Brazilian Agricultural Research Corporation
Ministry of Agriculture, Livestock and Food Supply

Sustainable Development Goal 14

LIFE BELOW WATER

CONTRIBUTIONS OF EMBRAPA

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Chapter 6

Advances and future challenges

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Introduction

Among the 17 Sustainable Development Goals (SDG) established in 2015 by the United Nations (UN), perhaps one of the most challenging for Brazil and for Embrapa is SDG 14 – Conserve and sustainably use the oceans, seas and marine resources for sustainable development – Life Below Water. This complex system has undergone several changes caused both locally and globally by human action.

Today, we observe the environmental imbalance caused by greenhouse gas emissions, great part of which (69%) comes from agriculture. In 2015, Brazil's gross emissions reached 1.927 billion tons of CO_2, 3.5% more than the 1.861 billion tons emitted in 2014 (Sistema de Estimativas de Emissões e Remoções de Gases de Efeito Estufa, 2017). In Brazil, agriculture based on extensive use of fertilizers and agricultural pesticides is of great concern because it contributes to air pollution and pollutes water streams, rivers and oceans. The environmental crisis over the last decades has not only raised the awareness of how unsustainable traditional production practices are, but has also opened up the possibility of joining nature in search for food security (International Policy Centre for Inclusive Growth, 2017). According to these guidelines, adopting new production methods, improving traditional technologies, fully using fish and keeping environmental quality are fundamental initiatives to ensure sustainable production of healthy and safe food (Barroso; Wiefels, 2010).

It is Embrapa's role to propose changes to current production systems towards a sustainable model guided by eco-systemic integration and appreciation of renewable natural resources. This is why studies and technologies for conserving ecosystems and their biodiversity, developing environmentally friendly aquaculture production systems and encouraging fisheries sustainability are essential.

Marine resources, impacts and management

Research studies and actions described in Chapter 3 specifically address marine (biological, genetic and biotechnology) resources, anthropogenic impacts and management of biodiversity and coastal marine environmental data as inputs to management plans in conservation units and aquaculture parks. Relevant knowledge advances already made include identifying genetic biodiversity of native crabs, lobsters and shrimps; observing mangrove crab production chain in the Northern and Northeastern regions of Brazil and bio-prospecting active compounds from marine resources.

Among the most significant results are the mangrove crab transportation methodology and the management plan for the crab harvesting reserve area within the Environmental Protection Area (APA) of the Parnaíba River Delta; these are examples of projects conducted by Embrapa that led to the formulation of public policies. These products reveal that Embrapa has already addressed the conservation of marine resources in different domains and as part of portfolios within its project platform. However, there is a need for stronger network projects, such as the proposal to create a National Aquaculture Environmental Monitoring and Research Network in Federal Waters, which would gather different institutions around a single theme, in order to support governmental agendas. Biodiversity data management and environmental management studies, geospatial indicators monitoring, debris flow modeling and flood events should also be addressed in projects to promote the conservation of seas and oceans.

Aquaculture

As with natural resource management, many environmental problems caused by aquaculture can be identified and minimized by using solutions offered by Embrapa, which imply changing certain management practices or developing new technologies (Tucker; Hargreaves, 2008), such as those described in Chapter 4.

Embrapa took the first step: it fostered the project Bases Tecnológicas para o Desenvolvimento Sustentável da Aquicultura no Brasil (Technological Bases for the Sustainable Development of Aquaculture in Brazil – Aquabrasil) and Rede de Pesquisa e Desenvolvimento em Piscicultura Marinha (Marine Fish Farming Research and Development Network – Repimar), and joined Rede de Pesquisa em Carcinicultura do Nordeste (Northeastern Shrimp Farming Research Network – Recarcine), Rede de Carcinicultura Nacional (National Shrimp Farming Network

– Recarcina) and Rede Ostras Nativas (Native Oysters Network). The projects included in these networks helped strengthening marine shrimp, cobia and native oyster production chains mainly by designing technical production models and identifying problems related to their production, processing and sale.

However, except for shrimp farming, other production chains are not based on a well-structured model, which is technically interesting because it is possible to promote an environmentally friendly system; but more substantial investment and human resources are needed to focus on these species.

Even in terms of fish science and technology based on biotechnology – on which researchers from numerous Embrapa Units work and offer professional training for extracting collagen and organic compounds from fish filleting waste, producing food products from mechanically separated fish meat (MSM) and improving fish quality in terms of contamination with pesticide residues, heavy metals, hydrocarbons and other substances harmful to the species' conservation and to human food safety –, there is still a long way to go if one compares shrimp farming technology development in Brazil with that of other countries.

The first step is conducting basic research, which is fundamental for understanding not only how the aquatic ecosystem in which activities are performed works, but also its connections with the production system, leading to a consolidated marine aquaculture. One of the main points to be studied is the monitoring of environmental parameters, which is essential to improve management practices and reduce the impacts of productive activities (Silva et al., 2015).

Therefore, projects of Embrapa on marine aquaculture should focus on Good Management Practices (GMP) in its original sense, namely: effectively validated practices compliant with sustainable natural resource management goals to reduce environmental impacts (Hairston Junior et al., 1995). In some situations, a single practice can solve the problem, but often environmental monitoring and a set of practices are needed to ensure efficient management. Several production sectors seek management practices as the best way to improve production, reduce external inputs and make more profit, besides serving a market that increasingly demands fish produced in environmentally correct and socially responsible systems, in order to rationally reduce the exploitation of natural fishery resources.

Other paths to be followed in innovating sustainable production methods are: integrated multi-trophic aquaculture (IMTA) and heterotrophic or biofloc technology systems (BFT), which use management techniques for multiple spaces and organisms. IMTA has been recently receiving special attention of the international scientific community as an alternative for mitigating aquaculture effluents and waste. It includes: raising fish or crustaceans that eat feed; inorganic nutrient (C, P and N) absorbing species, such as algae; suspended/dissolved organic matter filtering species, such as shellfish; and benthic detritus eating species, such as polychaetes (Soto, 2009; Troell et al., 2009).

The projects Bases ecológicas para a produção sustentável de ostras nativas no Norte e Nordeste do Brasil (Ecological bases for the sustainable production of native oysters in the North and Northeast of Brazil) and Ações estruturantes e inovação para o fortalecimento das cadeias produtivas da Aquicultura no Brasil (Structuring actions and innovation for strengthening aquaculture production chains in Brazil), approved in 2017, are already aimed at adopting good management practices, environmental monitoring and multitrophic production systems, thus supporting the actions of Embrapa for developing sustainable production systems.

Towards developing more efficient production systems for marine aquaculture in Brazil, one of the major challenges is the need for automated equipment and systems for safer and less workforce-demanding processes of aquaculture production in marine environment. Today, few companies manufacture equipment and other types of structures for breeding at sea, not to mention the lack of boats suitable for management support and ferries that can provide security and logistical support. The potential for developing marine aquaculture in less sheltered places in the open sea will depend on an entire chain still incipient in Brazil.

Sustainability of fisheries

Sustainability of fisheries, according to results described in Chapter 5, involves activity diagnoses, studies on bio-ecology and fishing, monitoring of boat loading and unloading for fishing statistics, studies on species reproduction, and processing and sale methods aiming at higher food security, integral use of fish and higher profits for fisherman, as well as product quality checks to identify presence of chemical contaminants in fish.

Despite progress made in knowledge and contributions of Embrapa to draft fishery management plans, there are still many gaps to be investigated, among them is the recovery of over-exploited fish stocks by reducing fishing pressure.

Another fundamental challenge is sustainably using existing marine resources while conserving the ecosystem on which they depend, which will require scientific and managerial actions (Dane, 2016).

Another problem is how to manage local marine resources in the face of pressure from developed countries' fishing activities off the coast of developing countries. It is a serious problem because most of these stocks are the basis for small-scale fisheries, which are critical for food security in developing countries. Unfortunately, there are more research studies on biodiversity conservation and maintaining fishing economic profitability than on food security of populations that live by artisanal fishing (La pesca…, 2014). It is necessary to develop efficient management tools for artisanal fisheries and require developing countries to promote sustainable industrial fishing based on assessing fish stocks and conserving marine biodiversity (Hazin, 2015).

Overview on contributions of Embrapa and potentialities

This overview on results shows that most of them involve advancing knowledge. The lack of technologies generated for marine aquaculture and fisheries is due to their complexity, numerous ecosystem users and lack of public sector involvement with the theme. This is reflected in Embrapa: out of its 42 Units, only 7 presented results to help achieving SDG 14 targets. However, other Embrapa Decentralized Units can and should join to contribute to this theme, either directly in the Aquaculture Portfolio or by establishing partnerships with Units that are already focused on studying the sea.

Among actions that Embrapa can take, are: a) conservation of biodiversity and prospection of bio-molecules of agroindustrial interest; b) data management and geospatial monitoring; c) fisheries monitoring; d) development of marine production systems; e) integral use of fish; f) fish quality and security assessment; and g) national and international institutional connections to guarantee the law of the sea (in its technical-scientific, managerial and territorial aspects) to Brazil. In a scenario of budget cuts and lack of specialist researchers in marine fisheries and aquaculture, Embrapa will need to set a well-structured institutional agenda to meet all these demands and help achieving the targets of SDG 14 – Life Below Water.

In its Sixth Master Plan, which covers the 2014 to 2034 period, Embrapa (2015) showed how its efforts are aligned with the international commitment to SDGs. The five impact axes of the VI Master Plan of Embrapa (namely Advancing in the Quest for Sustainability, Strategic and Competitive Entry in Bio-economy, Contributions to Public Policies, Productive Placement and Poverty Reduction and Being at the Knowledge Frontier) are clearly aligned with all 17 SDGs.

The impact axes are the main transformations that Embrapa expects to leverage in agriculture and in Brazilian society by implementing its Master Plan. In the case of SDG 14, this commitment is clearer in 4 of the 12 Strategic Objectives (SOs) established in the Master Plan, namely: sustainable use of Brazilian biomes (SO1); development of innovative production systems to increase productivity (SO6); concern with public policies (SO9); and generation of knowledge for family agriculture (SO10). By aligning its work with SDGs, Embrapa returns society's investment and shows that it can make a difference in conservation and use of the seas and oceans.

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