



2020



POSITIVE IMPACT:

PARTNER IMPROVEMENTS
THROUGH CERTIFICATION

CONTENTS

04	FOREWORD
05	OUR IMPACT
08	THE STORY SO FAR (1994–2020)
12	ASC AND THE UNITED NATIONS SUSTAINABLE DEVELOPMENT GOALS
14	ASC ASSURANCE PROGRAMME, THE M&E FRAMEWORK & ASC'S IMPACT PATHWAYS
16	ASC PROGRAMME REACH
27	PRODUCT AND MARKET TRENDS
32	EXPANDING OUR SCOPE
33	RESEARCH IN FOCUS: ASC SALMON STANDARD COMPARED WITH REGIONAL REGULATIONS
35	MEASURING ON-FARM CHANGE: METHODOLOGY
39	RESEARCH IN FOCUS: A LIFE-CYCLE ASSESSMENT OF ASC CERTIFIED PANGASIU
40	MEASURING ON-FARM CHANGE: ENVIRONMENTAL TRENDS
44	CASE STUDY INTERVIEW: MIYAGI PREFECTURE FISHERIES
45	CASE STUDY INTERVIEW: FUJIAN CHINA-SINGAPORE EVEREST
46	MEASURING ON-FARM CHANGE: SOCIAL TRENDS
51	RESEARCH COLLABORATION: THE TAPAS PROJECT
52	CASE STUDY INTERVIEW: BEST AQUACULTURE PARTNERS
53	CASE STUDY INTERVIEW: NIREUS AQUACULTURE
54	MEASURING PROGRESS IN FORAGE FISH USE
58	EXPANDING OUR FISH WELFARE INDICATORS
59	TRANSPARENCY IN METRIC SETTING
60	STRENGTHENING ASSURANCE
62	PARTNER INTERVIEW: IKEA
64	ANNEX 1: NUMBER OF CERTIFIED FARMS PER COUNTRY AND SPECIES
65	ANNEX 2: SUPPLEMENTARY INFORMATION FOR THE NON-CONFORMITY ANALYSIS
66	REFERENCES & ACKNOWLEDGMENTS

OUR VISION: A world where aquaculture plays a major role in supplying food and social benefits for mankind, whilst minimising negative impacts on the environment.

OUR MISSION: To transform aquaculture towards environmental sustainability and social responsibility, using efficient market mechanisms that create value across the chain.

FOREWORD

I'm pleased to present Aquaculture Stewardship Council's (ASC) first Monitoring and Evaluation Report, *Positive impact: Partner improvements through certification*. As part of our commitment to evaluating organizational effectiveness, we share information on the impacts of the programme with stakeholders on an ongoing basis. The information within these pages is the first comprehensive assessment of the benefits of the ASC certification over the first decade of operations, and will be used to both better understand, and inform future improvements of, the programme.

The core of ASC's mission is to help transform the aquaculture industry towards environmental sustainability and social responsibility, and we work to meet that goal by transforming farm practices, business practices, and consumer behavior. The programme includes highly respected standards for environmental and social performance, auditing protocols, and a logo which allows consumers to make an informed choice when purchasing seafood. Our efforts are undertaken and supported together with a wide range of partners, including producers of all sizes, certification companies, scientists, government officials, the seafood industry, the NGO community and other innovators who have joined forces to help move the production of farmed seafood towards a more sustainable future.

When ASC was established in 2010 to address the many environmental and social challenges of fish farming, we could not have anticipated the unprecedented growth and challenges of our first years.

First, I'll address the growth. Our success is a mark of the credibility of the ASC standards, and the trust we've earned due to our investment in a science-based development process, the requirement for regular, inclusive and transparent review, and the many collaborations with partners and stakeholders that are integral to our programme. Tilapia was the first standard to become operational in the summer of 2012 and the first ASC farm certificate was awarded in August of that year. The milestones over the years to follow came rapidly, including the completion of a further 10 farm standards to address the impacts of farming hundreds of species of finfish, shellfish and bivalves; one joint standard for seaweed with MSC; the development of an industry leading feed standard and the ongoing process of creating a single, aligned ASC Farm Standard to create an even more efficient and effective programme. Significantly, just four years after the first product bearing the ASC logo came to market, ASC became financially self-sustaining, covering all core operating costs from only logo license revenue. And, as we go to press with this report in July 2020, 2 million tonnes of aquaculture produced annually comes from farms certified as meeting the highest standards of environmental and social responsibility

The rapid uptake has brought us closer to a world where aquaculture plays a major role in responsibly supplying food and social benefits for mankind. However, ASC is still at the beginning of a decades-long journey, and to date only certifies a small percentage of global aquaculture production. To increase our global impact, we must navigate increasingly complex technical, supply chain and operational challenges—to say nothing of the increasingly sophisticated and interconnected political challenges—over the coming years. The social impacts of aquaculture can vary from country to country and by species, but they are persistent and widespread. Ecosystem degradation continues, and the effects of climate change create unpredictable complications for a global standard setter. While these issues are many and considerable, I am confident that ASC will meet them. We will do so partly through our own efforts, but also by continuing to actively seek opportunities to collaborate with like-minded partners working to promote sustainability and social responsibility in areas complementary to the reach of farm certification.

We are already engaging on the next set of challenges and are actively in the process of creating an organisation to meet the future. For now, ASC is proud to share this monitoring and evaluation report, and to recognise the progress the programme has enjoyed to date. The impacts presented in this report are part of a broader, growing global movement toward a world where our food supply is produced sustainably, transparently and traceably; where farmers work in safety, with respect and are compensated appropriately; and where our oceans, rivers and coastal communities are resilient and healthy.



Chris Ninnes, CEO



OUR IMPACT

The ASC's transformational aim is to promote more environmentally sustainable and socially responsible aquaculture through its certification programme and seafood logo. In order to maximise the impact of the programme it uses standards that set strict and measureable requirements for responsible aquaculture.

These standards, the most rigorous in the industry, drive improvements across a range of operational practices and help to safeguard the social rights and safety of those who work on farms and live in nearby local communities. Amongst other things ASC standards help protect ecosystems, sensitive habitats and biodiversity, control the use of antibiotics, reduce the use of pesticides and chemicals, proactively prevent fish escapes, preserve the quality of water, regulate feed use, promote fair and equitable treatment of workers on farms and positive engagement with communities where farms operate.

As a full member of the ISEAL Alliance, we ensure that our standards are grounded in science and best practice, as supported by stakeholder engagement and transparency. To ensure the ASC programme remains meaningful, credible, and effective we continually strive to improve through our standard revision process, the adoption of additional standards, monitoring and evaluation of our work, and the use of data that contribute to knowledge on the performance of aquaculture systems globally. Farm audits against our standards are conducted by independent and accredited third-parties, with extensive requirements for transparency and stakeholder engagement throughout the process, and high level of oversight by the ASC appointed accreditation body.

The key impacts provided in relation to ASC's strategic outcomes are featured throughout the report with added detail on analysis, graphics and case studies.



CONFIDENCE AND TRUST IN ASC PRODUCT ORIGIN, SUPPLY CHAIN AND ASSURANCE PROGRAMME

ASC uses chain of custody certification and allied measures to ensure that the integrity of the programme is maintained. Trust in our programme and a high level of assurance across the supply chain from farm to end products allows retailers and consumers to have confidence about where their seafood came from and how it was raised. Data collected throughout the audit process and supply chain ensure that the farm meets the requirements of the ASC standards and that products that bear the ASC logo can be traced to their source. Our transparent systems provide a comprehensive insight into the environmental and social performance on farms. This insight allows us to access and analyze information on farm level improvements resulting from certification that serve as a testament to the effectiveness of the programme. This first M&E report is an important milestone in demonstrating our commitment to this transparency.

HIGHER DEMAND FOR RESPONSIBLY CERTIFIED SEAFOOD CREATES INCENTIVES

Increasing demand for ASC certified seafood signals to farmers that there is a market for responsible farming that can make certification worthwhile. ASC's expanding market presence builds on the many relationships we have developed in seafood markets around the world, starting with strong and growing commitments from retailers and food service providers in Europe. Global companies such as Lidl, IKEA and Nomad Foods Europe are making commitments to carry ASC certified products both in Europe and globally. Commitments to responsibly farmed seafood have expanded across the Americas, Asia and Australia, providing a sense of the very active support that we have received from supply chain partners - a fundamental driver of the ASC programme's growth.

Nearly 18,000 products globally were able to carry the ASC logo as of the end of 2019, an increase of over 380% compared with five years earlier. One prominent partner featured in this report, IKEA, uses the ASC logo to communicate its responsible seafood commitment to customers in an honest and credible way. IKEA's commitment to source ASC and MSC certified products across its 430 restaurants operating in 52 markets around the world demonstrates the social responsibility the company feels to inform its customers about seafood sustainability topics and to help them to fulfil their interests in a better world.

RESPONSIBLE FARMING IS VIABLE

The ASC programme sets requirements for responsible aquaculture that meet best practices and exceed national regulations in many countries. According to one independent academic study, ASC requirements in the Salmon Standard for example were more stringent

than national regulations in Norway, Chile, Canada and the UK, in setting limits on the number of escapes allowed, antibiotic usage and fish resources in feed.

Analyses on ASC farm audit reports illustrate that ASC certified salmon farms in three of the main producing countries, Norway, Chile, and Canada, demonstrated improved conformance in recent years with evidence that producers with multiple farms are applying lessons learned from certified sites, such as updated fish health management plans and public reporting on wildlife mortalities, across their business. The first oyster farms certified in Japan, as part of the Miyagi Prefecture Fisheries cooperative, found that their certification led to access to new markets. Sales revenues increased faster compared to oyster producers from other areas, and certification gave farmers a sense of achievement and pride. The changes implemented across the farm increased product quality, improved working conditions and reduced environmental impact. More efficient production systems led to many of the female workers being able to maintain their income and have more time free for other things they valued.

MORE FARMERS IMPLEMENTING ASC STANDARDS

As more farmers implement ASC standards of responsible farming, negative environmental effects are mitigated and social improvements are promoted. ASC has exhibited a remarkable growth over recent years, with 1,134 farms certified across nine standards producing nearly 2 million tonnes of certified seafood in 42 countries by the end of 2019. This represents a 181% increase in certified volume and a more than 450% increase in the number of certified farms in just five years. We have recently increased the range of species covered by the programme with the approval and implementation of three additional standards at the end of 2019.

MINIMISED NEGATIVE EFFECTS ON THE ENVIRONMENT

During the audit process, corrective actions taken by farmers demonstrate the improvements in performance delivered through certification. For example, ASC certified shrimp farms in Vietnam have reduced non-conformance by 50% across environmental indicators between 2014 and 2018. In practice, this results in on site improvements across impact areas such as waste containment and management.

By analyzing farm performance against our metrics-based indicators, we can demonstrate trends in improvement. For example, ASC certified salmon and shrimp farms decreased their use of wild-caught fish meal by over 3% in feeds between 2015 and 2018, reducing their reliance on wild fishery resources. Farms across the species standards are also coordinating more closely with their feed suppliers to ensure they are using responsibly sourced ingredients. This in turn helps us continue to drive improvements, such as lowering the threshold for acceptable levels of wild fishery resources as an ingredient in feed. In an independent peer-reviewed study looking at pangasius farms, ASC certified farms were found to use water, land and total resources more efficiently and had lower impacts on their surrounding air and water than their non-certified counterparts.

SOCIAL IMPROVEMENTS

ASC certified farms exhibited clear trends in improved working conditions, as evidenced through analysis of non-conformances raised during farm audits and subsequent corrective actions. Health and safety performance improved with increased training provisions,

renovations to living quarters for staff and the provision and renewal of personal protective equipment. Immediate improvements to working conditions were documented for farms undergoing assessments, such as increased medical insurance coverage, clarification of contracts and transparency in wage setting.

Case study interviews provide further evidence of these improvements. Best Aquaculture Partners' shrimp farm in Thailand have reported greater transparency and training on pay and working conditions, as well as increased health and safety training. In China, Fujian China-Singapore Everest's abalone farm has gone to extensive lengths to improve working conditions, such as through the construction of new living quarters and the provision of sun shades and first aid kits.

LOOKING AHEAD

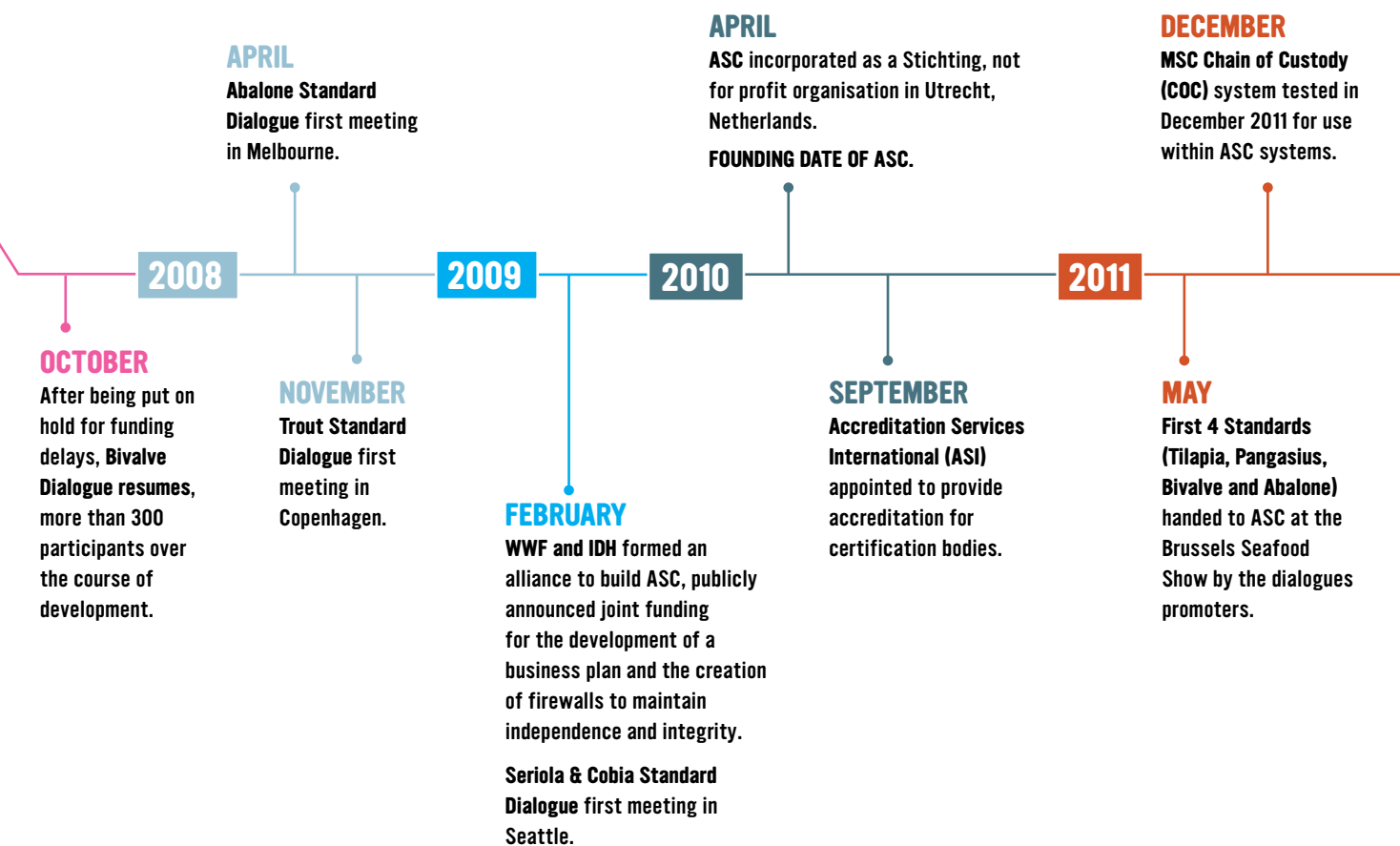
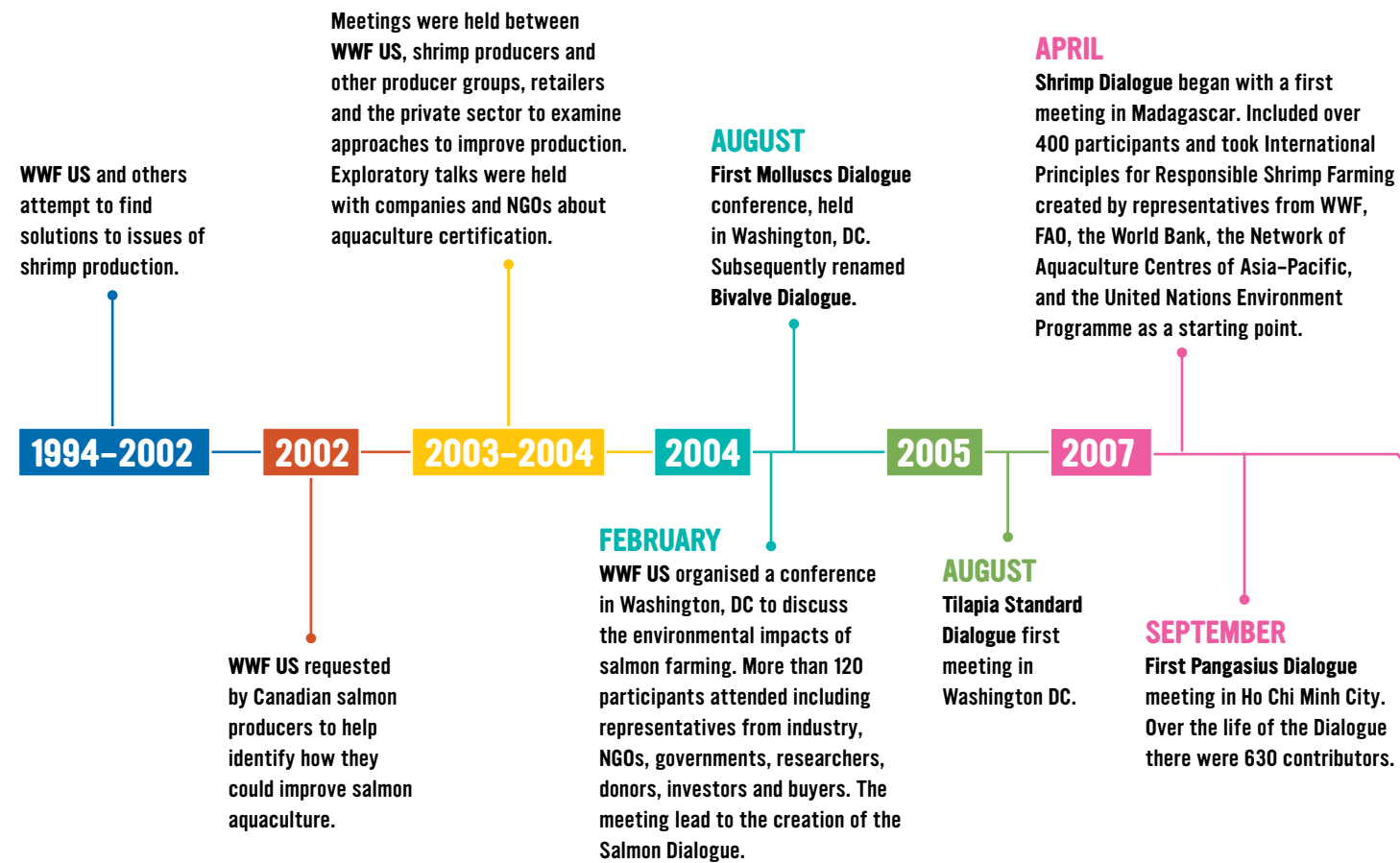
As we grow, the ASC actively works across a variety of projects that look to strengthen and further expand the ASC programme. One of our largest commitments is to the Alignment project. This seeks to develop a new farm standard that amalgamates common content found across all standards into a single, consistent core document. Production and species-specific metrics and requirements will be retained as bespoke content that is more narrowly applicable. Our scope is evolving through the development of standards to cover new areas of the aquaculture industry such as feed production as well as the refinement of our dedication to animal welfare and disease management that will feature within the new aligned farm standard. We are also collaborating with innovative partners, such as the Sustainable Fisheries Partnership and the Monterey Bay Aquarium's Seafood Watch programme, to drive integration across our programme's at scales beyond the farm to reduce costs for producers and provide clearer and more concise information to buyers, governments, producers and consumers. We are further strengthening our systems with the launch of our Geographic Information Systems (GIS) portal: by collecting and sharing more precise data on farm locations and boundaries we will empower auditors and stakeholders and unlock new opportunities for collaboration.

In 2021 we will launch an improved and globally accessible Improver Programme. This will help drive production improvements by targeting farmers through local extension agencies, training of trainer programmes and the use of technology to transfer the knowledge needed to make improvements. It's an ambitious programme, one we will test and pilot, but ultimately we see it as another tool to drive improvement at scale. In support of this programme the ASC is also developing a range of supporting tools and networks, including with local governments, to facilitate its successful uptake. A key component will be a thorough Gap Analysis methodology and tool that will capture the current state of the aquaculture production; which in turn will identify improvement areas, link to supporting tools to assist improvement and will have the ability to monitor impacts over time. The initial focus will be on Asia, but it will be applicable globally and will further allow the ASC to demonstrate programme impacts.

This report represents one example of how we are continually exploring and challenging our impacts, which is only possible through our dedication to transparency. Our commitment to an established monitoring and evaluation programme will help us evaluate our work, learn from results and grow our programme's ability to deliver impact at scale.

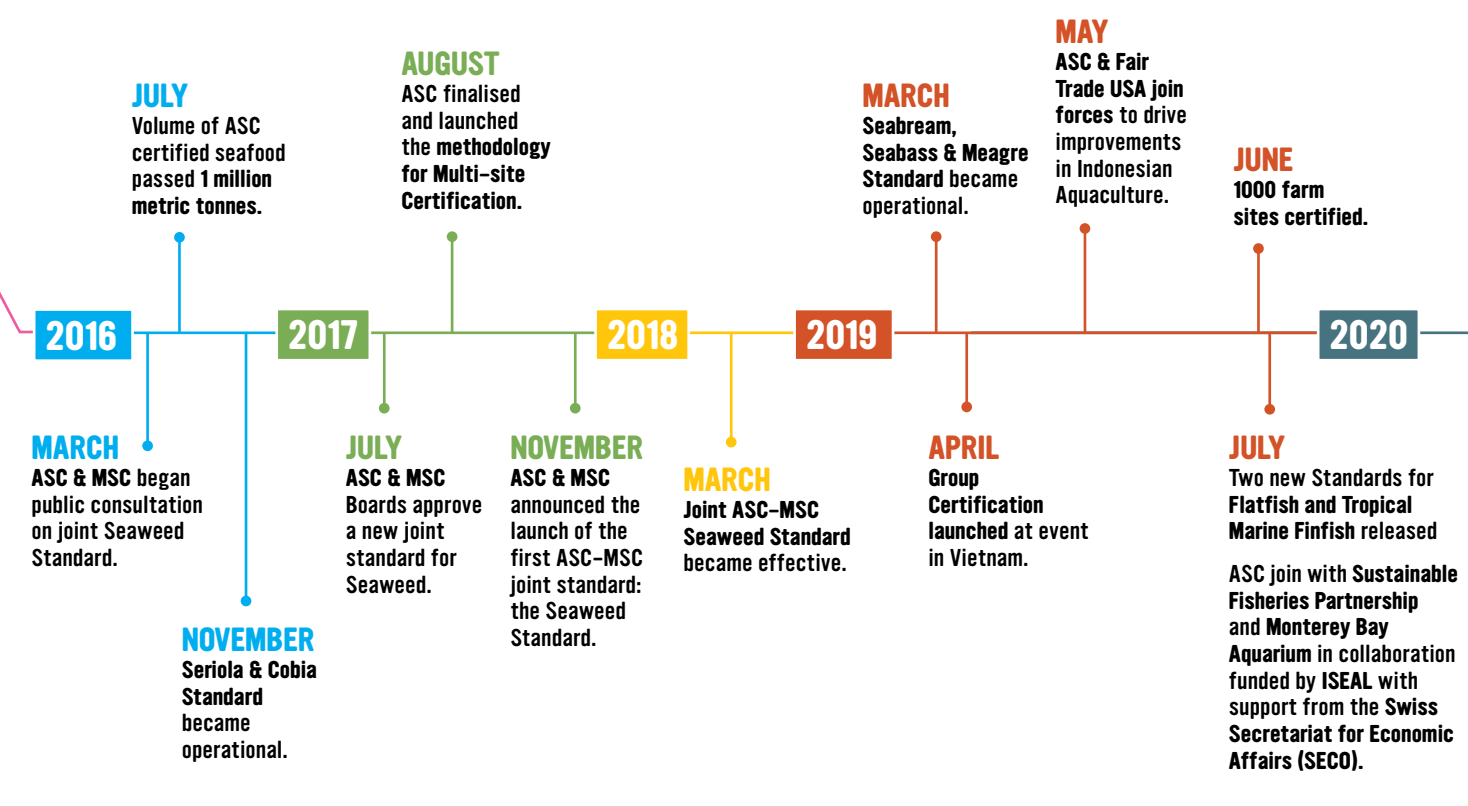
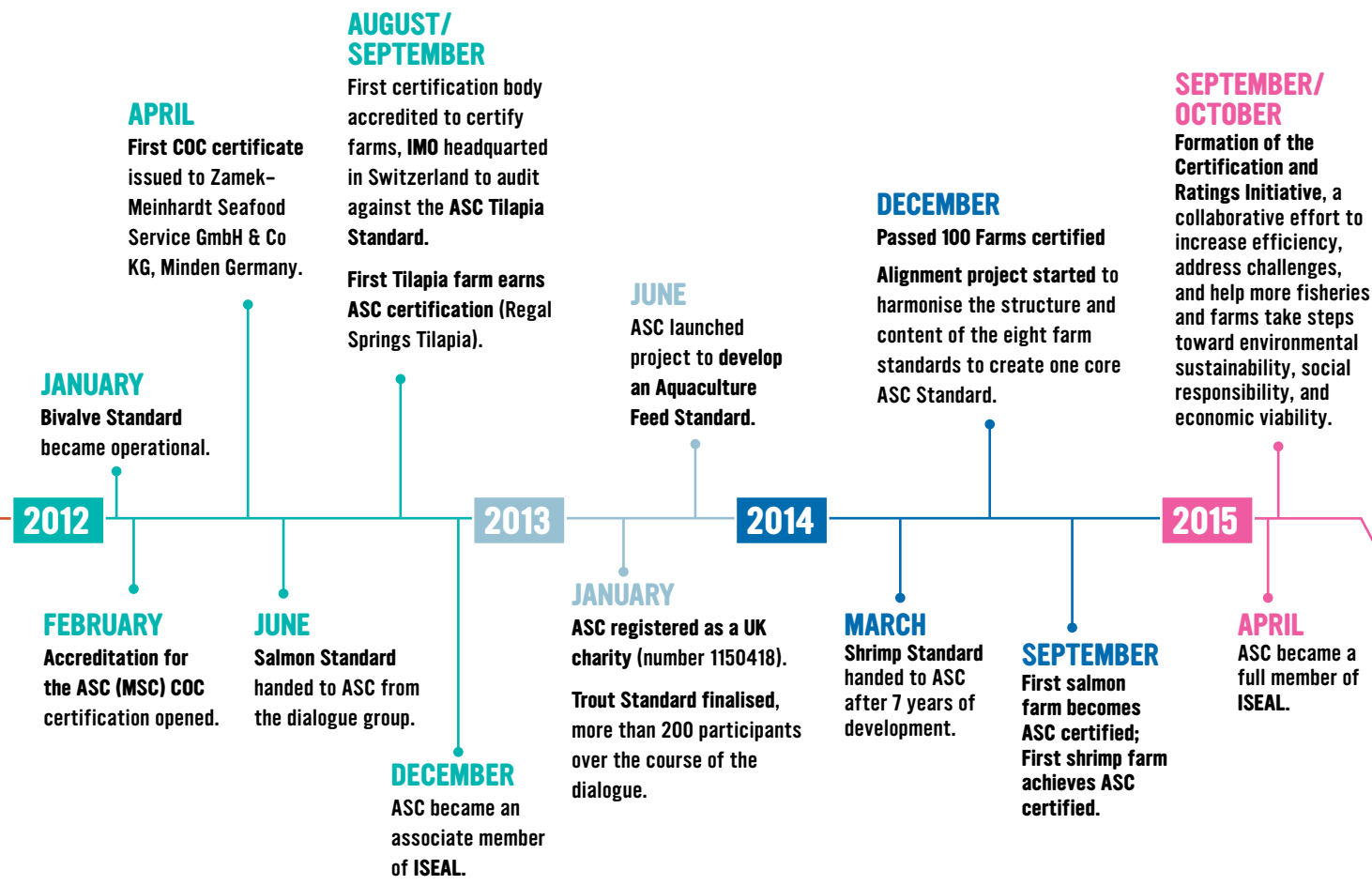
THE STORY SO FAR:

KEY MILESTONES IN ASC'S GROWTH 1994-2011



THE STORY SO FAR:

KEY MILESTONES IN ASC'S GROWTH 2012-2020



ASC AND THE UNITED NATIONS SUSTAINABLE DEVELOPMENT GOALS (SDGs)

As an international organization committed to environmental and social responsibility, ASC is an active partner in the global partnership to achieve peace and prosperity for people and the planet. The United Nations (UN) blueprint for sustainable development, now and into the future, identifies 17 Sustainable Development Goals (SDGs) that represent an urgent call to action. With increasing populations globally and threats to food security, the rapidly growing aquaculture sector is recognized as having the potential to provide a critical contribution to meeting many of the SDGs.

When buyers choose to source ASC certified and labelled products they are exhibiting their own contributions to the United Nations Sustainable Development Goals. By valuing environmentally sustainable farm performance, employment security and social responsibility for workers, ASC and our partners are committed to combating the ongoing challenges of population growth and increasing need for greater food security in a world with limited resources. The work of ASC in defining and certifying responsible aquaculture directly contributes to multiple SDGs.



SDG 1. End poverty in all its forms everywhere

ASC standards include criteria and terms of employment that contribute towards ensuring farms' social responsibility towards employees and local communities, including decent wages, transparency in contracts, benefits, and freedom from discrimination.



SDG 2. End hunger, achieve food security and improved nutrition and promote sustainable agriculture

ASC's vision and ethos is one of working towards long-term food security through responsible aquaculture. ASC works with a wide range of both large and small scale producers to achieve this.



SDG 3. Ensure healthy lives and promote well-being for all at all ages

Antimicrobial resistance caused by the overuse of antibiotics is a serious threat to human health: ASC bans the use of antibiotics listed as critically important for human medicine by the World Health Organisation, while strictly monitoring and limiting others. Standards include requirements that facilitate safer and healthier working conditions for farm workers.



SDG 5. Achieve gender equality and empower all women and girls

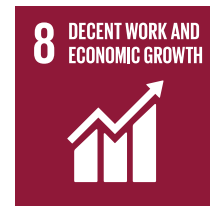
ASC certified farms must respect maternity rights and benefits, protect the health of pregnant women and must not discriminate based on gender, or any other grounds.



SDG 6. Ensure availability and sustainable management of water and sanitation for all

As well as ensuring that farm employees have access to clean, sanitary living conditions, ASC certified farms must also minimise the impact of their activities on surrounding water. ASC standards require monitoring of water quality, treatment of effluent water, mitigation of nutrient pollution in water, and responsible disposal of waste.

SDG 8.



Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all

ASC standards require freedom of association, the right to collective bargaining, and fair terms of employment for all employees. They also prohibit the use of forced, bonded or compulsory labour, and child labour.



SDG 10. Reduce inequality within and among countries

Discrimination based on gender, age, race, religion or origin is strictly forbidden by ASC standards, while certified farms must also ensure equality in salaries and equal access to opportunities.



SDG 12. Ensure sustainable consumption and production patterns

ASC's whole programme is aimed at defining, addressing and contributing to sustainable consumption and production patterns in aquaculture.



SDG 13. Take urgent action to combat climate change and its impacts

ASC certified farms must monitor energy consumption and several standards also require greenhouse gas recording and reduction strategies. Furthermore, ASC's standards promote the protection and conservation of environmentally critical areas.



SDG 14. Conserve and sustainably use the oceans, seas and marine resources for sustainable development

ASC standards ensure the protection of marine resources by limiting the use of wild caught fish in feed and requiring that wild fish is sourced from responsibly managed fisheries. ASC also works to protect marine mammals, High Conservation Value Areas and to establish best practices in gear management and nutrient pollution mitigation.



SDG 15. Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss

Illegal deforestation is prohibited by ASC standards when it comes to the sourcing of plant (e.g. soy and wheat) feed ingredients, and the upcoming ASC Feed Standard also requires a commitment of feed mills to work towards (total) deforestation and conversion free supply chains. ASC also works to protect mangroves and local biodiversity/wildlife, groundwater sources; and promotes the responsible, controlled handling and waste of chemical materials.



SDG 16. Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels

The certification process involves feedback from local and indigenous communities, and farms must proactively engage in meaningful consultation with these groups. ASC prohibits child labour, and forced, bonded or compulsory labour. The standards promote transparency and non-discriminatory laws and policies for sustainable development.

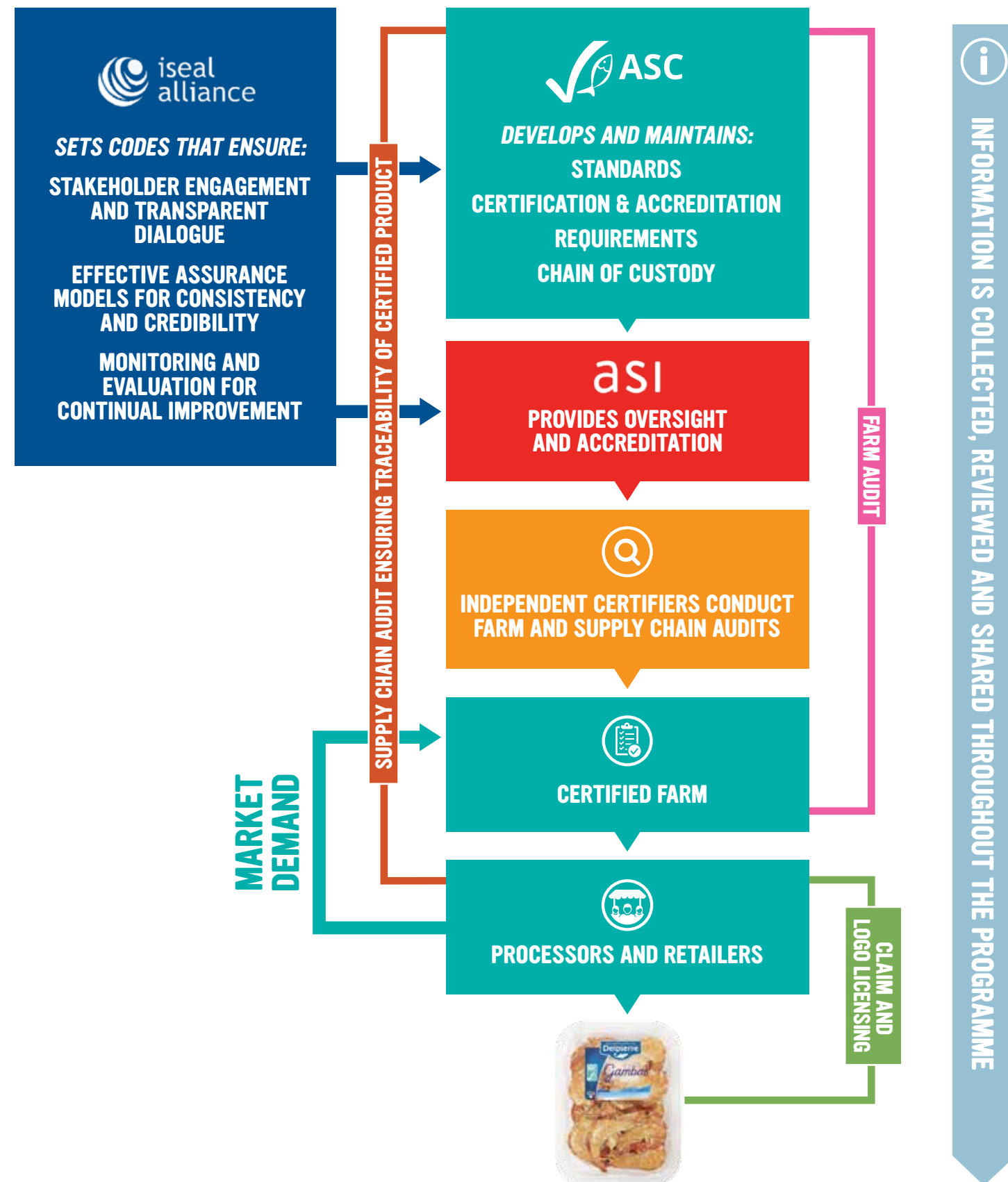


SDG 17. Strengthen the means of implementation and revitalize the global partnership for sustainable development

ASC promotes public, private and civil-society partnerships at both intra and international levels and works collaboratively with governments and NGOs on a number of projects aimed at promoting responsible aquaculture.

ASC ASSURANCE PROGRAMME

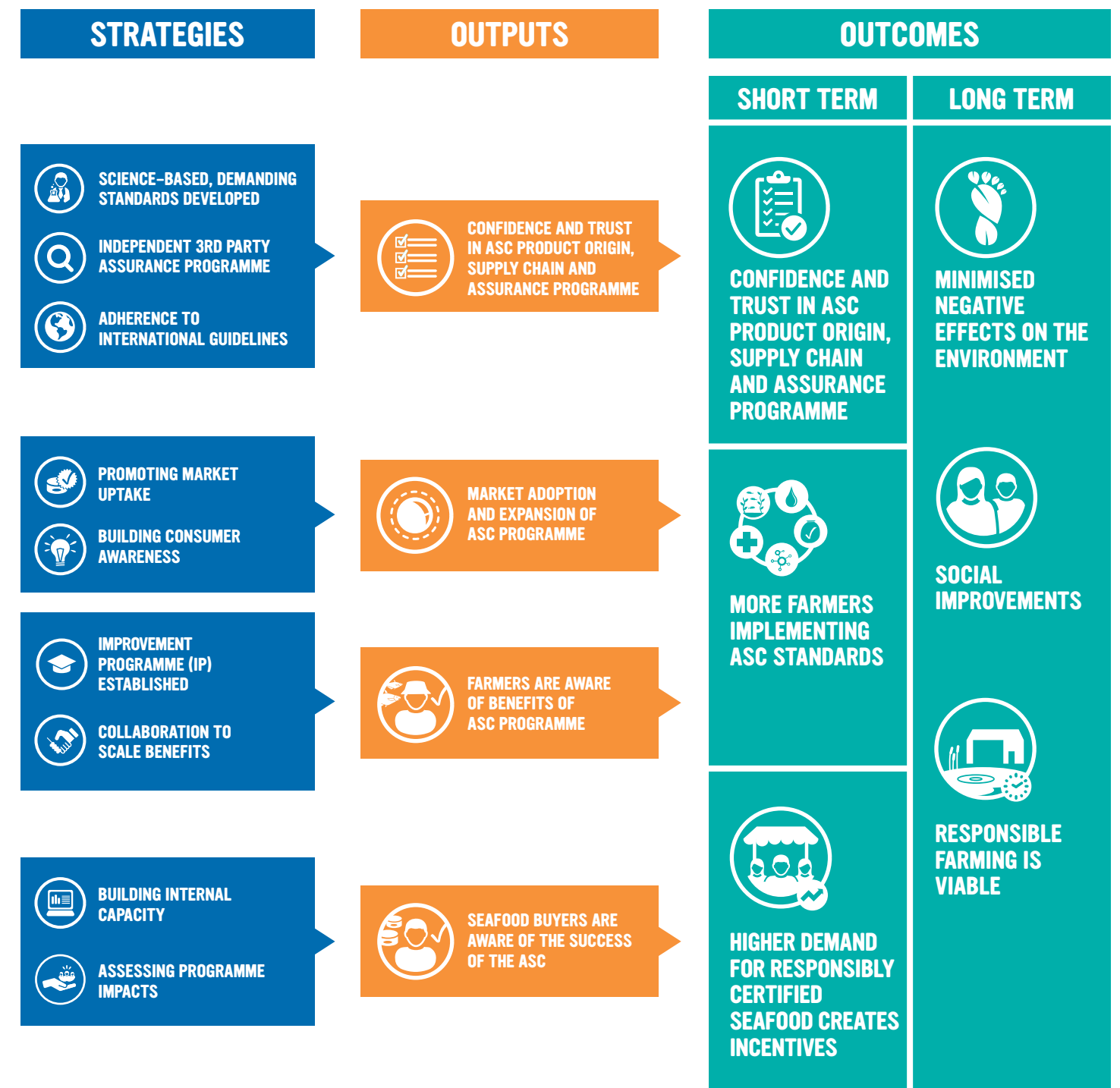
Unmatched transparency and rigor thanks to our partners' dedication and contributions.



THE M&E FRAMEWORK & ASC'S IMPACT PATHWAYS

ASC released the Monitoring and Evaluation (M&E) Framework in 2017 to describe how we will measure our progress in achieving our expected outcomes and impacts as we implement our strategies to achieve our Mission, the transformation of aquaculture towards environmental sustainability and social responsibility. The M&E Framework was developed in full compliance with the ISEAL Code of Good Practice for Assessing the Impacts of Social and Environmental Standards Systems, which ensures sustainability standards are accurately and transparently reporting on the impacts they deliver.

ASC draws upon a range of data types collected at varying scales and frequencies that are critical to informing our work in a number of ways, such as: the assessment and communication of key environmental and social impacts; ensuring our standards are effectively implemented and audited, with assurance across the supply chain; demonstrating our reach; and learning from farm performance to improve our standards. Our impact pathways shown here recognize the strategies, outputs and outcomes that we expect to see as we continually work to achieve our Mission.





ASC PROGRAMME REACH

GROWTH IN FARMS & CERTIFIED VOLUMES

ASC PROGRAMME REACH
GROWTH IN FARMS & PRODUCTION VOLUMES

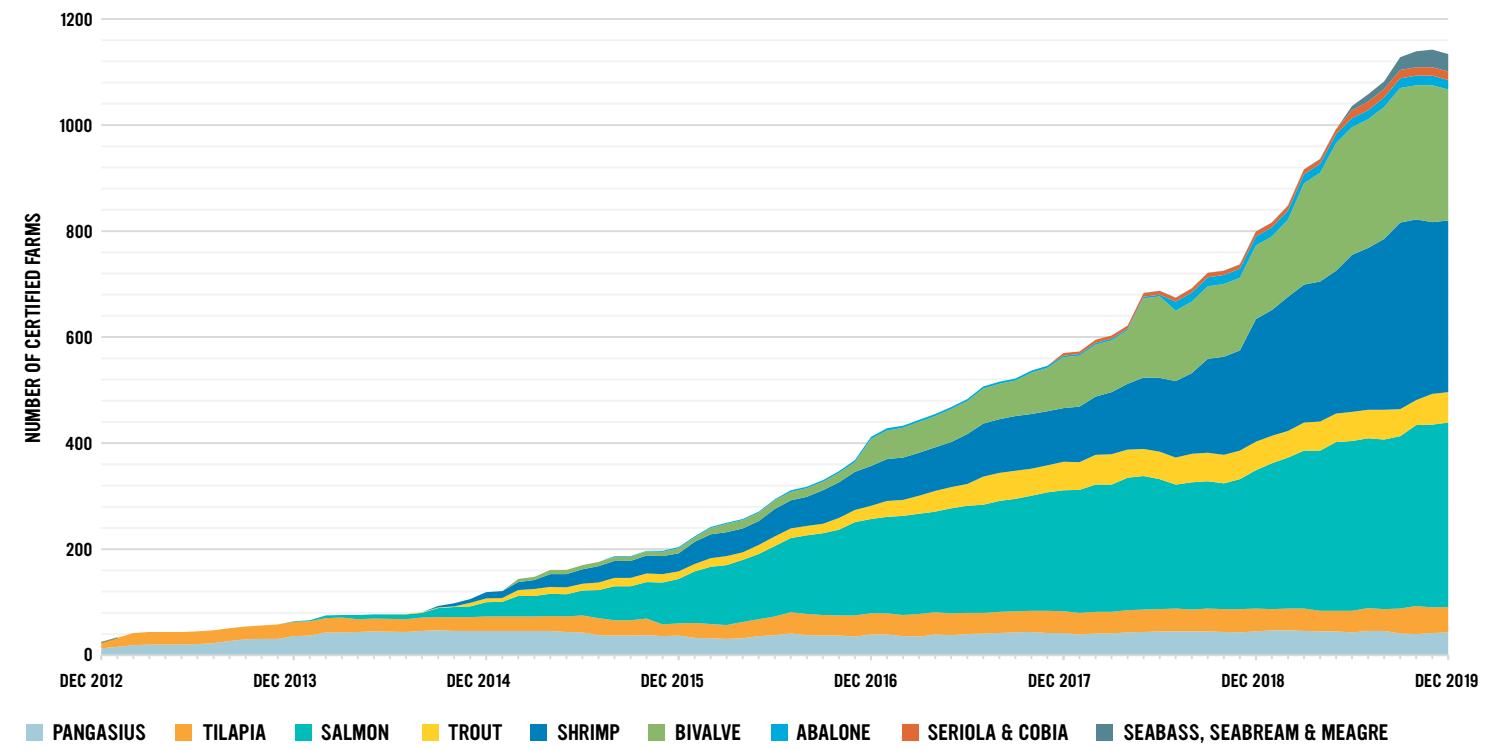


Figure 1. Growth in the number of certified farms per species standard, from December 2012 to the end of 2019.

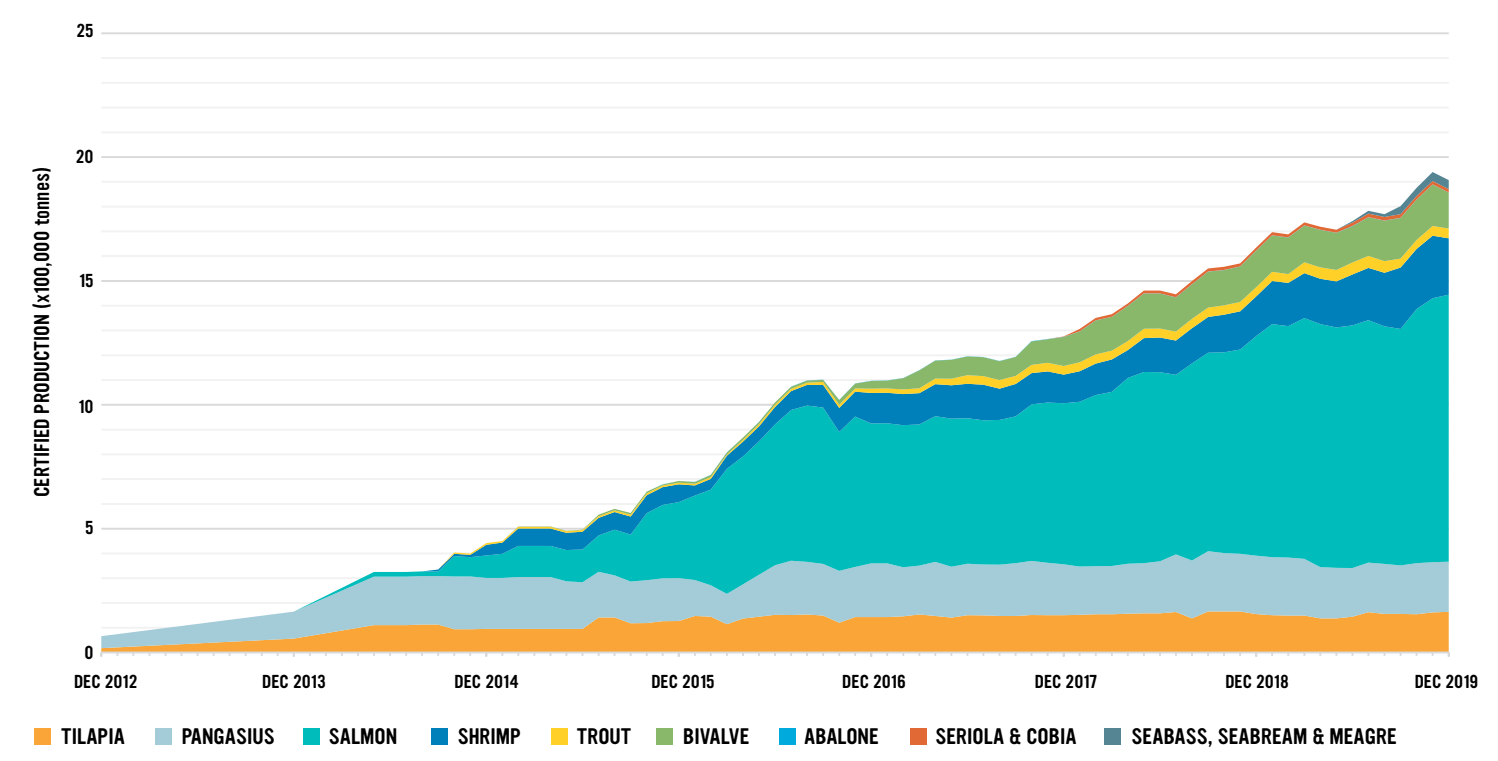
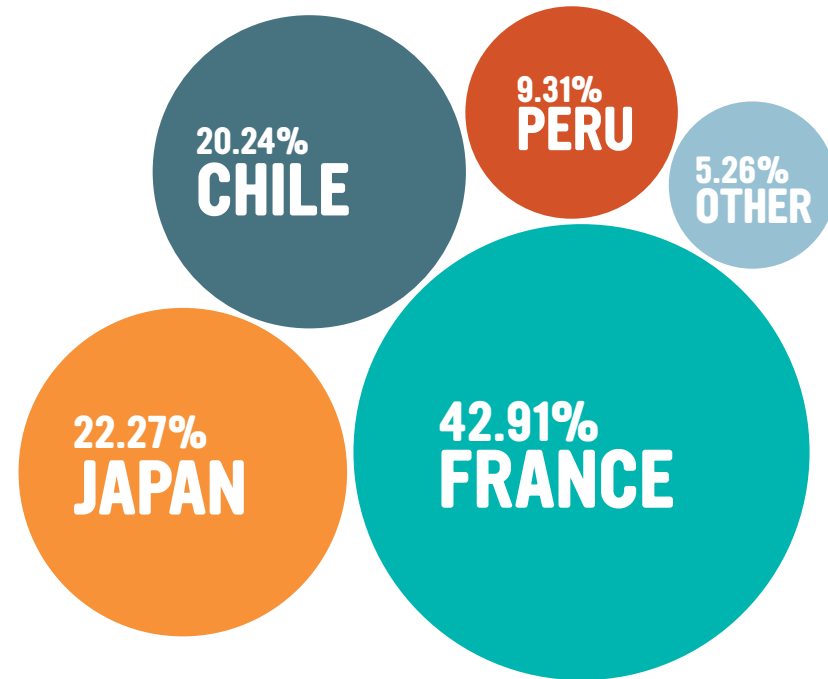


Figure 2. Growth in farm-reported certified production (in metric tonnes) per species standard, from December 2012 to the end of 2019.

TOP COUNTRIES PER SPECIES

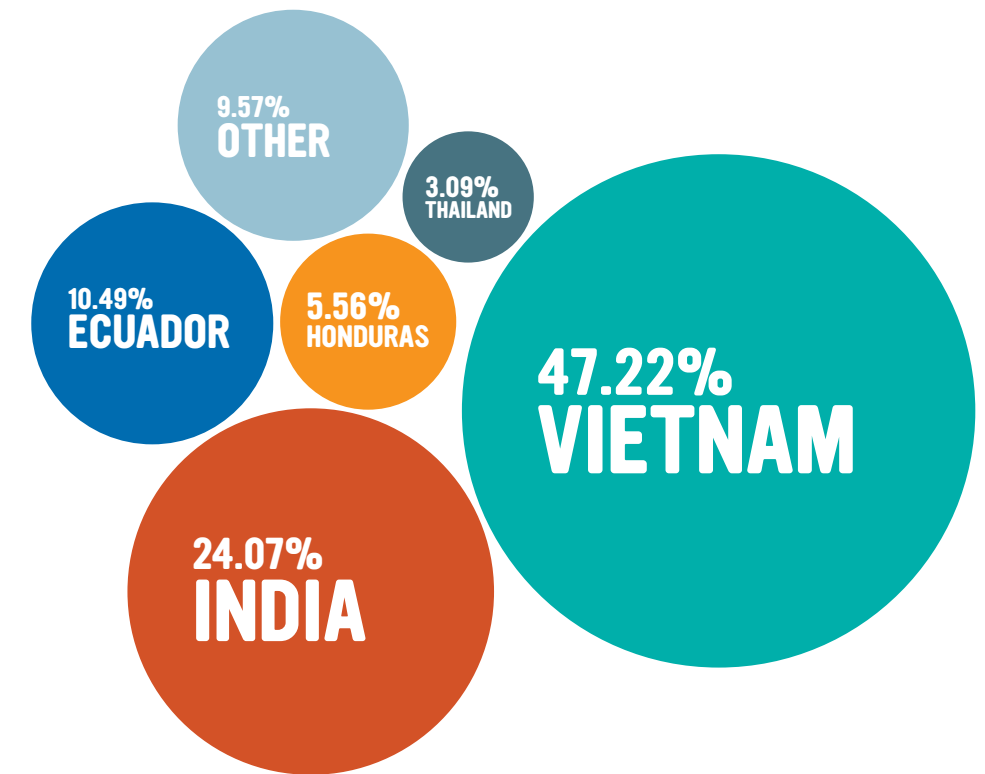
BIVALVE

Figure 3. The four countries with the highest percentage of ASC certified bivalve farms globally as of December 2019; with 3 countries representing 'Other'. The numbers of farms certified by country and standard are provided in Annex 1.



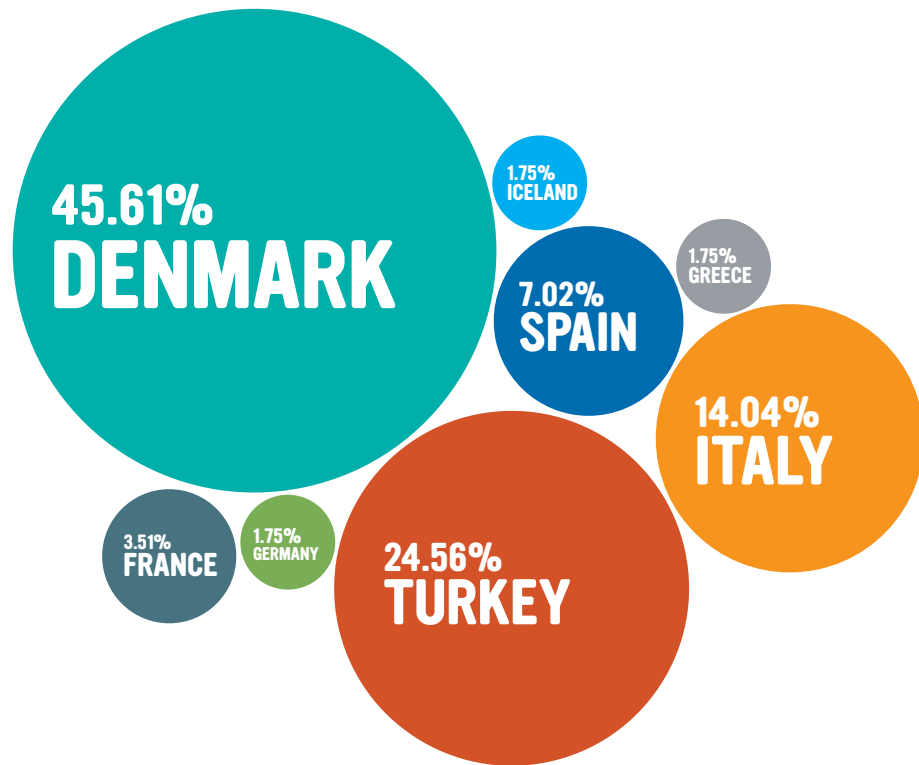
SHRIMP

Figure 5. The five countries with the highest percentage of ASC certified shrimp farms globally as of December 2019; with 12 countries representing 'Other'. The numbers of farms certified by country and standard are provided in Annex 1.



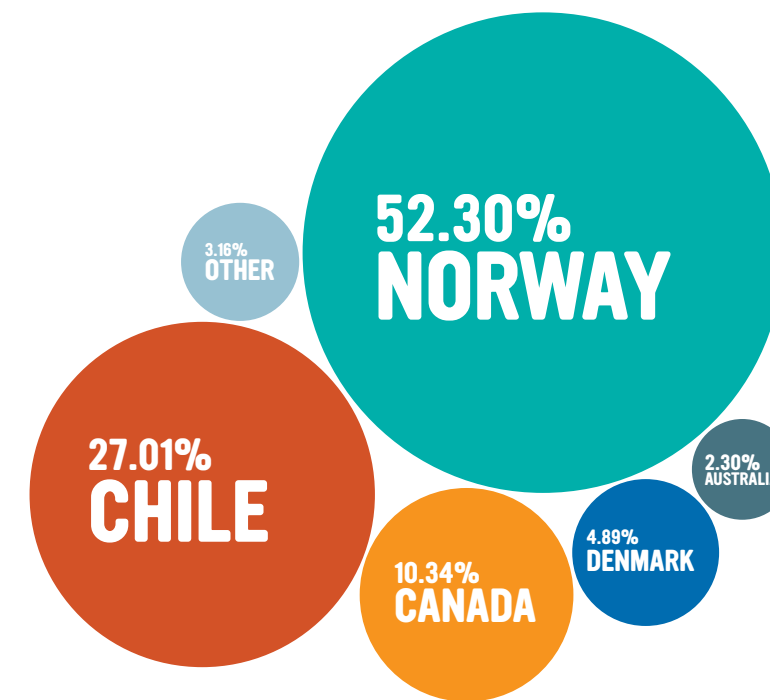
TROUT

Figure 4. The eight countries with ASC certified trout farms as of December 2019. The numbers of farms certified by country and standard are provided in Annex 1.



SALMON

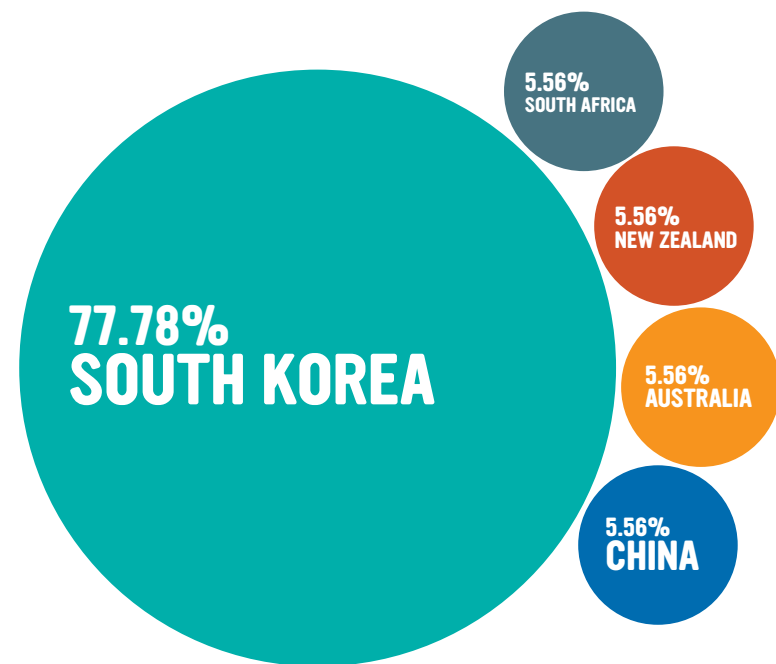
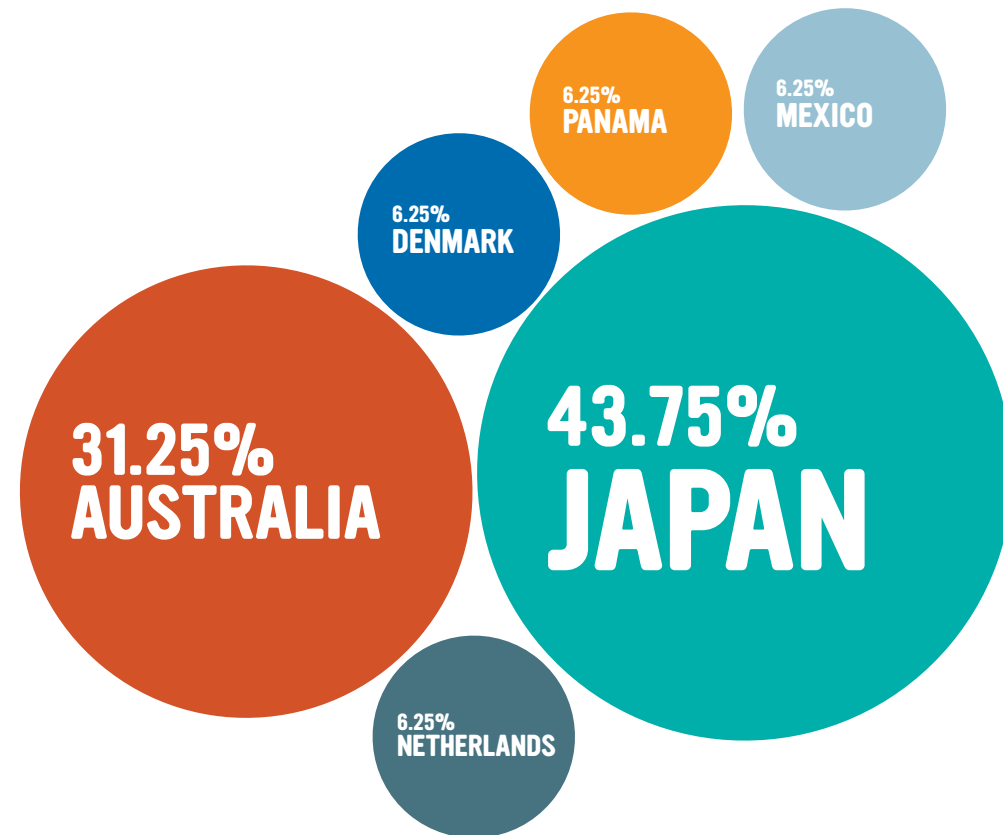
Figure 6. The five countries with the highest percentage of ASC certified salmon farms globally as of December 2019; with 5 countries representing 'Other'. The numbers of farms certified by country and standard are provided in Annex 1.



TOP COUNTRIES PER SPECIES

SERIOLA & COBIA

Figure 7. The six countries with ASC certified Seriola & Cobia farms as of December 2019. The numbers of farms certified by country and standard are provided in Annex 1.

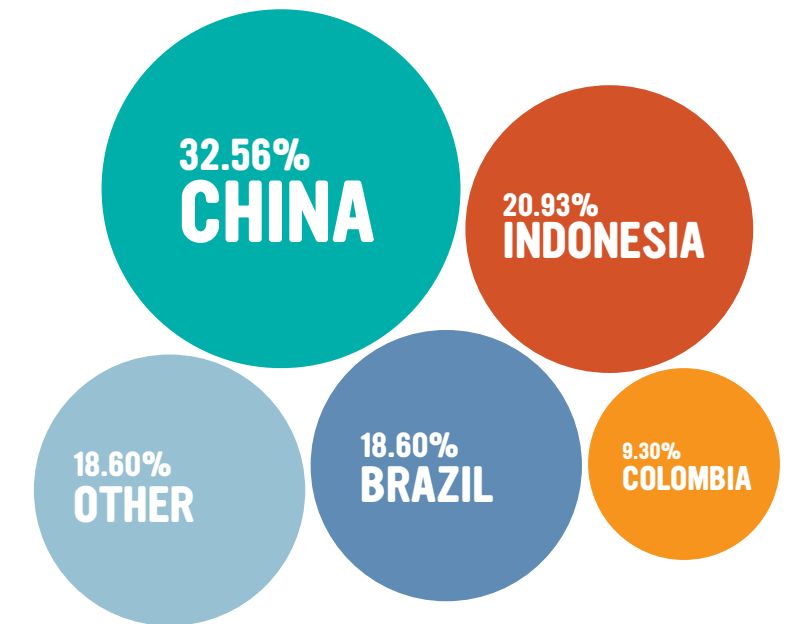


ABALONE

Figure 8. The five countries with ASC certified abalone farms as of December 2019. The numbers of farms certified by country and standard are provided in Annex 1.

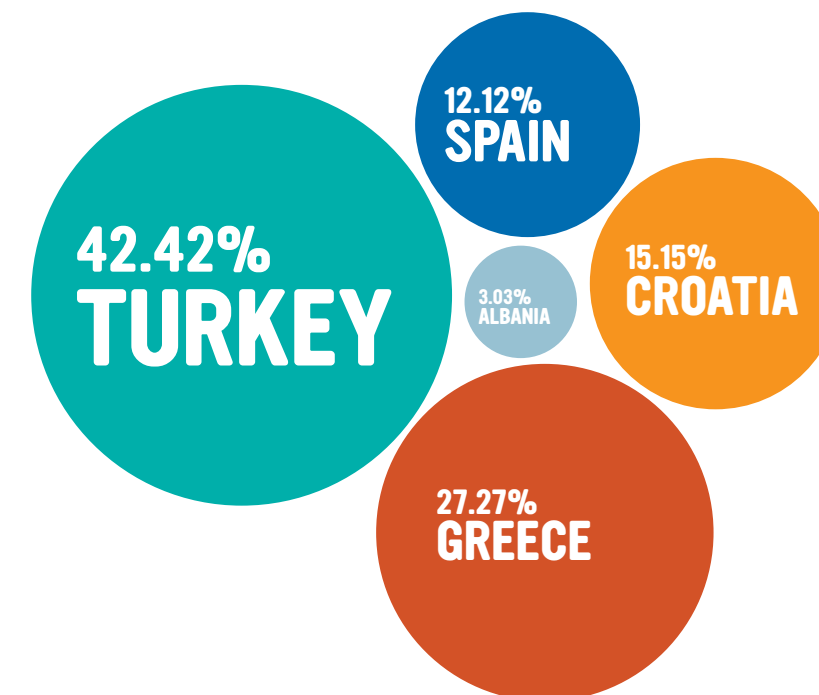
TILAPIA

Figure 9. The five countries with the highest percentage of ASC certified tilapia farms globally as of December 2019; with 5 countries representing 'Other'. The numbers of farms certified by country and standard are provided in Annex 1.



SEABASS, SEABREAM & MEAGRE

Figure 10. The five countries with ASC certified Seabass, Seabream & Meagre farms as of December 2019. The numbers of farms certified by country and standard are provided in Annex 1.



ASC FARM LOCATIONS

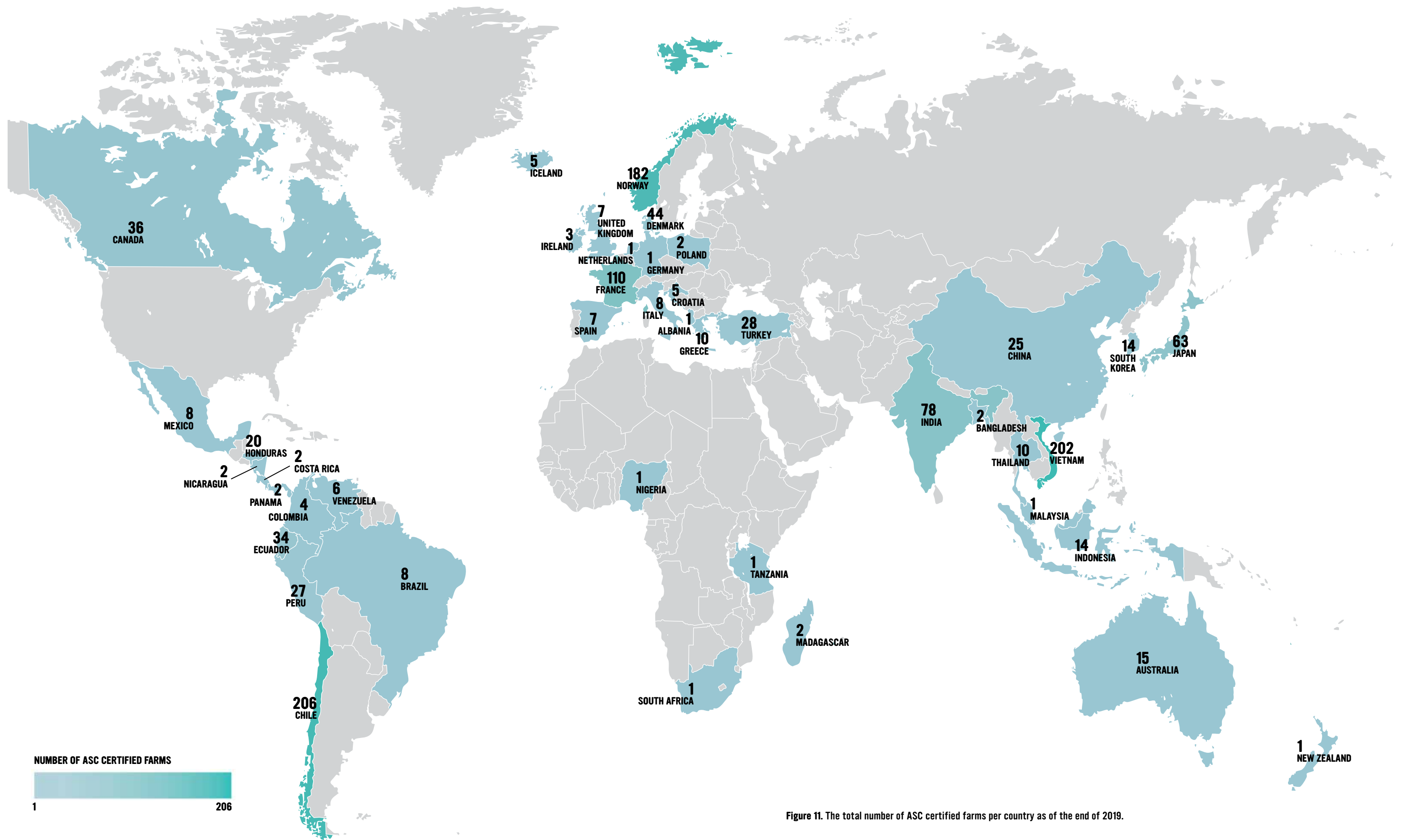


Figure 11. The total number of ASC certified farms per country as of the end of 2019.

NUMBER OF WORKERS ON ASC CERTIFIED FARMS

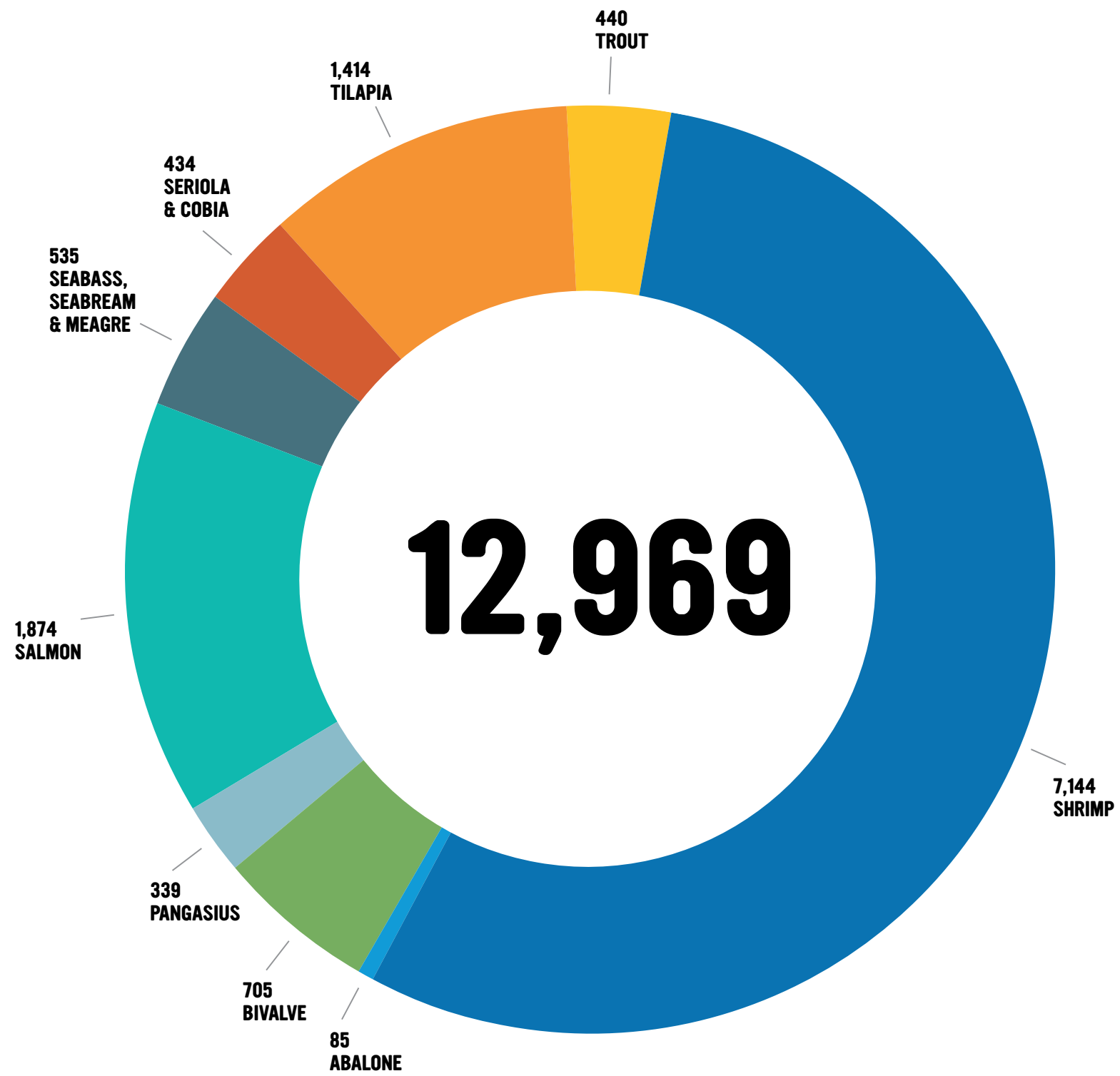


Figure 12. Total number of workers working on ASC certified farms per species standard, as of the end of 2019. The central figure is the total for the individual standards combined



ASC PROGRAMME REACH
NUMBER OF WORKERS ON CERTIFIED FARMS



PRODUCT AND MARKET TRENDS

PRODUCT GROWTH IN KEY MARKETS

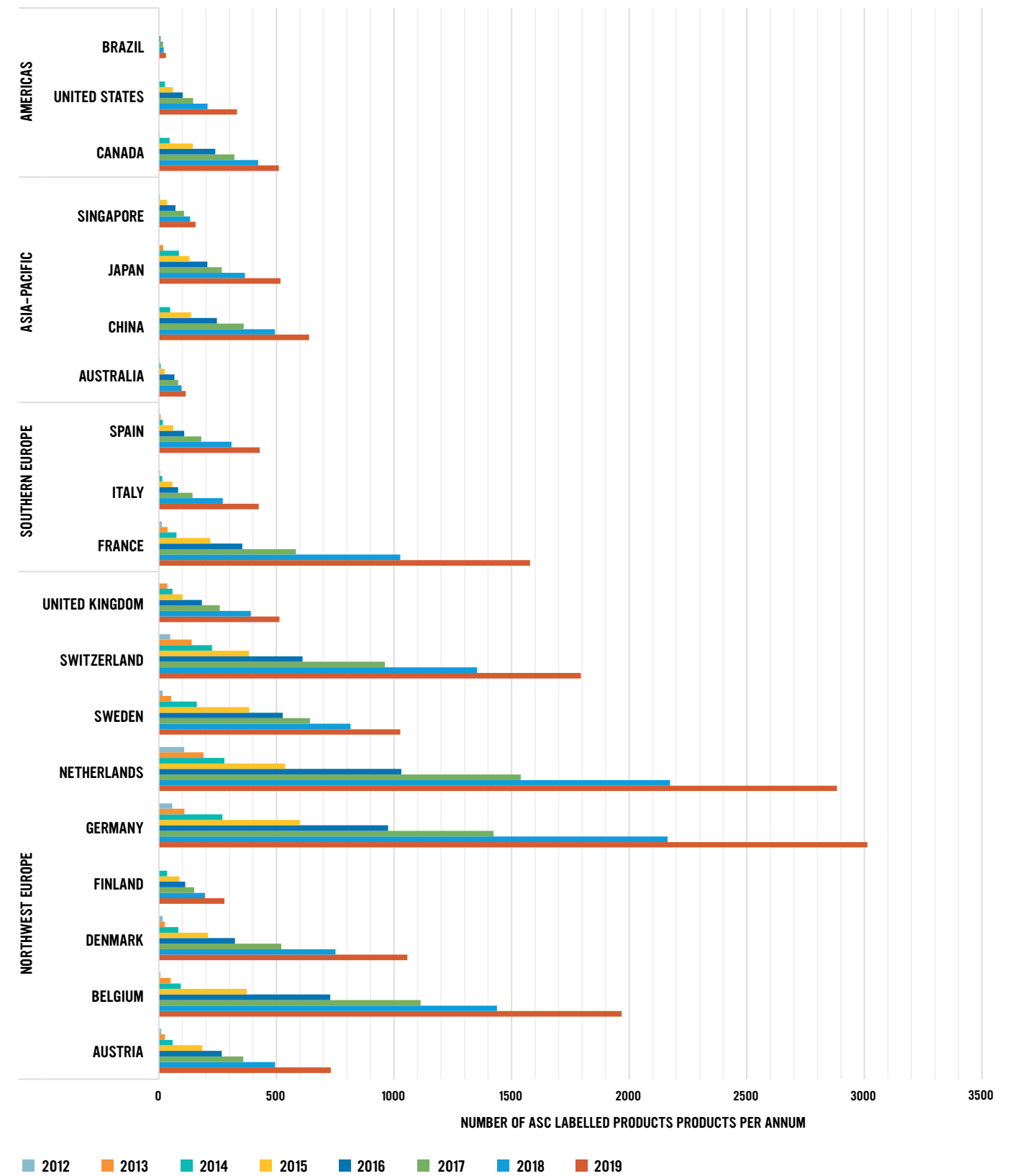


Figure 13. Growth in ASC certified products per country and region, up to the end of 2019.

COMMERCIAL UPDATES PER REGION

EUROPE

The world's first ever ASC labelled products were launched in Europe in August 2012. Newly certified tilapia from a farm operated by Regal Springs in Indonesia was brought to market by retailers including Albert Heijn (Alhold), Jumbo and Migros and seafood companies such as Queens, TopSea, Costa and bofrost*. Suppliers such Anova and Mayonna played an important role in getting products into the market as well. Since then ASC's presence in Europe has grown rapidly.

Northern European countries quickly took to ASC certified products with around 450 products on sale in The Netherlands, Switzerland and Germany by the end of 2013. The ASC programme was welcomed in northwest Europe with great enthusiasm, particularly among retailers already offering MSC certified wild caught seafood. Their interest, their committed suppliers and the interest of consumers in choosing certified products, created a fertile ground for the ASC programme.



Collaboration was key to this early success. Retailers such as Albert Heijn, Jumbo, Aldi and Lidl displayed a strong commitment to sourcing certified seafood. This collaboration led to the first successful joint awareness campaign between ASC, MSC, WWF

Netherlands and almost every major Dutch retailer in August 2013.

The second half of 2014 saw the launch of two new standards covering farmed salmon and shrimp. Producers of these species were quick to respond and seek certification, especially Vietnamese and Ecuadorian shrimp producers, and Norwegian salmon farmers. Both species are important in the Netherlands, Belgium, Switzerland, Germany and Austria, meaning ASC labelled shrimp and salmon products were quick to appear in these countries. The following year saw even greater growth – a 150% year on year increase in certified products, and a spread to new countries, thanks to early adopters like the Colruyt Group in Belgium, and Migros and Coop in Switzerland.

A major shift occurred in France in 2016, when Aldi and Lidl rolled out ASC certified products, and Carrefour France certified their fresh fish counters. French interest in the ASC was further helped by a growing awareness of seafood sustainability issues, the uptake of MSC labelled products, and an increasing supply of ASC certified shrimp and salmon. As a result, the country experienced an increase of 1,000 ASC labelled products from 2018 – 2020.

ASC's strong presence in Europe also impacts the rest of the world – many global companies

headquartered in Europe have made strong commitments to ASC, with these commitments often driving an increase in ASC products in markets beyond the continent. Companies such as Lidl, IKEA and Nomad Foods Europe – owner of brands such as Birds Eye and Findus – have all made strong commitments, many of which started in Europe but are now spreading to the companies' other markets.

Though the programme kicked off in northwest mainland Europe, recent years have seen increasing interest in the United Kingdom and in the south of the continent, particularly France, Spain and Italy which are the seafood loving countries in Europe. These markets are likely to see much more growth in the future. The increasing availability of ASC certified seabass and sea bream, and the future supply of certified flatfish species will further catalyse growth.



AMERICAS

ASC's presence in North America began in 2014 in Canada. One early adopter who helped bring ASC to consumers' attention was the retailer Loblaw, which added ASC certified seafood to its shelves as part of its strong commitment to seafood sustainability.



Ever since ASC certified shrimp and salmon became commercially available in late 2014, Loblaw has been steadily adding to its ASC certified range. Other influential companies such as Aramark Canada also helped to spread the availability of ASC certified products. As of January 2020 there are over 500 ASC labelled products available in Canada.

Canada is also one of the world's major producing countries for farmed seafood, with salmon and trout farms on the east and west coasts. By January 2020, 35 salmon farming sites were ASC certified, between them producing 6% of the globally available certified salmon volume. The debate around the sustainability of salmon farming and the role of ASC certification in independently assuring best practices based on solid standards, will further shape uptake of the programme in Canada.

The United States is globally an important seafood market and also a unique one – requiring an approach that is aligned with its size and diversity. The growth of ASC in the US began in the past two years, in which time the number of ASC labelled products has doubled to 330 (as of January 2020). However it has, as anticipated, been a very different and more challenging endeavour to establish an ASC presence in the US market.



In the US the food service sector is of major importance and already has strong partnerships with sustainable seafood NGOs, relying on their comparisons and ratings of different certification programmes. ASC has collaborated with some of these important NGOs, most notably World Wildlife Fund (WWF) and the Monterey Bay Aquarium Seafood Watch programme, which recognises the ASC Salmon Standard as equivalent to at least a Good Alternative. Target introduced ASC labelled salmon as a result of this benchmarking. In partnership with WWF, Hilton and Royal Caribbean launched several sourcing commitments, including one to offer ASC certified seafood for their guests. IKEA, Aldi and Lidl have also introduced ASC labelled products into their US stores as part of their global commitments to responsible seafood.

The ASC Salmon and Shrimp Standards have also been recognised by the Global Sustainable Seafood Initiative (GSSI). All of this has laid a

strong foundation for further ASC growth in this important market in the coming years.

Further south, ASC first gained traction in Brazil with the Rio Olympic Games in 2016 after the International Olympic Committee (IOC) announced that only ASC and MSC certified seafood would be served at the Games. The IOC also made an effort to prioritise local producers, with three of the largest tilapia producers in the country - Netuno, BrasFish, and Geneseas - able to achieve ASC certification in time to offer responsibly produced tilapia during the games. ASC has since gradually grown its presence in the country, thanks to more retail collaborations. Particularly important was the rapidly growing frozen retail company Swift, which recognised the business opportunity in offering ASC certified responsibly produced seafood. After introducing ASC labelled tilapia in 2018, the company added ASC salmon to its product range, with ASC labelled products now available in over 200 stores.



ASIA AND AUSTRALIA

Asia is perhaps the world's most important region with regard to aquaculture, both in terms of production and consumption. Around 90% of global aquaculture production takes place in the region, and per capita consumption of seafood is high in many Asian countries.

ASC labelled products first appeared in Asia in 2014 in Japan, when AEON began selling ASC certified salmon in stores around the country. AEON has continued to be a very active supporter of the ASC programme, not only in educating Japanese shoppers about making responsible choices, but also by engaging with their suppliers in Vietnam, Chile and Japan to move them towards ASC certification.

The first certified farming operation in Japan was the Shizugawa branch of the Miyagi Prefecture Fisheries Co-operative, which achieved certification in 2016 after a remarkable recovery and reorganisation following the devastating tsunami of 2011 (see case study on page 44).

As of January 2020, there are over 500 ASC labelled products on sale in Japan, thanks not only to the support of AEON, but also to COOP Japan (JCCU), IKEA, Itoyokado and more recently Seiyu. Outside of the retail sector, Panasonic have introduced ASC and MSC certified meals to their company canteens, with other large corporations following suit. World leading seafood companies such as Maruha Nichiro and Nissui have also played an important role in producing and processing certified products.

The Tokyo Olympic Games (now postponed) will offer ASC and MSC labelled seafood: a major opportunity to raise further awareness of the need for responsible and certified seafood products in Japan and beyond.

ASC's presence in China started in 2012, with ASC entering an EU-supported collaboration with WWF and China Aquatic Products

Processing and Marketing Alliance (CAPPMA) to encourage and assist tilapia producers in the country preparing for ASC certification. As a result, the first Chinese farms achieved certification in 2015. These early adopters, such as Xiangtai, Sky-Blue Ocean Foods and Qinfu, are still strongly engaged with the programme. More farms have since achieved certification, producing ASC certified tilapia, scallops, clams, mussels, and shrimp.



On the consumer side, international retailers operating in China such as IKEA, Metro, AEON and Walmart have all introduced certified seafood for sale. Home-grown retailers have also begun to embrace the ASC programme, with e-commerce giant JD.com prioritising certified seafood, Ole promoting certified seafood in a dedicated freezer section and Hema Fresh (owned by Alibaba) committing in 2018 to offer 100% ASC certified salmon in their 120 stores. As of January 2020, there are over 400 ASC labelled products for sale in China.

ASC has also been working with the Chinese government, other NGOs, and research institutes such as the Chinese Academy of Fisheries Science. For example, ASC engaged Chinese producers and researchers during the development of the ASC standards for Flatfish and Tropical Marine Finfish. Not only did this

help strengthen the standards, it also helped local producers understand how ASC could be relevant to the industry in China. Another recent collaboration saw ASC and CAPPMA team up with local charity Qingdao Marine Conservation Society (QMCS) to work together towards protecting the Yellow Sea region.

The ASC gained a foothold in Australia in 2014, when three Tasmanian Atlantic salmon farming companies moved towards ASC certification. This triggered one of the major supermarkets in Australia, Coles, to kickstart its offer of ASC labelled Australian salmon. In 2015, Coles was the first major supermarket in Australia to obtain ASC chain of custody certification for seafood deli counters. By collaborating with partners including iconic local company Mures, as well as Aldi, IKEA, Coles and Woolworths, ASC is working hard to educate consumers and build awareness of the importance of responsible aquaculture. Although Australia imports a lot of seafood, many retailers such as Coles and Woolworths like to focus on locally produced species, meaning strong demand from their customers can help encourage local producers to seek ASC certification and minimise their impacts. Furthermore, whilst salmon is an important species for home-grown seafood, it is far from the only species farmed in the country. ASC certified farms in Australia are producing species as diverse as abalone, black tiger prawns, cobia and seriola, and work is also underway to get local producers of barramundi, grouper and mussels interested in certification. The local availability of such a range of responsibly produced species, will be instrumental in further growing awareness of, and demand for, ASC products among Australian retailers and consumers.



EXPANDING OUR SCOPE

As part of ASC's commitment to continuous improvement, a number of new projects and standards have been developed to ensure that ASC can advance responsible practices throughout the aquaculture industry. These are always based on an analysis of how ASC can best use its resources to have the greatest impact on a rapidly growing industry. The projects below are examples of this, and demonstrate how ASC can expand its impact by covering new areas of production, add increasingly important species to the programme, or improve accessibility for small-scale producers.

FEED

Feed is a major component of the environmental and social footprint of aquaculture, and with increasing awareness of the potential impacts of producing fishmeal, fish oil, and many land-based ingredients, ASC is working to define what constitutes responsible fish feed.

While ASC standards already include requirements on feed, the new Feed Standard will cover all ingredients that make up more than 1% of a feed formulation. This means that importantly, it will set requirements for the sourcing of fishmeal and fish oil, and also terrestrial ingredients, such as soy, wheat, rice and corn. The global ASC Feed Standard will act as a tool to help recognise and reward responsible aquaculture feed and will be applicable to all ASC farm standards. It will look at the varied impacts that feed production can have, including over-harvesting, labour conditions, greenhouse gas emissions and deforestation.

Following two rounds of public consultation and approval from ASC's Technical Advisory Group and Supervisory Board, the Feed Standard will be published in Q3-2020.

GROUP CERTIFICATION

A significant proportion of global aquaculture is practiced by small-scale producers, and some of these will not be able to afford the cost of certification, thereby posing a challenge for ASC as it works to drive improvements around the world. To help address this issue, the Group Certification methodology was launched in Vietnam in April 2019, and makes applying for ASC certification more accessible for small producers.

Group Certification allows smaller-scale producers to join together as a group to collectively implement the requirements of ASC standards. This enables the sharing of costs and resources involved in meeting ASC requirements and auditing them. However, the applicable requirements of the standard remain the same, and every part of the group must meet these requirements to achieve certification. In this way the methodology makes the benefits of ASC certification more accessible, without lowering the requirements of the ASC standards.

The ASC Group Certification Methodology is the result of several years' work, guided by a diverse technical working group and public consultation, and piloted in Indonesia, Vietnam, Bangladesh and Finland.

SEAWEED

Seaweed has been cultivated for thousands of years for use as a fertiliser, and for food and medicinal purposes, but interest in this marine algae is now growing rapidly, thanks to its versatility. Current applications include food, health products, cosmetics, fuel, medicines, fertiliser and biofuel.



Seaweed can be farmed and wild harvested, and as a result, ASC joined forces with the Marine Stewardship Council (MSC) to develop the two organisations' first joint standard, the ASC-MSC Seaweed Standard. Released in 2017 after two years of development, the standard benefits from the combined expertise of ASC and MSC in standard-setting and certification, and allows producers to demonstrate that they are environmentally sustainable and socially responsible.

Environmentally, seaweed operations must show that they maintain sustainable wild populations and actively minimise their impact on the surrounding natural environment. Socially, the operations must be managed in an effective and socially responsible manner, caring for their employees, working with the local community, and being good and conscientious neighbours. The standard establishes a robust and efficient framework to certify seaweed through scientific understanding and industry best practices. It is applicable to both global wild harvest and aquaculture seaweed operations of all sizes. The standard also provides a tool to benchmark best practice and incentivises improvements.

The first two seaweed operations were certified in 2019, and demonstrate the varied nature of seaweed production and its many benefits. One produces microalgae used in cosmetics and health supplements, whilst the other produces wakame, a more traditional seaweed that is mostly sold as food around the world. What they have in common is an assurance that they are minimising their environmental and social impacts.



RESEARCH IN FOCUS

ASC SALMON STANDARD COMPARED WITH REGIONAL REGULATIONS

In this August 2019 article¹, a group of Swedish scientists from Södertörn University and the Stockholm Resilience Centre (SRC) at Stockholm University, highlighted four main sustainability concerns associated with the fast growing salmon aquaculture industry globally:

- Farmers' interaction with wildlife
- Fish health and how use (or overuse) of antibiotics in some regions can lead to antimicrobial resistance (AMR)
- Environmental impacts of farms' effluents
- 'High' dependence of fish feeds on wild-caught fish resources.

The study specifically looked at the differences between government regulations for salmon farming in the four largest salmon producing regions - Norway, Chile, Scotland (UK) and British Columbia (Canada) - and compared them with some of the requirements of the ASC Salmon Standard for their stringency in addressing the above-mentioned sustainability concerns. This enabled the researchers to calculate the "potential additionality" of the ASC standard, i.e. the positive "quantifiable differences" between the ASC standard and national/regional legislation or policies.

They found that "at present the ASC standard has mainly three strong

advantages over existing regional/national standards and these relate to: escape numbers allowed, antibiotic usage and fish resources in feed." They concluded: "Changing these three main divergences in the national/regional regulations would significantly improve some of the main sustainability issues with uncertified salmon farming." In particular, they found that "the feed impact category is where the ASC requirements have the highest potential for additionality." The study also found that the potential additionality of the ASC standard can differ between regions. It is highest in Chile, followed by British Columbia and Scotland, and lowest in Norway.



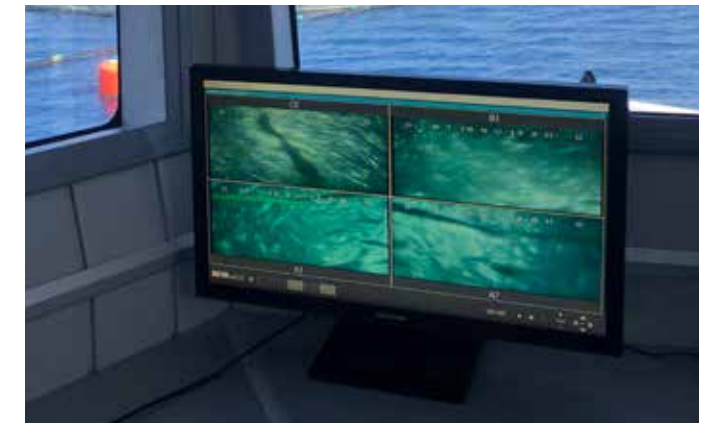
MEASURING ON-FARM CHANGE: METHODOLOGY

BACKGROUND

In order for a farm to become ASC certified, it must meet the requirements as defined in the relevant ASC standard and the Certification and Accreditation Requirements (CAR). Farms seeking certification are audited by independent third-party auditors from accredited Conformity Assessment Bodies (CAB). The rigour of this process is overseen by a third-party accreditor, Assurance Services International (ASI). Audit reports, including findings, are fully disclosed on the ASC website and open for public comment.

The auditor assesses the farm during an audit. When an auditor detects a shortcoming, they raise a “non-conformity” (NC). Depending on the severity of the issue detected, a NC can be either “major” or “minor”. A minor NC is for smaller, isolated incidences that are unlikely to seriously jeopardise the integrity of the certified product, whereas a major NC is for more systemic failures that may result in a failure of a farm to achieve the objectives of the ASC standard (see Annex 2 for definitions).

Once an NC is raised, the farm must develop and implement a corrective action plan to address the NC. The results of the implementation of the corrective action plan are verified by the auditor. From these raised non-conformities, an analysis of trends gives insights into the rate at which issues are being detected and addressed on ASC certified farms. This provides a direct link between the auditing of a farm and improvements needed to meet the ASC standard, allowing some conclusions to be drawn about the changes that ASC is driving on the ground.



OVERVIEW

All NCs were collected from a sample (see below) of audit reports across 4 key species standards: Salmon, Shrimp, Tilapia, and Bivalve. Within each species standard sample, countries were grouped into regions where sample sizes for the country alone were too low. To further aid interpretation, each standard’s indicators were grouped into impact areas taken from the ASC M&E framework. Lastly, each farm was given an “effort-adjusted non-conformity score” for each audit. This is a measure of the non-conformance of a farm against the relevant standard that accounts for the relative severity of minor and major NCs and the comparative amount of scrutiny the farm may have faced during audit (measured as the number of days spent on site by the CAB auditors). For further presentation, average effort-adjust non-conformity scores have been calculated per year for each country or region and for each species standard, with these then being presented in separate sections for the environmental and social impact areas (pages 40-43 and 46-49 respectively). Lastly, we briefly explore some of the potential reasons for farms leaving the programme on page 50.



SAMPLING

A sampling approach has been taken to collect the details of NCs from audit reports published between the start of the ASC programme and March 2019, focusing on the 4 ASC standards with the greatest certified production volume: Salmon, Shrimp, Tilapia, and Bivalve (see page 17). These 4 species groups accounted for 85% of total ASC certified production volume as of March 2019, with a total of 993 audit reports sampled across these species representing 62% of all audits conducted in that same time period (i.e. 1609 audits across all species standards up to March 2019). Audits from sites that were still certified as of March 2019 were the primary focus of sampling as this ensured that data collected would also be of most immediate use for other aspects of ASC’s work. A detailed breakdown of the total audits sampled per species is given in Table 1. Due to low sample sizes, grouping of countries into regions was necessary in several cases. Shown in Table 2 are the countries with low sample sizes that were therefore included in each regional grouping per species standard.

SAMPLE DETAILS

SPECIES STANDARD	CERTIFICATION STATUS					
	CERTIFIED		EXPIRED OR CANCELLED		FAILED, SUSPENDED OR WITHDRAWN	
	TOTAL	SAMPLED [% OF TOTAL]	TOTAL	SAMPLED [% OF TOTAL]	TOTAL	SAMPLED [% OF TOTAL]
SHRIMP	259	229 [88.4]	15	2 [13.3]	18	2 [11.1]
SALMON	653	537 [82.2]	37	11 [29.7]	40	13 [32.5]
TILAPIA	135	118 [87.4]	8	8 [100]	18	13 [72.2]
BIVALVE	66	60 [90.9]	5	0 [0]	1	0 [0]

Table 1. Total audits conducted and the number sampled for this study, per species standard. Totals are relevant as of March 2019. For detailed definitions of each certification status see Annex 2. In short, farms that have expired or cancelled certificates left the programme for reasons unrelated to issues with meeting the CAR or standard requirements, whereas this is not the case for those that have failed, been suspended or had their certificate withdrawn. Farms may also have their certificate suspended or withdrawn for contractual reasons between them and the CAB.

REGIONAL GROUPINGS PER STANDARD

SPECIES STANDARD	REGION	COUNTRIES
SHRIMP	ASIA (NOT OTHERWISE SPECIFIED)	CHINA INDONESIA THAILAND
TILAPIA	CENTRAL AND SOUTH AMERICA	BELIZE BRAZIL COLOMBIA COSTA RICA ECUADOR HONDURAS MEXICO
	SOUTH EAST ASIA	INDONESIA MALAYSIA VIETNAM
BIVALVE	GLOBAL	CHILE CHINA FRANCE JAPAN MEXICO PERU UNITED KINGDOM

Table 2. The regional groupings used per standard. Where a standard is not shown, that standard had sufficient sample sizes on a per country basis.

GROUPING INDICATORS INTO IMPACT AREAS

As a result of the ASC currently operating separate standards for different farmed species, direct comparisons between indicators or criteria is not always possible. However, there is a broad degree of equivalency between standards on the environmental and social impact areas to address. As a result, indicators have

been grouped into “impact areas” as identified in the M&E framework (available on the ASC website). The indicator topics and their groupings are shown in Table 3. The number of indicators per standard that have been counted against each impact area is given in Table 4.

IMPACT AREAS

FOCUS	IMPACT AREA	INDICATOR TOPICS
ENVIRONMENTAL	BENTHOS STATE	DIVERSITY INDICES; SULPHIDE LEVELS; CAGE PROXIMITY TO BENTHOS; COPPER NET MANAGEMENT
	RECEIVING WATER QUALITY	EFFLUENT QUALITY; SLUDGE DISPOSAL; DISSOLVED OXYGEN
	WILDLIFE AND ESCAPES	GENETICALLY MODIFIED (GM) STOCK; SEA LICE MANAGEMENT; PREDATOR CONTROL; ESCAPES; NON-NATIVE INTRODUCTIONS; PROTECTED SPECIES
	FISH HEALTH MANAGEMENT	THERAPEUTANT USE; DIAGNOSTICS AND HEALTH CARE
	HABITAT	ENVIRONMENTAL IMPACT ASSESSMENTS (EIA); SALINIZATION; WASTE MANAGEMENT; PROTECTED AREAS
	FEED-USE EFFICIENCY	FEED CONVERSION RATIO (FCR); FORAGE FISH DEPENDENCY RATIO FOR FISHMEAL AND FISH OIL (FFDRm/FFDRo)
	FEED ORIGINS AND TRACEABILITY	SOURCES OF FISHMEAL AND FISH OIL; DISCLOSURE OF GM INGREDIENTS
	ENERGY USE AND GREENHOUSE GASES (GHGs)	RECORD KEEPING; EQUIPMENT MAINTENANCE, PLANS FOR INCREASING EFFICIENCY
SOCIAL	HEALTH AND SAFETY	WORKER TRAINING; APPROPRIATE EQUIPMENT AND RESPONSE PLANS; PAYMENT OF MEDICAL COSTS; COMFORTABLE LIVING CONDITIONS
	WORKING HOURS AND OVERTIME	MAXIMUM WORKING HOURS; OVERTIME PAY
	FAIR WAGES	PAYMENT OF (AT LEAST) MINIMUM WAGE; TRANSPARENCY IN WAGE SETTING
	COMMUNITY RELATIONS	CONFLICT RESOLUTION; INDIGENOUS COMMUNITIES; PARTICIPATORY SOCIAL IMPACT ASSESSMENT (P-SIA); ACCESS TO SHARED RESOURCES; LOCAL EMPLOYMENT

Table 3. Summary of the sub areas covered by the impact areas used in the analysis. The impact areas are based on those identified in the ASC M&E framework.

NUMBER OF INDICATORS PER IMPACT AREA

FOCUS	IMPACT AREA	SPECIES STANDARD			
		SALMON ^(A)	SHRIMP	TILAPIA	BIVALVE
ENVIRONMENTAL	BENTHOS STATE	8	N/A ^(B)	1	5
	WATER QUALITY	8	7	11	3
	WILDLIFE AND ESCAPES	23	10	10	11
	FISH HEALTH MANAGEMENT	24	12	10	N/A ^(C)
	HABITAT	5	13	3	7
	FEED-USE EFFICIENCY	2	2	1	N/A ^(D)
	FEED ORIGINS AND TRACEABILITY	9	8	4	N/A ^(D)
	ENERGY USE AND GREENHOUSE GASES	3	2	1	2
SOCIAL	COMMUNITY RELATIONS	8	5	2	11
	FAIR WAGES	3	7	1	1
	HEALTH AND SAFETY	6	5	5	3
	WORKING HOURS AND OVERTIME	2	7	1	1

Table 4. The number of indicators that were classified against each impact area, per species standard. N/A = non-applicable. (A) Values for salmon exclude indicators that apply to the supplier of juveniles (smolt); the results for smolt suppliers will not be presented as part of this analysis due to differences in the level of assurance available. (B) Shrimp is produced in ponds or tanks, meaning there is no need for benthos state indicators in each standard. (C) Health management indicators in the bivalve standard primarily addressed impacts on wildlife (predator control and chemical use effects) so were grouped under the “wildlife and escapes” impact area. (D) Bivalves do not require feed inputs from the farmer as they are filter feeders, meaning they feed on naturally occurring food in the water column

ADJUSTING NON-CONFORMITY SCORES TO ACCOUNT FOR DIFFERENCES IN AUDIT EFFORT

The first step here was to calculate a “non-conformity score” per impact area for each audit. This is the sum score for the number of minor and major NCs found: each minor NC scores 1 point, a major NC scores 2, and full conformance remains at 0. The difference in scoring between a major and minor NC reflects the relative severity of the underlying issues detected (see the major and minor NC definitions in Annex 2).

The non-conformity scores have then been adjusted to account for differences in audit effort between surveillance and initial audits (more details on the methodology are given in Annex 2). Following this adjustment, the cumulative non-conformity score for an impact area (i.e. the sum of the 1s and 2s from minor and major NCs) is divided by the total number of indicators for that impact area (the value in Table 4), resulting in a measure of the

“mean effort-adjusted non-conformity score” per impact area per audit. This is then averaged per year and per country to give the graphs presented in the results sections.

For example, a salmon farm receives 1 major and 1 minor NC for indicators classified as belonging to the impact area “wildlife & escapes”. The unadjusted NC score for this farm for “wildlife & escapes” would therefore be 3 (2 points for a major and 1 point for a minor). After multiplying this by 1.21 to account for the fact that this audit was conducted with fewer auditor days on site than the average for that species, country and CAB combination, the score becomes 3.63. When we divide that by the total number of indicators under that impact category, 23, we end up with a final effort-adjusted non-conformity score of 0.158.



MEASURING ON-FARM CHANGE METHODOLOGY & RESEARCH IN FOCUS: PANGASIIUS

RESEARCH IN FOCUS

LIFE-CYCLE ASSESSMENT OF ASC CERTIFIED PANGASIIUS

In this 2016 study², researchers aimed to compare the environmental performance of ASC-certified and non-ASC certified pangasius production systems using life cycle assessment (LCA), an approach which enables the ‘cradle-to-grave’ inventory and quantification of a process/product’s various environmental impacts.

With the 10-fold growth of pangasius aquaculture in Vietnam’s Mekong delta between 1985 and 2012, various negative environmental impacts occurred and were highlighted by the media. These included mangrove destruction, eutrophication, high reliance on wild fish stocks, and high chemical and antibiotic usage. As a result, since 2016, all pangasius farms have been required by the Vietnamese government to meet one of several eco-certification standards - including the ASC Pangasius

Standard – making it important to test what role ASC certification has played in transforming the sector.

In this study, researchers focused on both resource-related (water, land and total resources) and emissions-related (global warming, acidification, freshwater and marine eutrophication) impact categories. They found that in comparison to non-ASC certified sites, ASC certification “induced a significantly lower environmental impact in most considered categories” and was shown to be “a good approach for determining adequate environmental sustainability, especially concerning emissions related categories.” In particular, ASC certified sites had better economic feed conversion rates (eFCRs), lower nitrogenous discharges, lower use of fish-derived feed ingredients such as fish

meal, fish oil and trash fish, and lower water usage per tonne of pangasius produced.

The authors also noted that whilst “not common” - and even if “the ASC certification scheme ascertains a low environmental impact” - some impacts (e.g. water resources and eutrophication) “were possibly lower” for some of the non-ASC certified farms. “due to the[ir] large spread”. The researchers also suggested some improvements*, such as making the implementation of certification schemes more affordable and accessible for small and medium-scale farms and focusing on the sustainability of feed marine ingredients.

*NB: These have since been considered by the ASC in its Improver Programme and in the forthcoming Feed Standard.

MEASURING ON-FARM CHANGE: ENVIRONMENTAL TRENDS

Presented here are some of the results of our non-conformity (NC) analysis, focusing initially on the environmental impact areas. Given the variation in the number of indicators per impact area across the species standards, comparisons between species standards could be misleading: impact areas where more indicators are taken into account will have more indicators that receive few or no non-conformities (NCs) at all, resulting in a lower average NC score. As a result, the most valid comparisons to make are of NCs received at the impact area and country level within each species standard. Our analysis of environmental impact areas therefore looks at the NCs and improvements made within a farmed species across countries or regions, with a focus on the key trends and improvements seen.

SALMON

ASC certified salmon farms received NCs in all eight impact areas across all countries, and demonstrate a clear trend of improving performance across the three countries with the most ASC certified farms (Figure 14). Furthermore, this trend of improvement across environmental indicators seems to be one of the strongest when compared with the other species standards. This may in part be due to the relative maturity and consolidation of the global salmon sector, with fewer companies operating many farms, often in more than one country or region, enabling greater consistency in practices. The lessons learnt during the certification of a company's first few sites can be applied to those sites that apply for certification at a later date. This seems to be supported by the data collected for this study: of 21 companies which had new sites certified in subsequent years, 14 achieved lower NC scores for the farms that entered certification later.

We also see a relatively persistent level of non-conformance for indicators relating to the state of the sea floor surrounding farms and the organisms that live there (i.e. "benthos state") (Figure 14). One of the main causes of non-conformance in this impact area is the requirement for sampling to be undertaken when the farm is at or near its maximum weight of fish on site (i.e. peak biomass). This has been an important area of consultation since the launch of the salmon standard, with the resulting revision allowing farms to use data from sampling undertaken when they are at 75% or more of peak biomass. Further work is ongoing to ensure our guidance on benthic monitoring continues to utilise the latest scientific research. The TAPAS project, featured in this report on page 51, provides an example of how ASC is engaging with academia on benthic impact monitoring.

As with the benthos state indicators, many of the non-conformances received on salmon farms in other impact areas result from missing or incomplete evidence being presented by the farm. Issues seen in the impact areas relating to feed (feed origins and feed-use efficiency) revolve around a lack of documentation from feed suppliers, such as insufficient information on the sources of fishmeal and fish oil in the

feed or a lack of proof of the feed supplier having undergone a 3rd-party audit. These NCs result in farms working with their feed supplier to address identified issues, illustrating that ASC certification may help to sustain an active and responsible approach to feed sourcing by farms.

SHRIMP

The NC scores of Indian shrimp farms (Figure 15) demonstrate a similar marked improvement over time in the feed origins impact area. Of particular issue was the sourcing of fishmeal and fish oil from the Indian Oil Sardine (*Sardinella longiceps*) fishery, which does not meet ASC requirements specifying minimum standards of fisheries management (as measured under the FishSource methodology of the Sustainable Fisheries Partnership). As a result, farms resolved to coordinate with their feed suppliers to source fishmeal and fish oil either from the by-products of fish being processed for human consumption, or from fisheries that were engaged in a fisheries improvement project (FIP).

Results are otherwise similar between India and Vietnam for the types of issues arising in other impact areas. Under "energy-use & greenhouse gases (GHGs)" farms in both countries lacked the adequate procedures to regularly and systematically record and calculate their annual energy use. As a result of going through an ASC audit, farms have clearly revised protocols and improved staff training. Accurate record keeping represents an important first step in moving farms towards better management and eventually increased energy efficiency. Furthermore, farms in both countries show similar trends under "fish health management", with deficiencies in biosecurity measures receiving the most major NCs for this impact area. Corrective actions resulted in improved measures for excluding wildlife (a potential carrier of disease) and improved isolation of farms from neighbouring water bodies through the repair of farm structures and improved waste management. The outputs from this analysis will form valuable input for ASC's ongoing work to strengthen our guidance and requirements for fish health management.

ENVIRONMENTAL NON-CONFORMITY SCORES: SALMON

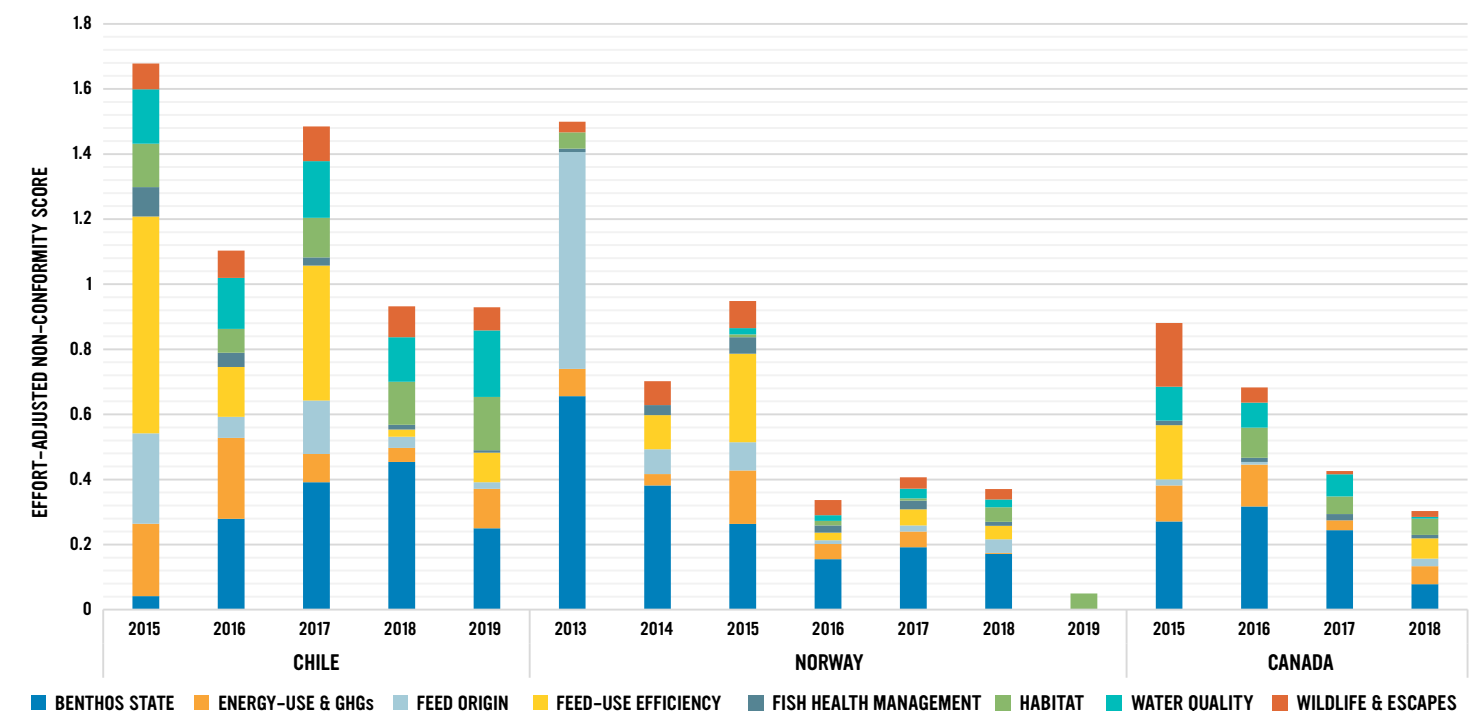


Figure 14. Average effort-adjusted non-conformity score (see box on page 38) for farms certified against the ASC salmon standard per country, year and environmental impact area. No results are presented for Canada in 2019 as there had been no audits finished before the March 2019 cut-off for sampling.

ENVIRONMENTAL NON-CONFORMITY SCORES: SHRIMP

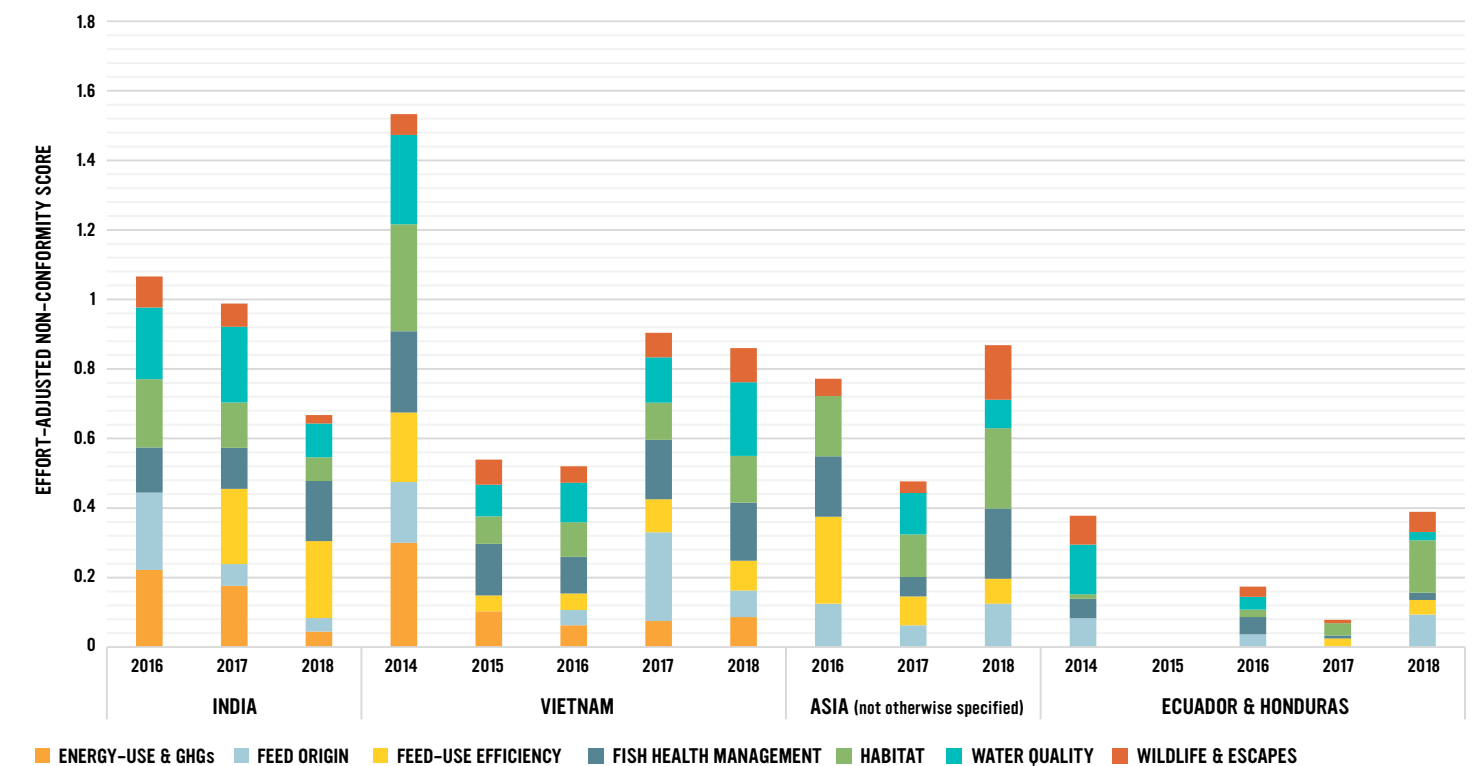


Figure 15. Average effort-adjusted non-conformity score (see box on page 38) for farms certified against the ASC shrimp standard per country, year and environmental impact area.



There is further similarity between India, Vietnam and the countries grouped as “Asia (not otherwise specified)” in the impact area of “water quality”. Most NCs were raised where farms were incorrectly measuring the dissolved oxygen of receiving water bodies and the suspended solids of their discharged water. In these cases, farms implemented revised procedures, enhanced training for staff and in several cases purchased new sampling equipment such as dissolved oxygen meters. Across all four countries/regions similar issues have been raised under the “habitat” impact area, relating to the prevention of chemical spills and the appropriate disposal of non-biological wastes. These typically result in the renovation of containment measures around generators and chemical storage, as well as improved staff training. An interview with Best Aquaculture Partners (page 52) offers a further look at what certification against the Shrimp Standard means to farmers.

TILAPIA

NC trends are slightly less clear for tilapia audits (Figure 16), compounded by two sharp peaks in non-conformance in 2012 (in China) and 2014 (in Central & South America). The peak in 2012 followed audits of four new sites operated by the same company, all of which lacked sufficient evidence regarding the provenance of feed ingredients. Not only do we see farms seeking improved transparency from their feed supplier, but also that newer farms from the same company receive fewer NCs, perhaps suggesting (as with salmon farms) that the company has learnt from some of the issues on their first certified farms. The spike in non-conformance in 2014 for Central & South America is similarly due to one company in particular, whose one site lacked energy-use records and evidence for the calculation of feed FishSource scores, as well as having errors in their calculations of

FFER (the forage fish equivalence ratio). This site achieved remarkable improvement in subsequent audits, receiving no NCs. High NC scores for tilapia farms in South East Asia in 2012 and 2013 are largely associated with a single company, with issues including incomplete evidence of feed origins and location in relation to surrounding wetlands, and poor technique in water sampling. These issues were resolved by the next audit.

BIVALVE

Farms saw higher non-conformance in 2015 compared with other years (Figure 17), with this increase in NC score again representative of a single company. Across the company’s three sites entering the ASC programme in 2015, the primary issue was a lack of the benthic sampling protocols required to establish a baseline for ongoing benthic monitoring. As a corrective action, the sites established a sampling programme through an accredited laboratory. Across the “habitat” impact indicators, NCs resulted in farms improving their abilities to respond to chemical spills through the increased availability of spill response kits, enhanced training for workers, and the removal of any remaining open-cell styrofoam (which is forbidden for ASC certified bivalve farms). Lastly, as a result of NCs raised on issues of energy-use and greenhouse gases, farms strengthened their plans for reducing energy consumption and ensuring generators and motors are properly maintained.

Abalone farming in open water (covered under the ASC abalone standard) uses a lot of the same techniques and equipment as for bivalve farms. An interview with one of China’s leading abalone farms (page 45) provides an in-depth look at what some of these changes can mean at farm-level.

ENVIRONMENTAL NON-CONFORMITY SCORES: TILAPIA

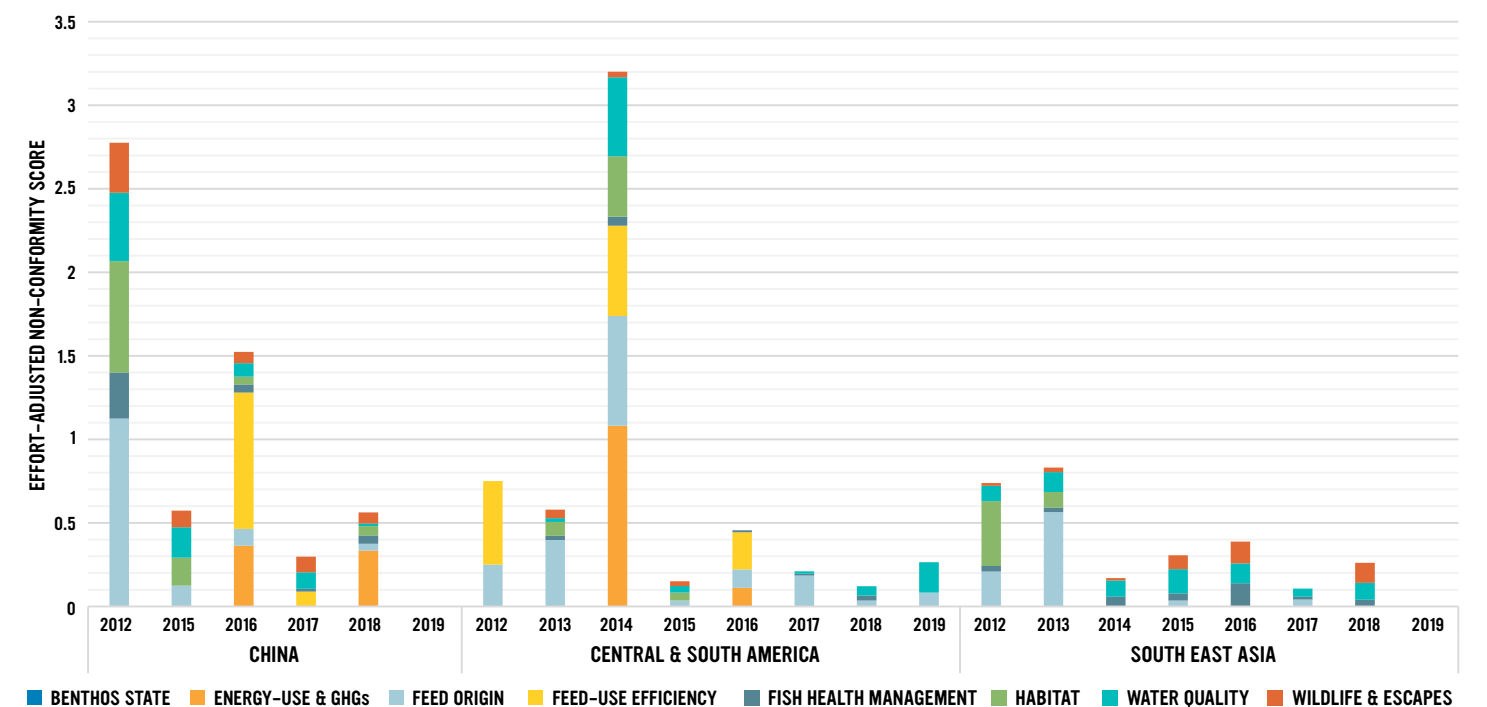


Figure 16. Average effort-adjusted non-conformity score (see box on page 38) for farms certified against the ASC tilapia standard per country, year and environmental impact area. Note that 2013 and 2014 are missing for China as the audits in that year were the last before a site dropped out, therefore excluding them from the analysis.

ENVIRONMENTAL NON-CONFORMITY SCORES: BIVALVE

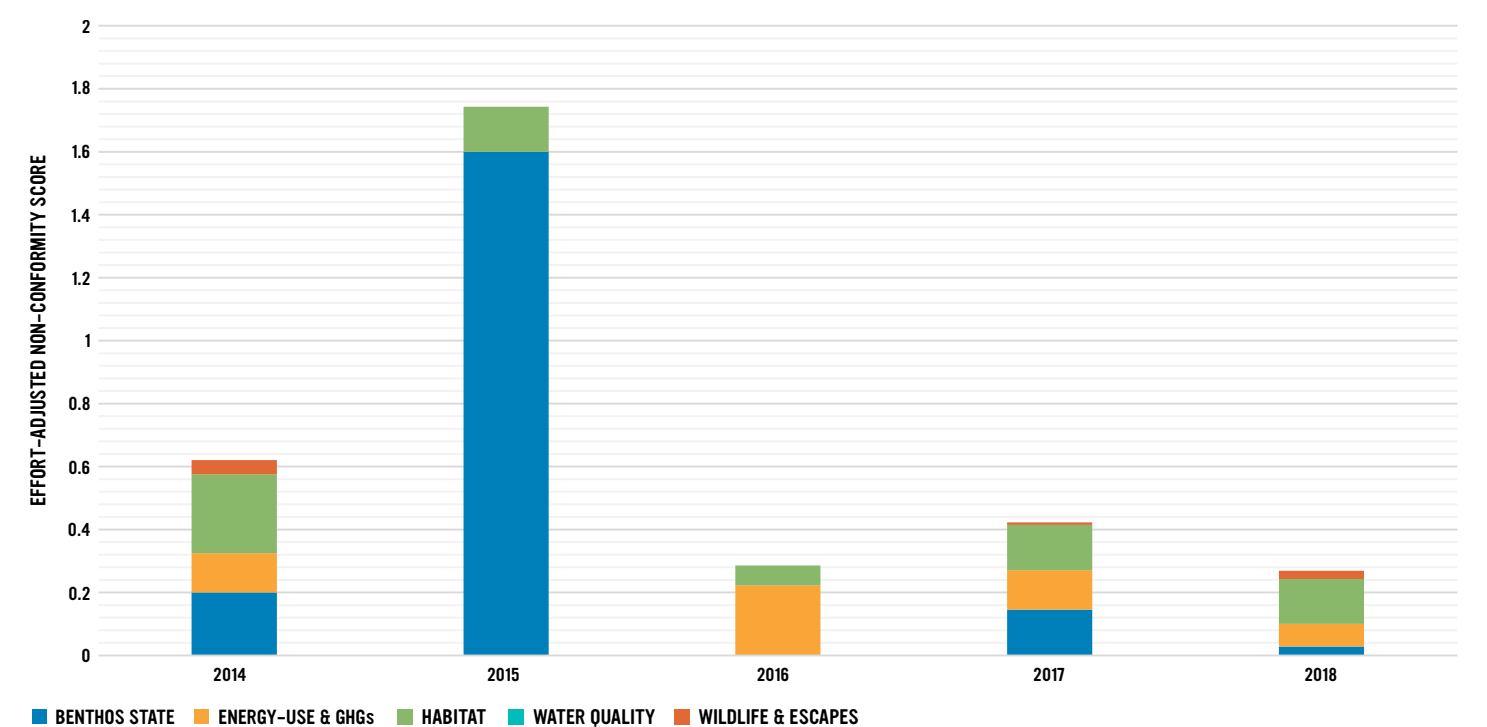


Figure 17. Average effort-adjusted non-conformity score (see box on page 38) for farms certified against the ASC bivalve standard per year and environmental impact area.

MIYAGI PREFECTURE FISHERIES

The 2011 Tohoku earthquake and devastating tsunami that followed, destroyed many lives, with at least 15,897 casualties and ~2,500 people declared missing. Communities were also affected, including that of the oyster farmers in Shizugawa Bay in the Miyagi Prefecture. Oysters had been farmed in the area for over a century, and had survived previous tsunamis, but in 2011 most of the aquaculture facilities were destroyed, the farmers' homes were destroyed, and lives were lost. It wasn't clear if farming would continue, and many long-standing farmers understandably felt unable to return.



However, for the remaining farmers from the Miyagi Prefecture Fisheries, the destruction of the tsunami brought into focus the importance of thinking about future generations, and they decided to use the opportunity to look at their farming practices.

With help from WWF Japan and a government grant, the cooperative entered a three-year pilot programme to promote more environmentally sustainable and responsible practices.

One big change made was to reduce the number of farming rafts. There were more than 1,000 rafts before the 2011 tsunami, and productivity and growth rate was often poor. As part of the pilot programme, the cooperative reduced the farming density to around 300 rafts, managed by 32 farmers. This improved productivity and encouraged oysters to grow faster, with better quality flesh. It had the additional benefits in lowering working for employees, specifically allowing female workers to maintain their income and have more time free for other things they valued, and lowering the risks associated with potential future natural disasters.

After completing the pilot programme, the cooperative wanted to demonstrate the important changes they had implemented to

make their practices more responsible and future focused. With help from WWF Japan, they applied for ASC certification, and in 2016, just five years after the tsunami, they became the first ASC certified farm in Japan. The achievement meant that the cooperative attracted attention from the media, retailers and processors. The ASC label allows the farmers to sell their oysters under the Togura brand name, to major retailers like AEON and Ito-Yokado, as well as Coop and Daichi-wo-Mamoru-kai, Japan's largest organic delivery service. The benefits have improved over time, as more and more retailers decided to stock ASC products.

Following certification, sales revenues of Togura oysters increased faster than those for oysters from other areas, and income increased 150% over pre-tsunami levels. Most importantly, certification has given the farmers a sense of achievement and pride, enabling them to demonstrate the hard work they have put in to improve their practices against such tough odds.

Another real and tangible benefit, thanks to the cooperative's increased pride in its products and farming practices, is helping to encourage younger farmers to join what was previously an aging workforce.

As Satoshi Maekawa from WWF Japan explains: "The inspiring story of ASC certification encourages greater pride in oyster production, and the age composition of the farmers is shifting as the farmers' sons and daughters and other younger people join the cooperative."

The benefits of ASC can vary from farm to farm. Some cannot always be quantified but can be just as important, such as allowing an inspiring cooperative to show the wider world that they have improved their farming practices in a way that has future generations firmly in mind. Fujio Abe, 56, is a director of Shizugawa Branch of Miyagi Fishery Cooperative and has worked at the cooperative since 1972.

"In the wake of the earthquake, we aimed to break away from overcrowding and shift to aquaculture that does not impose a burden on nature. Applying for ASC certification enabled us to see if this effort worked," he said.

"I think the biggest change we experienced, is that the transformation to responsible aquaculture and acquisition of the ASC certification, has increased income by improving quality, reduced working hours and helped to attract new farmers into the profession"

Fujio Abe

FUJIAN CHINA-SINGAPORE EVERVEST

In August 2019, China's largest abalone producer became the first in the country to achieve certification under the ASC Abalone Standard. The achievement for Fujian China-Singapore Evervest Co., Ltd (FCSE) represented a shift in focus toward green aquaculture in China, with the farm's ASC certification leading by example for other producers.

The farm is located in Lianjiang county, Fujian Province in the waters surrounding Datan Island in the East Sea. These waters provide several natural advantages including moderate salinity and abundant dissolved oxygen, which allows the farmed Japanese abalone to thrive.

According to FCSE president Mr Wu Yongshou, gaining ASC certification was paramount to the company's vision of gaining access to high-end markets and helping other Chinese abalone farms to review and improve their practices to increase their sustainability.

"Farmed Abalone in China are currently mainly fed with kelp, and consume more than a third of the country's kelp production. Given its need for clean production water and use of seaweed for feed, abalone farming is a model industry for green and sustainable farming in China," he said.

"We wanted to obtain international recognition of this green and sustainable farming through ASC certification, as it is recognised as the most popular standard worldwide for best practice and performance."

Some of the changes implemented by the farm in order to achieve certification included

the replacement of styrofoam floating rafts with sturdier wave-resistant alternatives, to reduce pollution. Improved management of farm vessels' discharge into the ocean was also put in place. Another important measure saw FCSE team up with Shanghai Ocean University, to develop a traceability system where feed, the marine environment and water quality changes are monitored. Farm employees also benefitted in terms of their social wellbeing.

"We also sought to improve the environment for our farm workers, enhance production safety, and pay attention to employee health and rights. We've improved accommodation conditions by building new apartments, toilets and showers on Datan Island, and this has greatly improved their living standards," said Mr Wu Yongshou

Changes to social conditions are felt keenly by employees such as Mr Dong Xiankun, who has worked on the farm since March 2016. He said that even small improvements such as the erection of sunshades and equipping raft platoons with first aid kits had made a noticeable difference.

"The construction of new dormitories and sanitary facilities in Datan Island, which is close to the farm's facilities and abalone rafts, enables employees to have a good rest during

production. "The farm raft platoon is equipped with first aid items and medicines, which means that minor injuries can be dealt with promptly," he said.

Despite achieving certification, Mr Wu Yongshou said further improvements were planned which include the installation of technology to reduce manual labour and further improve safety, as well as continuing to reduce plastic pollution.

"Traditional farming activities are very hard and tiring and the working environment is poor. ASC certification and ASC requirements can improve the production and living environment of workers so that they can work with dignity and with regular and fair payment"

Mr Wu Yongshou



MEASURING ON-FARM CHANGE: SOCIAL TRENDS

Similar to our analysis of non-conformities raised across environmental impact areas, here we analyse non-conformities with a focus on the social impact areas. Given that there is a greater deal of alignment between the standards in the impact areas addressed and the issues we see arising across the species, this section presents summaries of the main findings per impact area. The impact areas are presented in the order of the frequency in which they appear across the studied audits: health & safety was the most common area for which farms received non-conformities, followed by community relations, working hours and overtime and fair wages.

HEALTH & SAFETY

Across social impact areas, non-conformities (NCs) were most commonly raised on "health & safety", as we see them in almost every species, country and year; this is likely due in part to the relative ease with which issues such as missing and out-of-date safety equipment can be identified during on-site audits. For farms certified against the Salmon Standard, health & safety NC scores show little variability across countries and years (Figure 18). The high NC scores in Chile in 2015 resulted from five major NCs received for each of two sites in their initial audits, across the impact areas of health & safety and working hours and overtime. As a result, the sites installed new fire extinguishers; new emergency showers in the chemical store; bought new personal protective equipment (PPE); and revised their protocols for following up after accidents.

ASC certified shrimp farms have demonstrated a broad range of health & safety improvements. The majority of NCs relate to training and access to safety equipment (similar to salmon farms), resulting in the installation of new equipment such as fire extinguishers and first aid kits, as well as the training of staff (Figure 19). Non-conformities were also commonly raised about workers' access to decent and safe living conditions (in situations where they live on site), with corrective actions resulting in improved privacy of sleeping and sanitary facilities, new showers, and verification that water is safe to drink. Several sites received NCs for failing to provide all workers with medical insurance, an issue almost exclusively arising at first audit. This issue seems to be most pronounced in India, where the majority of the NCs raised for employee insurance were major non-conformities.

Similarly, both ASC certified tilapia (Figure 20) and bivalve (Figure 21) farms have received NCs for health & safety in all countries and across most years, with a slightly greater proportion of NCs raised regarding training and access to safety equipment. Whilst not within one of the four species groups analysed, the case study interview from a Chinese abalone farm presented (page 45) provides insight into what improvements in health & safety can mean for workers.

COMMUNITY RELATIONS

Non-conformities for community relations were identified across almost all species, countries and years. Several Norwegian salmon farms increased their engagement with local communities to include at least two meetings a year, whilst in Chile farms haven't sufficiently informed local communities about the timing and potential health risks of any therapeutic treatments used on site, and have revised their communications accordingly.

Across shrimp farms, India demonstrated the highest improvement in NC scores for community relations. Specifically, farms needed to communicate the findings of participatory social impact assessments (p-SIAs) to stakeholders and develop or otherwise share conflict resolution policies. This is very similar to the issues seen for tilapia, with farms at fault for not communicating clearly with communities about the results of their social impact assessment or their conflict resolution policy, requiring improved actions to enhance community relations. Non-conformities raised for bivalve farms were related to gear use, in particular requirements for buoys marking farm boundaries, use of uniformly coloured buoys, and ensuring traceability of all gear back to the farm. In several cases the farm could not demonstrate that they'd distributed their conflict resolution policy or otherwise engaged with local communities on a regular basis. In those instances, NCs resulted in increased community engagement by the farms, for example through participation in beach clean-ups.

Alongside collecting data on NCs, data was also collected on the number of stakeholders contacted by auditors as part of the audit. This provides a measure of the interest across stakeholder groups in the operation and certification of farms. Across salmon audits, Canada has the highest number of stakeholders contacted per audit, with an average of 18. By comparison, Norway and Chile average half that number, at nine and eight, respectively. Furthermore, the averages for salmon are higher than the other three species; Chinese tilapia audits average six stakeholders contacted, followed by Indian shrimp audits and the global combined bivalve average of five. As ASC continues to further strengthen its guidance and requirements on community and stakeholder engagement, the M&E framework will be similarly strengthened to collect data on the scope and efficacy of stakeholder engagement.

SOCIAL NON-CONFORMITY SCORES: SALMON

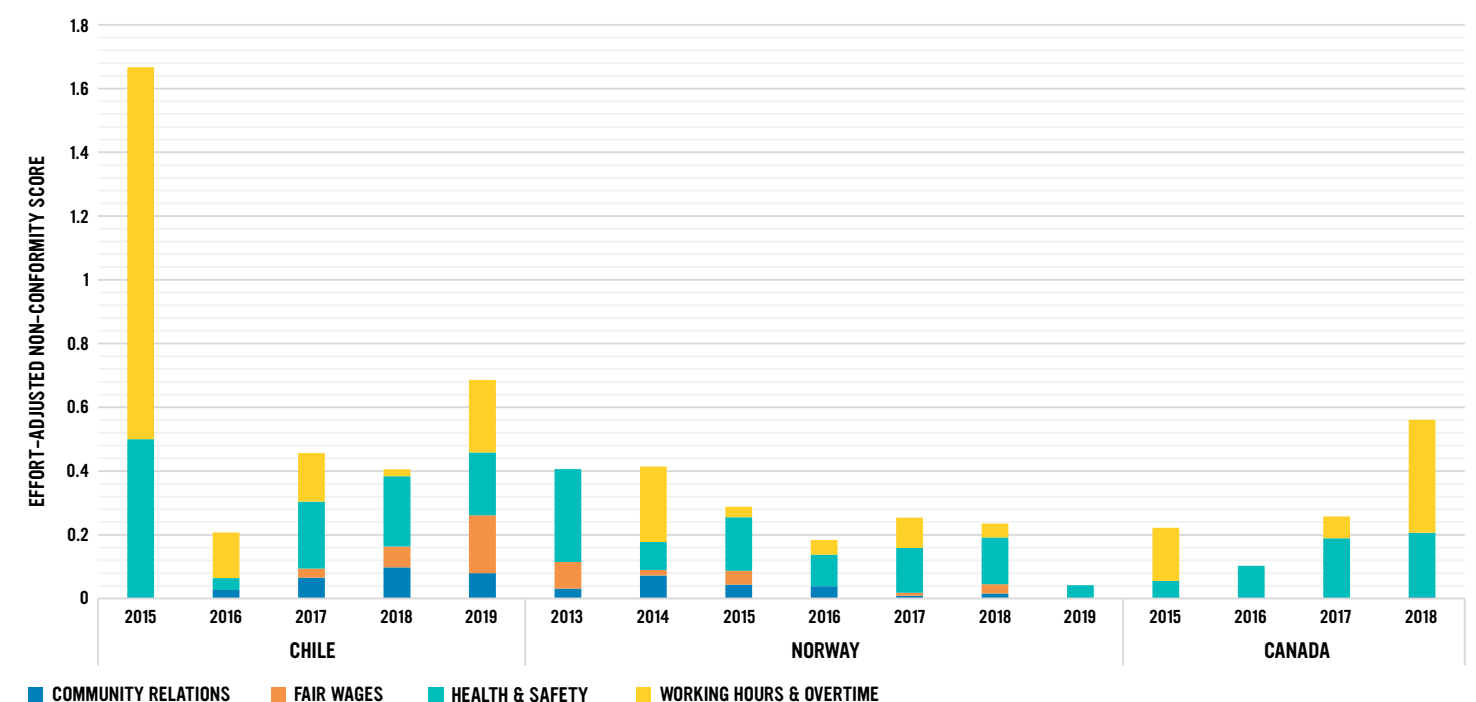


Figure 18. Average effort-adjusted non-conformity score (see box on page 38) for farms certified against the ASC salmon standard per country, year and social impact area. No results are presented for Canada in 2019 as there had been no audits finished before the March 2019 cut-off for sampling.

SOCIAL NON-CONFORMITY SCORES: SHRIMP

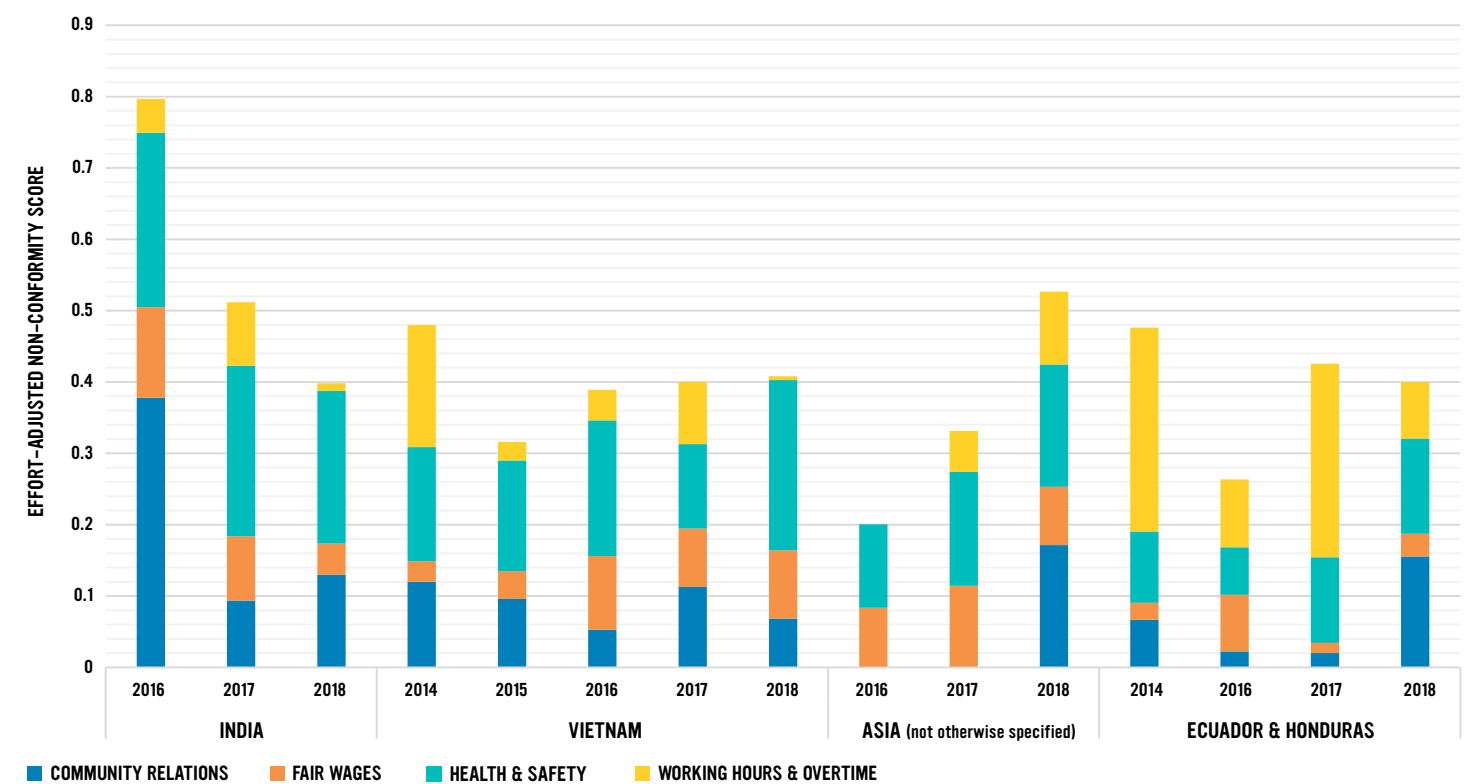


Figure 19. Average effort-adjusted non-conformity score (see box on page 38) for farms certified against the ASC shrimp standard per country, social impact area and year in which they were assessed.

WORKING HOURS AND OVERTIME

Across salmon farms, several NCs were raised for excessive working hours and overtime (Figure 18). Workers on several sites were found to be working overly long hours or be on-site for extended periods of time. Whilst this is mostly to be expected due to the fact that many salmon farms are in remote locations, in cases where the hours were still excessive we see farms introducing caps on working time or adjusting shift patterns, as was the case for Norway in 2014 and Canada in 2018. Across salmon, shrimp (Figure 19) and tilapia (Figure 20) farms, poor worker training and inadequate procedures and documentation have resulted in common errors in the accuracy of working hours records. These issues contributed to the high NC scores for Chilean salmon and Chinese tilapia in 2015 and across several years of Vietnamese shrimp audits. Identification of these NCs resulted in revisions to recording procedures and extra training for workers across species.

Reduced NC scores provide evidence of improving working conditions in relation to overtime across all four species. On bivalve farms (Figure 21) we see cases where overtime pay is increased and shift patterns adjusted to stay below the ASC overtime limit of 12 hours per week. This is echoed on shrimp farms in Ecuador and Honduras, where overtime was not explicitly voluntary (mainly during harvest) or overtime pay was below statutory minimums for night work (being paid at an extra 50% of normal wages, rather than 100%). In other cases, staff such as guards and chefs were not covered under the same overtime arrangements as other staff. Corrective actions included higher overtime pay, new contracts and revised procedures to determine staffing requirements during harvest.

Across tilapia farms, similar issues in working hours and overtime contributed to the high NC score for Central & South America in 2014, again resulting in revised shift patterns to allow workers more regular time off. Chinese tilapia farms also improved in relation to overtime,

though these NCs were in fact raised under the impact area “fair wages”: workers on several farms were receiving little or no overtime pay for working on a holiday. Farms corrected this by paying back the difference and updating contracts and policies.

FAIR WAGES

Salmon farms appear to have fewer issues with indicators relating to fair wages in comparison to the other impact areas (Figure 18), with NCs only recorded for farms in Chile and Norway. In Chile, workers were not sufficiently aware of how their pay and benefits are calculated, resulting in companies establishing training on contracts for workers. In Norway, contracts were revised to include the terms of benefits and bonuses; in several other cases auditors requested updated calculations of a basic needs wage (above the statutory level) and worker consultations.

These corrective actions are similar to those seen in Vietnamese shrimp audits, with workers receiving training on their contracts; basic needs wage calculations being refreshed and clarified; and contracts being revised to explicitly state an employee’s right to end employment. The increased scores in Vietnamese farms over time (Figure 19) are largely due to new companies entering the programme rather than worsening performance. Similar corrective actions have been implemented for tilapia farms but with additional cases identifying a lack of evidence for procedures ensuring equal pay for equal work. In bivalve farms the most common issue was the lack of a functioning labour conflict resolution policy.

The story of a Thai shrimp farm featured on page 52 offers a more detailed look at what improvements in pay transparency and employee training can mean for workers.



SOCIAL NON-CONFORMITY SCORES: TILAPIA

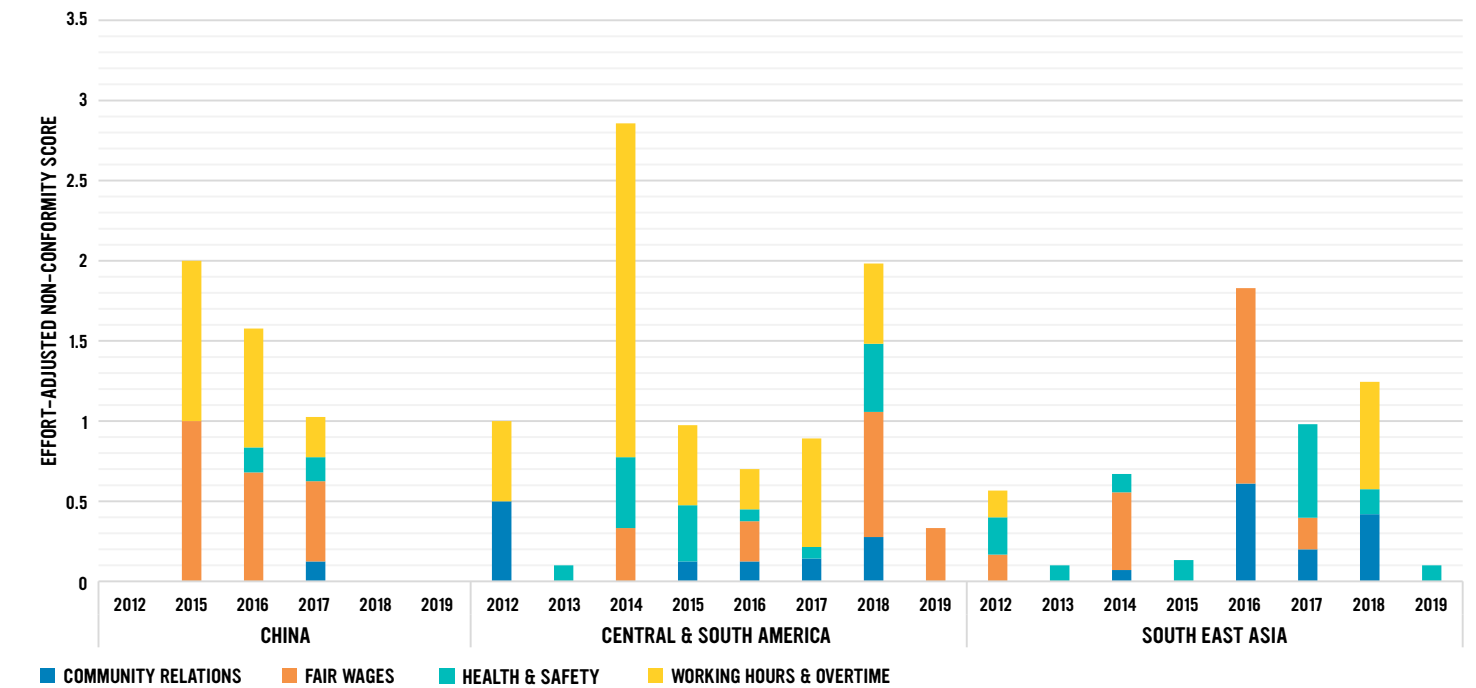


Figure 20. Average effort-adjusted non-conformity score (see box on page 38) for farms certified against the ASC tilapia standard per country, year and social impact area. Note that 2013 and 2014 are missing for China as the audits in that year were the last before a site dropped out, therefore excluding them from the analysis.

SOCIAL NON-CONFORMITY SCORES: BIVALVE

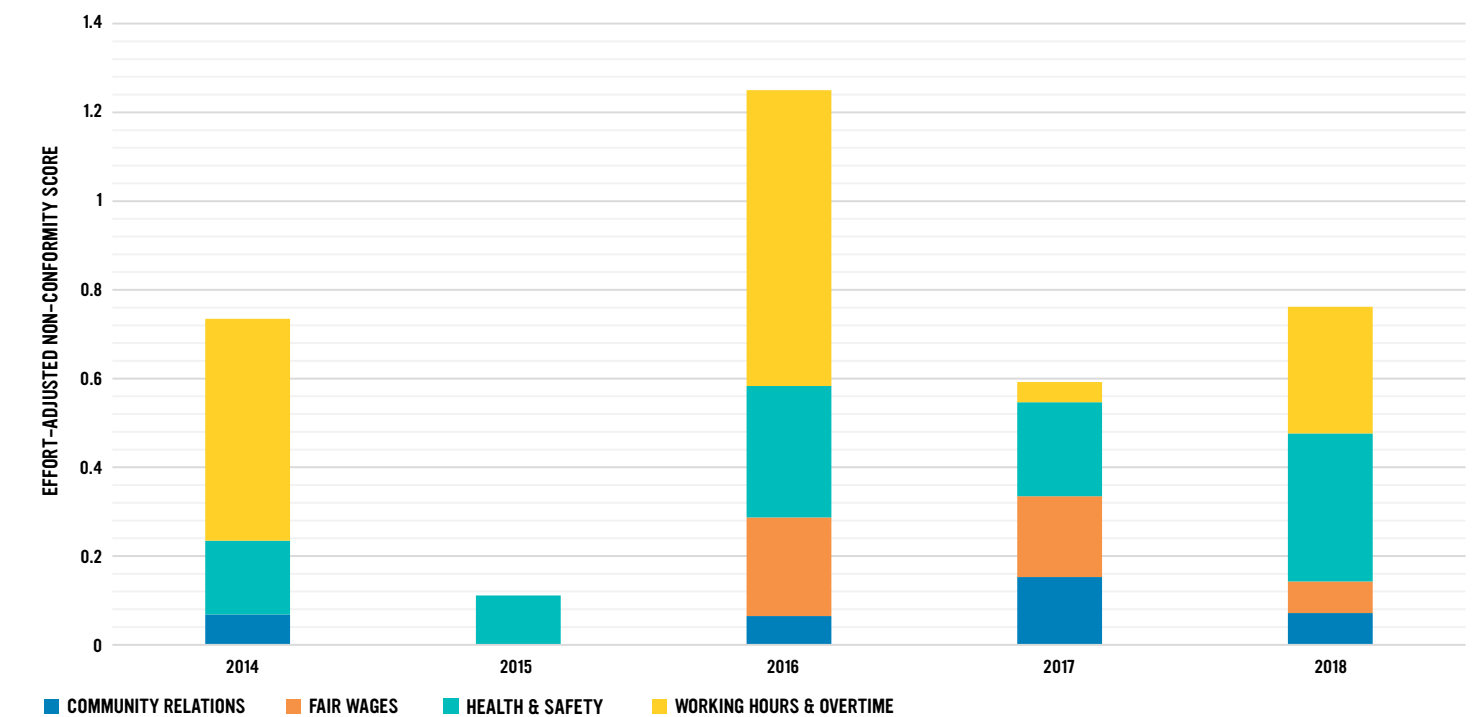


Figure 21. Average effort-adjusted non-conformity score (see box on page 38) for farms certified against the ASC bivalve standard per country, year and social impact area.

FARMS LEAVING THE ASC PROGRAMME

Not all farms achieve or are able to sustain certification. This is due to a range of reasons. Generally, the longer the farm has sustained certification, the less likely it is to leave the ASC programme, whether they have left the programme due to failure to adhere to the standard or have cancelled and not renewed their certification (Figure 22). On average, sites which leave the programme due to difficulties meeting the standard (“failed, suspended or withdrawn”) drop out earlier than those that leave the programme for other reasons (“expired or cancelled”). It is also important to note that not all farms within

the “failed, suspended or withdrawn” category will have left the programme due to issues with meeting the standard: their certificate can also be suspended or withdrawn by the conformity assessment body (CAB) for contractual or administrative reasons such as non-payment for CAB services or not scheduling an audit in time for the certification cycle. Additional years of data on the barriers and challenges leading to farms exiting the programme are likely to shed light on further areas of focus for programme improvement.

FARMS THAT DROP OUT OF THE ASC CERTIFICATION PROCESS

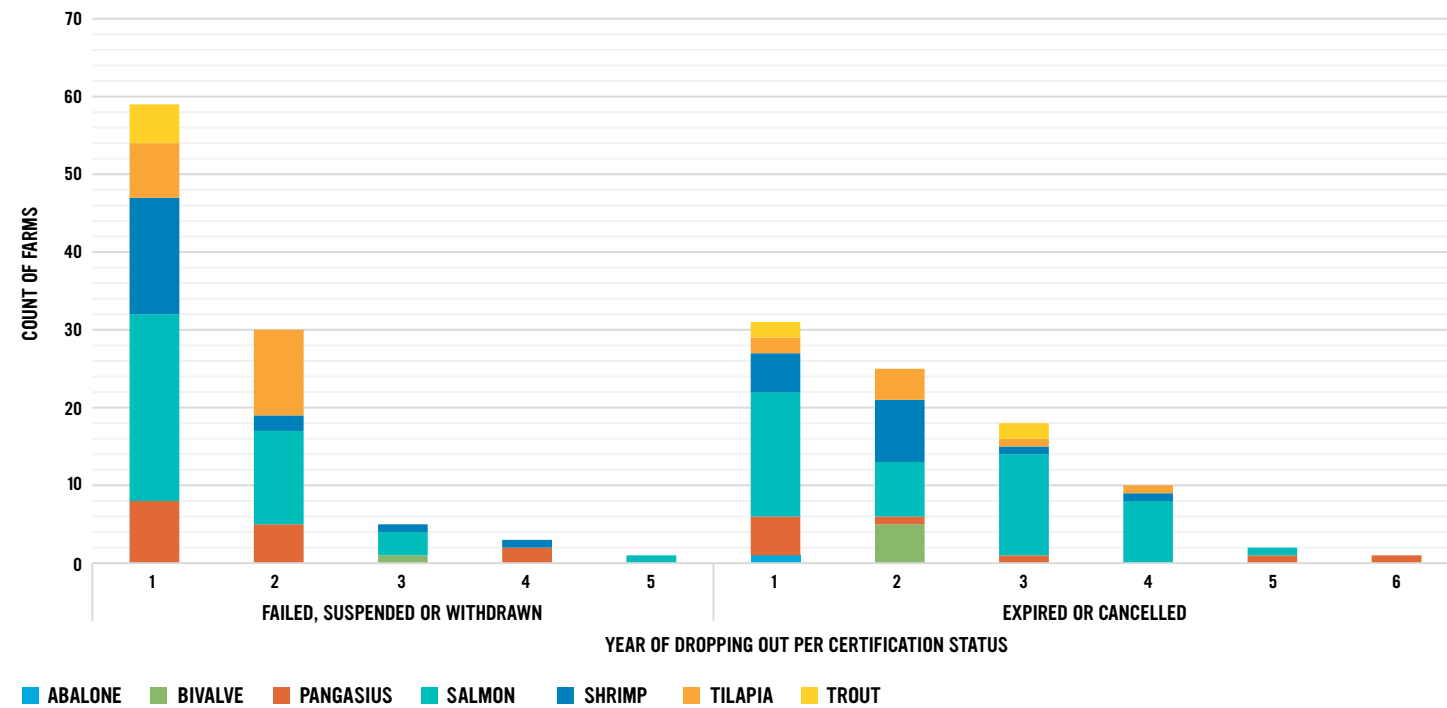


Figure 22. The count of farms that drop out of the ASC certification process, per ASC standard, type of dropout and the year of certification in which they dropped out, as of March 2019. For detailed definitions of the meaning of each dropout type, see Annex 2.



RESEARCH COLLABORATION – THE TAPAS PROJECT

Despite aquaculture being the fastest growing food production sector globally, the European Union’s self-sufficiency for seafood remains low, with nearly 70% of the seafood consumed being imported. As a result, EU member states have been implementing national strategies to achieve a 25% increase in domestic aquaculture production by 2020. However, a key challenge to this growth is assessing the environmental impacts of

aquaculture as part of licensing and regulation processes. For this reason, the TAPAS project (*Tools for Assessment and Planning of Aquaculture Sustainability*) was established in 2016 and ran for four years (ending in February 2020).

The TAPAS project involved 15 organisations including research institutions, small and medium sized enterprises, and regulators. The project developed and tested a range of impact modelling tools to

facilitate the licencing process using a case study approach across both freshwater and marine production systems, from carp ponds in Hungary to Norwegian salmon farming.

The ASC was engaged with the project to help make some of its monitoring data from salmon farms available to researchers. Furthermore, ASC continues to play a key role as a stakeholder and potential user of tools developed as part of the project. As a direct

result of its involvement, the ASC has been able to develop a database of salmon farm data on a range of environmental impact areas, which will benefit future standard revisions, and monitoring and evaluation (M&E) work. Lastly, the project has allowed the ASC to further develop its links with academics and regulators, to ensure it remains at the cutting edge of defining best practices for aquaculture.



CASE STUDY

NIREUS AQUACULTURE

When Greek seabass and seabream producer Nireus Aquaculture achieved ASC certification in 2019, it represented the successful outcome of an endeavour which stretched back to 2013.

The partnership between Nireus, WWF Greece, and retailer AB Vassilopoulos, began as a project aimed at improving practices at Nireus farms, and enable AB Vassilopoulos to provide a greater range of responsibly produced seafood to its customers.

This goal was bolstered by the publication of ASC's Seabass, Seabream and Meagre Standard in 2018. However, this wasn't an unrelated coincidence, since the partnership had been involved in the development of the standard.

When developing new standards, the ASC doesn't just rely on science-based rationales, experience from previous standards and expertise from diverse stakeholders. Real-world testing of the draft standard is also required, to ensure it works in practice as well as in theory. The Seabass, Seabream and Meagre Standard was tested around the world, and Nireus, AB Vassilopoulos, and WWF Greece were closely involved in this process, with pilots of the standard taking place at Nireus farms.

Currently, two Nireus seabass and seabream farms are ASC certified, and the company was the first in Europe to achieve certification against the new standard. The long-term collaboration was a big factor in helping to achieve this milestone.

"Collaborating with our retail partners and WWF Greece allowed us to make improvements to our practices over time, and the development of the ASC standard provided us with the required performance to aim for, and gave us an easy way to demonstrate our achievement," said Leonidas Papaharis, Director of Quality, and R&D at Nireus.

The involvement of a major retailer in the collaboration provided knowledge and experience of the market, but also had benefits for AB Vassilopoulos, as their Director of Quality Assurance Dionysis Dionysopoulos explained.

"Our aim was to give our customers a large range of sustainable and responsibly produced seafood. The ASC logo gives our customers robust assurance and allows them to reward responsible practice," he said.

"This partnership was a fascinating and challenging process with the aim of improving standards throughout the industry, and we hope to serve as a model for the wider sector."

Leonidas Papaharis

The Nireus experience brings together many aspects of the ASC vision: a producer collaborating with NGO experts, with support from the market to improve the supply of responsibly produced seafood, using stringent ASC requirements and the trusted ASC logo to measure and reward their practices. It also demonstrates the two-way nature of the ASC programme, with the important contribution the partnership made to the development of a standard for seabream, seabass and meagre which works well in practice.



CASE STUDY

BEST AQUACULTURE PARTNERS

Best Aquaculture Partners was the first shrimp farm to become ASC certified in Thailand, but this is not what sets them apart from their competition. The farm prides itself on the social welfare of its employees to such an extent, that they have not implemented some time and cost saving measures, in order to retain staff members who depend on employment at the farm for their livelihoods.

Assistant farm manager Mr Piyanan Sangmani explained that creating a family atmosphere where employees and their families could thrive was of the utmost importance.

"We have 13 employees, seven women and six men, and most of the employees have worked here for many years," he said.

"We don't want to replace human power with machines, such as an automatic-feeder, even though it would probably help us save on costs, because it would certainly affect our workers, and we don't want them to lose their jobs. We prefer to work and live together like a family."

The farm's commitment to its employees was given a boost when it achieved ASC certification in 2016, which led to greater transparency on pay and working conditions, as required under the ASC standard.

Farm employee Pai Jit has worked for the company for the past nine years, and said the changes brought in as a result of ASC certification, had led to greater education for staff, including on health and safety, minimum wages and respect of labour laws.

Pai Jit and her coworkers now also have a greater understanding of how to protect the environment surrounding the farm.

"Compared to previous practices, we are now so different and so much better. We have better discipline, a cleaner atmosphere and better farming methods. For example, we changed the water management to a recirculation system, which helps us to minimise pollution and negative effects on the environment. Also, visitor screening has been put in place to help us enhance farm security and

biosecurity. And as we operate in a better environment, the surrounding villagers are happy," she said.

"We changed our working hours to be more compliant with national and international standards. Wage calculations are now transparent, and all workers have been trained in how to calculate their benefits and rights."

Piyanan Sangmani

MEASURING PROGRESS IN FORAGE FISH USE

Fish farms use fishmeal in their feed as a source of protein, and fish oil as the main source of essential omega-3 fatty acids. Fishmeal and fish oil are largely produced from wild-caught forage fish species, such as anchovy, herring, and blue whiting, but can also be produced from the byproducts of processing seafood for other purposes. And whilst proteins from plants also form an important component of fish feeds, at least 74.6% and 72.7% of the global production of fishmeal and fish oil respectively, was consumed by the aquaculture sector in 2018, according to IFFO³.

To help achieve our mission of reducing aquaculture's environmental impact and to promote efficient use of these resources, all ASC standards limit the inclusion rates of fishmeal and fish oil for species fed on formulated diets. Both salmonid and shrimp species are among the top consumers of fishmeal and fish oil in worldwide aquaculture production. A dedication to decrease fishmeal inclusion rates, whilst ensuring that any which is used comes from responsibly managed sources, therefore demonstrates a significant potential impact.

ASC requires salmon farms to measure their use of fishmeal (FFDRm) and fish oil (FFDRo). We track this using the Forage Fish Dependency Ratio (FFDR): values below the designated threshold indicate best practice for the inclusion of fishmeal and fish oil from wild-caught sources and thus increased reliance on byproducts and other protein sources. The ASC Salmon Standard requires FFDRm to be below 1.2 (lowered in 2017 from the original threshold of <1.35). This variable is specific to ASC requirements and not globally measured, but can be used to determine the percentage inclusion of forage fish fishmeal in feed. For the detailed formulas used, see appendix IV of the ASC Salmon Standard.



Forage Fish Dependency Ratios for certified salmon farms across Canada, Chile and Norway have demonstrated average dependency on fishmeal below the requirement threshold, with differences seen between salmonid species (Figure 23). With average levels in some years well below 0.6 but higher in others, there is clear evidence that the reliance on fishmeal from wild-caught sources can be further reduced.

The amount of feed used to produce the quantity of fish harvested is a critical component to track the efficiency of feed use in production, as measured by the Economic Feed Conversion Ratio (eFCR). Working backwards from values for the eFCR and FFDR can yield the forage fish fishmeal inclusion rate. A lower value for fishmeal inclusion is indicative of a reduced use of fishmeal from wild-caught sources in feed. Whilst this is most likely driven by lower availability, higher prices and increasing knowledge of alternative protein sources⁴, ASC certification plays a part in promoting this trend. Further work will be looking to establish sources of data from non-certified farms to further explore ASC's impact.

Feed used to produce Atlantic salmon contains lower amounts of fishmeal compared with other salmonid species tracked (Figure 24). ASC certified salmon farms have seen a decrease in their average inclusion rates for both fishmeal and fish oil from wild-caught sources, from 15.4% in 2015 to 12.3% in 2018 for fishmeal and from 10.1% in 2015 to 8.7% in 2018 for fish oil. These values demonstrate the increasing efficiency of certified farms in the ASC programme, a trend which we intend to explore further as our M&E system matures.

Naturally, fishmeal and fish oil are not the sole ingredients of fish feed, with other ingredients such as soybean meal posing an equal, if not greater risk for additional impacts. Therefore, tracking feed-use efficiency via the eFCR can serve as one way of addressing the overall impacts from feed production. The ASC collects data on average eFCR from certified salmon farms as part of their FFDR calculations. During the development of the ASC Salmon Standard, an average eFCR of 1.3 was assumed by the Aquaculture Dialogues to calculate the original limits for FFDR. This means that on average 1.3 kilograms of feed is needed to grow 1 kilogram of fish. Average values in Canada, Chile and Norway ranged between 1.08 and 1.44, with a combined

FORAGE FISH DEPENDENCY RATIO (FFDRm) – SALMONIDS

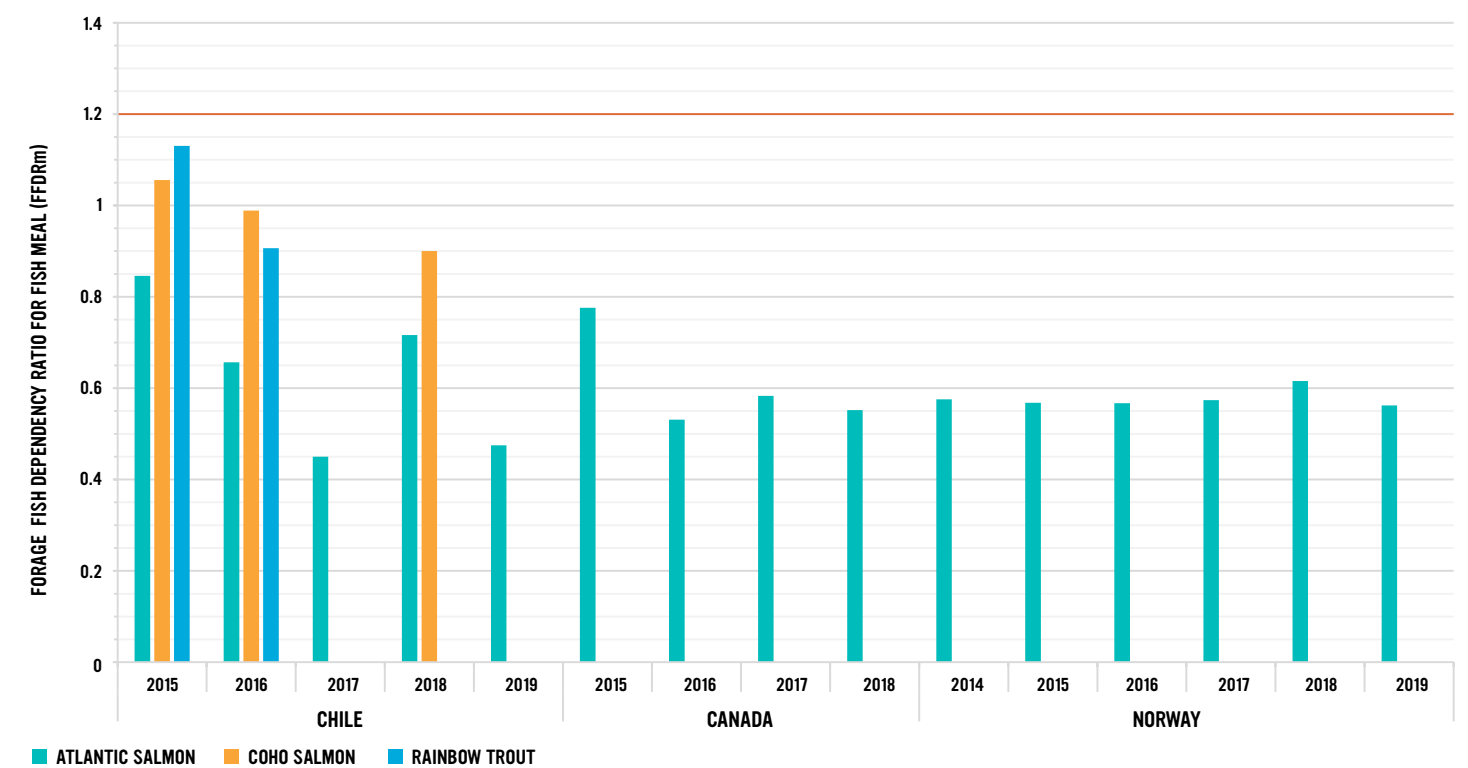


Figure 23. Average FFDRm on ASC certified Salmon farms in Canada, Chile and Norway. The horizontal line at 1.2 represents the current limit for FFDR for fishmeal as set in the ASC salmon standard.

FORAGE FISH FISHMEAL INCLUSION RATES – SALMONIDS

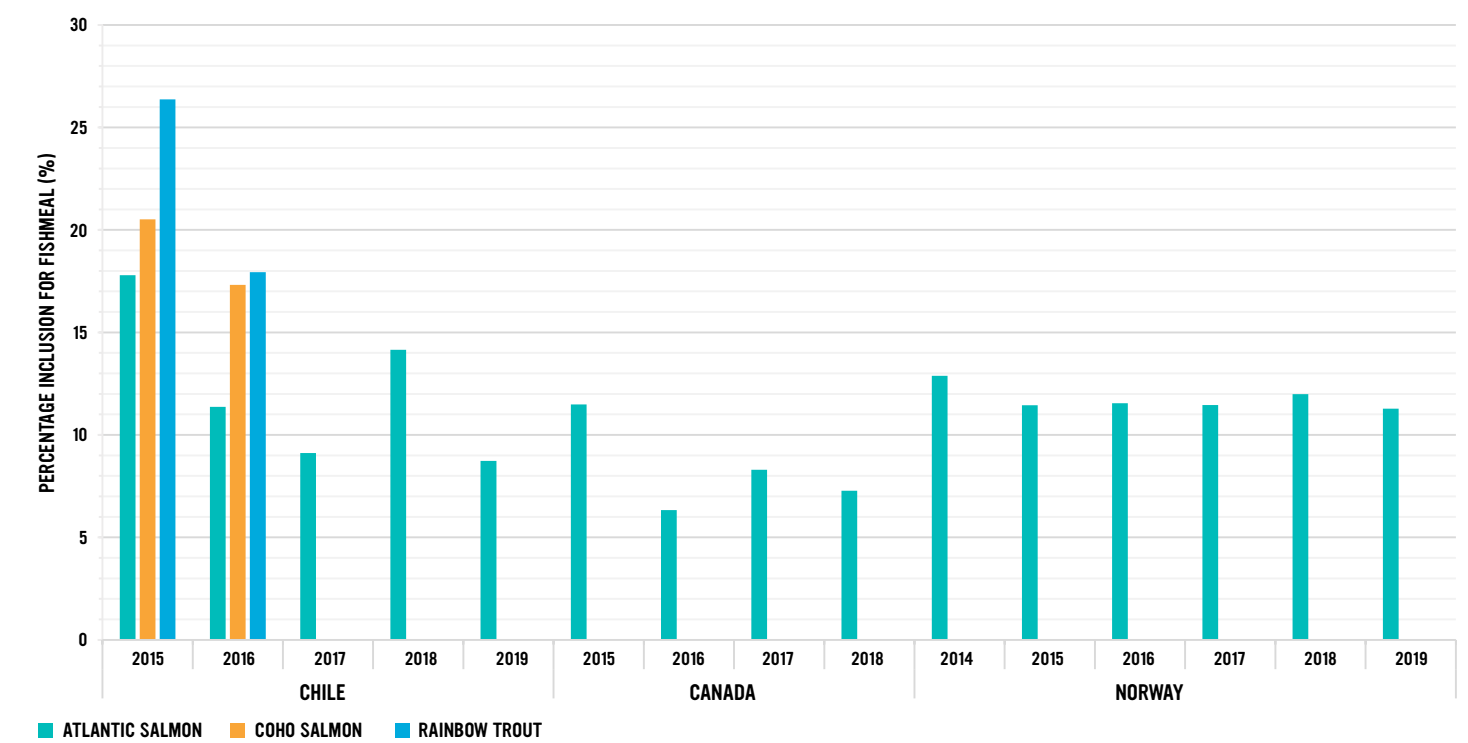


Figure 24. Average forage fish fishmeal inclusion rates per country, year and cultured species. Calculated values derived from submitted data on FFDRm and eFCR.

average of 1.2 across all years, species and countries (Figure 25). The fact that eFCR has stayed relatively consistent over time despite variations in FFDR indicates that substitution of forage fish ingredients is the principle reason for the variability within the FFDR requirement: farmers are maintaining the efficiency of their feed use and reducing their reliance on forage fish based meals and oils. This is important as the supply of marine ingredients is limited while demand from the aquaculture industry is growing.

Shrimp farming also relies heavily on fishmeal and has also seen improvements in the efficiency of its use. This is in part due to advances in technology, such as the use of automatic feeders, but is also motivated by increased fishmeal prices⁵. With increased research dedicated to potential fishmeal replacements, studies have found that the growth performance of Whiteleg shrimp (*Penaeus vannamei*) was not affected by partially replacing fishmeal with soybean meal⁶, confirming that decreased reliance on fishmeal is unlikely to compromise production. The Forage Fish Equivalence Ratio (FFER) in the ASC Shrimp Standard is comparable to the FFDR in the ASC Salmon Standard; the different terminology is reflective of the different stakeholder dialogues that developed each Standard. Across ASC certified shrimp farms producing *P. vannamei*, the average FFER decreased slightly from 0.97 in 2015 to 0.84 in 2018, this equates to an inclusion rate decrease from 18.2% to 12.7% (Figure 26).

However, there are some distinct regional differences, with average FFERs on ASC certified shrimp farms in Asia nearly two times those recorded across farms in Central & South America (the countries and audit reports sampled are consistent with those presented in the non-conformity analysis earlier in this report). The variability in the efficiency of feed used (as measured by the eFCR) between the regions is much smaller, with slightly higher values for shrimp farms in Central & South America in comparison to Asia (Figure 27); suggesting that the large regional differences in the FFER are again driven by fishmeal inclusion rates, with higher forage fish fishmeal content in feeds used in Asia.

Fishmeal inclusion can vary considerably between regions and years, as seen across ASC certified salmon and shrimp farms, with more pronounced differences in the shrimp farming sector. These data illustrate recent improvements in the use of wild-caught fish and feed-use efficiency, but there remains opportunity for further progress in most regions. Dedicated research on feed formulation and feeding techniques will help to improve the FFDR and FFER in the future. For our part, the ASC will continue to engage with academia, the industry and other stakeholders to ensure that our standards reflect and help define the latest best practice, driving further improvements. Evidence of this is perhaps best reflected in the upcoming ASC Feed Standard, which you can read more about on page 32.

ECONOMIC FEED CONVERSION RATIOS (eFCR) – SALMONIDS

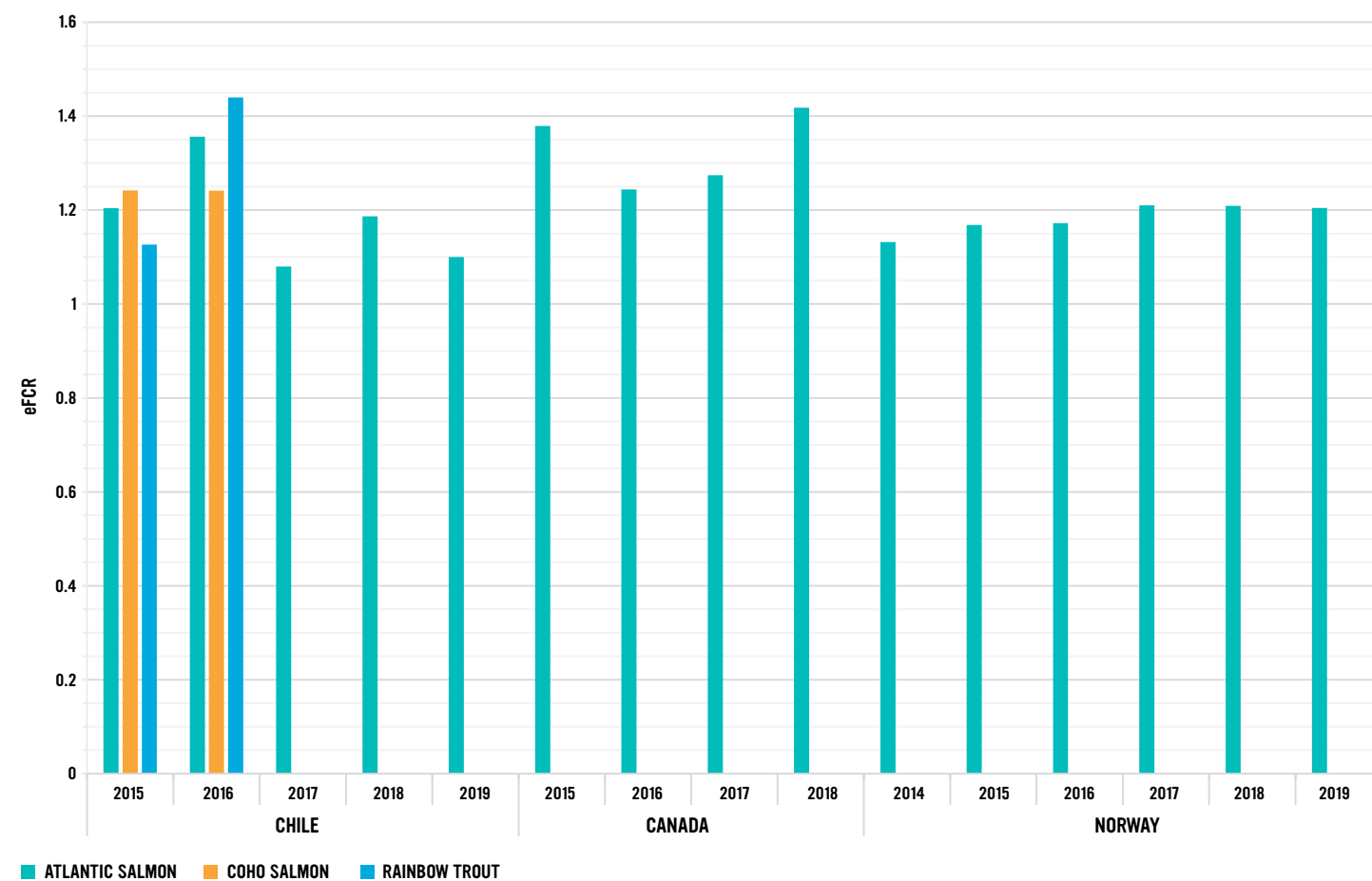


Figure 25. Average eFCR (economic feed conversion ratio) of ASC certified salmon farms in Canada, Chile and Norway.

FORAGE FISH EQUIVALENCE RATIO (FFER) – WHITELEG SHRIMP

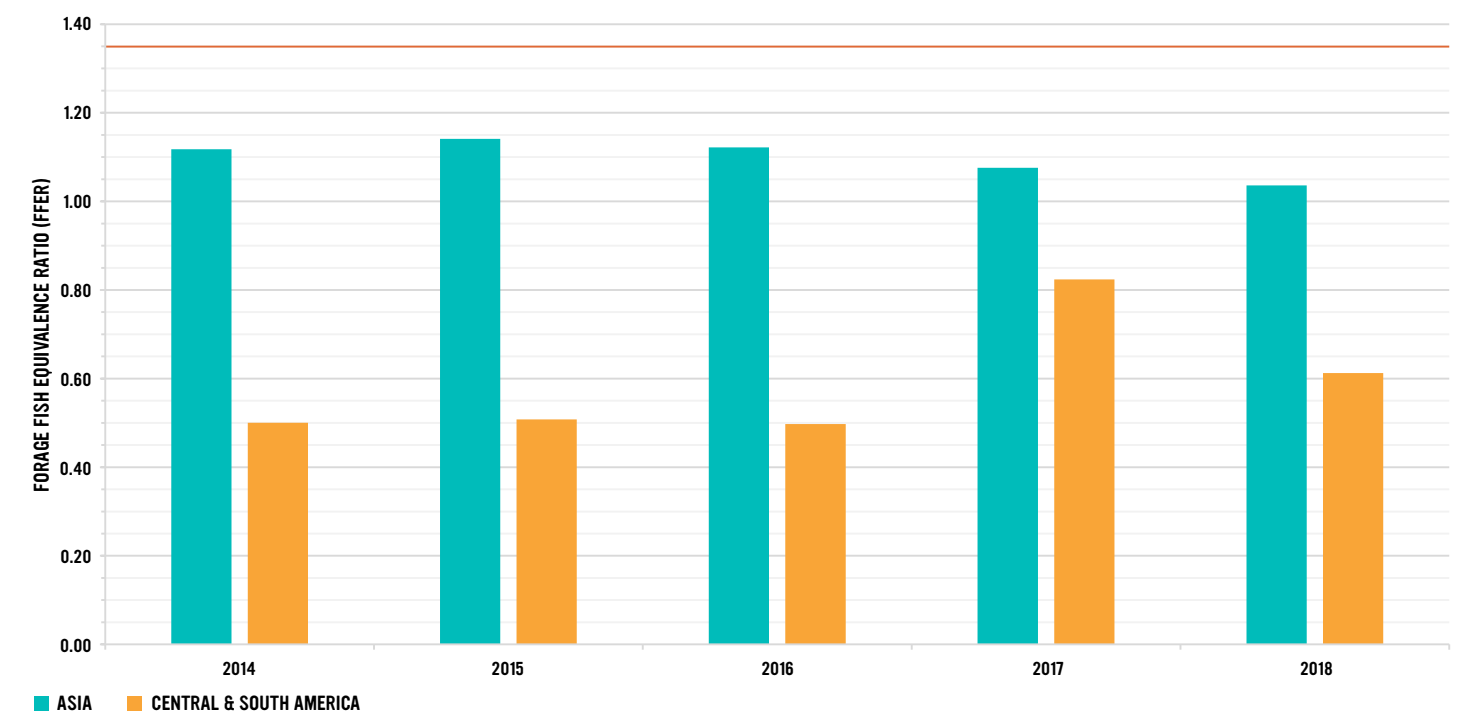


Figure 26. Average Forage Fish Equivalence Ratio (FFER) on ASC certified shrimp (*Penaeus vannamei*) farms in Asia and Central & South America. The horizontal line at 1.35 represents the current limit for FFER as defined in the ASC shrimp standard. The Forage Fish Equivalence Ratio (FFER) in the ASC Shrimp Standard is comparable to the FFDR in the ASC Salmon Standard; the different terminology is reflective of the different stakeholder dialogues that developed each Standard.

ECONOMIC FEED CONVERSION RATIOS (eFCR) – WHITELEG SHRIMP

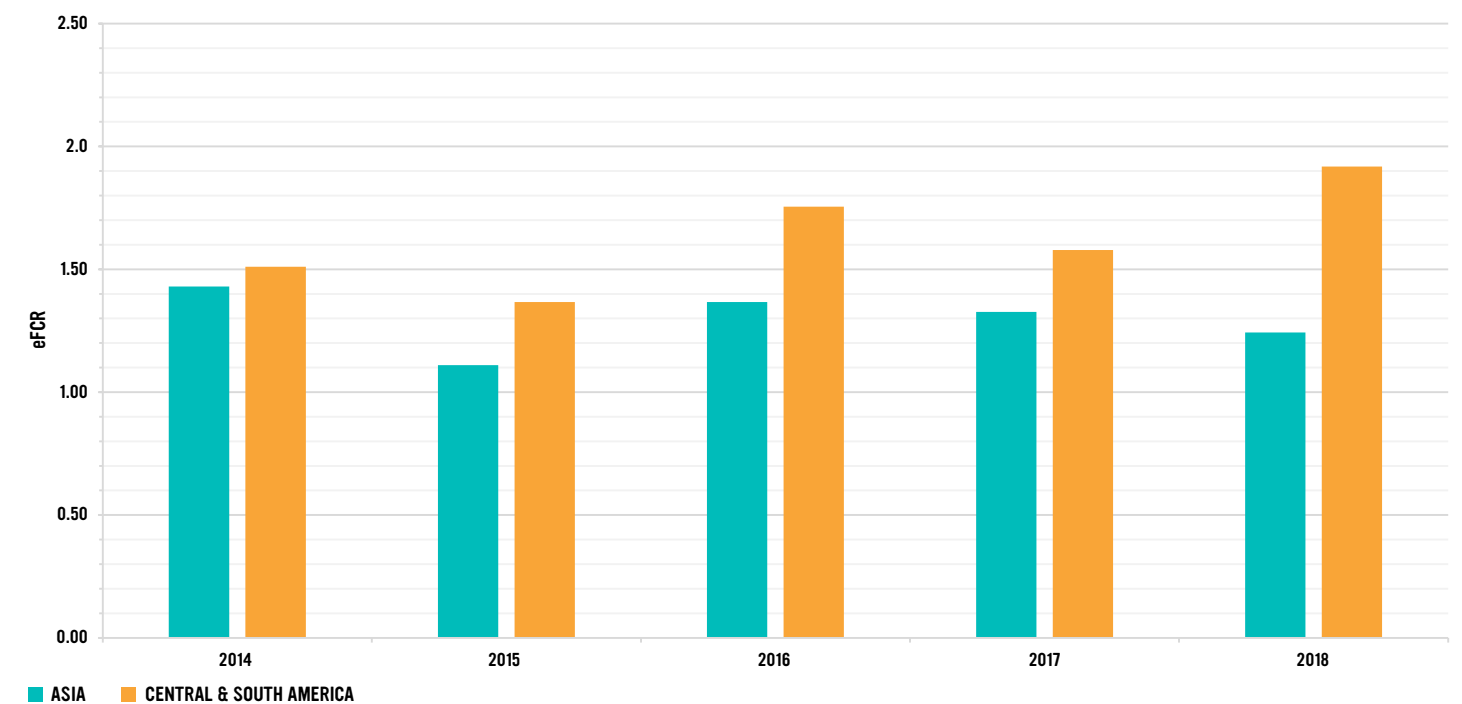
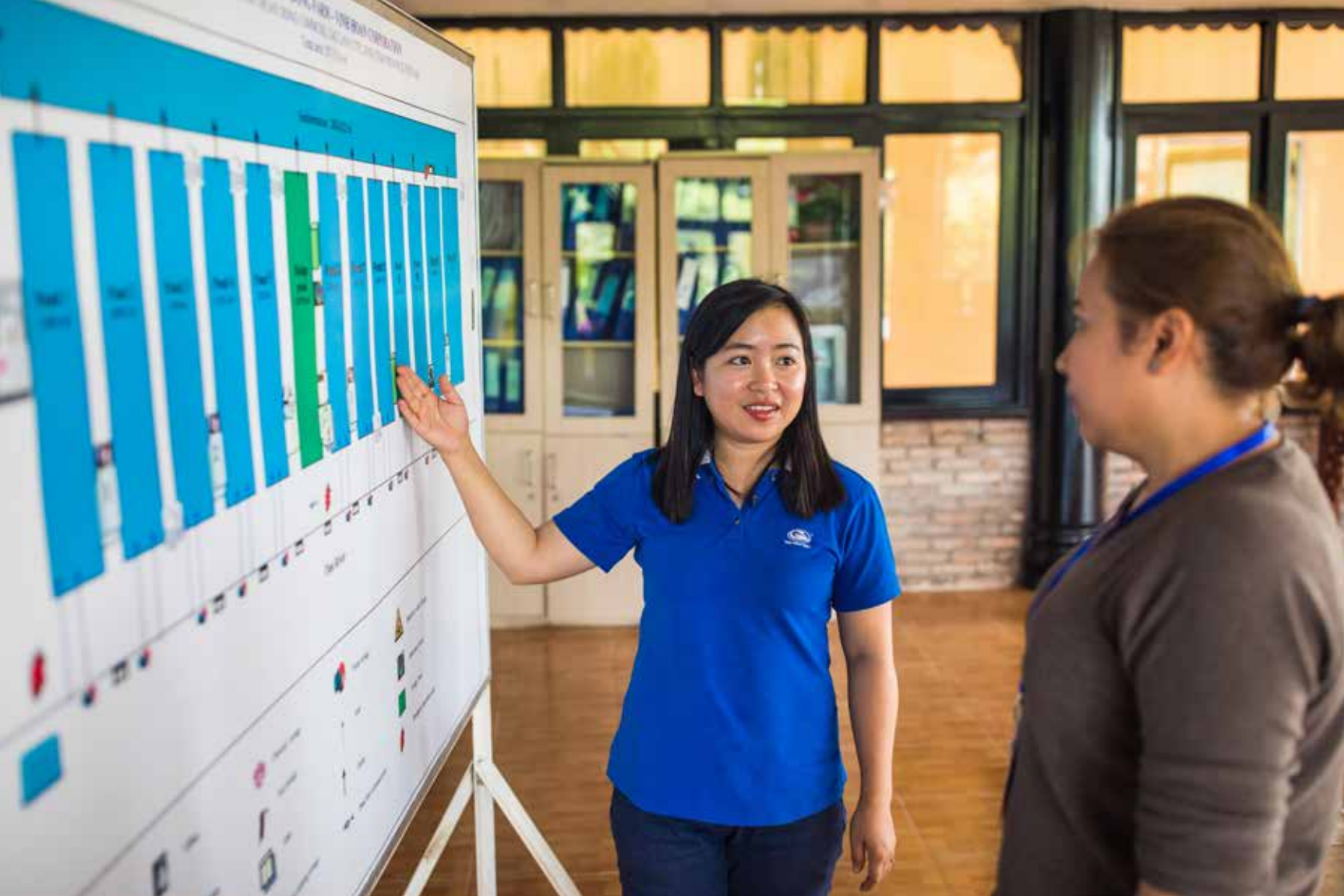


Figure 27. Average economic feed conversion ratio (eFCR) on ASC certified shrimp (*Penaeus vannamei*) farms in Asia and Central & South America.



TRANSPARENCY IN METRIC SETTING

The goal of the Metrics Methodology project is to create transparency in how the metric-based indicators in the ASC standards are set. Those are the indicators that are used to set compliance limits that can be measured, based on farm-level performances, such as requiring the survival rate of the farmed fish to be greater than a specified percentage.

The aim of the project is to provide robust and standardised rationales, which will be science-based where possible. These will be used to conduct efficient reviews of performance-based metrics in the current standards, and provide a framework for the inclusion of new or additional metrics in new or existing standards.

All ASC certified farms are subject to annual audits to ensure ongoing compliance against the standards, and these audits include data collection. This data feeds the ASC Monitoring and Evaluation (M&E) database and will also be used for operational reviews.

The Metrics Methodology, along with data sets

and analysis, will all be made publicly available on the ASC website. The methodology will be valid for all species metrics and include general definitions that will be used throughout the metric-setting process. It will also provide measuring and sampling guidance, and define the minimum amount of data necessary for metric-setting.

EXPANDING OUR FISH WELFARE INDICATORS

ASC launched its Fish Health and Welfare project in 2019 with an initial public consultation on three key documents, including an ASC position paper on fish welfare.

The focus on fish welfare stems from the fact that fish are sentient beings, current aquaculture practices may impair their welfare needs, and therefore this issue needs to be addressed. The precise working definition of animal welfare used by ASC will be determined at the start of the project's technical working group discussions and will include all crucial elements of welfare.

Animal welfare is increasingly considered as a key factor in defining responsible

production and determining the social acceptability of an animal production system. Ethical and science-based animal welfare considerations not only have the potential to improve product quality through differentiation, but food safety issues are also closely linked to animal welfare issues. For example, stress factors and welfare conditions influence disease susceptibility and in turn may impact consumer risks linked to food-borne infections. Furthermore, optimising fish welfare may

provide a win-win situation, by providing more cost-effective productivity. Acknowledging that there is now sufficient scientific research available on fish welfare, and as part of its commitment to continuous improvement, ASC aims to expand its current fish welfare requirements to a more comprehensive set of indicators and requirements that will be applicable to all culture systems and species currently in the ASC portfolio.

This will be further strengthened with species-specific metric-based indicators where possible. A key design principle will be that all indicators should either directly or indirectly contribute to improving fish welfare in aquaculture, and represent outcome-based best practices in the field. It is foreseen that these fish welfare indicators will be embedded within the aligned ASC Farm Standard currently in development.

STRENGTHENING ASSURANCE

ASC's Programme Assurance (PA) team is tasked with maintaining the integrity of the ASC programme, working with auditors and other stakeholders, to ensure the ASC standards are being applied robustly and consistently. But their work goes beyond this, and also includes projects that look to continuously improve the rigour of the ASC programme, whether that is through embracing new technology or improving auditing methodologies. A selection of the PA team's current projects is shown below.

KEY DATA ELEMENTS (KDE) PROJECT

The project looks at introducing the use of technology to improve digital traceability of ASC certified products. This involves using software to capture and convey key data elements from certified farm origin throughout the supply chain. The project aims to enhance supply chain transparency, mitigate risk and provide greater verifiable information to meet industry expectations.

The KDE project is being developed in collaboration with farms, industry and retailers, and ASC is working together with the Global Dialogue on Seafood Traceability (GDST) towards industry alignment. The benefits will be shared by all stakeholders, as reinforced traceability reduces risks in the supply chain.

An efficient information flow requires a flexible IT system and the PA team is currently trialling different data element sets, software providers and platforms in several countries. Interoperability with in-house software already used by industry is an important criterion.

The collected data elements, some of which will flow through the complete supply system, will most likely be species-dependent. These will evolve as the standards, requirements and needs of the supply chain evolve, allowing ASC to keep pace with future challenges.

SOCIAL AUDITING METHODOLOGY (SAM)

As concern around social issues in the seafood supply chain increases, the ASC is taking steps to strengthen its audit methodology for social requirements.

Labour and community indicators have been a mandatory part of the farm audits since the beginning of the ASC programme. Those requirements will now cover processors and feed mills, as a way to assure that ASC labelled products meet socially responsible standards at every step of the supply chain to the final consumer.

Launching in 2021, the new Social Audit Methodology (SAM) will be part of the Certification and Accreditation Requirements (CAR) and is based on months of research involving expert workshops, CAB surveys, consultation with other social auditing systems and expert input. This methodology has already passed public consultation, and includes an explicit two-step audit, with a comprehensive Desk Review and due diligence prior to on-site audit.

The SAM is based on an innovative weighted risk assessment approach. Drawing from worldwide recognised indices relevant for the seafood sector (e.g., World Bank's Work Governance Indicators, Corruption Perception Index, and Global Slavery Index), coupled with historical ASC audit data of social non-conformances, and data of individual applicants provided to auditors before each audit, the risk assessment approach allows for a balanced weighted risk profile of individual applicants or certificate holders.

The new methodology also gives social auditors more flexibility on low risk countries, and allows certificate holders with certain previous social certifications to reduce their risk level, promoting synergies and efficiency. The SAM moves the certification requirements away from a one-size-fits-all methodology to one that recognizes the different realities of the social issues, balancing a robust and cost-efficient system and including all actors of the seafood supply chain.

SUPPLIER MONITORING TOOL

The Supplier Monitoring Tool is a collaboration between ASC and its supply chain partners to address the issue of antibiotic presence in ASC products.

This voluntary, virtual network of supply chain partners facilitates anonymous sharing testing reports to create a central database of antibiotic results. Initiative participants gain insights on positive and negative antibiotic test results across different suppliers, allowing partners to make more data driven decisions and take action to mitigate the risk of antibiotic presence in ASC certified products. By increasing the likelihood of detection, the tool also creates a stronger disincentive for non-compliance.

Collaboration through the tool improves product integrity by collecting and integrating antibiotic test result data from certificate holders, supply chain partners, ASC sampling and reliable government databases. These insights also allow the ASC to focus resources on higher risk suppliers and products, applying assurance tools such as unannounced audits and product authentication testing, to improve programme assurance and integrity of certified product.

Confidential submissions are provided through a simple online reporting tool. The results are held in a database, and data are aggregated and reported periodically to the participating network. Companies interested to participate are welcome to contact assurance@asc-aqua.org.





PARTNER INTERVIEW:

IKEA

IKEA's current journey towards more responsibly sourced food began in 2015, when the company introduced a vegetarian alternative to their famous meatballs, then moved its focus to responsible sourcing of fish and seafood.

With more than 680 million customers around the world, Ola Nyrinder, Sustainability Developer for the IKEA Food business, says that the company has both an opportunity as well as a responsibility to encourage more sustainable practices.

"At IKEA we want to have a positive impact. We know that customers are becoming more and more interested in sustainability topics, and this includes knowing where their food comes from and if it was responsibly produced," said Ola. "Seafood, particularly salmon, is an important part of Swedish and Scandinavian culture and heritage, it was a natural step to make sure that the seafood we serve and sell to our customers is sourced responsibly."

But IKEA needed to be assured that its seafood was coming from responsible producers, and to provide the same assurance to its customers. This was not an easy task with over 430 IKEA

restaurants operating in 52 markets around the world.

The ASC programme was able to help provide this assurance for farmed seafood, while also covering a diverse range of potential impacts from aquaculture.

"ASC seemed to be the most robust and credible programme for aquaculture," said Ola. "Its standard has requirements covering both environmental and social issues, and Chain of Custody (CoC) certification also allows transparency and traceability to follow on along the supply chain."

As a result, IKEA committed to only sourcing seafood that was either ASC or MSC certified. With so many stores and so much demand for salmon, meeting this commitment has required hard work and collaboration.

"We worked closely together with ASC to identify producers in different regions who were

either certified or in the process of becoming certified," said Ola. "The ongoing success of this commitment is thanks to the strong collaboration between IKEA, ASC, suppliers and business partners."

"At IKEA we want to have a positive impact, and we know that customers are becoming more and more interested in sustainability topics"

Ola Nyrinder

The ASC logo is also important for IKEA, allowing it to communicate its seafood commitment to customers in an honest and credible way.

"Everyone at IKEA is fully committed to certified seafood, and the ASC logo helps us demonstrate to our customers that our seafood is responsibly produced," said Ola.

"A big part of our commitment is that our individual stores should achieve MSC and ASC Chain of Custody certification so they can use the logos on their local menus. This is a big undertaking with so many stores, and one that is ongoing – we have recently certified stores in Morocco, Jordan and Kuwait, for example." CoC certification requires that anyone selling ASC seafood and using the ASC logo is doing so properly, with full traceability and transparency. This maintains the credibility of the ASC logo, which in turn helps companies like IKEA to demonstrate their own commitments to responsibly sourced seafood.

Work on achieving this CoC certification is ongoing, as is the IKEA Food Health and Sustainability plan. The ASC programme fits in well with this plan, according to Ola. "Our wider food strategy is not just about sustainability, it is also about promoting healthy living, being climate positive, and creating a positive social impact across our value chain. ASC certified seafood is an important contribution to achieving the ambitions set out in our plan."

ANNEX 1: NUMBER OF CERTIFIED FARMS PER COUNTRY AND SPECIES

	ABALONE	BIVALVE	PANGASIUS	SALMON	SEABASS, SEABREAM & MEAGRE	SERIOLA & COBIA	SHRIMP	TILAPIA	TROUT	GRAND TOTAL
ALBANIA					1					1
AUSTRALIA	1			8		5	1			15
BANGLADESH							2			2
BRAZIL								8		8
CANADA				36						36
CHILE		50		94						144
COLOMBIA								4		4
COSTA RICA								2		2
CROATIA					5					5
DENMARK				17		1			26	44
ECUADOR							34			34
FRANCE		106					2		2	110
GERMANY									1	1
GREECE					9				1	10
HONDURAS							18	2		20
ICELAND				4					1	5
INDIA							78			78
INDONESIA							5	9		14
IRELAND				3						3
ITALY									8	8
JAPAN		55		1		7				63
MADAGASCAR							2			2
MALAYSIA								1		1
MEXICO		1				1	4	2		8
NETHERLANDS						1				1
NEW ZEALAND	1									1
NICARAGUA							2			2
NIGERIA							1			1
NORWAY				182						182
PANAMA						1	1			2
PEOPLE'S REPUBLIC OF CHINA	1	6					4	14		25
PERU		23								23
POLAND				2						2
SOUTH AFRICA	1									1
SOUTH KOREA	14									14
SPAIN					4				4	8
TANZANIA							1			1
THAILAND							10			10
TURKEY					14				14	28
UNITED KINGDOM		6		1						7
VENEZUELA							6			6
VIETNAM			48				153	1		202
GRAND TOTAL	18	247	48	348	33	16	324	43	57	1134

ANNEX 2: SUPPLEMENTARY INFORMATION FOR THE NON-CONFORMITY ANALYSIS

DEFINITIONS FROM THE CERTIFICATION AND ACCREDITATION REQUIREMENTS (CAR)

1. MAJOR NON-CONFORMITY

Any non-conformity with an ASC requirement that has one or more of the following characteristics:

- + The absence or total breakdown of a system that is likely to result in a failure to achieve the objective of the relevant ASC Standard Criteria or another applicable certification requirement
- + Would result in the probable shipment of product that does not conform to ASC requirements
- + Is likely to result in a failure of the system or materially reduce the ability of the client to assure the integrity of the certified product
- + Is shown to continue over a long period of time
- + Is repeated
- + Is systematic or is the result of the absence or a total breakdown of a system
- + Affects a wide area and/or causes significant damage
- + Is not corrected or adequately responded to by the client once identified
- + Where two (2) or more minor non-conformities may together meet any of the above criteria

2. MINOR NON-CONFORMITY

Any non-conformity with an ASC requirement that does not jeopardise the integrity of the certified product. This includes one or more of the following characteristics:

- + Where failure to comply with a requirement which is not likely to result in the breakdown of a system to meet an ASC requirement
- + Where the failure is a single observed lapse or isolated incident
- + Where there is no systemic failure to conform to ASC requirements
- + Where the impacts are limited in their temporal and spatial scale

AUDIT EFFORT ADJUSTMENT METHODOLOGY

A typical ASC certificate lasts for 3 years from the time of first certification, with farms being audited annually throughout the duration of their certificate. The first audit a farm undergoes is called the "initial audit", with each annual check called a "surveillance audit". After 3 years (i.e. 2 surveillance audits) a farm has to undergo a "recertification audit" in order to renew their certificate.

There is a variation in the number of auditors and days used per audit between conformity assessment bodies (CABs), with this variation further depending on the audit type (initial or surveillance) and the type of unit of certification (single or multi-site). These factors led to a likely inaccurate decrease in NCs during surveillance audits, with sites then showing an increase in non-conformities again at recertification (i.e. the initial audit of the next certification cycle). To account for this, the mean auditing effort (measured as the number of auditor days per unit

- + Where there is minimal risk of the shipment of a product that does not conform to ASC requirements
- + Where the failure does not meet the definition of a major non-conformity
- + Where the failure will not produce a non-conforming product

3. CORRECTIVE ACTION

The implementation of a systemic change or solution to ensure an immediate and on-going remedy to a non-conformity.

4. EXPIRED CERTIFICATE

A certificate that reached the expiry date without having been renewed by the issuing CAB. This certificate is no longer valid.

5. CANCELLED CERTIFICATE

Voluntary cancellation of a certification contract by any party to it according to the contractual arrangements.

6. SUSPENSION OF CERTIFICATE

The temporary removal by the CAB of all or part of a certificate holder's scope of certification pending corrective action by the certificate holder. A suspended certificate cannot be transferred

7. WITHDRAWAL OF CERTIFICATION

The irrevocable removal by the CAB of all or part of a certificate holder's certification as a result of non-conformance with certification requirements or contractual commitments

of certification) was calculated per species standard, excluding audits of more than 16 days in duration as these are likely artefacts of the data collection process. The average surveillance audit effort (again measured in auditor days) was then calculated per CAB and further used to give a ratio per CAB of surveillance audit effort versus initial audit effort. Where a CAB has on average spent less effort on a surveillance audit than the average initial audit effort from across all CABs for that species standard, the NC score is multiplied by a weighting factor specific to that CAB (that is based on the ratio calculated earlier).

Based on this weighting and filtering, the non-conformity score of a surveillance audit conducted with below average effort should now be directly comparable against those of initial and recertification audits. As a result, the findings have been further visualised by year rather than by audit type.

REFERENCES

[1] LUTHMAN O. ET AL (2019).

Governing the salmon farming industry: Comparison between national regulations and the ASC salmon standard. *Marine Policy*. Volume 106, August 2019, 103534: <https://doi.org/10.1016/j.marpol.2019.103534>

[2] NHU T.T. ET AL. (2016).

Environmental impact of non-certified versus certified (ASC) intensive *Pangasius* aquaculture in Vietnam, a comparison based on a statistically supported LCA. *Environ Pollution*. 2016 Dec. 219:156-165. <http://dx.doi.org/10.1016/j.envpol.2016.10.006>

[3] IFFO, THE MARINE INGREDIENTS ORGANISATION.

personal communications, 2020
<https://www.iffonet/>

[4] FAO, 2018. THE STATE OF WORLD FISHERIES AND AQUACULTURE 2018.

Meeting the sustainable development goals. Rome.
<http://www.fao.org/3/I9540EN/I9540en.pdf>

[5] ULLMAN, C., RHODES, M.A., DAVIS, D.A., 2019.

Feed management and the use of automatic feeders in the pond production of Pacific white shrimp *Litopenaeus vannamei*. *Aquaculture* 498, 44–49.
<https://doi.org/10.1016/j.aquaculture.2018.08.040>

[6] XIE, S. WEI, LIU, Y. JIAN, ZENG, S., NIU, J., TIAN, L. XIA, 2016.

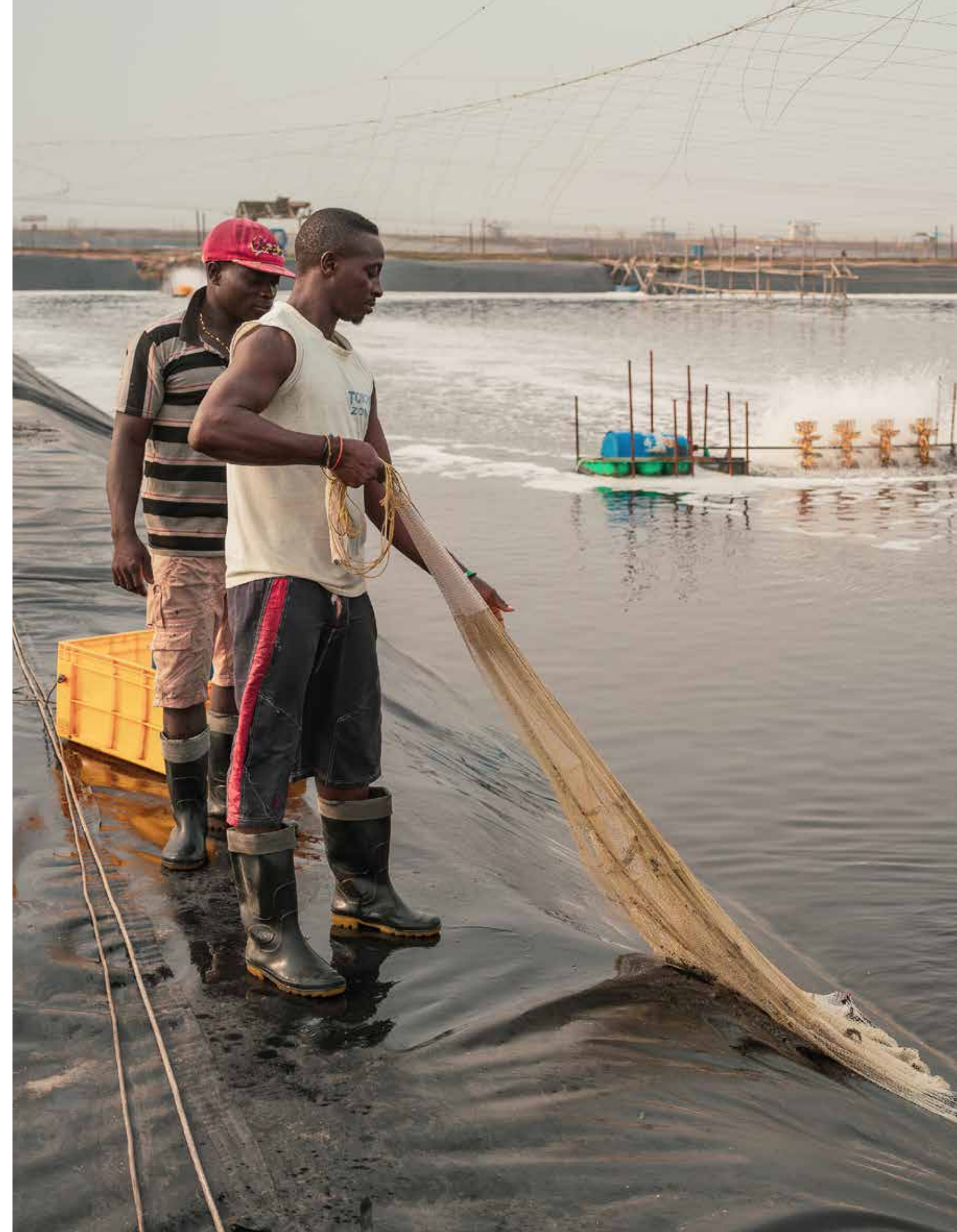
Partial replacement of fish-meal by soy protein concentrate and soybean meal based protein blend for juvenile Pacific white shrimp, *Litopenaeus vannamei*. *Aquaculture* 464, 296–302.
<https://doi.org/10.1016/j.aquaculture.2016.07.002>

ACKNOWLEDGMENTS

This report was prepared by Douglas Tenison-Collins with significant contributions from Jack Cutforth, Genevieve Hayward, Bertrand Charron, Contessa Kellogg-Winters, Nicki Holmyard, Jill Swasey, Dr Kathrin Steinberg, Dr Francis Murray, Inger Melander, Esther Luiten, Laura Guthschmidt, Paolo Pizzasegola, Ollie Tollford, Dimitar Taskov, Sérgio Abreu, Lauren Purton, Jason Hoepfl, Faridah Bukirwa, Hafize Aybike Adıgüzel, and Simão Zacarias. A further thanks to the rest of the ASC staff for their help.

The ASC would also like to acknowledge and thank the CABs, farms and supply chain partners that support our programme and strive to make improvements. Without their cooperation, these analyses would not be possible.

Design: Simon Avery, Nice Graphic Design www.nicegraphicdesign.co.uk





Aquaculture Stewardship Council
www.asc-aqua.org