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联合国粮食及农业组织 Food and Agriculture Organization of the United Nations Organisation des Nations Unies pour l'alimentation et l'agriculture Продовольственная и сельскохозяйственная организация Объединенных Наций Organización de las Naciones Unidas para la Alimentación y la Agricultura منظمة الأغذية والزراعة للأمم المتحدة

COMMITTEE ON FISHERIES

SUB-COMMITTEE ON AQUACULTURE

Ninth Session

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SPECIAL EVENT ON AQUACULTURE IN THE SMALL ISLAND DEVELOPING STATES (SIDS): BLUE GROWTH OPPORTUNITIES FOR SIDS IN A CHANGING CLIMATE

Executive Summary

This document reviews aquaculture in the Small Island Developing States (SIDS). A review of the background provides context to their aquaculture status, mainly described by statistics, species and culture systems. Technologies and investment needs are outlined. Inter-Islands and Regional initiatives are presented and some of the critical impacts of climate change on SIDS are highlighted. Based on these, the conditions and potentials for aquaculture to be sustainable, particularly under the Blue Growth Initiative are presented. **The Sub-Committee is invited to:** Reflect on the emergence and development of aquaculture in SIDS and provide advice to orient future interventions, initiatives and networks.

INTRODUCTION

1. Small Island Developing States (SIDS) are a group of countries located in the Caribbean, the Pacific, and the Atlantic, Indian, Mediterranean and South China Sea Region (AIMS),[1] whose designation was developed in 1992 at the United Nations Conference on Environment and Development (the Rio Summit), where the unique challenges facing SIDS within the context of sustainable

[1] www.fao.org/countryprofiles/geographic-and-economic-groups/en/

development were first formally recognized by the international community. The term has evolved since then into a formal movement of designated countries and territories that share a number of characteristics that interfere with their ability to promote sustainable development.

2. The Barbados Programme of Action adopted in 1994, further complemented by the Mauritius Strategy of Implementation (MSI) of 2005, the SIDS Accelerated Modalities of Action (S.A.M.O.A Pathway) in 2014, as well as several international meetings, such as the Sendai Framework for Disaster Risk Reduction 2015–2030, the Addis Ababa Action Agenda, the 2030 Agenda for Sustainable Development or the Paris Agreement, all recognized that although SIDS face economic difficulties and development imperatives similar to those of all developing countries, SIDS have their own unique challenges, limitations and vulnerabilities. Therefore, achieving sustainable development is particularly complex for them.

3. Some common challenges and limitations shared by SIDS are, among others: the greater risk of marginalization emanating from their small land size, their remoteness from large markets, their high vulnerability to economic and natural shocks beyond domestic control, their small but growing populations, their limited natural, human or financial resources, their excessive dependence on international trade and imports, their fragile environments, and their vulnerability to the adverse effects of climate change and sea-level rise. In general terms, growth and development of SIDS is held back by high communication, energy and transportation costs, irregular international transport volumes, disproportionately expensive public administration and infrastructure due to their small size, and little to no opportunity to create economies of scale.

4. The Millennium Development Goals proved to be an important framework for development, but progress was uneven in areas such as the Small Island Developing States.[2] As a result, the Sustainable Development Goals (SDGs) are now considering targets that have been specifically developed for SIDS. One is SDG 14.7 ("By 2030, increase the economic benefits to Small Island developing States and least developed countries from the sustainable use of marine resources, including through sustainable management of fisheries, aquaculture and tourism") for which FAO is a custodian UN agency.

5. FAO has been actively involved in supporting SIDS by addressing the sustainable development issues related to food security and agriculture.[3] The High Level Panel on the Work of FAO with Small Island Developing States held on 6 June 2015, during the 39th Session of the FAO Conference, provided a platform to present and exchange views on possible approaches, options and actions that will promote food security and nutrition while also addressing climate change and environmental threats in SIDS. It also discussed ways and means to move forward through improved policy, capacity building and effective, well-coordinated, partnerships.[4]

6. During its 155th Session, the FAO Council endorsed the conclusions and recommendations of the 32nd Session of the Committee on Fisheries (COFI), stressed the need for improved aquaculture production efficiency and requested FAO's assistance in promoting sustainable aquaculture development in SIDS.

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[2] Transforming our world: the 2030 Agenda for Sustainable Development https://sustainabledevelopment.un.org/post2015/transformingourworld

[3] www.fao.org/sids/

[4] High Level Panel FAO and Small Island Developing States (SIDS). Capturing new opportunities and strengthening partnerships for concrete actions Saturday 6 June 2015. www.fao.org/about/meetings/conference/c2015/side-events/sids/en/

AQUACULTURE IN SIDS

7. Freshwater resources are scarce in many SIDS but the marine environment provides a strong opportunity for aquaculture and fisheries development to contribute to sustainable food systems and the livelihoods in coastal communities.

8. In 2013, the average seafood consumption in SIDS was 12.4 kg/capita/year, with national figures ranging from 1.4 kg/capita/year in Guinea-Bissau to 185 kg/capita/year in Maldives.[5] Many SIDS currently have a large demand for high quality seafood products owing to local diet preferences, tourism and promotion of fish as a healthy diet choice. Demand for fish and fisheries and aquaculture products is expected to increase with future population growth, increase in wealth, changing diets, health concerns related to increasing obesity rates and changing demographic pressures.

9. The demand for seafood can be partially satisfied through imports. For example, fish imports by the countries of the Caribbean Community (CARICOM) in 2011 had reached 76 000 tonnes, a 35 percent increase from the 56 000 tonnes of imports in 2000.[6] This trend has continued and currently CARICOM SIDS fish imports are estimated to be in excess of 90 000 tonnes annually. Their heavy dependence on imported food and goods makes SIDS vulnerable to price volatility. Therefore, encouraging import substitution through the diversification of local production and the increased utilization of local products is considered a preferred development option.[7]

10. The promotion in SIDS of aquaculture development for food security is thus crucial. In the Caribbean, a recent paper on fisheries and aquaculture suggests that a Caribbean Blue Revolution is both needed and possible.[8] Revenues from aquaculture have risen, and its further development can increase total fish production in the CARICOM states by 30 percent within 10 years if essential investments are made in enabling aquaculture policy and legal frameworks, supported by applied research, capacity building and information systems. Similarly, aquaculture has been proposed as a way to secure food security for Pacific and African SIDS[9,10]. An FAO/SPC Regional Scoping Workshop was held in 2011 to draft a Regional Aquaculture Strategy which contained the vision, guiding principles, and 6 major priority programmes (i.e. biosecurity, capacity building, feasibility assessment, statistics and data, markets and trade, technology transfer and improvement).[11]

Production

11. Out of the 40 SIDS member countries, 32 have been registered in FAO database with aquaculture production statistics. In 2015, however, only 30 SIDS had aquaculture productions reflected in FAO statistics. On average, less than half of the SIDS aquaculture producers were able to report their respective national aquaculture production data to FAO in the past several years. Estimates were made by FAO for non-reporting countries in the absence of their national data reports, based on information from various sources if available to FAO. Whenever and wherever it is practiced, aquaculture

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[5] FAO Fishery Statistical Collections. Consumption of Fish and Fishery Products. www.fao.org/fishery/statistics/global-consumption/en

[6] FAO. 2014. Securing fish for the Caribbean. Sub-regional office for the Caribbean. Issue brief 10. www.fao.org/3/a-ax904e.pdf

[7] FAO. 2012. Pacific Multi-Country CPF 2013 – 2017 for the Cooperation and Partnership between FAO and its 14 Pacific Island Members ftp://ftp.fao.org/TC/CPF/Countries/SAP/SAP_PacificMulticountry_CPF_2013-2017%20docx.pdf

[8] Patil, P.G., Virdin, J., Diez, S.M., Roberts, J. & Singh, A. .2016. Toward a Blue Economy: A Promise for Sustainable Growth in the Caribbean. An Overview. The World Bank, Washington, D.C.

[9] Bueno P., Kuemlangan B., Bitoch Rechelluul P. & Chopin, F. 2016. Micronesian Association for Sustainable Aquaculture established. FAO Aquaculture Newsletter 23. www.fao.org/3/a-bc866e.pdf

[10] www.uneca.org/stories/blue-economy-are-african-small-islands-ready-embrace-opportunities

[11] www.fao.org/3/a-i3060e.pdf

contributes positively to local and national economies, nutrition and food security, employment opportunities and livelihoods.[12]

12. In 2015, the total aquaculture production of SIDS was 71 893 tonnes with total estimated farm gate value of US$125.1 million, including 50 126 tonnes of aquatic animals (US$123.8 million) and 21 857 tonnes of seaweeds (US$1.3 million). However, the national aquaculture production capacity varies greatly among SIDS countries, ranging from less than 1 tonne (such as Nauru and Marshall Islands) to around 30,000 tonnes (Cuba). In 2015, only six SIDS produced more than 1 000 tonnes of farmed aquatic animals, five of them between 100–1000 tonnes and the rest below 100 tonnes. Farmed freshwater fishes also play a major role in some States with abundant inland water resources, like Cuba and Jamaica, where respectively a range of carp species and tilapia are produced successfully at commercial scale.

13. Despite that many SIDS have desirable conditions for the development of seaweed farming, only five SIDS farmed seaweeds in substantive volume, with Solomon Islands counting for 56 percent of the total SIDS farmed seaweeds production in 2015.

14. Given the seasonality of the capture fisheries production in most SIDS and the shortages in supply of fish off-season, the aquaculture sector has an opportunity to fill part of this supply gap, as well as to meet the demand domestically for fish without increasing further reliance on fish imports. In many SIDS the market prices of fish are very high outside the fishing season and aquaculture can facilitate the availability and accessibility of good quality fresh fish at reasonable prices domestically year-round.

Species

15. Aquaculture efforts have been directed towards both native and non-native, marine and freshwater species. In 2014, 76 species were reported to FAO as being farmed in SIDS: 31 marine or diadromous fishes, 21 freshwater fishes, 10 crustaceans, 11 molluscs (including pearl oyster), 2 seaweeds and one species of frog. This is a 25 percent increase in the number of farmed aquatic species in SIDS over the last decade, and a 65 percent increase since 1994. However, the 10 most produced species account for 71 percent of the total production in volume.

16. Both success stories and failures have been reported in most SIDS. A review of national initiatives in eight selected SIDS in the Pacific (Cook Islands, Fiji, Kiribati, Marshall Islands, Palau, Samoa, Tonga and Vanuatu) conducted by FAO in 2014[13] concluded that even though most of the culture species proved to be technically feasible, they failed to fulfil commercial expectations. One reason is the limited market, another is the difficulty in accessing or competing in the International markets (the exceptions are pearls, aquarium-size giant clams and live corals), particularly when the availability of inputs is limited and their price is high. Lately, cheap imported cultured fish from Asia, particularly basa catfish and tilapia as whole and fileted products, have been competing directly with local cultured fish.

[12] FAO. 2017. Regional review on status and trends in aquaculture development in Asia-Pacific – 2015, by Rohana Subasinghe. FAO Fisheries and Aquaculture Circular No. 1135/5. Rome, Italy.
[13] Bueno, P.B. 2014. Lessons from past and current aquaculture initiatives in selected Pacific Island countries. TCP/RAS/3301. Sub-Regional Office for the Pacific Islands. Rome, Italy.

Technologies

17. Many technologies have been used, ranging from the traditional earthen ponds to marine cages, and from Recirculating Aquaculture Systems (RAS) to aquaponics systems. Aquaponics[14,15] is a new practice that combines recirculating aquaculture systems with hydroponic vegetable production. It makes an efficient use of limited resources, especially freshwater, and has shown potential for both family-farms and commercial development in several SIDS, whether in the Caribbean, AIMS or in the Pacific[16]. However, in many cases, the development strategies had been primarily focused on the research/pilot-scale phases, leaving insufficient resources for scaling up into commercial enterprises or addressing the essential requirements of economic viability, particularly market access, market development, and competitiveness.[13]

18. The pronounced distance and indeed remoteness of most SIDS from large international markets undermines their export-led development; it reduces their competitiveness as a result of a higher cost of transport and logistics. This suggests the need to focus on technologies that are less impacted by geographical disadvantages and/or based on species with a high added-value that can compensate for higher production and transportation costs.

19. Integrated fish/livestock farms in Fiji or Samoa, milkfish farms in Palau and Kiribati, rabbit fish farming in Mauritius, small-scale aquaculture in Guyana and aquaponics in The Bahamas or Antigua and Barbuda are examples of the former strategy. High added-value aquaculture products such as pearl oysters in Cook Islands, Fiji or Seychelles, live corals in Fiji, seaweed farms integrated with tourism in Saint Kitts and Nevis or Saint Lucia, shrimp in Cape Verde and Belize or aquarium-size giant clams in Kiribati, Palau, Marshall Islands, Samoa and Seychelles are examples of the second strategy.[17,18,19]

Investment in aquaculture development in SIDS

20. Public and private investments are required for the sector to develop in a viable manner. Key decisions involve, first, getting the balance right between government-led development of aquaculture and providing incentives for the private sector, and second, identifying the appropriate scale of operations for the region.[10]

21. Governments need to create the enabling aquaculture policy and legal frameworks that would encourage the private sector to invest with fewer uncertainties. Applied research, pilot demonstration sites, capacity building and extension services, technology transfer, sharing of best-practices information and success stories are needed as well. However, the relatively low borrowing power and static growth of many SIDS significantly compromises the ability of governments to channel national resources towards aquaculture.

22. Stakeholders should have access to reliable data on local profitability of aquaculture, including on opportunity costs and on the reliable availability of production factors/inputs to both small-to-medium scale farmers as well as to larger private investors/operators, so that a reliable investment risk assessment can be conducted. An FAO review of national initiatives in eight selected Pacific Island

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[14] FAO and CDEMA. 2016. Regional Workshop to Formulate a FAO Livelihoods Resilience Programme for Caribbean SIDS. Port of Spain, Trinidad and Tobago. 22 – 23 March 2016. 44 pp. Rome, Italy. ISBN: 978-92-5-109297-2

[15] FAO. 2016. Report of the FAO technical workshop on advancing aquaponics: an efficient use of limited resources, Bogor, Indonesia, 23–26 November 2015. FAO Fisheries and Aquaculture Report No. 1133. Rome, Italy.

[16] Small-scale aquaponic food production available at: www.fao.org/3/a-i4021e/index.html

[17] www.fao.org/3/a-i4139e.pdf

[18] www.uneca.org/sites/default/files/uploaded-documents/Climate/unlocking_the_full_potential_of_the_blue_economy_en.pdf

[19] http://maribe.eu/wp-content/uploads/2016/10/c1-aquaculture-and-tourism-combination-caribbean-report.pdf

countries noted that investments were ill-defined or insufficiently addressed.[20] FAO is working to address this gap by supporting stakeholders in conducting in-depth aquaculture risk assessments and business investment planning through various projects.

23. Examples of such activities include the Technical Cooperation Projects on "In-depth aquaculture risk assessment and business investment planning" in Tuvalu (TCP/TUV/3601/C1), Kiribati (TCP/KIR/3602/C2), Marshall Islands, Federated States of Micronesia, Nauru and Palau (TCP/SAP/3602/C2), "Towards a Caribbean Blue Revolution" in Antigua, Barbuda, Bahamas, Barbados and St. Kitts and Nevis (TCP/SLC/3601), and the Government Cooperation Programme on "Adoption of efficient and climate-smart agriculture practices in African SIDS" in Cabo Verde, Guinea Bissau and Seychelles, as well as Comoros, Mauritius or Sao Tome and Principe (GCP/RAF/506/MUL).

24. Foreign direct investments (FDIs) are another source of support for aquaculture development in the SIDS. In this case, it is advisable that investment contracts are in line with international instruments, especially the FAO voluntary guidelines on the Responsible Governance of Tenure of Land, Fisheries and Forests in the context of National Food Security.[21]

Inter-Island and Inter-Regional cooperation

25. Collective action and pooled resources among the SIDS is one option to overcome the challenges to aquaculture development, specifically the limited technical expertise, infrastructure, and capital investment. Many forms of collaboration are available as options, including intergovernmental networks, the establishment of regional facilities, co-management of aquatic genetic resources, capacity building of stakeholders in the wider SIDS community, and joint research activities, among others.

26. One such example is FAO's support to the establishment of a "regional shellfish hatchery" in order to produce native species that fulfil the Caribbean countries' needs in developing an aquaculture value chain based on indigenous shellfish.[22] The collaborative management of the farmed red drum genetics by various tropical islands scattered around the globe is another useful example.[23] The establishment of the Micronesian Association for Sustainable Aquaculture (MASA)[24] is expected to strengthen the development in sustainable aquaculture for food security, rural and economic development through technical cooperation among members and participating states.

27. South-South Cooperation is another way of facilitating technology transfer to benefit aquaculture in SIDS, as highlighted by the 4th ACP Fisheries and Aquaculture Ministerial meeting held in July 2015.[25]

Climate change vulnerability and emergency preparedness

28. During its 155th Session, the FAO Council endorsed the conclusions and recommendations contained in the Report of the 32nd Session of the Committee on Fisheries (COFI). It welcomed the FAO draft Strategy for Fisheries, Aquaculture and Climate Change for 2017–20, recognizing the

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[20] Bueno, P.B. 2014. Lessons from past and current aquaculture initiatives in selected Pacific Island countries. TCP/RAS/3301. Sub-Regional Office for the Pacific Islands. Rome, Italy. www.fao.org/3/a-i4139e.pdf

[21] FAO. 2012. Voluntary guidelines on the Responsible Governance of Tenure of Land, Fisheries and Forests in the context of National Food Security. Rome, Italy. 40 pp.

[22] Lovatelli, A. & Sarkis, S. 2011. A regional shellfish hatchery for the Wider Caribbean: Assessing its feasibility and sustainability. FAO Regional Technical Workshop. 18–21 October 2010, Kingston, Jamaica. FAO Fisheries and Aquaculture Proceedings. No. 19. Rome, FAO. 246 pp.

[23] www.spc.int/DigitalLibrary/Doc/FAME/Meetings/11_Tahiti_Aquaculture_2010_abstracts.html

[24] FAO. 2013. Assistance in the establishment of a Micronesian Network on Sustainable Aquaculture. TCP/SAP/3403

[25] www.fao.org/3/a-bc866e.pdf

important role of the ocean on climate change and the impacts of climate change on the ocean, fisheries and aquaculture.

29. The Intergovernmental Panel on Climate Change (IPCC) describes several key threats to SIDS as a result of climate change in its Fifth Assessment Report (AR5) published in 2014.[26] These are sea level rise, tropical and extratropical cyclones, increasing air and sea surface temperatures and changing rainfall patterns, which are among the most widely recognized threats to vulnerable islands and atolls. It is noted that not all small islands have uniform climate change risk profiles.

30. As a result, SIDS are expressly invited by the Paris Agreement[27] to "prepare and communicate strategies, plans and actions for low greenhouse gas emissions development reflecting their special circumstances" (Article 4, paragraph 6). The adaptation of aquaculture, and indeed all agriculture, to climate change must consider, mediate and reconcile the simultaneous and sometimes conflicting development challenges, as outlined in Article 7 paragraph 5 of the Paris Agreement, as follows: "Parties acknowledge that adaptation action should follow a country-driven, gender-responsive, participatory and fully transparent approach, taking into consideration vulnerable groups, communities and ecosystems, and should be based on and guided by the best available science and, as appropriate, traditional knowledge, knowledge of indigenous peoples and local knowledge systems, with a view to integrating adaptation into relevant socioeconomic and environmental policies and actions, where appropriate."

31. Changes in precipitation or in storm activity (intensity and occurrence) endanger the lives of fishers, fish farmers and coastal/riparian/lacustrine communities directly, can cause damage to fisheries and aquaculture infrastructure and housing, and present additional threats for coral reefs and mangroves.[28] In addition, SIDS are also increasingly vulnerable to external stressors such as invasive species and the spread of aquatic pathogens. In the tropical Pacific, mariculture is likely to experience decreased production as a result of ocean acidification, higher water temperatures, higher rainfall and/or storm damages. In the Caribbean, negative impacts are expected for aquaculture systems,[29] and in African SIDS, aquaculture is likely to be negatively affected, particularly by extreme weather event on farmed fish in mariculture and open sea cages.[30] Other potential risks to aquaculture operations include increased incidence of epizootics or fish disease outbreaks.[31] In the Caribbean region FAO, the Caribbean Regional Fisheries Mechanism (CRFM) and the University of the West Indies developed a Strategy and action plan for disaster risk management and climate change adaptation in the fisheries and aquaculture sectors of the CARICOM and wider Caribbean region,[32] which is currently being implemented through various development and investment projects.

32. The GEF Special Climate Change Fund (SCCF) and a range of Caribbean SIDS (Antigua and Barbuda, Dominica, Grenada, St Kitts and Nevis, Saint Lucia, St Vincent and the Grenadines, and Trinidad and Tobago) are currently investing substantial funds in a Trust fund project "Climate Change Adaptation of the Eastern Caribbean Fisheries Sector Project (CC4FISH)" (GCP/SLC/202/SCF), which aims, among others, to increase awareness and understanding of climate change impacts and

[26] www.ipcc.ch/report/ar5/
[27] unfccc.int/paris_agreement/items/9485.php
[28] www.fao.org/fishery/climatechange/en
[29] Brugère, C. 2015. Climate change vulnerability in fisheries and aquaculture: a synthesis of six regional studies. FAO Fisheries Circular No. 1104. Rome, FAO. 88 pp.
[30] FAO. 2014. Report of the FAO/NEPAD Workshop on Climate Change, Disasters and Crises in the Fisheries and Aquaculture Sector in Southern and Eastern Africa, Maputo, Mozambique, 22 to 24 April 2013. FAO Fisheries and Aquaculture Report/FAO Rapport sur les pêches et l'aquaculture No. 1055. Rome. 86 pp.
[31] Cattermoul, B.; Brown, D. & Poulain, F. eds. 2014. Fisheries and aquaculture emergency response guidance, Rome, FAO. 167 pp.
[32] McConney, P., Charlery, J., Pena, M., Phillips, T., Van Anrooy, R., Poulain, F. & Bahri, T. 2015.Disaster risk management and climate change adaptation in the CARICOM and wider Caribbean region – Strategy and action plan. Rome. 29 pp. www.fao.org/3/a-i4382e.pdf

vulnerability for effective climate change adaptation in the aquaculture sector, improve resilience of aquaculturists and mainstream climate change adaptation mainstreamed in multilevel fisheries and aquaculture governance.

33. If aquaculture in SIDS has specific vulnerabilities to these threats, some opportunities may also arise. For example, rising sea level will displace freshwater in river deltas, low lying ponds and wetlands, potentially creating new environments and some opportunities (e.g. for brackish species). In Papua New Guinea and Vanuatu, increased water temperature in freshwater bodies has broaden the range of tilapia farming development in highlands. Climate change risk assessment conducted in the tropical Pacific concluded that existing and planned freshwater aquaculture activities to produce tilapia, carp and milkfish are likely to benefit from the anticipated changes (higher water temperature and increased rainfall).[33,34]

34. To enhance the long-term resilience of aquaculture, risks need to be assessed and their potential impacts mitigated, together with plans to increase adaptive capacity, resilience and reducing vulnerability to disasters.[35] FAO has issued two publications to support this preparation: 1/ Fisheries and Aquaculture Emergency Response Guidance[36] and 2/ Guidelines for the fisheries and aquaculture sector on damage and needs assessments in emergency.[37]

Sustainable aquaculture in SIDS

35. Aquaculture in SIDS is still in its infancy in most areas, which makes it even more crucial that its development duly considers maintaining sector sustainability while addressing the potential impacts of climate change[38] and preventing the introduction of pathogens and invasive species. In SIDS, freshwater is also frequently in short supply and likely to be contaminated with saltwater and waste water. Around the world, coastal areas are currently considered in a critical state and highly endangered, with approximately 35 percent of world's mangrove area and 20 percent of the world's coral reefs having been lost in the last few decades.[39]

36. SIDS have a high biological diversity, but the recent spread of invasive exotic species has emerged as a major factor in endemic species decline, extinction and loss of biodiversity, with subsequent consequences on goods and services derived from this species. Aquaculture facilities have an inherent risk of pest and pathogen introduction, exacerbation or spread. At the same time, the aquaculture industry can be impacted through the spread of pests, invasive species and disease introduced through vectors such as the hulls of marine ships and ballast water and effluent discharge. Biosecurity measures systematically applied and harmonized can be employed to effectively manage

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[33] Bell, J.D., Johnson, J.E., Ganachaud, A.S., Gehrke, P.C., Hobday, A.J., Hoegh-Guldberg, O., Le Borgne, R., Lehodey, P., Lough, J.M., Pickering, T., Pratchett, M.S. & Waycott, M. 2011. Vulnerability of Tropical Pacific Fisheries and Aquaculture to Climate Change: Summary for Pacific Island Countries and Territories. Secretariat of the Pacific Community, Noumea, New Caledonia.

[34] Johnson, J., Bell, J. & De Young, C. 2013. Priority adaptations to climate change for Pacific fisheries and aquaculture: reducing risks and capitalizing on opportunities. FAO/Secretariat of the Pacific Community Workshop, 5–8 June 2012, Noumea, New Caledonia. FAO Fisheries and Aquaculture Proceedings No. 28. Rome, FAO. 109 pp.

[35] McConney, P., Charlery, J., Pena, M., Phillips, T., Van Anrooy, R., Poulain, F. & Bahri, T. 2015. Disaster risk management and climate change adaptation in the CARICOM and wider Caribbean region – Programme proposals. FAO Rome. 21 pp.

[36] www.fao.org/3/a-i3432e.pdf

[37] www.fao.org/3/a-i3433e.pdf

[38] FAO. 2017. Regional review on status and trends in aquaculture development in Asia-Pacific 2015, by Rohana Subasinghe. FAO Fisheries and Aquaculture Circular No. 1135/5. Rome, Italy.

[39] Millennium Ecosystem Assessment. 2005. Coastal Systems. In Ecosystems and human well-being: current state and trends: findings of the Condition and Trends Working Group. Edited by R. Hassan, R. Scholes, and N. Ash. Island Press, Washington DC, USA. pp. 515–549.

these risks. Preventive biosecurity is more cost effective than reactively trying to solve a problem once it has occurred.[40]

37. The patterns of interaction between aquaculture operations, the environment, other activities and other stakeholders are complex and their outcomes can be difficult to predict, particularly if the outcomes result from the combination of a large number of individual decisions. Aquaculture development has the potential to contribute to the resilience and sustainability of the social-ecological system,[41] but it can also create adverse consequences.

38. Regardless of the size of the operation, sustainable aquaculture, by definition, must be economically viable and environmentally sound. It must also be culturally appropriate and socially equitable especially with regards to gender or decent work, and must not be at the expense of reducing access to essential resources by small-scale fishers and others. The FAO Code of Conduct for Responsible Fisheries[42] contains principles and provisions in support of sustainable aquaculture development. It is supported by several technical guidelines and frameworks such as the Ecosystem Approach to Aquaculture (EAA)[43] and the Blue Growth Initiative (BGI).[44,45]

FAO, SIDS AND BLUE GROWTH OPPORTUNITIES

39. In September 2014, Heads of State and Government and high-level representatives adopted the S.A.M.O.A Pathway. They invited FAO to facilitate a meeting on food security and nutrition in SIDS to develop an action programme to address their specific food security and nutrition challenges. Following the High Level events during the 39th Session of FAO Conference and on the occasion of Expo Milano which provided a platform to exchange experiences and priorities for SIDS in the areas of food security and nutrition, FAO and its partner organizations, the United Nations Department of Economic and Social Affairs and the United Nations Office of the High Representative for the Least Developed Countries, Landlocked Developing Countries and Small Island Developing States, developed an indicative roadmap for concrete actions towards fulfilling the resolution contained in Paragraph 61 of the S.A.M.O.A Pathway. In early 2016, FAO hosted three high-level meetings during its Regional Conferences to provide the basis for the development of the Global Action Programme on Food Security and Nutrition in SIDS for presentation and endorsement at the FAO Conference in July 2017.

40. FAO already supports SIDS through policy advice, analyses and technical assistance in agriculture, fisheries, forestry and natural resources management to promote resilient livelihoods and enhance food security and nutrition. FAO has developed an Interregional Initiative to serve as its main delivery mechanism in support of the Global Action Programme.

41. The FAO Blue Growth Initiative (BGI) is a coherent framework for the sustainable and socioeconomic management of living aquatic resources and is anchored on the principles set out in the Code of Conduct for Responsible Fisheries (CCRF) in 1995. It emphasizes the integration of fisheries

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[40] Georgiades E., Fraser R., Jones B. 2016. Options to Strengthen On-farm Biosecurity Management for Commercial and Non-commercial Aquaculture. Ministry for Primary Industries, Technical Paper No: 2016/47, Wellington, New Zealand. 353 p. www.mpi.govt.nz/document-vault/13287

[41] Rodima-Taylor, D. 2012. Social innovation and climate adaptation: Local collective action in diversifying Tanzania. Applied Geography 33: 128–134. Elsevier Ltd. doi: 10.1016/j.apgeog.2011.10.005.

[42] FAO. 1995. Code of Conduct for Responsible Fisheries Rome, Italy. 41 p.

[43] FAO. 2010. Aquaculture development. 4. Ecosystem approach to aquaculture. FAO Technical Guidelines for Responsible Fisheries. No. 5, Suppl. 4. Rome, FAO. 53p.

[44] FAO. 2014. Global Blue Growth Initiative and Small Island developing States (SIDS). Rome, FAO. 7p.

[45] www.fao.org/sids/

and aquaculture with other users and services of aquatic ecosystems and underscores the value of fisheries and aquaculture for these users. It aims to support more productive, responsible and sustainable fisheries and aquaculture sectors by improving the governance and management of the aquatic ecosystems, conserving biodiversity and habitats, and empowering communities. BGI is being implemented in some countries and a specific strategy is currently being prepared for SIDS.

42. Implementation of the Blue Growth Initiative is particularly important for SIDS which cover much of the tropical and subtropical Pacific Ocean, Indian Ocean and the Caribbean. Opportunities may arise not only from sustainable fisheries and aquaculture or resilient livelihood and food systems but also from the economic growth generated by ecosystem services such as tourism. It is thus essential for the SIDS to protect, restore and improve the health, productivity and resilience of oceans, coastal and inland ecosystems and to maintain their aquatic biodiversity while developing aquaculture.

CONCLUSIONS

43. Global aquaculture production in SIDS will likely continue to increase in the coming decades, either for improving the resilience of local communities, for generating income or both. Differences among islands are foreseen and the future performance of aquaculture will depend on its embeddedness into the local environment and on the availability of adapted production methods for species currently being farmed or of techniques for propagating and growing "new" species.[46]

44. Many aquaculture technologies, species and systems have been experimented in SIDS. Many have the potential to increase islands' income, food security and nutrition, provided they are or can be adapted to the local context. Intervention based on standardized and proven successful technological packages could allow for a quick growth and economies of scale with regards to equipment and input costs, but the observed trend towards diversification of species is also making sense, given the diversity of SIDS and their potential markets. Pilot commercial-scale operations, research combined with assistance, training and education programmes may be needed to test, adapt and demonstrate the economic viability of some of the technologies proposed.

45. The diversity of SIDS is considerable and interventions to promote aquaculture development should avoid "one-size-fits-all" solutions. Favourable outcomes in the aquaculture sector will require a shift in emphasis towards identifying and building comparative advantages and promoting an enabling business and policy environment for private sector-led aquaculture enterprise development.[47]

46. In many SIDS the fish supply fluctuates highly with the fishing seasons. By focusing on production for the domestic market and addressing seasonal gaps in supply aquaculturists will be able to provide access to and increase availability of high quality fresh fish that cannot be supplied easily through imports. An emphasis on production for the domestic market, supplying the local population and tourists with fish, will in many cases result in greater sustainability for aquaculture enterprises than competing on the international and export market.

47. The Blue Growth Initiative provides an adequate framework for planning aquaculture development in fragile but rich social-ecological systems like SIDS, that are vulnerable to both local and global drivers of changes, particularly climate change, and for which the desirable outcomes in

[46] FAO. 2017. Regional review on status and trends in aquaculture development in Asia-Pacific – 2015, by Rohana Subasinghe. FAO Fisheries and Aquaculture Circular No. 1135/5. Rome, Italy.
[47] FAO. 2012. Pacific Multi-Country CPF 2013 – 2017 for the Cooperation and Partnership between FAO and its 14 Pacific Island Members ftp://ftp.fao.org/TC/CPF/Countries/SAP/SAP_PacificMulticountry_CPF_2013-2017%20docx.pdf

terms of aquaculture, societies, economy and natural resources are entangled through complex socio-technological and cultural dynamics.

48. Inter-island and Inter-Regional cooperation, such as that supported through the Global Action Programme, should be sought and promoted in order to develop tools and knowledge in support to strategies, while optimizing resources and maximizing impacts for SIDS.[48] They do not replace or compete with national initiatives, but rather reinforce these. A strong mechanism for coordination between both levels is needed for the scheme to deliver its full benefit.

GUIDANCE SOUGHT

49. The Sub-Committee is invited to:

- Take note of and consider further the information provided in this Working Document;
- Reflect on the emergence and sustainable development of aquaculture in SIDS and provide advice, as required, to strengthen the recommendations;
- Provide guidance on how to strengthen the implementation of the recommendations for future interventions and initiatives;
- Support resource mobilization efforts to implement priority areas to promote aquaculture development in SIDS.

[48] FAO. 2012. Report of FAO/SPC Regional Scoping Workshop: Development of a Pacific Aquaculture Regional Cooperative Programme. www.fao.org/docrep/017/i3060e/i3060e00.htm