Effects of Japan's ODA to Latin American countries: The Case of Salmon Industry Development in Chile

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I. Introduction

Japan's Official Development Assistance (ODA) has played an important role in the international aid arena. Its multi-dimensional contribution to the economic, social, and environmental development of many recipient countries is recognized not only at the national and regional levels, but also globally (OECD, 2017:225-227). The origin of the nation's aid program policies can be traced to the ODA Charter, which outlines that the foreign assistance aims to ensure the Japan's own security and stability, while addressing risks, such as poverty, climate change, and natural disasters (MOFA, 2016; 2018); affecting the welfare of human beings in developing countries.

The scarcity of natural resources and the reliance on raw materials and food commodities from overseas are some of the current national issues that are likely to make Japan's ODA a crucial political instrument. This leads one to assume that the nation's foreign assistance has a twofold objective. First, contribute to the development in countries owning abundant available resources, and, second, facilitate the introduction of those resources to Japan to meet its local demand (MOFA, 2003). We can argue, thus, that the term "cooperation" has become an important element that ties the relationship between the donor and the aid-receiving community.

Although the historical background demonstrates that most of the economic assistance has been directed toward Asian countries (Watanabe and Miura, 2003:9; Jain, 2016:63), other regions in the southern hemisphere, such as countries in Latin America, have also been benefited from Japanese foreign assistance. Latin America is endowed with fertile lowlands and pristine water resources that are suitable for undertaking economic activities. Fisheries and aquaculture are two areas in which Japan has allocated financial and technical assistances in the region to improve the

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living conditions of coastal communities, while promoting fisheries production through the establishment of partnerships with local governmental organizations.

This paper aims to examine the effects of Japan's ODA on local communities' development and assess the governmental aid mechanism in resource use programs. It also intends to determine how Japan has implemented the aid programs by identifying their impacts to local communities. Latin American region is the case studied in this research that focuses on the development of Chilean salmon aquaculture. The first section explains the current situation of fisheries and aquaculture and outlines the need to tackle the issues of depletion and overfishing. It includes the fisheries situation in Japan and discusses the operational limits in securing fish resources. Second, we argue the evolution and the role of Japan's ODA policies in fisheries and aquaculture and its implications to Japan's food security. Third, the salmon aquaculture program is examined by analyzing the socioeconomic and environmental impacts on local communities. It concludes that several factors have contributed to the sustainable growth of the salmon industry in Chile. Further, we suggest the need to address the environmental issues by formulating new strategies involving stakeholders that tackle the resource-use dilemmas.

II. Trends and issues in world fisheries

Recent trends indicate that the world marine capture fisheries have declined in the past few decades. This decline is seen to be a consequence of overexploitation and depletion of aquatic resources. The Food and Agriculture Organization (FAO) predicts that wild capture fisheries will continue to decrease unless further conservation measures are formulated and implemented to restore the overfished stocks (FAO, 2010:42).

The segment prone to capture declines is the coastal community that relies on fisheries for subsistence. According to FAO, most of the small-scale fishermen and post-harvest workers live in poverty and are mainly from developing countries (FAO, 2010:10-11). Even though many smallholders are contributors to world's marine and inland fish captures, it is estimated that those fishers lack the capacity to practice sustainable fishing activities (JICA, 2010). Therefore, conservation management and

responsible use of resources become critical to prevent further overfishing and degradation of the ecosystem.

In terms of conservation management, several countries have signed partnerships aiming at controlling the decrease in certain fish populations. The tuna captures from the ocean grounds is one of the case that shows production has been decreasing since 2008 (Komatsu, 2008:111; FAO, 2010:15). Japan can be considered to be one of the countries that have contributed to the decline in tuna captures. Japan's Fisheries Agency revealed that it had the largest tuna catch in the world in 2007, and was also the largest consumer of tuna fish during that year (Japan's Fisheries Agency, 2009a). Komatsu estimates that 57 countries, including China, Korea, and Taiwan exported tuna products to Japan in the previous year. Despite the rearing of some kinds of bluefin tuna being practiced in countries around the Mediterranean Sea and Australia for trade, issues concerning overexploitation at early stage remain (Komatsu, 2008:110-111). Therefore, owing to the decline in tuna production, several harvest restrictions are currently in force to conserve and reduce the catch of these stocks. For instance, Japan has joined the Regional Fisheries Management Organization to contribute to the efforts to control tuna captures and advocate a sustainable management of fish stocks in the high seas (Japan's Fisheries Agency, 2009a).

1. Impacts of international regulations on Japanese fisheries

Prior to 1970s, the offshore captures of marine wild fish stock were sustainable in Japan. However, after 1977, with the advent of international restrictions over the use of aquatic resources and regulations imposed by the United States and the former Soviet Union, the offshore catch began to decrease (Komatsu, 2008: 166).

Disputes over the rights on territorial waters have existed for a long time. However, after the 1960s, there has been a gradual intensification of international claims over multiple issues, such as navigation rights, national jurisdiction, sovereignty, and economic interests. Moreover, as the ocean started to suffer from the stress and consequences of the exploitation of natural resources, such as oil, minerals, and fisheries, some countries began to call for the protection of the environment. Therefore, under these circumstances, the United Nations Convention on the Law of the Sea, (hereinafter, the "Law of the Sea") was adopted in 1982 to establish a legal

instrument to regulate the use of the ocean waters (Oceans and Law of the Sea United Nations, 1998). The most prominent resolution was based on the establishment of the Exclusive Economic Zone (EEZ), which determined a 200 mile (approximately 370 km) zone as an economic jurisdiction (Oceans and Law of the Sea United Nations, 1982).

The Law of the Sea stipulated that developing countries may give access to other countries to capture the resources available within their jurisdiction through agreements in conformity with the Law of the Sea regime. Moreover, it has been established that the conservation and protection of marine resources requires that foreign countries using their resources provide adequate assistance on trainings, transfer of fishing technologies, and fisheries research (Oceans and Law of the Sea United Nations, 1982:46-47). Therefore, international cooperation on resource management became a crucial endeavor for fishing activities.

As the enactment of the EEZ restricted the areas of fishing, and captures from the seashore reached the production limit, the Japanese capture fisheries from marine stock dropped abruptly after the 1990s (Komatsu, 2008:167). Even though several access agreements have been signed with foreign countries for the operation of Japanese fishing vessels on their waters for captures, harvesting has remained low, owing to the implementation of the regulation for the conservation of water resources (OECD, 2010:280-281). Recent data of Japan's Fishery Agency also reveal that production from fisheries and aquaculture in 2008 was less than that in the previous year (Japan's Fisheries Agency, 2009b).

Japan's Fisheries Agency statistics indicate that even though imports of fish food and fisheries products are higher than exports in Japan, the percentage increase in volume of the latter over the previous year was 26.8%; mackerel and sea cucumbers were the major products exported (Japan's Fisheries Agency, 2007). However, according to FAO statistics, Japan was the world's largest importer of fish products in 2008; this implies that it remains one of the major fish food-consuming markets (FAO, 2011:10). This trend explains the importance of Japanese foreign aid in ensuring the supply of fish products from overseas to meet the local demand.

III. World trends and issues of aquaculture

In contrast to the stagnation of world marine stock captures, world aquaculture has shown a rapid growth in recent decades. FAO statistics indicate that global production of aquatic animals from aquaculture has outpaced the growth of world population; this has contributed to the supply of fish products for human consumption. It is expected that this sector will continue to grow to meet the increasing demand for aquatic food (FAO, 2011). Even though there is a long tradition of aquaculture in some countries, it is a relatively young industry globally that has progressed with the advent and adoption of new farming technologies (FAO, 2011:4; JICA, 1984a).

Some scholars argue that world aquaculture can alleviate poverty, mitigate malnutrition and hunger, and promote the empowerment of women in developing countries (Beveridge et al., 2010; FAO, 2011:59-66). Nonetheless, bad governance and inadequate use of natural resources can generate adverse results, such as a deterioration in the environment and a halt in sustainable production. As Smith and Peterson assert, an adequate background research on the local circumstances, such as the socioeconomic, cultural, and technical factors of the region in which fish farming is to be introduced is crucial to avoid such pitfalls (Smith and Peterson, 1982:1-9). Martínez-Espinosa and Barg add that the environmental, political, and institutional aspects, especially those that have strong government intervention, should also be considered and assessed in aquaculture development programs (Martínez-Espinoza and Barg, 1993:42). Therefore, successful aquaculture production can be achieved as long as development programs are adapted to local circumstances.

Pillay defined two patterns of aquaculture in developing countries, depending on whether the projects aimed at economic or social benefits. She asserts that the countries undertaking the projects can obtain the result of their choice. The projects that target economic benefits, generally seek to farm high-value fish species on a large scale for export to boost profits. The projects seeking social benefits are usually targeted at low-income fishing or rural communities that need nutritional food. This type of aquaculture generally tends to foster extensive farming for subsistence, recreational or restocking purposes (Pillay, 1997:3). Japanese foreign aid has generally inclined toward adopting the projects that bring social benefit (JICA, 2008: 94).

However, Chilean projects involving the introduction of exotic species, such as the salmonids, as well as those in Southeast Asian countries culturing shrimp species, aimed at producing both economic and social benefits.

1. Aquaculture in Latin American countries

Aquaculture in Latin American countries has grown rapidly since the 1980s (FAO, 2011:5). Their potential to produce cultured species in an unexploited environment has led to the introduction of modern fish farming technologies that foster intensive production (Agüero and González, 1997). Fish farming activities began in the early 1900s, but the production was on a small scale to cater to the local market and recreational fishing purposes. Trout species were some of the animals introduced; semi-intensive shrimp farming began to develop mainly in Ecuador, Costa Rica, Mexico, Brazil, and Colombia (Noriega-Curtis and Vera Rivas, 1989). However, progress in increasing production has been relatively slow owing to its low impact on economic development (FAO, 1976).

Vegas Vélez, a Peruvian biologist, asserts that several factors have delayed the development of aquaculture in Latin America. These include the lack of technology and capable scientists or experts to undertake both inland and marine fish farming projects; further, governments and private enterprises have tried to foster an "aquaculture project with rapid results" by disregarding "a posteriori" low production results; furthermore, the construction of modernized facilities has been inadequate to local operations. Vegas Vélez has suggested some solutions to develop the sector. First, foster training programs on fish farming. Second, formulate a strategic plan to implement aquaculture research projects at national level. Third, select suitable species for domestic production, instead of farming the exotic species (salmonids, carps, and tilapia) recommended by developed countries (Vegas Vélez, 1980).

However, it seems that the growing demand for fish products and the introduction of new farming technologies have led to the development of aquaculture programs. The average annual aquaculture production in Latin American was the highest in the world during 1970-2008 (FAO, 2010:6). The major contributors to aquaculture growth in Latin America during 2006-2008, in decreasing order of production volume, have been Chile, Brazil, Ecuador, and Mexico (Wurmann, 2012:11).

VI. Japan's ODA to Latin American countries

The economic and diplomatic relations between Japan and the countries in Latin America have a long history, starting with the first settlement of Japanese immigrants over 100 years ago. Trade agreements and partnerships have further strengthened the relationship. The region is considered an important supplier of resources, such as ores, timber, grain, and fish commodities to developed countries. Although the gross disbursement to this region has reduced from 5.9% (1980s) of the total amount to 3.5% (2014) (MOFA, 2016a:34), there is a desire to continue aid to tackle poverty issues in rural areas, natural disasters, and environmental problems. The 2017 White Paper on Development Cooperation (Kaihatsu Kyoryoku Hakusho) outlines that the government of Japan has provided infrastructure assistance including a grant to Paraguay for dredging equipment, a loan to Nicaragua for road construction planning, and grants to Bolivia on road disaster prevention. In addition, cooperation has been provided on environmental programs such as in climate change research, conservation of biodiversity, and studies on carbon dynamics in Amazonian tropical forest (MOFA, 2018:121-122).

The Japanese aid programs implemented in the region include the Cerrado agriculture project performed in Brazil (Hosono et al., 2015) and the salmon aquaculture project carried out in Chile (Hosono et al., 2016). The grain produced in Cerrado and salmon farmed in Chile are mainly exported to Japan; thus, these countries have emerged as crucial partners in meeting the Japan's domestic demand for food commodities. This paper selected the aquaculture project to examine how Japan implemented its aid program to transform the recipient country into a leading salmon producer in the world.

The "Salmon Project" in Chile began in the late 1960s, with the training programs granted to local experts to acquire salmon farming technologies from Japan (Nagasawa, 1980:19; Hosono, 2010:21); next, Pacific salmonids were introduced with the aim of propagating them in the southern waters of Chile (JICA, 1984b). The introduction of exotic new species into water bodies can, at times, be detrimental to the environment, as happened with the release of Nile Perch into Africa's Lake Victoria (Pringle, 2005:511; Matsuishi et al., 2006:53-54). However, long-term projects,

such as the salmon aquaculture project implemented with the help of Japanese aid, can produce the expected results; we will be discussing this in the following section. The growth of salmon farming activities in Chile encouraged other Latin American countries, such as Argentina and Bolivia, to introduce aquaculture technologies of endemic and exotics species from Japan (JICA, 1993; JICA, 1986). In Argentina, despite large-scale production not being achieved, salmonids farming facilitated the production of seeds to promote recreational fisheries, and, in Bolivia, rural communities have acquired the techniques to produce trout species for local consumption.

1. Japan's ODA policy in fisheries and aquaculture: transformation from hard to soft cooperation

Until the 1970s, it seems that the official assistance in the area of fisheries and aquaculture was intended mainly to increase the volume of fish production in the aid-receiving countries. The financial and technical cooperation was focused on the transference of technologies, implementation of training programs, construction of fishery facilities, and provision of vessels (JICA, 2010). However, as Yamao points out, the aim of the cooperation was to not only achieve the development of fisheries, but also to secure the resources and the fishing grounds of developing countries (Yamao, 2016); this was because of the gradual reduction of operational fishing areas in the home country. The reduction in fishing operations was probably owing to the EEZ's establishment and the advent of several international changes that raised awareness about conserving resources and their sustainable use.

As explained in the 2010 JICA Guidelines on the Fisheries Sector, the adoption of the Law of the Sea in 1982 and the "Agenda 21" at the Earth Summit in 1992, led to the international community recognizing the importance of including the conservation and preservation of the environment in the national agenda. In the area of fisheries, stipulations have been established to assist developing countries in managing aquatic resources. Norms and declarations, such as the "Code of Conduct for Responsible Fisheries" and the 1995 "Kyoto Declaration and Plan of Action on Sustainable Contribution of Fisheries to Food Security" have also come into force with the aim to practice sustainable management of marine resources and make joint efforts to alleviate poverty in fishing communities (JICA, 2010).

From the above mentioned issues and international trends, it appears that Japan has recognized that chronic poverty still exists in coastal areas of developing countries; further, its foreign assistance policy in the area of fisheries has gradually changed from cooperation intended to increase fishing and aquaculture production, and the development of fisheries industry, to the construction of a mechanism to foster the development of coastal communities, ensure food security, and conserve aquatic resources. Thus, aid programs have focused on adopting the bottom-up approach by implementing the community participation models to contribute to the improvement in the living condition of people relying on fishing activities (JICA, 2010). Therefore, the shift in policies and emphasis from hard to soft cooperation seems to address more the social benefits of development programs than the economic ones, while meeting the national objective of procuring the resources to meet the local demand for fish products.

2. Programs in aquaculture development

The Japanese government, through its ODA policy, has implemented several aquaculture development programs in developing countries. The shrimp, salmonids, and endemic pejerrey are some of the farming species bred by the aid recipients. The shrimp farming development project is a renowned foreign assistance in the field of fisheries and aquaculture. Particularly, South East Asia was the region selected to develop farming activities during the global boom of shrimp consumption in Japan that lasted from the 1980s and 1990s (JICA, 2010). However, the aid programs for shrimp industry development are considered to have threatened local social and environmental sustainability. As stated by Murai in his book *The Japanese and the Shrimp,* the Japanese agribusiness undertaken by private enterprises and supported, in some ways, by the government of Japan changed the living conditions of coastal fishing villages and the traditional artisanal fisheries, depleting the natural resources and causing a deterioration of the aquatic ecosystem (Murai, 1988).

In 1985, the National Seed Production Research Center was constructed in Malaysia through Japan's foreign aid program to provide technologies for production and foster exports to the Japanese market. As Murai points out, the new infrastructure does provide the basis for producing seeds, but it leads to the creation

of farmers, construction of new ponds, and deforestation of more mangroves (Murai, 1989:5-6). We can infer that the aid programs of that time focused mainly on developing the industry without considering the local social and environmental impacts; however, after the shift toward a more social and conservationist approach, aid programs began addressing issues related to the development of local communities.

V. The "Aquaculture Project in Chile": Aysen, region XI

The Republic of Chile is located in the southwest of the South American continent. The distinctive feature of the country is its extreme length (4.337 km of coastline) and narrow strip surface (average width of 180 km); the EEZs occupy an area of almost 2.8 million km2, and it possesses as much nautical space as land. The peculiar geographical position explains the contrast in its climate and landscape across its twelve regions, from the north to the south (Grupo Océano, 2002; OECD, 2009:21).

Although the northern region is dry and arid, the southern region is endowed with many natural resources including fiords, archipelagos, and pristine freshwater; further, the Pacific Ocean temperatures off the coast of Region X and XI are suitable for salmonids' cultivation. Wild fish captures have concentrated on pelagic species, such as sardine, anchovy, and mackerel, and their commercialization picked up pace in the early 1960s. However, it seems that the uncontrolled overfishing gradually led to the depletion of wild fisheries, forcing the government to promote the introduction of high-value fish species, such as salmonids, into the unexploited southern waters of Chile, thereby diversifying its traditional fisheries (OECD, 2009:12-27).

1. Historical background

The introduction of salmonids into the Chilean waters dates back to the beginning of the 20th century. According to historical data, eggs and the young of coho salmon (*Oncorhynchus kisutch*) and sockeye salmon (*Oncorhynchus nerka*) were imported from the United States during 1901-1910, and 1921-1930, respectively. However, there is no official record concerning their propagation (Nagasawa, 1980:3-9). In 1905, trout species was introduced from Europe and released into the lakes and rivers of central and southern Chile for recreational and commercial purposes. These exotic species

thrived, leading to sustain sport fishing activities and domestic commercialization in the region (Claude and Oporto, 2000:8).

The economic viability of trout production led local entrepreneurs to launch the first trout farming enterprise, the Piscicultura Lago Llanquihue, Ltd., which was established in 1975, with the support of the Production Development Corporation (CORFO), a government agency. Even though the production was initially on a small scale, it increased after 1978, when Chile began exporting to European countries (UNCTAD, 2006:6; Hosono, 2010:51).

Although there were attempts to introduce and propagate Pacific salmon into the southern region of Chile before the launch of the Japanese initiative, it appears that they were unsuccessful. The United States had introduced high-technology equipment in Chile for salmon farming. However, the project failed because it did not address local capability (Nagasawa, 1975:3). Vegas Vélez stated, it is crucial to have effective long-term planning and transfer of technology that addresses local circumstances to develop a new aquaculture industry in developing countries (Vegas Vélez, 1980).

During this period, poverty worsened in the coastal southern region of Chile. Hosono explains that the depletion of fish stocks and the scarcity of fertile land made the government of Chile promote the introduction of new valuable and profitable exotic species, such as the Northern Pacific salmon to overcome this situation and foster the development of coastal fisheries (Hosono, 2010:17). However, the government required technical and financial aid to implement the salmon farming project and restock the southern waters (JICA, 1984b).

In the same period, private entities, such as the Japan Fisheries Association, were seeking new destinations to produce salmonids to supply the Japanese market: this was because of the drop in supply caused by the new restrictions and capture limitations in Japan (Hosono, 2010:17, Hosono, 2016:28) as explained earlier. Hence, the first mission from Japan Fisheries Association was dispatched to research the Chilean southern sea waters in 1969 (JICA, 1984b:16). It seems that the inspection served to determine the economic viability and the water conditions for salmon exploitation. In 1972, as Hosono has also stated, technical cooperation agreements were ratified between the two countries to implement the introduction and propagation of salmon species into the Chilean waters because the interests of both parties coincided

(Nagasawa, 1975:1; Hosono, 2010:17; Maruha Nichiro Holdings, 2019). Thus, the Japanese government accepted the official request from Chilean government on the technical cooperation to introduce and develop Japanese salmonids in Aysen, region XI (JICA, 1984b).

2. Evolution of the "Salmon Project"

The previous and current sections cite, in particular, the studies of Hosono and reports of Japan International Cooperation Agency (JICA) to understand the historical phases and the development of salmon farming projects implemented in Chile under Japan's financial and technical cooperation project. It aims, thus, to analyze the socioeconomic and environmental impacts of the program on local communities and the national economy.

The studies of Hosono explain that the "Aquaculture Project in Chile", or the "Japan-Chile Salmon Project", (hereinafter, the salmon project) as he calls it, covers the period from 1969 to 1989, including the training program of Chilean experts sent to Japan. After 1979, the program became a long-term Project Type Technical Cooperation; the Chilean counterparts were the National Fisheries Service (SERNAP) during 1979-1988 and the Institute of Fisheries Promotion (IFOP, a subsidiary of CORFO) during 1988-1989 (Hosono, 2010: 21;30;88, Hosono, 2016:28-29).

JICA stated that the objective of the salmon project was to promote the development of coastal fisheries and produce valuable fish species by introducing the Japanese salmonids in Aysen, region XI (JICA, 1984b). However, Nagasawa, who was involved on the project, explains that even though he was mandated to transfer farming technologies, the objective of the Chilean side was to develop an export-oriented industry (Nagasawa, 1975:2). Therefore, the project had two main objectives. First, the development of fish production, coupled with poverty alleviation, and, second, the creation of an economically viable industry.

During the first stage, Pacific salmon eggs were imported from Japan to rear the alevins and release them seawards to achieve natural returning and spawning; it was not intended to farm adult salmon (Hosono, 2010:18;27-30). Thus, both the imported cherry salmon (*Oncorhynchus masou*) and chum salmon (*Oncorhynchus keta*) were cultivated to release their alevins into the Simpson River located near Coihaique city

(JICA, 1984b:16). In 1976, the Dr. Shiraishi Hatchery Center (Piscicultura Dr. Shiraishi, in Spanish) was built to conduct the incubation and rearing processes in freshwater (from egg to alevin) in a well-equipped environment. Thus, we can infer that the aid served as the basis to conduct the main farming activities.

Even though the releasing processes were successful, it appears that the return for spawning did not thrive; there are several possible reasons, such as predation of the alevins after the releasing process for this (Hosono, 2010:29-30). During the same period, an American private enterprise Domsea Farms, a subsidiary of Union Carbide, imported coho salmon (*Oncorhynchus kisutch*) and chinook salmon (*Oncorhynchus tshawytscha*) eggs from the United States to initiate intensive production. However, the project was abandoned owing to its poor returns (UNCTAD, 2006:6).

In 1979, the salmon project was extended and, in the midst of the program, as Hosono indicates, the new "sea farming" system was introduced by Japanese experts using floating net cages to control fish growth in the coastal marine waters. He explains that the preliminary testing consisted in cultivating the eggs and the alevins in freshwater, and transporting the reared alevins to the seawater net cages to continue the fish growth process. Then, the adult salmon species were released into the sea or rivers. It is considered that this system was crucial in achieving the development of salmon aquaculture in Chile (Hosono, 2010:45-48).

This mechanism led to the production of adult and broodstock salmon from Japanese progenies, which led to a reduction in the import of eggs from Japan. In 1986, under the sea farming system, the released chum (7) and coho (58) salmon returned into the coastal fjords of southern Chile, and in 1989, some returns of cherry salmon were observed in the same region (JICA, 2011; JICA, 1987). In 1988, cherry salmon species, which can live on landlocked freshwaters (Wegrzyn and Ortubay, 2009:83), was used for liberation into Lake General Carrera, Aysen, Region XI (Chilean name), a lake which is shared with Lake Buenos Aires, located in the Santa Cruz province of Argentina. The operation led to the return of some cherry salmon, which, in turn, encouraged the establishment of small-scale salmonid projects in the region (Hosono, 2010:73; Overseas Fisheries Cooperation Foundation of Japan, 1993-1996).

During the implementation of the sea farming system, the cooperation agreement period was extended twice – from 1984 to 1987, and, from 1987 to 1989. The project

was extended on the request of Chilean government with the aim to first, stabilize the production of salmons to develop a sustainable fishing industry in Aysen; second, provide technical assistance to produce coho salmon; and, third, survey the return of the liberated salmons, develop an adequate feed technique for production and market, and study the ecological and limnological impact, as well as the mitigation of salmon diseases (JICA, 1984b; JICA, 1987). The Chilean government has had a long-term interest of continuing the promotion and building capacity of local experts and Japan has acceded to its requests for transferring the technologies and assisting in the farming activities; this creates a cooperation mechanism between the donor and recipient countries that meets the interests of both parties.

Although the salmon project ended in 1989, complementary cooperation agreements were signed between Japan and Chile to transfer new technologies. In 1992, technical assistance was provided by the Japanese government to improve food production, increase the propagation of cherry salmon, and transfer other technologies, such as those required for the establishment of quality standards for feeding, classification of captured salmonids, and elaboration of reports on released salmonids (Overseas Fisheries Cooperation Foundation of Japan, 1993-1996:1-20).

3. Development process of salmon farming industry: collaboration between local public and private enterprises

Despite of the political transitions, the initial objective to produce salmon species on a large-scale and reactivate the southern region remained throughout the salmon project, leading to a growth in exports (Barton, 1998). Moreover, governmental agencies have maintained the policies of promoting the salmon industry by merging with private organizations and complementing its roles. World Bank studies estimate that this process facilitated the adoption of foreign technologies and the incorporation of international standards for sustainable production. Their studies underscore that initially, the public sector acted as the facilitator to build the base of the salmon industry; specifically, it introduced foreign technology and prepared the aquaculture infrastructure to increase production. Once the aquaculture industry matured by the 1980s, it became the regulator of the sector. Since then, it has established the legal framework for fisheries and aquaculture activities, and administered the common

properties (The World Bank, 2005).

The Production Development Corporation (CORFO) is a governmental development agency that fosters investments and technological innovations. In the aquaculture sector, it provides funds to undertake projects, carry out research, and transfer technologies (CORFO, 2019; UNCTAD, 2006:8). The Fisheries Development Institute (IFOP) is a non-profit research corporation created by CORFO in 1964; it provides scientific and technical assistance to regulate the fisheries and aquaculture sector, as well as ensure the conservation of environment. Further, it organizes inspection trips to foreign countries to acquire new technologies (The World Bank, 2005). Both these organizations were the counterpart of JICA for the implementation of the salmon project.

The Fundación Chile, a body created by merging a government organization with a private one, has contributed in consolidating Chile's aquaculture industry. Aside from its policy to support enterprises, it conducts scientific research and provides technical aid to local farmers (Fundación Chile, 2019). Studies of United Nations Conference on Trade and Development (UNCTAD) emphasize that Fundación Chile facilitated the creation of the Association of Salmon and Trout Producer of Chile (APST), a local salmon producers' body that developed a 'quality seal' for its members (UNCTAD, 2006:10).

In developing countries, cooperation between public and private institutions is crucial to consolidate an industry. Public institutions can enforce rules and regulations to maintain order within the sector and can provide some credits or subsidies to encourage private undertakings. Conversely, certain governmental organizations can coordinate with private sector bodies, such as associations or cooperatives, to foster innovation, development, and research. This is because the direct inputs they receive from the non-state actor can complement the information available and enable them to increase production and compete at the global level. On the other hand, international aid agencies and foreign private investment can play a fundamental role in developing an industry in aid-receiving countries.

In 1979, the Japanese fisheries enterprise, Nichiro Chile (currently called Maruha Nichiro Holdings), was established in Puerto Montt city, in region X of Chile. Nichiro Chile became a pioneering enterprise dedicated to salmon farming by utilizing floating

cages under the sea farming system (Hosono, 2010:48). Most of the production was exported to Japan, making it an important salmon producer in Chile (Maruha Nichiro Holdings, 2019). Eventually, aquaculture experts from Nichiro Chile integrated the salmon project team to provide technical assistance (Hosono, 2016:34). The combination of foreign state and non-state actors, who maintained close relationships, contributed to the consolidation of the fish farming industry in Chile, while supplying fish to the Japanese market.

Smith and Peterson assert that each player, whether in the public or private sector, has different objectives and approaches toward the development of aquaculture. While private enterprises carefully study the feasibility of the investment, government planners who do not expect a net return from projects, intend to contribute to the development of local communities. However, government development projects should be assessed carefully to prevent negative social and environmental impacts on communities (Smith and Peterson, 1982). In the case of Chile, the salmon project, a government project, attained both an export-oriented salmon industry, besides mitigating the poverty in coastal areas. Even though the rapid growth and the intensive exploitation of natural and human resources contributed to the development of salmon industry, it seems that some social and environmental concerns have emerged in the southern region of Chile.

4. Socioeconomic impacts on local community

Since the 1980s, the salmonids industry in Chile has been growing rapidly. The production rose from nearly 1,200 tons in the mid-1980s to 224,000 tons in 1997; it reached 600,000 tons in 2007, and kept growing in the following years, except when there were virus outbreaks (see Table 1). It is considered that the salmon farming activities have been temporarily paralyzed owing to a viral epidemic (Iizuka and Katz, 2011), but production picked up since 2011.

Table 1. Evolution of Salmonids Production *Thousand tons*

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Total	600	630	486	452	648	820	792	955	834	676	791

Note: Numbers are rounded
Source: SalmonChile, 2019

Moreover, the main export markets have been Japan, the United States, and Brazil, with Japan clearly being an important destination. Achurra indicates that Chile exported 34,000 tons (68% of its total exports) of farmed salmon to Japan in 1993 (Achurra, 1995:48); this increased to 146,000 tons (37% of the total exports) in 2007, and reduced slightly to 142,921 tons in 2018 (See Table 2).

Table 2. Exports by Markets in 2018

Country	Tons	Percentage
Japan	142,921	23%
USA	170,058	27%
Brazil	87,082	14%
Others	231,248	36%

Source: SalmonChile, 2019

It is perceived that the growth of salmon industry increased the local employment, and, thus, the population working in the emerging industry in the southern region of Chile. Studies of SalmonChile indicate that the salmon industry created 60,000 direct and indirect employment opportunities in 2012 (SalmonChile, 2019), and new enterprises began to engage in aquaculture activities in the region. Reports estimate that around 80% of the industry is concentrated in Puerto Montt city and in the Island of Chiloe, region X, while the rest are located in region XI (Claude & Oporto, 2000:39; Barrett, Caniggia and Read, 2002:1954; Hosono, 2010:131-132; Barton, 1998:42-43).

Despite of the dynamic growth of the salmon industry, which contributed to the development of regions X and XI, and the country itself, it appears that the revenue benefitted only a small section of the society, leading to an unequal distribution of income. Thus, the wages of unskilled laborers have been low in relation to the earnings from salmon production (Claude and Oporto, 2000:39-42). There have been protests seeking an increase in salary (Vida Sindical, 2011). It is considered that the basic average salary of unskilled workers has not exceeded the minimum wage of $152.00 (Pinto P., 2007:36). Further, layoffs have increased because of the introduction of modernized equipment (Claude and Oporto, 2000:39).

Critics argue that the development of the salmon farming industry and its boom

has caused cultural and economic difficulties in coastal communities. Studies by Claude and Oporto establish that:

"The development of aquaculture industry, mainly in Chiloe, has affected the features of the "Chilota culture". Chilotas communities have moved away from homeland and from subsistence economy, and customs are changing radically owing to the arrival of farm centers and processing plants (Claude and Oporto, 2000:43)."

The Chilota culture or Chilotes is considered as a culture that emerged from the mingling of natives and Spanish conquerors (Harambour Ross, 2009:371, Claude and Oporto, 2000). According to Claude and Oporto, it seems that prior to the establishment of salmon industry, the Chilotas communities have relied on traditional or artisanal fishing, such as collecting shellfish and algae from the coastal area, and small-scale agriculture for subsistence. In addition, their studies show that the industrial development has forced the local community to sell or abandon their land; thus, the youth moved to cities and work in other labor sectors. Moreover, it appears that the Chilota culture has undergone a cultural transformation ever since the shift from land owners to unskilled laborers pauperized them and changed their living conditions. Further, the local Chilotes have also apparently been affected by the stagnation in capture fisheries caused by the overexploitation of natural resources in the region (Claude and Oporto, 2000:43-44).

However, studies conducted by Barret, Canniggia and Read yielded different results. With respect to property issues, their surveys indicate that the villagers who remained on Chiloe Island still practice traditional small-scale fishing and agriculture for self-subsistence. Moreover, it seems that the migration of the younger generations occurred with the advent of modernization because urban areas provide more convenience and facilities than rural areas. With respect to employment issues, their surveys show that the salmon industry has created new employment for the youth who continue to live on the island, and that the infrastructure development, such as the construction of roads, and the connecting bridge to the mainland have been beneficial for the community. Further, despite the environmental implications of escaping salmon, it appears that has contributed some profits for small-scale capture

fishers, albeit its trade is prohibited (Barret, Canniggia and Read, 2002). Therefore, there are two studies and positions regarding the social impacts of aquaculture development programs.

5. Environmental impact: consequences of the salmon industry development

The rapid expansion and development of salmon industry, coupled with the overexploitation of natural resources and the urbanization, can gradually cause a deterioration in the quality of waters and the ecosystem of Chile's southern region. The principal factors threatening the sea grounds are as follows: the outbreak of salmon diseases; chemical uses; urbanization; construction of many farming facilities; and the escape of salmon from net-cages. These elements can affect the environment in several forms.

Fish diseases have been a major concern for countries involved in salmon farming. Literatures assert that fish diseases can emerge from the imported eggs or from intensive husbandry in a concentrated enclosure. The latter refers to the fact that fish diseases tend to arise because of fish population density and stress (Barton, 1997:316; Bjorndal, 2002:101). Both features are present in Chile. In 2007, there was an outbreak of a viral disease called Infectious Salmon Anemia (ISA), which affected the farming site located on Chiloe Island (Floysand et al., 2010:202). This disease, which was apparently transmitted from imported Norwegian embryos, is evidence that exotic pathogens and vectors can generate new threats to natural resources and endemic species (Iizuka and Katz, 2011:269).

The disease issue remains the main concern for Chilean salmon producers and the government. From the governmental side, sanitary controls as well as regulations programs and resolutions have been developed to implement the Codes of Practice and "clean production" systems (OECD, 2009:50). However, unlike other salmon-producing countries, it seems that management of diseases to ensure a sustainable environment is as yet unregulated in Chile. According to Iizuka, the so-called 'Barrios or Neighborhoods' regulation has been introduced by the government to control the environmental and sanitary conditions of those undertaking fish farming (Iizuka, 2016:144).

The escape of salmon from the farming sites is another environmental dilemma.

Reports estimate that 1.726.919 salmonids escaped from Chilean marine farming sites during the year 2007 (Sepúlveda et al., 2009:9). Escapes from sea net enclosures can occur during juvenile and adult stages, as well as the spawning stage (Freheim et al., 2010:220). It seems that the causes, and extent of, escapes vary according to a country's political, social, economic, and natural circumstances. In the case of Chile, according to Sepúlveda et al., the causes can be external (climatic conditions, predation, and poaching) and internal (boat collision or lack of net cage maintenance) (Sepúlveda et al., 2009:13-17). Although the escape of salmon from cultivation site implies economic loses for farmers and ecological alteration, it can also have some positive effects, such as the promotion of recreational fishing (Olaussen and Liu, 2011: 245-261). From the environmental perspective, the escape of infected salmonids can transmit the diseases to other native species (Sepúlveda et al., 2009:21); thus, adequate regulations should be formulated to mitigate salmon escapes.

VI. Conclusion: the results of Japan's ODA programs, its limitations and future prospects

The aim of this paper was to examine the effects of Japan's ODA on recipient countries by focusing on the salmon industry development project implemented by it in Chile. It intended to determine the impact of Japan's foreign aid on local socioeconomic development and the environment in Chile. In this concluding section, we analyze the results of the salmon aquaculture project, outlining its limitations and exploring the future prospects of development assistance programs.

As discussed in the first section, the global decline and stagnation of marine wild stock capture is likely to be offset by the growing aquaculture production. Japan has granted aid in the area of fisheries and aquaculture development to many developing countries. Even though there have been certain criticisms of the impacts of the aid programs, we can state that some projects, such as the one in Chile, have contributed to the socioeconomic development in recipient countries. Japan's foreign aid policy in fisheries shifted gradually from aid intended to increase production to one more focused on programs leading to social benefits. The salmon project was implemented before the change in aid policies; however, despite the environmental concerns, the

aquaculture project not only contributed to the transformation of the Chilean salmon industry into a world-leading producer and exporter, but also provided new employment opportunities to the youth in local communities.

The financial and technical cooperation of Japan was crucial to establish the new industry in Chile. As explained in this paper, it appears that the adoption of the sea farming system was attuned to local circumstances, enabling the further development of salmon aquaculture. However, we identified several factors that facilitated the sustainable production and export of salmonids. The Chilean government played a fundamental role in the consolidation of the salmon industry. Despite the changes in government during the implementation of the project, the interests in developing the farming activities remained throughout the project, leading to a continuous generation of the resources necessary to maintain it. Moreover, the participation and collaboration of the private sector contributed to the sustained production in the region. Therefore, partnerships and cooperation between donors and aid-receiving countries, as well as between the public and private sectors can at times lead to sustainable industry, as long as the actors involved collaborate to develop an enduring aid program.

However, the sanitary and environmental problems remain as unresolved national issues. Even though several formal regulations, including controls and surveillance have been implemented, a more informal and cooperative action among the direct users, such as the farmers, can probably mitigate future dilemmas affecting the aquatic environment. Further research should be conducted to find new local mechanisms that prevent the over use of the resources; this will help us predict whether the decline in capture fisheries will lead to a continuous growth in aquaculture production to meet the global demand for fish commodities. Moreover, it will enable us to incorporate the new findings while planning future aid programs.

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