Market Access for Small-Scale Fishermen through Private-Public Partnerships (PPPs)".* This presentation explored successful and innovative PPP models, related to areas such as: (i) quality improvements: a collaboration between the IPNLF, Seafood Souq and Omani fishers where sashimi grade yellowfin is processed using improved handling techniques; (ii) renewable energy: a solar-powered ice maker where IPNLF is working with German agency GIZ; and (iii) operational efficiency: electronic monitoring and electronic catch documentation and traceability systems (eCDT). On the topic *'Making the invisible, visible: strengthening the role of women in the tuna sector',* **Ms Sandra Ochoa Jaramillo** (Chief Industrial Officer, Bolton Food and Tri Marine), highlighted that women in the tuna industry have played a crucial, but often overlooked, role in the tuna industry, Gender-sensitive policies would aid women workers to achieve better welfare and working conditions; and women themselves need to better understand their rights. An example of Bolton Food's work in enhancing gender equality is the launch of a new Conduct Code. Future plans include: (i) mapping the minimum living wage; (ii) enhancing employment engagement; (iii) by 2025, 40% of management positions to be held by women; and (iv) offering professional development training to women.

Session 6 – Blue transformation, innovation, research, science and technology and Sub-session 6.1 – Innovation and food safety was moderated by **Mr Bubba Cook,** Program Manager, World Wide Fund for Nature, New Zealand. In a presentation on *'Digital analytical solutions & environmental safety',* **Mr Antonio Bustamante** (Manager, BIOLAN Southeast Asia) stated that digitalisation is playing an important role in assuring market players and retailers of the validity and transparency of data that has been collected and the processes involved. Further, every tool in the processing sector will very soon be digitally connected, increasing accessibility and transparency. In doing its part, BIOLAN has adopted new laboratory and software innovations which aim towards cleaner and more sustainable practices while optimising efficiency. On *'Tuna Grading using AI',* **Mr Kazuhiro Shimura** (Group Creative Director, Dentsu Inc) and also the project leader of TUNA SCOPE, presented on the world's first AI solution which assesses tuna quality ("an expert eye for AI"). It uses deep learning to master the discerning skills possessed by skilled artisans in Japan, translating this rich tradition into a single smartphone application that anyone can use to judge tuna quality. It also focused on the development and future possibilities of "TUNA BRAIN", an AI development platform that can be tailor-made to meet the discerning standards of different factories. **Mr Julien Vidus** (Regional Sales Director, Fish Asia and Oceania, Marel) presented on the topic *'Innovative and sustainable practices in tuna grading'.* He spoke on the company's commitment to sustainability, as reflected in its innovative equipment and software solutions which are designed to mitigate food waste, enhance resource efficiency, and reduce environmental impact in food (including fishery products) processing. Its weighing, grading, and batching solutions for tuna help streamline production processes, aligning with purchase orders and customer requirements. In future, the company expects that its processing systems will be based on IoT and AI. *"A journey of innovation"* was the theme for the presentation by **Mr Jorge Perez-Bouzada** (Sales Director, Marine Instruments). He focused specifically on the Tunadrone, a drone designed specifically for the fisheries sector; it allows fishers to locate tuna, FADs and birds, while also helping in security monitoring. The Tunadrone actually evolved from an earlier drone model which was used by the Spanish navy and government to locate and track targets at sea, as part of IUU surveillance and control efforts. As it is solar and battery-powered, the carbon footprint is reduced. After a long period of trials, this year, he said, the Tunadrone is ready for the tuna industry.

Session 6 – Blue transformation, innovation, research, science and technology and Sub-session 6.2 – Smart and innovative fishing technology was moderated by **Mr Bubba Cook,** Program Manager-World Wide Fund for Nature, New Zealand. **Mr Pedro Vigil Díaz** (Global Sales Director, SATLINK) in his presentation on *'Smart technologies towards a new era in sustainable tuna fishing'*, stated that tuna fishing is evolving towards a new era, where smart technologies are essential to guarantee the long-term sustainability of both the fishing activity and ocean resources. Among SATLINK's solutions for the tuna fishing industry are smart DSFs (Devices for Sustainable Fishing), that allow fleets to obtain accurate information on the best fishing locations and different species present. The capture of species subject to restrictions is minimised, while allowing fleets to focus on target species and comply with quotas, optimising fishing efforts and saving time, resources, fuel, and carbon footprint. **Mr Ángel Martinez** (Commercial Director, Zunibal) in his presentation on *'Sustainability as opportunity: reframing the future with smart technology'* described some of Zunibal's state-of-the-art products which aim at locating optimal fishing areas; web-based electronic monitoring using buoy technology; accurate biomass estimation and specific species detection; and evaluating the effectiveness of FADs through bio-based FAD rafts. An interesting fact is that, as part of the global Searcle project, Zunibal engages with artisanal fishing communities in closed-loop recycling initiatives, in collaboration with industry partners, government agencies, scientific groups and local communities. **Mr Eric Enno Tamm,** CEO/Co-Founder of ThisFish Inc., Canada, presented on *"The role of Artificial Intelligence (AI) in Blue Transformation and tuna sustainability - how AI will disrupt the tuna industry"*. He spoke about the current uses of AI in the seafood sector; for example, how AI can make predictions on salinity based on real-time data so that the fishers on purse-seiners can better manage salinity levels during chilling, freezing and storage onboard. Concepts such as machine learning, neural networks, computer vision and large language models were explained. He concluded with some practical advice on how companies can prepare themselves for the AI revolution.

Session 7 – Blue transformation and the future of certification, social accountability and sustainability in contributing to a safer, clear and responsible global tuna industry and planet, was moderated by **Mr Phil Roberts,** Board Director, Tri Marine International. In his presentation on *'New horizons: Ensuring crew welfare at the nexus of technology'*, **Mr Bubba Cook** [Western and Central Pacific Tuna Programme Manager, World Wide Fund for Nature (WWF)] highlighted that "there are no shades of grey when it comes to treating fishers with respect". Recent advancements in technology have provided valuable tools and methods for promoting human rights and labour rights at sea, including worker voice initiatives, cameras on vessels, satellite tracking and monitoring, as well as data analytics and predictive models. However, technological solutions must be complemented by robust legal frameworks, effective enforcement mechanisms, and collaboration among stakeholders. **Mr Mohammad Arifsyah** (Global Project Lead, Beyond Seafood Campaign, Greenpeace Southeast Asia) highlighted that fishers, many of them migrant workers, are vulnerable to severe forms of human rights abuse on board fishing vessels. It is crucial to mainstream and enhance a human rights-based approach in fisheries management and ocean protection at all levels to achieve effective, inclusive, sustainable, and just conservation of marine ecosystems; as well as to eliminate human rights abuses and advance accountability, transparency and sustainability in the global tuna fishing industry and its supply chains. **Ms Nada Bougouss** (Fishery Officer, Fisheries and Aquaculture Division, Food and Agriculture Organization of the United Nations) spoke on *"Social responsibility and traceability in aquatic value chains"*, linking it to the Blue Transformation framework. Child labour, fair treatment of migrant workers, gender equity and equality are some of the key issues that are discussed in FAO Guidances on social responsibility. The traceability landscape continues to improve as a result of the expanding implementation of international instruments designed to combat IUU fishing. Some of the key traceability documents are the FAO Agreement on Port State Measures; FAO Voluntary Guidelines for Transshipment; and the Voluntary Guidelines on Catch Documentation Schemes. **Mr Bill Holden** [Senior Tuna Fisheries Outreach Manager, Marine Stewardship Council (MSC)] updated delegates on the *'MSC Fisheries Standard v3.0'* which will become effective in February 2025, for all fisheries seeking to become certified to the MSC Standard. While all fisheries will need to transition to this version of the Fisheries Standard by 1 November 2030, tuna fisheries in the WCPO region have engaged early by requesting independent assessors to apply Section SE of this Standard for

the scoring of Principle 1 Performance Indicators for Harvest Strategies and HCRs in 2023-24. In doing so, these fisheries have agreed to be assessed against all of Fisheries Standard v3.0 at their next reassessment for WCPO bigeye, yellowfin, skipjack and South Pacific albacore. **Mr Paolo Bray** (Founder and Director, Friend of the Sea and Dolphin-Safe Project) in his presentation on *'Satellite and CCTV monitoring, augmented reality audits and marine biodiversity offsets: sustainable seafood certification according to Friends of the Sea and Dolphin-safe project'*, he stated that Friend of the Sea is the only certification which can potentially certify both wild-caught and farmed seafood. The organisation conducts continuous post-audit satellite monitoring of approved Friend of the Sea vessels to verify compliance with Dolphin-Safe and other requirements. In addition, the program is introducing Marine Biodiversity Offsets to allow seafood companies to offset their impact on the environment by contributing to marine restoration and conservation programs.

Key closing remarks

Ms Rhea Moss-Christian, Executive Director of the Western & Central Pacific Fisheries Commission (WCPFC), summed up the 18th INFOFISH World Tuna Trade Conference & Exhibition in her capacity as Chair. She said that in the past three days there have been many interesting presentations and conversations both in the Conference room as well as in the corridors. Much time has been spent on discussing issues such as the global tuna market; how to add more value to our product; the amazing technological advances that are happening; and how these will change the way that we work in the industry. She added that the Conference ended appropriately with a focus on the people that matter, to do right by the people who are dependent on what we do. The commitment is clear for the industry, that all stakeholders must make a lasting impact on people and the environment; and in doing so, it will not be possible to not play our part in contributing to the Blue Transformation objectives.

Ms Gemma Meermans Matainaho, Acting Director, INFOFISH, thanked all speakers, moderators, participants, and exhibitors for sharing their expertise and innovations at the Conference. Deep appreciation was also expressed to the Chair Ms Rhea Moss-Christian and co-Chair of TUNA 2024 Dr Chanintr Chalisarapong; the sponsors (Platinum Sponsors: Marine Instruments, and Maldives Industrial Fisheries Company; Gold Sponsor: BIOLAN; and Silver Sponsor: Arcadia); the joint organisers Department of Fisheries, Thailand; Thai Tuna Industry Association; IATTC, IOTC, and the WCPFC; collaborators FAO and ANFACO-CECOPESCA; and media partners, Atuna and Undercurrent News.

2nd High-Level Ministerial and Industry Roundtable on Sustainable Tuna Fisheries

The 2nd High-Level Ministerial and Industry Roundtable on Sustainable Tuna Fisheries was held on 22 May on the sidelines of the 18th INFOFISH World Tuna Trade Conference and Exhibition.

The event brought together the Honourable Ministers from Fiji (Acting Permanent Secretary **Rovereto Nayacalevu**, on behalf of the Hon Minister), Kiribati (**HE Ribanataake Tiwau**), Maldives (**HE Ahmed Shiyam**), Papua New Guinea (**HE Jelta Wong**), Republic of the Marshall Islands (**HE Anthony Muller**) and Solomon Islands (**HE Nestor Ghiro**); as well as the Western & Central Pacific Fisheries Commission (Executive Director, **Ms Rhea Moss-Christian**), Pacific Islands Forum Fisheries Agency (Director General, **Dr Manumatavai Tupou Roosen**), Department of Fisheries Thailand (**Ms Sampan Panjarat**, Director of the Fisheries Development Policy and Planning Division), and President of the Thai Tuna Industry Association (**Dr Chanintr Chalisarapong**).

Observers included representatives from the Autonomous Region of Bougainville; Food and Agriculture Organization of the United Nations (FAO); Thai Tuna Industry Association (TTIA); Ministry of Foreign Affairs, Thailand; Embassy of the United States of America; Bolton Group Food Business Unit; Princes Group, UK; National Fisheries Authority, Papua New Guinea; Tri Marine International; Bolton Food and Tri Marine, USA; Tri Marine International, Singapore; Global Tuna Alliance; Indonesia Tuna Consortium; Global Dialogue on Seafood Traceability; International Seafood Sustainability Foundation; Marshall Islands Marine Resources Authority; and Bureau of Fisheries and Aquatic Resources, Philippines.

The 2nd High-Level Ministerial and Industry Roundtable on Sustainable Tuna Fisheries was moderated by **Mr Marcio Castro de Souza**, Senior Fisheries Officer for international trade, Food & Agriculture Organisation (FAO) and Secretary of the FAO Sub-Committee on Fish Trade (COFI:FT) of the United Nations. The two key themes were (i) cooperation and partnership; and (ii) fair access to major markets. A Joint Communique was issued as an outcome of this Ministerial and Industry Roundtable.

JOINT COMMUNIQUÉ

The closed-door 2nd Ministerial and Industry Roundtable on Sustainable Tuna Fisheries, held in conjunction with the 18th INFOFISH World Tuna Trade Conference and Exhibition (TUNA 2024), was a pivotal event. It provided an excellent opportunity to revisit the discussions and statements made during the 1st Ministerial and Industry Roundtable, which took place during the 17th INFOFISH World Tuna Trade Conference and Exhibition in October 2022.

Present at the 2nd Ministerial and Industry Roundtable on Sustainable Tuna Fisheries were the Honorable Fisheries Ministers from Fiji (Acting Permanent Secretary Rovereto Nayacalevu, on behalf of the Hon Minister), Kiribati (HE Ribanataake Tiwau), Maldives (HE Ahmed Shiyam), Papua New Guinea (HE Jelta Wong), Republic of the Marshall Islands (HE Anthony Muller) and Solomon Islands (HE Nestor Ghiro); as well as senior authorities of the Western & Central Pacific Fisheries Commission (Executive Director, Ms Rhea Moss-Christian), Pacific Islands Forum Fisheries Agency (Director General, Dr Manumatavai Tupou Roosen), Department of Fisheries Thailand (Ms Sampan Panjarat, Director of the Fisheries Development Policy and Planning Division), and President of the Thai Tuna Industry Association (Dr Chanintr Chalisarapong).

Observers included representatives from the Autonomous Region of Bougainville; the Food and Agriculture Organization of the United Nations (FAO); Thai Tuna Industry Association (TTIA); Ministry of Foreign Affairs of Thailand; the Embassy of the United States of America; Bolton Group Food Business Unit; Princes Group UK; National Fisheries Authority of Papua New Guinea; Tri Marine International; Bolton Food and Tri Marine USA; Tri Marine International Singapore; Global Tuna Alliance; Indonesia Tuna Consortium; Global Dialogue on Seafood Traceability; International Seafood Sustainability Foundation; Marshall Islands Marine Resources Authority; and the Bureau of Fisheries and Aquatic Resources of the Philippines.

The 2nd Ministerial and Industry Roundtable on Sustainable Tuna Fisheries was moderated by Mr Marcio Castro de Souza, Senior Fisheries Officer for International Trade, Food and Agriculture Organization of the United Nations (FAO). He additionally serves as the Secretary of the FAO Sub-Committee on Fish Trade (COFI:FT).

The Roundtable:

Focused on *two* key themes that were considered to be of pressing importance in the industry: (i) **cooperation and partnership;** and (ii) **fair market access.**

Recognized that the Western and Central Pacific Ocean is home to the world's largest tuna fishery, upon which resource-holding countries and communities, as well as intermediary processing nations are greatly dependent for livelihoods, food security and socio-economic development.

Acknowledged that the collective action of all stakeholders remains critical to the effective implementation of **Blue Economy** and **Blue Transformation** strategies. Specifically mentioned was the East New Britain Initiative which aims to equitably redistribute the benefits derived from tuna fisheries among the Pacific Islands who are members of the Forum Fisheries Agency (FFA).

Recognized that **illegal, unreported and unregulated (IUU)** fishing remains an ongoing concern in global tuna fisheries and that many vessels still do not use electronic monitoring and tracking systems. Tackling the issue necessitates having the capacity and an enabling legislative environment in accordance with key international agreements that address IUU fishing, including the 2009 Agreement on Port State Measures to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing (PSMA) and other associated instruments. The Roundtable highlighted the importance of collaboration and cooperation in addressing IUU fishing and promoting sustainable management of tuna resources in EEZs and on the high seas beyond national jurisdiction, particularly through initiatives at the national and regional levels. The Roundtable further urged increased **cooperation between the resource-holding countries and the industry,** including processors, distributors and traders to minimize the possibility of and penalize the entry of illegally caught fish into global markets.

Highlighted that there are disparities and inequalities in global trade which restrict **market access** for tuna originating from developing countries, both resource-holders and processors, as a result of tariff and non-tariff measures in the importing nations.

Resource-holding countries, which were described as receiving only 20 percent of the economic benefits of trade, consider that they should be able to realize more revenue from global trade. On the other hand, it was suggested that in order to achieve this goal, resource-holders should consider **adding value** to the tuna that they export ("focus on value, not volume") and that the Vessel Day Scheme (VDS) needs to be dismantled or reformed to improve control over harvested volume. In order to add value to tuna and increase trade revenue, it was noted that additional conversations should be high on the agenda at all regional and sub-regional forums, including RFMOs.

Processors are dependent on the supply of raw material, certified as sustainable, from resource-holders and are, at the same time, affected by tariff and non-tariff barriers as the producing nations. Therefore, a call was issued for both processors and resource-holders to cooperate in speaking forcefully in one voice to developed markets, either bilaterally (processor-producer), trilaterally (processor-producer-developed market representatives) or through larger platforms. It was suggested that the tuna sector in each country should collaborate with their respective ministries in charge of fisheries, foreign affairs, and trade, to improve market access considering its multi-level dimensional complexity. If tariffs can be reduced and non-tariff barriers eliminated, both processors and producers will benefit. Ultimately, **market access must be fair.**

Further highlighted that the price of tuna found on the shelves in major markets remains too low, typically less than USD 1 per can. Although this has been discussed at numerous global forums, the topic was raised once more: how can tuna be sold at prices that represent their genuine value as a rich source of protein?

Reaffirmed the importance of **Regional Fisheries Management Organizations (RFMOs),** which have the authority to establish fisheries conservation and management measures on the high seas for tuna and other fisheries based on cooperation among fishing countries. It was observed that many RFMOs associated with tuna production are investing heavily in data systems to facilitate traceability processes. Furthermore, cooperation and collaboration were recognized as being of vital importance to achieve RFMO objectives in resource management and climate change mitigation. With regard to the latter, the recent ground-breaking advisory opinion issued by the International Tribunal for the Law of the Sea (ITLOS) was highlighted as being an important call for States to exercise their obligations to protect and preserve the world's oceans from climate change impacts, such as ocean warming, sea level rise and ocean acidification; and

Reminded participants that cooperation and market access are key elements contained in the **Blue Transformation** framework which seeks to achieve balance and shared benefits.

The Roundable concluded that:

(i) Cooperation and collaboration initiatives within the Western and Central Pacific among the resource-holding countries are continuing apace, but more can be done. Similarly, enhanced cooperation and dialogue between resource-holding countries, the intermediary processing countries and international markets is vital;

(ii) IUU fishing remains an ongoing concern, and that all States should ratify and adhere to the PSMA and other relevant instruments, as well as take all steps to enhance traceability and transparency;

(iii) Value addition on a larger scale was proposed as an approach for resource-holding countries to increase the revenue derived from the tuna caught in their EEZs;

(iv) Tariff and non-tariff measures in major global markets bring significant disadvantages to tuna and tuna products from developing countries. Further opportunities for dialogue among all stakeholders in the global trade should be promoted, including the participation of representatives of major importing markets and their governments;

(v) Further dialogues should be held among all stakeholders, so that concrete steps and action can be taken. The Food and Agriculture Organization and INFOFISH stand ready to assist in these efforts, guided also by the tenets of the Blue Transformation framework.

— New Show Dates —

Asian-Pacific Aquaculture 2024

Aquaculture - Driving the Blue Economy

2-5 July, 2024

Grand City
Surabaya, Indonesia

The Annual International Conference & Exposition of World Aquaculture Society and Asian Pacific Aquaculture 2024 Annual meeting of Asian Pacific Chapter, WAS

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EUROFISH

EUROFISH HOSTS THREE ASSOCIATIONS AT SEG/SPG

The Eurofish stand at Seafood Expo Global/Seafood Processing Global this year hosted associations from Hungary and Lithuania

Eurofish participated in the 42nd edition of Seafood Expo Global/Seafood Processing Global (SEG/SPG) in Barcelona at the end of April. The event is the biggest seafood show in Europe in terms of the numbers of exhibitors, visitors, and countries represented. This year the 2 250 exhibitors were spread over more than 51 000 sq m of space.

Four Eurofish member countries did not have national pavilions at the show (all the other nine did). As part of the member country benefits that Eurofish offers, seafood associations from the four countries were invited to share the Eurofish stand. This year Albania, Hungary, and Lithuania were represented by a ministerial delegation (from Albania) and three associations, one from Hungary and two from Lithuania. For the Hungarian delegate, a producer of African catfish, the fair proved an eyeopener. Although he had visited in previous years, having access to a stand and being able to offer samples of his products to passers-by made it a completely different experience. For the Lithuanians too, it was again a very positive experience with lots of interest in the products (smoked carp, carp bellies, trout, and African catfish) they had brought with them.

The products, services, and processing machinery on display at the two events, SEG and SPG, offered valuable insights into market and consumer trends in seafood and packaging. As one attendee, a chef, remarked, today packaging is equally, if not more, important as the taste of the content. Through the Seafood Excellence Global Awards, the show highlights these trends, providing a useful summary of the latest in tastes, textures, and presentation forms.

Eurofish itself attended with three people including Marco Frederiksen, the Director, who spent one afternoon moderating a GLOBAL G.A.P.-organised panel discussing traceability and transparency in aquaculture supply chains. The show in 2025 will run from 6 to 8 May and Eurofish plans again to offer associations from its member countries the opportunity to participate as the potential benefits in terms of promotion and information-gathering are significant.

REDUCTIONS IN QUOTAS OF KEY WHITEFISH SPECIES

The Globefish Highlights have been given a new look in 2024

Analysis in the latest edition of the Globefish Highlights, a quarterly publication from FAO Globefish, supports some of the trends seen at the recent Seafood Expo Global. Increased consumer confidence and the stabilisation of commodity prices on several important markets for fisheries and aquaculture indicate a break with the shocks that have rocked economies the last few years, from the pandemic to energy shortages to inflation.

The FAO Fish Price Index suggests that global prices for aquaculture products have been declining over last year, though this may not have been felt in Europe where, according to the monthly European Price Report, also published by FAO Globefish, seafood prices increased sharply in April.

The Globefish Highlights report that salmon supply in 2024 could increase by up to 4.5% in 2024 compared to last year with a 4% increase in Norwegian production and growth of 2% in output from Chile. The whitefish trade, on the other hand, can expect a reduction in the availability of cod following a recommendation from ICES to limit the Barents Sea cod quota to 791 000 tonnes in 2024; this follows reductions in both 2023 and 2022. The haddock quota has also been reduced by 4.6% in 2024 to 267 000 tonnes also following reductions in 2023 and 2022. On the other hand, the forecast for Alaska pollock is brighter with a growth of 3% predicted in 2024, to 3.79 million tonnes. The Globefish Highlights can be downloaded from https://www.fao.org/3/cd0274en/cd0274en.pdf

INFOPECHE

HIGH-LEVEL MEETINGS HELD TO REVITALISE INFOPECHE

In recent years, INFOPÊCHE has experienced enormous financial and operational difficulties, leading to Côte d'Ivoire, as Chair of the Governing Council, requesting ECOWAS support for a performance evaluation mission, which took place in March 2020.

The third extraordinary session of the Governing Council was held online on 4 February 2021. During this session, several important decisions were taken by the member states. These included (i) revision of INFOPÊCHE's mandate to take account of changes in the economic and institutional environment related to fisheries and technological innovations; (ii) revision of the mandate to adapt it to the new context; (iii) the elaboration of a five-year strategic development plan; (iv) the launch of a two-year transitional phase which will see the revitalisation of the organisation and the restarting of its operational activities.

This was followed by a high-level online meeting held on 6 March 2024 to assess the progress of activities implemented during the transition period which had started from September 2021 to 31 December 31 2023. In addition to member country representatives, technical and financial partners, including FAO, ATLAFCO and AU-IBAR, were invited to attend.

Accordingly, the FAO Regional Office for Africa (FAORAF) organised a workshop from 6–7 May 2024 at the Golden Palace Hotel (Grand-Bassam - Côte d'Ivoire), on the topic "Supporting the revitalisation of the Intergovernmental Organisation for Marketing Information and Cooperation Services for Fishery

Products in Africa (INFOPÊCHE)". Participants invited by FAO came from the FAO Regional Office in Accra (Ghana); the Sub-Regional Offices (Dakar, Libreville) and the FAO Representation in Côte d'Ivoire; GLOBEFISH/FAO – Rome; ATLAFCO; the Technical Advisor of the Ministry of Animal Resources and Fishery Products of Côte d'Ivoire; the representative of the Mayor of Grand-Bassam; INFOPÊCHE staff and resource persons.

The workshop recommended the following steps:

(i) FAO to provide technical and financial support for the rapid implementation of policy, institutional and governance reforms; and a sustainable funding mechanism for the organisation;

(ii) INFOPÊCHE to prepare a five-year strategic plan that takes into account the global context of cooperation for the marketing of fishery and aquaculture products;

(iii) ATLAFCO to provide financial support for the implementation of the capacity-building program for fisheries and aquaculture stakeholders for the period 2024 and 2025;

(iv) INFOPÊCHE to strengthen its collaboration with the private sector with the aim of defining a relevant technical assistance framework relating to: the development of value chains; the implementation of the FTAA free trade agreements; and Blue Transformation in the fisheries and aquaculture sector;

(v) INFOPÊCHE to strengthen its collaboration with the Regional Economic Communities (RECs) ECOWAS and ECCAS; Sub-Regional Fisheries Commissions (COREP, CPCO, CSRP); partners in the GLOBEFISH FISHINFONETWORK (FIN); agencies and organisations specialized in fish marketing; and

(vi) Develop a communication, visibility and resource mobilisation plan.

INFOPESCA

REGIONAL NUTRITION ENCOUNTER: CONTRIBUTIONS OF AN ALTERNATIVE FOR DIETARY DIVERSITY

INFOPESCA participated in the *Nutrition Symposium towards a healthy, inclusive and sustainable food system to reduce anaemia and malnutrition: innovation in nutrition, agrobiodiversity and rural-urban links,* held from February 29 to March 1, 2024 in Lima, Peru.

The event was organised by the International Potato Center (CIP, by its Spanish acronym), the Nutritional Research Institute (IIN, by its Spanish acronym) and the Andean Initiative. The objective of the symposium was to share diverse experiences from the public sector, civil society and academia about three related axes: the double burden of nutrition, the use of agrobiodiversity to achieve healthy diets, and urban-rural links to achieve better nutrition.

Experts from FAO, the UN World Food Program (WFP), CIP, the Ministry of Development and Social Inclusion, the Ministry of Health, the IIN, the University of Michigan, and the National Center for Food, Nutrition and Healthy Living participated in the event, among others.

David Mendoza, representing INFOPESCA, spoke on Amazonian fish being an important source of nutrition

INFOPESCA's participation was led by expert David Mendoza, who presented the topic "Amazonian Fish, an alternative for dietary diversity". He highlighted that the Amazon basin in South America covers an area of 6.11 km2, where 48 million people live and there are 3 000 species of fish for ornamentals and consumption, thus becoming an important provider of healthy and nutritious foods. Likewise, he mentioned that in 2022, Peru registered a production of more than 32 000 tonnes of Amazonian fish, 86% from capture origin and 14% from aquaculture. He also highlighted the importance of consuming Amazonian fish, considering the access that rural populations have to it, as well as the nutritional benefits of amino acids, protein, omega 3 and 6.

Among the recommendations provided to promote the consumption of Amazonian fish, he mentioned: (i) the importance of disseminating knowledge of the various species for food and nutrition, pointing out that in Peru there are at least 70 species for consumption; (ii) generate informed demand through food education; (iii) encourage the development of new products that contribute to strengthening local markets; (iv) ensure the application of good fishing and aquaculture practices and standards to ensure the quality and safety of Amazonian products; and (v) promote gastronomy based on Amazonian products to encourage their consumption outside the Amazon area.

INFOFISH

18TH INFOFISH WORLD TUNA TRADE CONFERENCE & EXHIBITION (TUNA 2024)

The 18th INFOFISH World Tuna Trade Conference & Exhibition (TUNA 2024) was held on 20–22 May 2024 at the Shangri-La Hotel in Bangkok, Thailand, with the theme 'Advancing Blue Transformation, Sustainability and Innovation through the Global Tuna Industry'. There were over 300 delegates in attendance from over 40 countries and a total of 41 booths representing 36 companies and organisations, promoting proven and cutting-edge products, equipment, machinery and services, all of which were very relevant and unique to the tuna industry.

The Chairperson of the Conference was Ms Rhea Moss-Christian, Executive Director of the Western and Central Pacific Fisheries Commission (WCPFC), with Dr Chanintr Chalisarapong, President of the Thai Tuna Industry Association (TTIA), serving as the co-Chair. The co-organisers of the event included the Department of Fisheries, Thailand and Thai Tuna Industry Association (TTIA); the Food and Agriculture Organization (FAO) of the United Nations; three RFMOs (WCPFC, IATTC, IOTC); ANFACO; Atuna.com; and the TUNA 2024 media partner, Undercurrent News. TUNA 2024 was also supported by Platinum Sponsors, Marine Instruments and Maldives Industrial Fisheries Companies (MIFCO); Gold Sponsor, BIOLAN; and the Silver Sponsor, Arcadia Chemical and Organic Ingredients. The opening ceremony and conference began with a Welcome Address by Gemma Meermans Matainaho, Acting Director of INFOFISH, followed by the Keynote Address by Ms Rhea Moss-Christian, and Special Addresses by the Hon. Fisheries Ministers or delegate from several INFOFISH Member Countries: HE Kalaveti Ravu from Fiji, represented by Rovereto Nayacalevu; HE Ribanataake Tiwau (Kiribati); HE Ahmed Shiyam (Maldives) and HE Jelta Wong (Papua New Guinea).

A summary of the 18th INFOFISH World Tuna Trade Conference & Exhibition can be found on pages 54-61.

IN MEMORIAM

DR WOLFGANG KRONE

Dr Wolfgang Krone at the first Tuna Conference organised by INFOFISH in 1986

It is with great sadness that we announce the passing of Dr Wolfgang Krone on 14 June 2024 at the age of 89 years in his home in Parioli outside Rome, Italy.

Dr Krone started his professional career in his native Germany, but joined the Food and Agriculture Organization of the United Nations (FAO) in the early 1970s, where he held positions both in the field and in headquarters in Rome.

More than 40 years ago in 1981, INFOFISH started out as a project funded by Norway and executed by the Food and Agriculture Organization of the United Nations (FAO). Consequently, most of the senior staff was recruited from FAO.

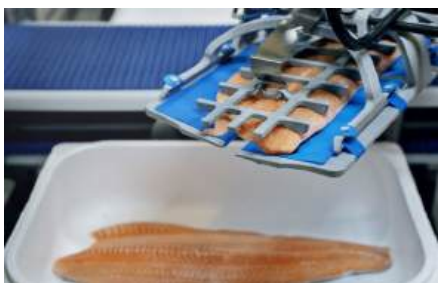
Dr Krone was Chief of the Fish Utilization and Marketing Service in the Fisheries Department in Rome before he became the Founding Director of INFOFISH (the title in the beginning was "Project Manager"). He was joined by other colleagues from the FAO network, including Hinko Lisac, Jochen Nierentz, and Erik Hempel. Dr Krone was called back to Rome to fill a senior position there as Director of Fisheries Industries Division in 1983. He later took over the position as Assistant Director-General of FAO's Fisheries and Aquaculture Division and was a driving force for a number of important initiatives during his time in this position. The Code of Conduct for Responsible Fisheries was one of the initiatives during his time as Assistant Director-General.

In 1984, INFOFISH transitioned to an inter-governmental organisation, retaining its close cooperation with FAO to this day. Its strong footing in Asia and the Pacific owes much to Dr Krone's steady hands at the wheel in those early years, guided by his vision of what the organisation could be and its role in the region's fisheries. INFOFISH is grateful for his wise counsel then, and his continued support for many years thereafter even after his retirement from FAO. We extend our deepest sympathies to his family.

PROCESSING

Transforming the way fish is packed

Robotics such as Marel's RoboBatcher Box are catapulting fish processing to an entirely new level of optimization and efficiency. It automatically packs and styles up to 24 boxes simultaneously, with up to 12 different predefined jobs, into polystyrene and cardboard boxes.



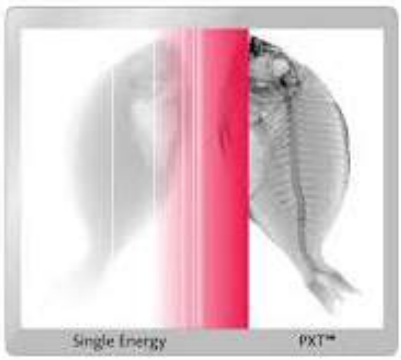
Intelligent software combined with robotic technology

In order to anticipate the fillets entering the RoboBatcher Box, the fish fillet is weighed by a standard weighing unit and scanned once it enters the system. Knowing the fish's precise measurements entering on a moving conveyor belt, the RoboBatcher's robotic arms pick up the product and gently place it into one of the boxes. Fillets or loins are packed according to catch-weight or fixed-weight requirements and a predefined styling pattern. The fully automated dispatch process ensures that once a box reaches the set target weight, it is immediately conveyed out of the robot and swiftly replaced by a new box to pack. The packing process is completed without any human contact by automated solutions that include a foil applicator, checkweigher, labeler, IceDoser and lid applicator, securing the end product's hygiene and safety.

Further information: Marel, Norway (https://marel.com/en/)

Detection of bones and contaminants

Seafood processing solutions which reliably detect fish bones and other foreign bodies such as hooks, blades, shells, and hard or sharp objects, are on the market. One new piece of equipment from Eagle Product Inspection offers what it calls "Performance X-ray Technology (PXT)" to capture detailed x-ray images. Used together, PXT and Eagle's latest-generation SimulTask PRO software read and interpret data for desired fill level inspection, mass measurement, zonal measurement, package integrity, component counts and the identification of missing items within a tenth of a second.



Further information: Eagle Product Inspection, USA (https://www.eaglepi.com/)

Seaweed processing solutions

Dried seaweed being packed

A seaweed solutions company, Sirputis UAB, offers custom-designed and manufactured equipment and supplies for seaweed farming, harvesting, pre-processing and processing, including seaweed washing machines, blanchers, dryers, grinders and freezers. The company also provides packing and storing solutions (bag sealers, boxes, racks and containers).

Last year, Sirputis signed an agreement with Polar Algae AS, a seaweed production company. Under the agreement, Sirputis and its partner UAB Metal Production, will provide two custom processing lines for dry and wet processing, to support Polar Algae's processing facilities at NorSea Polarbase.

Further information: Sirputis UAB, Lithuania (https://sirputis.com/processing/)

ANALYTICAL TOOLS

Pocket-sized, digitalised salt sensor

In addition to its solutions for the quantification of histamine in fish and sulphite in crustaceans, BIOLAN has announced the BIOFISH 7000 SALT device for the analysis of salt in fresh, cooked, canned, canned fish, salted anchovy, fish meal, and crustaceans.

According to the company, the device is an easy-to-use potentiometric instrument that allows to determine the amount of salt by sodium quantification- in less than two minutes at any point of the value chain. Salt concentrations of 0-15%, or 0-6000 mg Na+/100g, are quantified. The portability, the fact that it does not use hazardous reagents, the speed, the accuracy and the wide range of measurement matrices,

make it a very competent tool. It is also very versatile in that it can be used to be able to quantify other parameters of interest such as histamine or sulphite.

The determination of salt in fish, besides being a factor that determines the quality of the product, is also important for the health of the consumer since a high level of sodium in the diet is a risk factor for arterial hypertension.

Further information: BIOLAN (info@biolanmb.com)

Sorting device for marine species

German startup Eseidon has designed the AquaDetector, a smart sorting device for marine species. It consists of three units that ensure accurate analysis and sorting of aquatic organisms of all sizes. The first is the Isolator which ensures a controlled flow of organisms through the device; followed by an Image Recognition Device where the AI-based real time detection happens; and lastly, the Sorter which allows for individualized sorting of organisms. The device uses artificial intelligence, real-time image recognition, and cloud computing to detect fish size, deformation, sex, diseases, and other aquatic species. The solution improves stock management and supports decision-making based on the collected data.

Further information: Eseidon GmbH, Germany (info@eseidon.de)

Handheld scanner to assess provenance

Australian researchers have developed a handheld device capable of assessing seafood provenance, or origin, and to determine if it was wild-caught or farmed. The device, which stems from a collaborative effort led by Australia's Nuclear Science and Technology Organization (ANSTO) and included researchers at Australian governmental departments and Sydney-based universities, discerns the origin and production method of seafood with an accuracy of more than 80%. It includes the use of stable isotopes, X-ray fluorescence scanning, and customised computational modelling. Investigators can also draw on ion beam analysis and neutron activation analysis in provenance investigations.

The approach is based around the concept of an environmental fingerprint, which reflects the location where an animal was bred and fed or where a crop grew or was cultivated. An animal or plant takes in elements and their isotopes from water and food sources at these locations; in other words, the fingerprint on the piece of seafood comes from the animal's diet, the climate in which it lived or was raised, and other factors. These isotopic and elemental fingerprints can then be used to confirm if a product indeed came from that place.

In preliminary assessments of the approach, two important, high-value seafood products, barramundi *(Lates calcarifer)* and giant tiger prawn *(Penaeus monodon)* collected from seven different geographic locations in the Asia-Pacific region were analysed for their isotopic values and elemental profiles. Analytical results of the barramundi and tiger prawn suggested that nuclear-based techniques could effectively distinguish whether they were farmed or wild-caught and the geographic locations of both species with a high degree of accuracy.

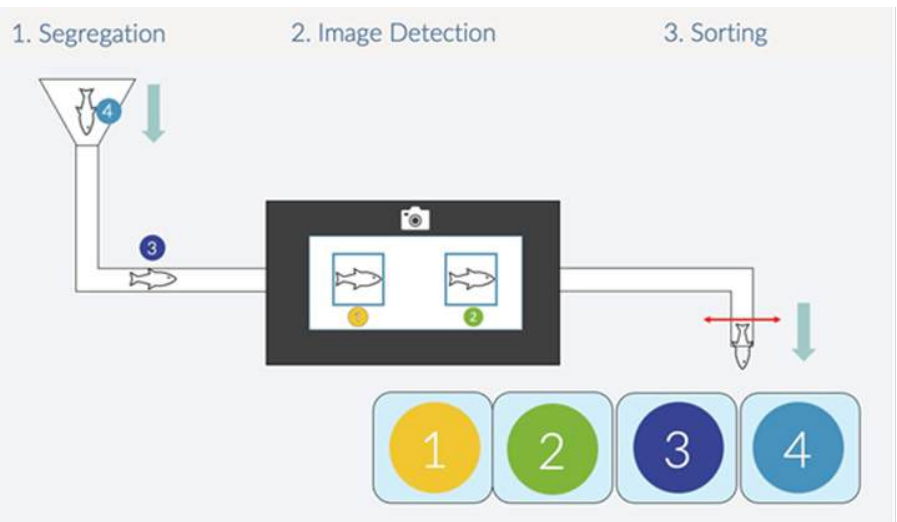
Further information: Dr Debashish Mazumder, ANSTO Sydney (dma@ansto.gov.au)

Recognition and sorting machine

A German start-up, Eseidon, has developed an image recognition and sorting machine for aquatic organisms such as fish, crabs and shrimp. The AquaDetector enables the reliable counting and differentiation of animals through real-time evaluation of image material based on various characteristics. The device uses artificial intelligence, real-time image recognition, and cloud computing to detect fish size, deformation, sex, diseases, and other aquatic species. The solution improves stock management and supports decision-making based on the collected data.

The process begins with an isolator which ensures a controlled, singular flow of organisms through the device for sorting and data acquisition. The organism then flows through the AquaDetector where the AI-based real time detection is initiated. Sorting occurs within seconds. Pre-programmed characteristics can be selected, allowing for individualised sorting of organisms.

Further information: Eseidon GmbH, Germany (http://www.eseidon.de/)



Fish for fish, not birds

Each year thousands of albatrosses and petrels in New Zealand die through entanglements with fishing gear and swallowing baited hooks and drowning. Southern Seabirds, in partnership with the Department of Conservation, has a programme underway to help stem the loss of birds at sea. The company is producing tools and resources such as the Seabird-Smart Fishing Toolkit, so that those involved in fishing have the knowledge and practical information they need to catch fish without endangering albatross and petrel populations.

The Toolkit facilitates direct engagement with the fishing industry and equips them with essential information to help reduce seabird bycatch. This includes the ocean areas important to threatened seabirds, access to distribution maps for all ACAP (Agreement on the Conservation of Albatrosses and Petrels) species, information on seabird bycatch mitigation options (including ACAP's Best Practice Advice guidelines), as well as information on fisheries monitoring tools for verification.

Virtual tracking from end to end

FAO reports that around 35% of harvested fish and seafood is either lost or wasted along the supply chain—with other studies putting that number closer to 50%. Where does this loss happen? To help us better envision this long trip, WWF worked with Condition One and Google to bring a seafood journey to life using 360° video and virtual reality (VR). Through this visualization, we are inspired to find solutions and empowered to eliminate waste to fully value the time and energy behind every wild-caught or farm-raised fish we consume.

Supported by Google's Daydream Impact program and produced by Condition One, the VR project aims to help raise awareness around the challenges facing our oceans using VR video. Short of actually being on a fishing boat or in a processing plant, there's no better way to understand these issues. For the most immersive experience, view the video on YouTube using a VR viewer like Cardboard or Daydream View.

Viewers can also dive in and explore one sample supply chain with a new Google Voyager – a map-based guided story that casts off from a dock in California and follows the fish on their journey, while exploring loss along the way. For further information: https://www.worldwildlife.org/blogs/sustainability-works/posts/out-of-the-sea-waste-i-could-be

AI start-up wins award

PanaceaLogics, a Pakistani AI-driven software solutions company, has claimed the top spot at the recent AquaCon Invest competition organised by the U.S. Soybean Export Council (USSEC). Its award-winning Recirculating Aquaculture Systems (RAS)-based solution was designed to aid fish farmers in such critical areas as fish biomass estimation, health monitoring and disease prevention, water quality management, and feed optimisation through the integration of cameras, sensors, and advanced AI technology.

Explaining the system, Adeel Pirzada, CEO of PanaceaLogics, said that the AI system monitors aquaculture life and production, and measures precise fish or shrimp growth and feeding cycles. "The data informs fish farmers about how their production is going by accurately measuring the size of fish, growth, welfare status, and parasite counting," he added.

Start-up turns excess seaweed into an agroecology solution

A start-up in Barbados, Red Diamond, is turning the invasive and destructive Sargassum seaweed into big business, turning it into organic and biologic agrochemicals, like fertilisers, bio-stimulants, crop protection products, and soil additives. One of the soil additive products, called Supreme Sea, includes growth-stimulating plant hormones and microorganisms extracted from the seaweed.

(L) Large amounts of Sargassum seaweed wash up on the shores in Barbados; (R) Supreme Sea for plants

Sargassum contains nutrients, minerals and microorganisms that can foster and even accelerate plant growth, such as iron, magnesium, potassium, calcium and more. But rather than simply add nutrients such as nitrogen and phosphorus into the soil, it helps plants to be more efficient at taking up those nutrients, incentivising less synthetic fertiliser application in exchange for higher yields and healthier plants and crops.

Next-generation filter media for RAS

Biopebble, a next-generation filter media developed by Warden Biomedia in partnership with Cranfield University, has shown promise for improving the efficiency of RAS systems by lowering the energy input required by the effluent treatment process. The spherical design requires less energy to be agitated in solution than other media, improving wastewater treatment efficiency.

The new Biopebble media, which can be made from 100 percent recycled plastics, features a structure and surface texture designed specifically to result in optimum biofilm attachment and biological treatment performance. When tested against other filter media, Biopebble showed high removal rates of phosphorous and ammonia, both of which are found in large quantities in RAS effluent. It is durable, with density close to water, making it ideal for MBBR applications. The large surface area (500 m^2/m^3) allows for optimum biofilm attachment, which promotes the generation of healthy and thin biofilms, improving resistance to shock loads, as well as increasing wastewater treatment capacity and reducing the required tank volume for wastewater treatment.

Credit: Warden Biomedia

In addition to reduced energy requirements, the design offers significant benefits for RAS including improved biological commissioning times and process security, higher biomass retention, increased wastewater treatment capacity, reductions in required tank volume, and the generation of healthy and thin biofilms.

Following successful pilot and full-scale trials, the new filter design has now been released for application in commercial aquaculture. The media is manufactured in the UK, available in both high-quality recycled or virgin polypropylene, and is fully recyclable at the end of its process life, contributing to a circular economy.

THE GLOBAL AQUABUSINESS INVESTMENT GUIDE

A living framework to guide sustainable development in the world's fastest growing food sector – Summer 2024. Washington, D.C.:World Bank Group.

The rapid growth of the aquaculture sector, coupled with various trends such as increasing demand, technological advancements, and supportive investments, presents numerous opportunities for stakeholders across the industry. These opportunities are relevant to producers, investors, policymakers, and consumers, offering avenues for economic growth, innovation, and food security. However, to fully harness these opportunities while safeguarding against potential challenges and negative social, ecological, and economic impacts, there is a critical need for a consolidated set of principles to guide sustainable commercial aquaculture development. Accordingly, the World Bank Group (WBG)'s Global Aquabusiness Investment Advisory Platform (AquaInvest Platform) prepared a set of global principles to promote sustainable aquaculture growth through investment and business development. The WBG then contracted Advance Africa Management Services to develop and disseminate The Global Aquabusiness Investment Guide.

The Global Aquabusiness Investment Guide was formulated through a combination of (i) desktop-based reviews of the existing frameworks and best practices for aquaculture development and management; (ii) a review of global case studies representing successes, challenges and lessons learnt in aquaculture investment and aquabusiness development; and (iii) comprehensive stakeholder engagements with a variety of aquaculture industry actors. Through these activities, the needs of the intended users of the Guide, and commonalities driving sustainable aquabusiness development, were identified.

These Principles do not duplicate existing frameworks, guidelines, principles, and Best Management Practices (BMPs) for sustainable and responsible aquaculture but build on these in a practical way (providing specific recommendations), with a specific focus on investment and business development. Importantly, the Principles are a publicly accessible "living document" (currently Summer 2024 Edition) that will be updated periodically as new learnings emerge.

The publication can be downloaded at no cost from: http://documents.worldbank.org/curated/en/099051424100040397/P5031171986f9e0bc1ba561d4aebd9fcca9

SMALL-SCALE FISHERIES GOVERNANCE

FAO. 2024. Small-scale fisheries governance – A handbook in support of the implementation of the Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries in the context of Food Security and Poverty Eradication. Rome.

The small-scale fisheries subsector is a crucial provider of livelihoods, nutrition, and food security to millions of people all over the world. However, small-scale fishers, fishworkers and their communities face many challenges, including lack of recognition, limited participation in decision-making, unsustainable use of aquatic resources, climate change impacts and conflicting interests with other sectors.

The Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries in the Context of Food Security and Poverty Eradication (SSF Guidelines) are the first international instrument entirely dedicated to small-scale fisheries and provide guidance on how to address existing challenges in the subsector. One of the key areas discussed in the SSF Guidelines is the need for an enabling environment that promotes good governance.

This publication, Small-scale fisheries governance – A handbook in support of the implementation of the Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries in the Context of Food Security and Poverty Eradication, was based on a number of training courses on governance in small-scale fisheries. It offers an overview of the SSF Guidelines and guidance on their implementation in particular with regard to good governance and the enabling environment needed.

The publication can be downloaded at no cost from: https://doi.org/10.4060/cc9784en

2024

JULY

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

17-19
Indo Fisheries 2024 Expo & Forum
Jakarta, Indonesia
https://indofisheries.id/

17-19
Bangladesh International AQUACULTURE & SEAFOOD SHOW
Dhaka, Bangladesh
https://seafoodexpobd.com/

AUGUST

14-15
The Aquaculture Roundtable Series (TARS)
Bangkok, Thailand
https://tarsaquaculture.com/

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

28-30
Aqua Fisheries Cambodia 2024
Phnom Penh, Cambodia
https://veas.com.vn/event/aqua-fisheries-cambodia-2024/

SEPTEMBER

3-5
Global Shrimp Forum
Utrecht, the Netherlands
https://www.shrimp-forum.com/

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/

25-27
China International (Guangzhou) Fisheries & Seafood Expo 2024
Guangzhou, China
http://www.chinafishex.com/

OCTOBER

9-11
AQUACULTURE VIETNAM
Ho Chi Minh City, Vietnam
https://www.aquafisheriesexpo.com/en/aquaculture-vietnam/

30 Oct - 1 Nov
China Fisheries & Seafood Expo (CFSE)
Qingdao, China
https://chinaseafoodexpo.com/

NOVEMBER

6-8
Busan International Seafood & Fisheries Expo 2024
Busan, South Korea
http://www.bisfe.com/

DECEMBER

3-6
The 8th International Fisheries Industry Exhibition (IFEX)
Tehran, Iran
https://fisheries-expo.ir/

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EDITORIAL PLAN 2024

INFOFISH

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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

Guidelines for authors: *Word count* ***2000 - 2500****, accompanied by photographs/ illustrations, short abstract of article, and author's photo & brief biography.*

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PTF 2025

Announcing the 9th PACIFIC TUNA FORUM

OCTOBER 2025

Fiji

Jointly organised by:

Ministry of Fisheries

National Fisheries Authority
Papua New Guinea

INFOFISH

Contact INFOFISH via email: ***info@infofish.org*** *for more information*