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alimentaria en Bolivia



CIFS RF FINAL TECHNICAL REPORT: AMAZON FISH FOR FOOD “PECES PARA LA VIDA” BOLIVIA

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Table of contents

1	Executive Summary	3
2	The research problem.....	5
3	Progress towards milestones	6
4	Synthesis of research results and development outcomes	6
	Objective 1. To refine protocols and capacity for sustainable management of paiche (<i>Arapaima gigas</i>) fisheries	6
	4.1.1 Objective overview	6
	4.1.2 Results achieved and development outcomes	6
	Objective 2. Increase aquaculture livelihoods through family-based small-scale aquaculture, with a focus on female leadership, environmental sustainability, and social responsibility	13
	4.2.1 Objective overview	13
	4.2.2 Results achieved and development outcomes	14
	Objective 3. To improve and expand fish marketing strategies and enhance fish quality for improved income and nutrition	18
	4.3.1 Objective background.....	18
	4.3.2 Results achieved and development outcomes	19
	Objective 4. To continue to build and support a facilitating governance environment for accelerated development of sustainable small-scale fisheries and aquaculture sectors in Bolivia	22
	4.4.1 Objective overview	22
	4.4.2 Results achieved and development outcomes	22
	Objective 5. To develop and provide appropriate financial support mechanisms for scaling up small-scale family-based entrepreneurship in fisheries and aquaculture	29
	4.5.1 Objective overview	29
	4.5.2 Results achieved and development outcomes	29
	Objective 6. To improve understanding of how scaling up strategies in fisheries and aquaculture affect livelihoods and food security of participants, and what barriers exist for greater participation of women and those living in poverty	33
	4.6.1 Objective overview	33
	4.6.2 Results achieved	33
5.	Synthesis of results towards AFS themes.....	39
6.	Project Communication Outputs	43
7.	Problems, challenges, and Project responses.....	44
8.	Overall assessment and recommendations	45



List of Tables

Table 1. Indicators and results of Objective 1	5
Table 2. Indicators and results of Objective 2	10
Table 3. Indicators and results of Objective 3	15
Table 4. Indicators and results of Objective 4	18
Table 5. Indicators and results of Objective 5	22
Table 6. Distribution of loans provided during the PPVII.....	23
Table 7. Indicators and results of Objective 6	25

List of Figures

Figure 1.Limitations identified by the aquaculture sector and responses of the PPVII.....	8
Figure 2. Aquaculture production in Fish farms from PPVII core project region.....	11
Figure 3. Extended multi-actor platform composition of the PPV.....	27
Figure 4. Scaling-up pathways used during PPVII	37



1 Executive Summary

The Amazon Fish for Food project (Peces para la Vida - PPV) proposed to improve livelihoods and food security of Bolivian small-scale farmers and fishers, particularly women and indigenous families, through fish. Improving the availability and access to locally produced, high quality dietary component creates food security and sovereignty of Bolivian consumers. Informed by research of PPVI, this second phase selected the fishery of paiche (*Arapaima gigas*) – a recently introduced species- and family-based, women-led pond culture of the native fish pacu/tambaqui (*Piaractus brachypomus* & *Colossoma macropomum*) as sectors with solutions that could be scaled up effectively within the CIFSRF project.

Six institutions partnered – two research and development Bolivian non-profits (Faunagua and CEPAC), a Bolivian business consulting firm (IMG), a Bolivian financial institution (CIDRE), a Canadian NGO (World Fisheries Trust) and a Canadian university (UVic).

An integrated multi-faceted approach to scaling-up was taken for the emerging sectors. Food security, a complicated construct, was generally considered to be facilitated through improved livelihoods. Complementary and interacting pathways aimed at policy, production/market, and knowledge scaling were pursued, including both bottom-up and top-down approaches, but utilizing participative processes, collaboration, and resolving beneficiary-identified production bottlenecks.

In the policy stream, a new fisheries and aquaculture law, in addition to three other regulations specific to indigenous fisheries and paiche were facilitated, based on local user inputs. In parallel, 14 fishing associations and 12 aquaculture associations were legalized, including organizational training that emphasized gender equality (particularly in aquaculture). In fisheries, this led to an agreement between the fishing federation FEUPECOPINAB and the governmental SEDAG to collaborate in fisheries management and control. Multi-stakeholder roundtable “platforms” for aquaculture were created in two municipalities, setting the stage for integrated on-going support for increased productivity of the activity, creating a model for other municipalities, and allowing for collaboration with the governmental SENASAG to implement fish handling and hygiene best practices and training. Four Policy briefs on several topics have been written and are being publicized this summer, with yet unknown impact.

In the production/market pathway, aquaculture productivity was enhanced primarily through technical training with strong South-South learning, and implementation of improved culture protocols, whose adoption was facilitated by participative research, peer-peer learning practices, and organizational capacity building. During the project, productivity increased by a factor of 6 (811 t/year to 4805 t/year), in the core region of 5 municipalities, while farmers in the adjacent region that received more limited project support still increased their number of ponds per producer from 3.4 to 4.6.

In the fishing sector, the project supported improvements and innovation in processing of paiche in Riberalta, including production of value-added specialty dishes by women entrepreneurs through a “cooking for social change” process. In addition, a new fish leather value chain was created, providing added income to fishers and processors, and incentive for better handling of fish to conserve the quality of the skins, which had previously been left to decompose on the side of the lagoons. Improved income in aquaculture (\$7,705 USD/year to 19,079 USD/year for families), and fisheries (through improved fish



prices from 14-40%). Consolidating participation of indigenous communities in these benefits still needs work, considering their mix of seasonal livelihoods and dependence on native fish for subsistence fisheries.

The project included innovation of credit instruments for the fishing and aquaculture sectors, with novel guarantees, leasing, structured credit contracts, and comprehensive insurance. 254 loans were disbursed to 196 clients in fisheries and aquaculture, with a total value of \$1,420,130 USD provided to the sector during the project, including support for an entrepreneurial fish feed mill, constructed by the largely women-led aquaculture association APNI and partners.

Market development pathways were pursued with 3 multi-day gastronomic events in urban centers of Cochabamba and Santa Cruz, and with fish fairs in rural regions. Creation of novel fish dishes and nutritional benefits were the focus of these events, as well as recognition of paiche fish, with market surveys indicating a growth of 20.8% in paiche consumption and 37.9% in pacú/tambaqui consumption nationally from 2015 to 2017. In the project intervention area, paiche and pacú consumers are increasing by 9,000 new people /year. Interestingly, fish farming families showed a significant increase in fish consumption as well, by 12 kg/family/year in an area with traditionally conservative dietary habits that did not include farmed fish. In addition to the farmers themselves, who now proudly consider themselves “businesswomen,” the recently established aquaculture platforms are expected to help carry these trends forward.

In the Knowledge pathway of scaling up, both academic and more applied research were pursued. The “academic” research on the paiche and its fishery was and is a key factor in influencing policy and practice, as well as communicating the lessons learned with the global development community (a process that is still underway) and helping build the capacity of the team for further research. More practical research was focused on immediate results to improve productivity and markets. Communications tools, such as manuals, brochures, and videos, were broadly used to support capacity building, as well as building consumer, governmental, and public support for the project and its participants. Capacity-building activities recognized the importance of process and relationship-building, focusing on participative and appreciative inquiry methodologies including peer-peer learning, university certification of technical experience, participative research, and co-thematic training. The latter entails using a popular theme as a “hook” for training but also includes other development themes – e.g. Cooking for Change, with a gastronomic primary theme, also addressed questions of gender equality, food handling and hygiene, and strategic planning; Economic Viability Evaluation (EVE), with an economic theme, also addressing gender equality, resource co-management, collaboration, and strategic planning). South-south technical exchange, primarily with Brazilian inputs, was a particularly effective mechanism for learning and behavioural change.

Graduate and other research still under way at the end of the project is providing insights on the social mechanisms involved in the project’s advances and future development initiatives. Other ongoing research, initiatives of the Bolivian partners in the project, and self-driven continuation of development trajectories by the beneficiaries themselves, triggered or facilitated by the project, is providing sustainability to the project’s impacts on food security and the scaling up process.



2 The research problem

Food security is a complex and highly contested construct (Renhazo and Mellor, 2010¹; Rideout et al., 2006²). Improving it in a locally relevant and sustainable fashion is a substantial and complex challenge that is best based on an intimate understanding of both local and global socio-economic realities. Developing effective strategies for doing this is an on-going challenge within the diversity of situations that exist in the developing world, particularly with respect to obstacles that women and people living in poverty face in accessing the resources needed to improve their lives, including tools, knowledge and power.

Bolivia, the poorest country in South America, and ranked 65th on the Global Food Security Index (EIU, 2014³), has the highest percentage of its population classified as indigenous in Latin America (62%) (CIA World Factbook, 2013⁴). Poverty is deeply entrenched within Bolivia's rural indigenous communities surviving on a mixed livelihood that includes subsistence agriculture, artisanal fisheries, collection of wild nuts and game, and seasonal labor. Food deficits are frequent, resulting in high levels of chronic malnutrition among children. Indigenous women are particularly marginalized with little access to training, credit or technical assistance (Deere et al., 2011⁵). These factors are exasperated in the flood-prone Amazonian plain, where villages are inundated seasonally and/or more drastically by extreme floods.

Fish are recognized as a particularly valuable source of protein, healthy fatty acids, and micronutrients, as well as contributing significantly to poverty alleviation and food security through fisheries and aquaculture in much of the developing world (Bene et al., 2010⁶, Toufique and Belton, 2014⁷). Bolivia has significant aquatic resources, particularly in the Amazon basin, with underdeveloped capture fisheries of an introduced species in northern Bolivia (the paiche, *Arapaima gigas*) and markedly underdeveloped aquaculture potential in other parts of the basin, where fisheries are in decline (Bombin et al., 2009⁸; Van Damme et al., 2011⁹). Currently, per capita fish consumption in Bolivia is one of the lowest in the world,

¹ Renhazo, AMN & Mellor, D. 2010. Nutrition 26: 1–9

² Rideout, K., Seed, B. and Ostry, A. 2006. Canadian Journal of Public Health, 97(3):233-236.

³ EIU - Economist Intelligence Unit. 2014. Global Food Security Index 2014. An annual measure of the state of global food security. The Economist, 67 pp.

⁴ CIA - Central Intelligence Agency. 2013. World Fact Book. on line.

⁵ Deere, C.D., Lastarria-Cornhiel, S. Ranaboldo, C. 2011. Tierra de Mujeres: Reflexiones sobre el acceso de las mujeres rurales a la tierra en América Latina. La Paz, Fundación TIERRA (Bolivia), ISBN: 978-99954-770-4-2 116p.

⁶ Béné, C., Hersoug, B., & Allison, E.H. 2010. Not by Rent Alone: Analyzing the Pro-Poor functions of small-scale fisheries in developing countries. Development Policy Review, 28:325-358.

⁷ Toufique, KA and Belton, B. 2014. Is aquaculture pro-poor? Empirical evidence of impacts on fish consumption in Bangladesh. World development 64: 609-620.

⁸ Bombin L., Mena A., Salas, R., Salinas F, Lino F., Van Damme P., Bravo N. 2009. Diagnóstico de pesca continental y acuicultura en Bolivia. Anexo I. Mejoramiento de la Legislación para la Pesca y Acuicultura en Bolivia. TCP/BOL/3101 (D).

⁹ Van Damme, Paul A., Fernando M. Carvajal-Vallejos, A. Rua, L. Córdova, and P. Becerra. 2011. "Pesca comercial en la cuenca amazónica boliviana" In Paul A. Van Damme, Fernando M. Carvajal-Vallejos, and Jorge Molina Carpio, eds., Los peces y delfines de la Amazonía boliviana: Hábitats, potencialidades y amenazas. Cochabamba, Bolivia: INIA, 247–91.



but fish imports were over \$6 M in 2011 (Mundi, 2014¹⁰), indicating both an unsatisfied demand and potential for local fish-related livelihoods. The current project investigated how greater development of small-scale Bolivian paiche fisheries and pacú aquaculture can contribute to improved rural livelihoods and food security for the poor, indigenous communities, and women.

3 Progress towards milestones

The table in Appendix 1 shows estimated progress towards indicator milestones proposed for this project. A more detailed explanation of this progress is found in the next section.

4 Synthesis of research results and development outcomes

Objective 1. To refine protocols and capacity for sustainable management of paiche (*Arapaima gigas*) fisheries

4.1.1 Objective overview

The project proposed to improve food security of fishing families, particularly indigenous ones, through two approaches:

- i. building a legislative framework, governance systems and strategic management proposals with inputs from participative monitoring and research
- ii. market-driven upgrading of the paiche value chain embracing gender equality, environmental, and fish quality considerations, and resulting in economic, social, health and food security benefits

4.1.2 Results achieved and development outcomes

Table 1. Indicators and results of Objective 1

Indicator	Base Line	Target	Result to date
Tonnes of paiche caught per year MSY is Maximum Sustainable Yield*	300 t/year (2011) 600 t/year (2014)	1200 t/year or MSY	742 t/year (2017)
Income of commercial fishers, indigenous fishers, vendors augments due to (i) increased production (400t to 700t), (ii) increased price of fish due to better quality, (iii) increased price per unit weight due to selling fish with skin attached.	0% increase	>10%	<ul style="list-style-type: none"> 379 indigenous fishers increased their income by 47.5% (sales of paiche meat) 32 indigenous fishers improved income by 23% (sale of skin) 393 commercial fishers improved income by 35.5% (sales of paiche meat)

¹⁰ Mundi, 2014. Introduction. In: Expanding the Boundaries of Transformative Learning Essays on Theory and Praxis. O'Sullivan, E., Morrell, A., and O'Connor, M. (Eds.) New York: Palgrave Macmillan

			<ul style="list-style-type: none"> 5 commercial fishers improved income by 23% (sale of skin) 56 vendors (retailers) improved income by 28% (sales of paiche meat)
Number of Productive Family Units of the North Amazon strengthened	0		20
Monthly income of 250 families of commercial fishers in Riberalta	\$ 100 USD (2015)	Over \$100 USD	\$ 120 USD (2018)

4.1.2.1 *Management approach and strategic planning*

The fisheries component of the project initially had a strong research focus, in partnership with the governmental national agriculture research organization (INIAF¹¹), culminating in the publication of a seminal book on paiche biology, fishery, and other aspects ("INIAF book"). The book¹² included studies on:

- the nutritional benefits and risks of consumption of paiche
- the population status of paiche in four indigenous territories (TIOC¹³s) (subject of a M.Sc. thesis)
- the production potential of paiche in the Manuripi protected area
- genetics and population structure of paiche to inform management
- the effect of anthropogenic and climatic factors on expansion of paiche range
- innovation in participative monitoring of fisheries
- the role of fishing in local livelihoods and dynamics of well-being in rural communities (subject of a PhD. thesis)
- predictive modeling of paiche fishing (subject of Postdoctoral work)

An international conference on Amazonian fish, hosted by the PPV project and WWF¹⁴, built on this material. This verifiable and visible research was an essential cornerstone to influencing policy, not only for fisheries but also for development plans, such as the construction of hydroelectric dams. Ongoing monitoring is just as essential, providing both important baseline information and a basis for adaptive management. Tools and proposals for this continuity were developed in the PPV project.

Paiche production more than doubled after the start of the first Amazon fish for Food project in 2011 (from 305 t/year to 724 t/year). While this is less than the predicted target of 1200 t/yr., it is an unprecedented growth in Bolivian fisheries and a higher yield than would be expected from a similar area in Brazil, where the paiche is native. Much of this growth is attributable to the inclusion of new fishing areas (mostly indigenous territories) made possible by legal advances fostered by the project and increasing demand. This has taken longer than initially predicted, but we expect a further increase to approximately 1000 t/year through inclusion of protected areas in the Pando department (especially the Manuripi reserve), where paiche fishing will now be allowed to protect native fish species based on

¹¹ Instituto Nacional de Innovación Agropecuaria y Forestal

¹² "Technical bases for the management and use of paiche (*Arapaima gigas*) in the Bolivian Amazon"

¹³ Territorio Indígena Originario Campesino

¹⁴ World Wildlife Fund



advocacy and administrative resolutions informed by the project. With the expansion of paiche to other river basins (Mamoré and Iténez), paiche captures may soon surpass the predicted 1200 t/year.

While much of the PPV work on paiche value chains has been concentrated in the Riberalta region (see below) activity in the Pando department has included advocacy resulting in two administrative resolutions on fishing for paiche in protected areas, and experimental fishing and fish counting to estimate available stocks (reported in the INIAF book). The IUCN will now support management of sustainable paiche fisheries in the Manuripi Reserve of an estimated 200 t/yr., and improved income for the 900 peasant and indigenous families living in the reserve. Improved Bolivian markets for paiche (see below) will facilitate the sale of these fish within Bolivia, rather than into the illegal Peruvian or Brazilian markets. This process will continue independent of the PPV support.

There are biological limits to the sustainable use of paiche resources, considered a maximum sustainable yield (MSY), which limits the extent of scaling up fisheries yield.

The conceptual model developed in this project suggests that the Bolivian paiche resource in fished lagoons is supported by immigration of fish from un-fished lagoons (a sink-source hypothesis) that helps explain the higher yield compared to Brazilian lagoons. According to this model, resource access control is a key factor in stabilizing the fisheries yield. An important element of this proposal is that it responds adaptively to new social and biological information. Research is still underway to confirm or discount the hypothesis, including a predictive mathematical model (Appendix 2). On-going participatory fisheries monitoring is being recommended to stakeholders and is part of the new co-management agreement between FEUPECOPINAB and SEDAG. Pilot participative monitoring was carried out for a year (Appendix 3), including with electronic datasheets, a review of potential telephone app development strategies has been prepared (Appendix 4), and fishers have evaluated the process (Appendix 5). Nevertheless, implementation of the co-management and monitoring will be an on-going challenge.

The paiche fish leather initiative, led by Curupaú, a small family-owned business, and supported by Fundación Valle, FUNDESNA, and Pro-Bolivia (part of the Ministry of Productive Development) has trained female and male fishers and fish traders to prepare fish skins. National and international interest in the semi-industrial, environmentally-friendly tanning product is growing rapidly. By the end of 2017, 8400 ft² of paiche leather had been produced, representing 56 tonnes of fish caught by 30 commercial and indigenous fishers (Appendix 6). Other tanneries are now also showing interest in the paiche fish skins.

This model, as well as project interventions in fisheries (Appendix 6), was used to propose a national management strategy of paiche that has been published (Appendix 7); and is being distributed widely. It informs national-level decision-makers who are now designing specific fisheries regulations mandated by the national Sustainable fisheries and Aquaculture law (see Objective 4), and local organized stakeholders (indigenous and rural territories, departments, fisheries organizations, municipalities, etc.). It has six development axes: legislation, strengthening of the fisheries sector, resource management, integrated use, value chain development, and research and monitoring. Each axis has different lines of action,



concrete activities and project ideas that can be adopted by local governments and stakeholders in an adaptive fashion. The PPV II team will continue to monitor the regional and local impacts of these legal instruments on fisheries and value chains.

4.1.2.2 Value chain development and upgrading

The value chain foci connected changes at the governance level with the target groups (indigenous families and women), through a market-driven upgrading of the paiche value chain, embracing gender and environmental considerations. This was done by combining complementary strategies, from marketing to microcredits to building alternative value chains for new value-added products.

Different interventions in the value chain were pursued by the project (Figure 1):

- a) Microcredits to 144 indigenous fishers and to 8 fish processing units (see objective 5)
- b) Innovation in ice boxes with improved cooling capacity, and adapted for paiche transport in 25 families
- c) Lake fisheries management informed by participative monitoring and (ongoing) research with 12 communities (4 TIOCs)
- d) Capacity-building and institutional strengthening of 14 fisheries value chain organizations
- e) Business plans for two fish processing units and diversification/marketing of fish meat products (ex. Arapaima group, Marvin products) (see objective 3)
- f) Increased fish meat demand by 32% in La Paz, Cochabamba and Santa Cruz through gastronomic events and other marketing strategies (see objective 3)
- g) Increased fish meat demand in Riberalta by 17% through value-added product development and fish fairs
- h) Governance (institutional platforms) and construction of legal framework (see objective 5)
- i) Chain diversification through a fish leather industry and value-added meat products
- j) “Cooking for social change” process with 9 women from ARAPAIMA Association to improve how small-scale family units process and sell value added fish products. This improved ability led to 2,000bs (\$300 USD approx.) income/person during the 10th annual fish fair (August 2017).

Considering that the meat value chain proved difficult to influence directly for improved equitable returns, the project also began to develop a parallel value chain of fish leather which has created more rapid improved returns to the fishers (especially indigenous peoples) and indirect benefits to the meat value chain (see text box). The benefits of the interventions are social, economic and environmental. In general, the project contributed to the horizontal and vertical elements of the optimized and upgraded value chain (Figure 2).

4.1.2.3 Economic, social, and environmental benefits

The **economic benefits** cascade down to all the value chain links, including the most vulnerable, traditionally the fishers. This occurred via three avenues: i) increased production (400t to 700t), (ii) increased price of fish due to better quality, (iii) increased price per unit weight due to selling fish with



skin attached. Approximately 742 t/year of paiche are now (2017) being exploited by 772 fishers (379 indigenous and 393 commercial¹⁵), commercialized by 12 sellers and 54 retailers. This represented an increase relative to the 304 and 520 t/yr captured by the whole fisher community compared to 2011 and 2014, respectively. The total income of all commercial fishers in 2017 is estimated as \$1 078 885 USD, and of the indigenous fishers as \$68 230 USD, with profits of 35.5% and 47.5% respectively. For the sellers, the economic return is \$ 1 957 823 USD with an additional economic return of 29.7% (Figure 1).

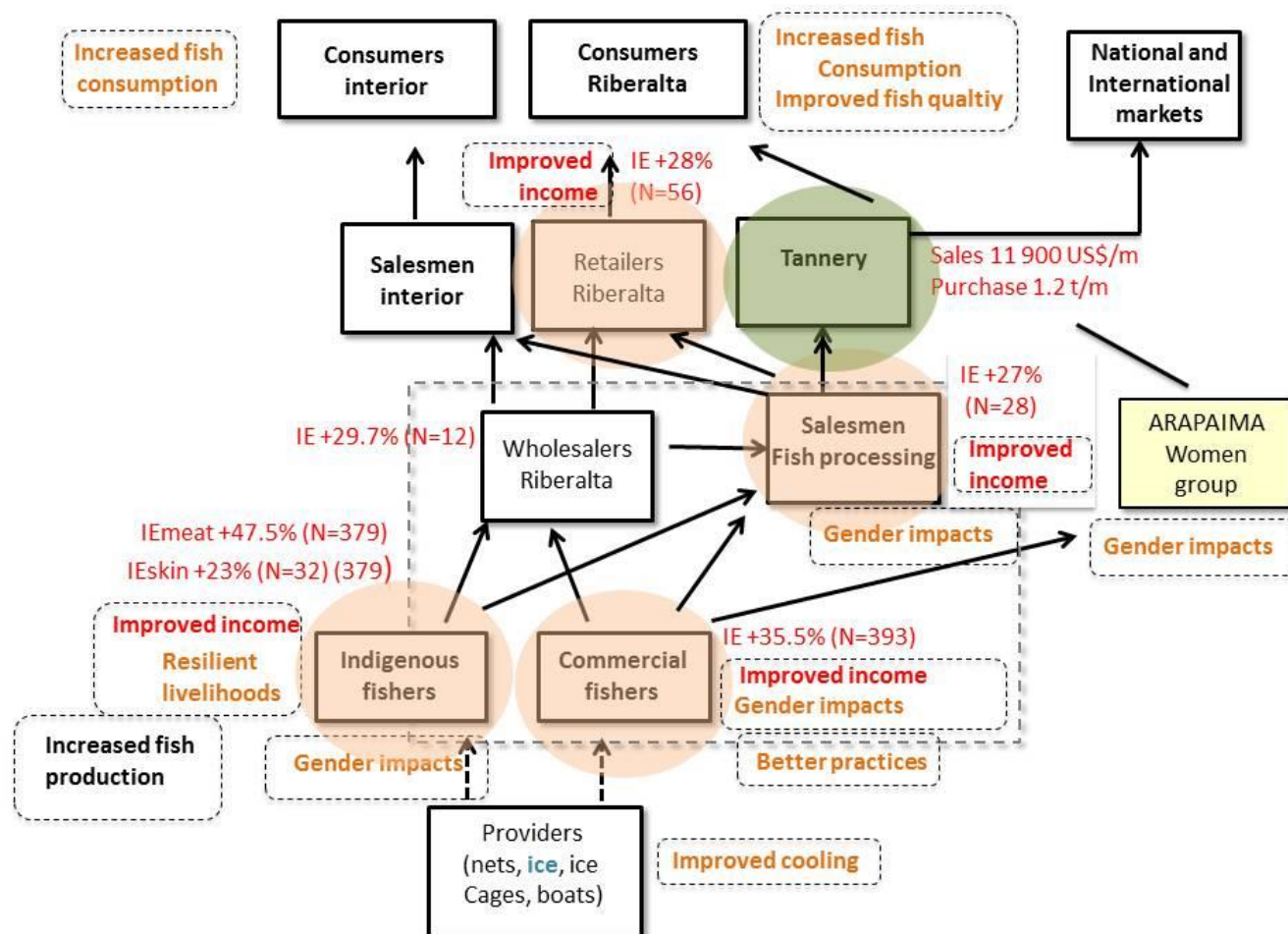
In total, 40 indigenous fishing communities from the TIOCs Cavineño (11), Takana Cavineño (12), Chácobo Pacahuara (10) and Multiethnic TIM II (7), with a population of 3,040 inhabitants in 630 families, receive economic benefits from paiche fishing at the end of the project, representing an increase compared with the 11 communities involved in this activity in 2011.

A further increase of the total annual paiche yield to 1200 t/year is expected, with the opening of new fishing areas (protected areas and new river basins), but whether this yield will stabilize over the long-term, and continue to provide equitable benefits will depend on the management strategy adopted by the various actors at different levels. The project has published a policy brief and management guidelines for this purpose (Appendix 7 and 18a).

In the study period the economic benefits of the value chain upgrading through value added to the fish skin cascaded down to all the value chain links, including the most vulnerable, traditionally the fishers. In the last quarter of 2017, it has been monitored that of a total of 379 indigenous fishers, 32 fishers applied the good practices introduced by the project and caught 24 850 kilograms of paiche in whole pieces with scales, which they sold to marketers at the price of 1.6 USD/kg, for a total value of 39 760 USD, representing a 23% increase in income per unit of paiche weight (Figure 1), with a projection of obtaining similar benefits for all fisher families until the end of 2018, including all the commercial fishers. As of February 2018, 379 indigenous fishers have increased their income by 47.5% (sales of paiche meat), 32 indigenous fishers improved income by 23% (sale of skin), 393 commercial fishers improved income by 35.5% (sales of paiche meat), 5 commercial fishers improved income by 23% (sale of skin) and 56 vendors (retailers) improved income by 28% (sales of paiche meat).

¹⁵ “Commercial” fishers may or may not be indigenous, are primarily urban based, and have fishing as a primary livelihood. Indigenous fishers are primarily rural based, and sell fish as a supplement to other livelihood components

Figure 1. Benefits obtained through optimizing and upgrading the paiche value chain. Red circles show target groups,



the green circle shows introduced processing industry (tanning of fish skin). The project benefits at the level of the different chain nodes are highlighted in dotted rectangles. The red-colored data show the % increase in income per fish unit and the number of beneficiaries per chain node (IE = economic income from fish or fishing). The large dotted rectangle shows that many commercial fishers (and some indigenous fishers) are under contract by salesmen.

The **social, health and food security benefits** were evident in terms of clear opportunities for low income urban-based fishers and their families in Riberalta and the indigenous community of Trinidadito. This has included organizational and technical support and entrepreneurial support for the women, primarily with production and sale of value-added food products. This has in turn provided benefits to Riberalta through the availability of high-quality, nutritious fish.

While other indigenous communities have participated in PPVII research, and there have been organizational, networking, and economic benefits from project activities, they have been more



challenging to work with. Within TIOCs, where many of the productive paiche lakes are located, there are significant informal relationships between the communities, travelling sales persons and urban-based commercial fishers. Indigenous fishers will frequently sell fish to visiting sales persons who arrive by boat or truck, often at a low price. Fish is sometimes also exchanged for basic staples such as fuel, cooking oil, rice, sugar, etc. Other times, communities may allow temporary access to fish in their traditional territory in exchange for a royalty paid on fish harvested (anywhere between \$0.14-0.43 USD/kg). Occasionally, commercial fishers rent gear to communities or hire individuals from the community to participate in paiche harvesting. The shift in commercial fisheries from rivers to lakes, due to the paiche exploitation has increased the control of indigenous people over the fish resource and has improved their position in the negotiation process with other members of the value chain.

This improved positioning of indigenous peoples within the fish value chain has been strengthened through the legal framework. The fisheries & aquaculture law and the departmental (Beni) fisheries and aquaculture regulations are milestones towards improved access rights. The administrative resolution of SERNAP¹⁶ on paiche fishing goes further and establishes exclusive user rights for people living within the protected areas, excluding entirely the urban commercial fishing sector.

There is still an on-going need to improve legal-organizational tools or frameworks to regularize and manage these agreements to benefit the communities in a more sustainable and equitable way. The project developed additional actions and processes for organizational strengthening with indigenous organizations, especially CIRABO, the Central Indigenous organization from the Amazon Region, and FEUPECOPINAB. These include the legalization of fisheries organizations (including indigenous), strategic planning and economic Viability Analysis training with CIRABO staff and community members, and the eight-month capacity building and outreach process with FEUPECOPINAB, resulting in their first ever “ampliado” conference (general assembly) described in section 4.4.2.2.

The project has also contributed to the **health and food security** of paiche consumers in general. Training and creating a value for the skins has provided an incentive to bring fish of higher quality to the processors, who in turn have been trained by the project to process to higher standards, supported by new governmental regulations. New fish processing plants which comply with all regulations (and a free-to-use template of building plans for a typical plant) have significantly improved food safety, with increasing reach predicted in the next few years.

Nutritional analysis, reported in the INIAF book (Appendix 25), confirmed that the paiche meat is lean and high in minerals. Fatty acid analysis also indicates that the fish has unusually high relative amounts of omega 3 unsaturated fatty acids, compared to other Amazonian fish. This fatty acid is thought to have particular health benefits for humans, but is more common in cold-water marine fish. The results need further corroboration, but are promising. However, paiche are also known to contain mercury, as do

¹⁶ The National Service for Protected Areas



many carnivorous Amazonian fish, originating from high native mercury content of the soils and gold mining. Chapter 11 in the INIAF book reports on the mercury content in paiche of different sizes and from different regions, with a fuller publication in preparation. While the variability in mercury content is only partially explained by fish size and source, the levels in general are below those considered dangerous to human health by the World Health Organization and other authorities. Nevertheless, an informative brief (Appendix 33) for FEUPECOPINAB and policy brief describing responsible use, particularly for pregnant and lactating mothers and young children, is being prepared (Appendix 18c).

There were also **environmental benefits**. Making use of the paiche skin reduces the environmental impact at the fishing sites, where they were previously left to rot on the shoreline. Approximately 1.2 tonnes of paiche skins are now used in the leather value chain per month, with a projected increase to 100 tonnes/yr. in 2018. This was made possible through a new agreement between the fisheries federation and the tanning industry, which is a significant contribution of value added to a byproduct which was previously discarded. Moreover, the new fish processing plants, complying with all SENASAG regulations, have significantly improved environmental considerations in terms of water use and discarded bi-products.

A spin-off benefit of this work is the piloting of a new environmentally friendly technology that recycles the chromium used during the tanning process, rather than discarding it. This new technology has the potential to be scaled to tanning companies nationwide, not only for fish leather.

The maximum processing capacity of the Curupaú tanning company is 10% of total skin production, at a price of 18Bs/kg. In February 2018, one of the larger tanneries located in Trinidad (Beni department), offered to purchase the other 90% of skins available in the market from the FEUPECOPINAB, at a price of 40Bs/kg (a threefold increase). Commercial and indigenous fishers are becoming involved in both the fish meat and fish leather value chains. This is an exceptional example of upscaling of value added, with significant impacts on income at all nodes of the value chain, as well as better practices and positive environmental impacts (reduction of environmental waste). The interest in this value-added product has triggered an increase of fishing in remote areas, which will need to be monitored.

Objective 2. Increase aquaculture livelihoods through family-based small-scale aquaculture, with a focus on female leadership, environmental sustainability, and social responsibility

4.2.1 Objective overview

PPVII has worked to ameliorate the livelihoods of fish farming families, to improve food security and reduce poverty. These results have been achieved mainly through three streams:

- i. Increased fish production and efficiency (milestone 6.2) utilizing best practices and knowledge gained and used through South-South exchanges and capacity-building

- ii. Superior income, and better access and control of these new resources, especially by women
- iii. Greater rights and participation of women in decision-making stemming from organizational strengthening of aquaculture organizations

4.2.2 Results achieved and development outcomes

Table 2. Indicators and results of Objective 2

Indicator	Baseline	Target	Result to date
Number of tonnes produced by Productive Family Units in project intervention area	811 T/yr.	1622 T/yr.	4805 T/year
Number of tonnes produced per family	2.8 T/family/yr.		4.4 T/family/year
Level of satisfaction in production		>50% satisfied or very satisfied	75% satisfied or very satisfied
Number of families producing pacú /tambaqui	532 families (937 with other municipalities)	1000 families	1030 families (1757 with other municipalities)
Increase in gross income from aquaculture Perception on increased income	\$ 7,705 USD/year)	\$ 10,000 USD/year	\$19,079 USD /year 72% have increased by 50%-100%; (52% increased by 50%)
Level of satisfaction with aquaculture as part of livelihood			84% satisfied or very satisfied

4.2.2.1 Increased production: more families, ponds, and tonnes¹⁷

At the onset of PPVII, 532 families engaged in fish farming were identified in the Core Project Area¹⁸, with an average production of 2.8 tonnes/family/year, and a total of 811 tonnes/year (Appendix 8). We surpassed our target and reached 1,030 families in total, whose production increased to 4.4 tonnes/family/year for a total of 4,805 tonnes/year. Additionally, when considering the municipalities outside our Core Project Area, producer numbers reach 1757. This means more families prioritizing aquaculture as part of their diverse livelihoods strategies. Of the 4,805 tonnes/year produced, 43% comes from Yapacani (2039 t/year), 2% from San Carlos (75 t/year), 39% from Entre Ríos (1889 t/year) and 17% from Puerto Villarroel (803 t/year).

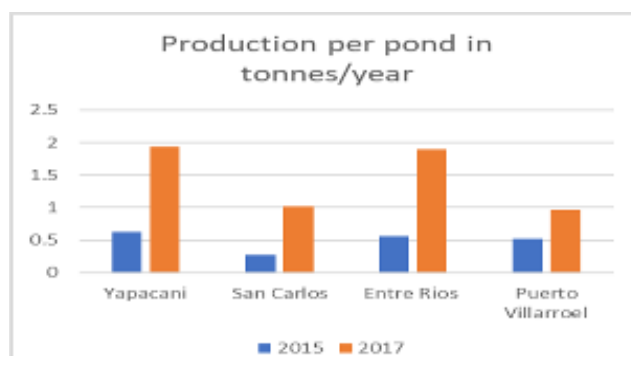


Figure 2. Increased production in fish ponds with improved protocols

¹⁷ The extensive baseline and exit surveys included 30 interviews per 4 municipalities for a total of 120. A focus group evaluation with 87 representatives from the Core project region and secondary sources (Instituto Nacional de Estadísticas) rounded out the data.

¹⁸ Municipalities of San Carlos, Yapacaní, Entre Ríos and Puerto Villarroel

The most notable growth comes from Entre Rios municipality, which jumped from 19% (154 t/year) to approach Yapacaní's production.

"The capacity-building process has taught us not only how to manage aquaculture production, but also how to develop as facilitators and interact with producers who seek us out to solve a problem or optimize their production." (Alumna Y. Mamani C, trainee).

This is a significant increase in production, and comes

from more productive family units producing fish, from more ponds; families in most of the municipalities added one new pond to their productive family unit (PFU). Some significant mechanisms which supported this change were programs by the national government (IPD – Pacú y PAR project) and municipal governments (Entre Ríos and Puerto Villarroel), as well as private investments (including credits) and a move away from communal production. In adjacent Shinahota, Chimoré and Villa Tunari, where the PPVII also provided technical training, the number of ponds per producer increased from 3.4 to 4.6, increasing production to 5,114 kg fish per producer (Appendix 9).

"This participatory work showed specifically how applying Best Practices results in specific economic savings in production (more efficiency). These results have helped create behaviour changes, with producers implementing and promoting the use of Best Practices to their neighbours" (Claudia Coca, EVE Co-facilitator)

Training for improved culture protocols has had a demonstrable effect on productivity (see text boxes and Fig. 2). This included:

- 77 trained "Auxiliary Technicians" from 14 different municipalities of Bolivia, of which 45% were women and girls (see text box)
- 5 leaders (3 men, 2 women) from trained technicians implementing field schools
- Participative research on mud removal and aerators
- 11 Demonstration farms and field schools performing peer-to-peer knowledge exchange with 972 producers (44.3% women)
- 88% claimed to be satisfied or very satisfied with this type of training and found medium or high benefit from technical assistant services; 57% found high benefit
- Specialized, high level experts (and quality humans) from Brazil and Canada. Experts from Brazil and Canada, with demonstrated skills in appreciative outreach and teaching. Recently, three experts visited Bolivia to give short courses to fish feed and fish fry producers (Appendix 31 a-c), responding to bottlenecks identified earlier in the project and providing tools for improved practices and better-quality products
- Training in Economic Viability Analysis (EVE) with a train-the-trainer approach. (4 women, 7 men from the Technical Extension Agent course; 45 producers (29 men, 16 women), as well as 7 Association-level EVEs)
- Publication of technical material, including a Digital Best Practices Manual

" I have the great satisfaction of having been one of the first people who dedicated themselves to fish farming in this municipality and opened the way for other people to enter into this field. ... working niches were opened for many people. That's why I like when people visit my ponds and other families learn. (Facilitator Demonstration Unit, Yapacani, A. Olpo).

In total, 972 people participated in peer-to-peer training, with 252 participating in 75% or more of the course. 292 (30% of all trained) had demonstrably implemented key best practices by the end of the project but 95% believed that Best Practices have good or high impact on production, income and quality of life. Further research will demonstrate what additional barriers exist for men and women in implementing these changes.

"There was a process of joint construction of knowledge ... for improving fish farming based on the local reality, so that the knowledge generated here [in Bolivia] can be applied by farmers".¹ (Patricia Maciel, fish disease specialist, EMBRAPA)

4.2.2.2 Superior Income

Approximately 84% of the fish farmers surveyed in workshops were satisfied or very satisfied that they have incorporated aquaculture in their livelihood strategy, and 72% consider their income has increased by 50%-100% (52% claim 50% increase). This is corroborated by household survey results. In 2015, producer families from our core region made \$7,705 USD/year on average, while by 2018, gross average income had risen to \$19,079 USD, an increase of 148%. Interestingly, 45% have a positive perception of the market for fish because of the increase in ponds and production, while 41% are preoccupied by this. More work is needed to address this, described in Objective 3.

"Aquaculture has allowed me to have income... the success of this activity has meant that my husband no longer needs to go work far from home, now we work together. I've been able to invest in better education for my children, and I've also changed. Before, I was very shy, and now my husband says, "you've really livened up". I have money to give myself small pleasures. Because of the growth of my activity, I now see it's important to learn more. I want to prepare myself technically and manage my business better. My life has changed in a way I never imagined thanks to this activity (Ana Aguilera, APNI/Yapacani)

4.2.2.3 *Greater rights and participation of women in decision-making through organizational strengthening*

In focus groups of 87 participants from the region, 75% remarked being satisfied or very satisfied with their increased production. Incorporating aquaculture as part of a diverse livelihoods strategy has resulted in significant increases in their income. It is noteworthy that the participation of women as producers and leaders of their fish farm is much higher in the Core project region where our “model” has its roots (Yapacaní 48% women, San Carlos 60% women), but is increasing and approaching 30% in others (Chimoré, Shinahota, Puerto Villarroel and Entre Rios). The leadership of these mainly-female producers, has been recognized internationally (e.g. Learning Networks OXFAM - Winner of the award for “Success Stories in Climate Change Adaptation for family-based agriculture” funded by the International Development Bank) and continues to be a reference point regionally for its remarkable positive impact on livelihoods and empowerment of women. A cross-cutting priority in the project for **gender equality** has helped create the following results:

“Among the things that motivate women in fish culture is the promotion of family union and participation. The whole family participates in feeding and harvesting. The availability of fish to eat also helps a great deal, especially when the rest of the family comes to share fish together” (Demetria Fuentes – fish farmer, AMPAAB/San Carlos)

4.2.2.4 *Equity in access for women*

“In my District 3 organization, in Entre Rios, we’re conscious of the importance of women participating in organizations and in the board of directors. In our bases this consciousness is still low, but in our board of directors we have parity and now we’re promoting that women and men participate equally, since both participate in the activity [fish farming].
(Mario Arnez Herrera, Fish farmer/Entre Rios)

Women have been identified as legitimate owners of productive enterprises in 341 out of 1030 total producers in the core region. The process of valuing and recognizing women’s productive roles has been achieved through sensitization of gender roles during training opportunities by PPVII (eg. In course curricula and parity of participation “rules”), as well as during three specific leadership retreats focused on “economic rights” of productive leaders, especially women.

Representatives of the district organizations were more conscious of the importance of making sure women and men participate (Edgar Rojas, Technician, Entre Rios Municipality).

Despite challenges (see text box), 44.3% of the 972 producers trained during peer-to-peer field schools and 45% of the Technical Auxiliaries were women. This included producers, municipal

technical staff, family of producers, etc.



4.2.2.5 *Women Participation in decision making*

Over the last three years of PPVII, the participation of women on the board of the 14 aquaculture associations in the Core Project Area increased by 28%, from 19% to 40%; There is still a distinction between associations, which have up to 55% women's participation on the board, and local unions, which have only 23%, demonstrating that there is work to do. Nonetheless, significant strides have been made in prioritising women's role in decision-making positions, and valuing women's voice and leadership in aquaculture production.

4.2.2.6 *Women exercising their rights*

During the three leadership meetings for economic rights, 53% of the participants were women. Twelve fish farming organizations, including 335 members, benefitted from organizational strengthening training with 24 of them receiving additional training to improve competencies in management (see text box). By better understanding their rights and having technical and organizational capacities to back up their participation, women are increasingly able to exercise their rights, have a say in their changing position in society, and improve the effectiveness of organizations.

"The training with the associations' board of directors helped me a lot, because I didn't know how to do an expense report. Now the members are more motivated to contribute their monthly dues, because I can explain to them how much money comes in, how it was spent, and they can see it all like a bank history report. I knew nothing of that before and now I know how to do it." (Janneth Uzieda / Treasurer of APNI, Yapacaní)".

Objective 3. To improve and expand fish marketing strategies and enhance fish quality for improved income and nutrition

4.3.1 *Objective background*

To improve peoples' income and nutrition, PPVII focused on improving fish quality and providing marketing support for fish in key municipalities through:

- i. Improving fish hygiene and handling practices by vendors and wholesalers in regional markets;
- ii. Promoting fish consumption through promotional events and education;
- iii. Providing better market opportunities for small and medium businesses
- iv. Incorporating advances into policy changes

Market surveys at the start and end of the project (Appendix 10 and 11) helped inform these activities, as well as evaluate effectiveness in small communities of Riberalta, Yapacaní, Entre Rios and Puerto Villarroel, as well as larger urban centers of La Paz, El Alto, Cochabamba, Santa Cruz and Tarija. These surveys provided key information on fish handling, quality, and consumption habits, from the point of view of vendors, consumers, producers, wholesalers, restaurants and supermarkets.

Focus group interviews and evaluations in 4 municipal markets at the end of the project also helped to better understand peoples' perspectives on market conditions, and vendors' implementation of best practices for fish quality. Preliminary nutritional research of the paiche has indicated relatively high levels of omega3 fatty acids and reasonable levels of mercury (see discussion p. 11). Pacu is quite low in this fatty acid, but preliminary results of research at UNIBOL and UMSS indicates that it could be increased through inclusion in the feed. Results in the PPV Phase 1 indicated that bouchere, a fish with exceptional mineral content, could also be co-cultured with the pacu and/or be more of a targeted fishery in northern Bolivia, while sardines (small fish which arrive by hitchhiking on transitory birds' feet as though "magically" to fish ponds), also high in minerals and vitamins when eaten whole, have great potential for human use and extra income. The farmed fish are devoid of mercury. So far, these extra details have not been used in marketing initiatives, farming or fishing strategies, pending more conclusive research results and consolidation of the fishing, farming, and consumer protocols that users have prioritized.

4.3.2 Results achieved and development outcomes

Table 3. Indicators and results of Objective 3

Indicator	Baseline	Target	Results to Date
Number of producers and vendors in each municipality with improved <i>capacity</i> to sell fish with guaranteed quality and food safety standards, including solid waste management and water management	0	100	100% (146 producers and vendors)
Number of points of sale selling fish with good hygiene and handling practices (implementing practices)	0	50	63
Number of markets with vendors complying with fish quality and food safety standards	0	5	5
% satisfaction with the improvements to fish stalls and markets	0	80%	69%
Number of marketing tools or events to improve market access (Business model, business plan, productive or commercial plans)	0	5	7 plans 5 Events

4.3.2.1 Improved hygiene and handling practices through capacity-building

The consumer surveys indicated that sixty-five percent of people use fish quality (freshness, hygiene, smell, color, etc.) as the only factor in their decisions to purchase pacú/tambaqui or paiche. Other factors included price and quantity or size of the fish. 95% of consumers consider quality, price and quantity/size when they decide to buy fish.

Current practices and Best Practices in fish handling and hygiene were researched by a PPVII team and used to develop training courses and associated manuals. Seven training workshops were delivered in 5 municipalities to 146 fish vendors and municipal staff (101 women, Appendix 12). Based on the exit survey, over 70% of those surveyed were satisfied with this training (Appendix 13) and 126 vendors had improved their fish hygiene and handling practices. However, barriers to implementation remain, particularly from deficient infrastructure, but also from difficulties in changing established practices. In best practices, only 63 vendors have been able to implement them in the 6 months since being trained. Nevertheless, the supporting manuals and posters on the most important best practices (Appendix 14 a-



f) were distributed to municipal governments to use in their future training in markets, which happens 3-4 times a year, and a policy brief created with 7 municipalities (Appendix 15), is being delivered to the national authority in March 2018, highlighting requirements for improvement.

The multi-actor platforms of Entre Rios and Puerto Villarroel, created by the PPVII, include many municipal actors, producers, and private sector representatives, and helped support this process during the workshops, as well as including market improvement projects in Sectoral Aquaculture Innovation Plans (2018-2022) representing an expected municipal investment of 27.1 million bolivianos.

4.3.2.2 Promoting fish consumption through events and education

Both paiche and pacú are good sources of high-quality protein and micronutrients, providing Bolivian consumers with healthy and affordable options for locally produced foods in the market. The PPVII delivered five major events promoting fish consumption, with significant impact. A “Paiche week” in Cochabamba counted on the participation of almost 30 different actors, including 13 restaurants, catering and culinary schools, and public actors through 7 different sub-events and 8 courses with over 500 participating students, vendors, and professional chefs (over 80% women). In Santa Cruz, a similar Paiche Festival was carried out, while local fish fairs in Riberalta and the Tropico of Cochabamba, spearheaded by multi-actor platforms supported by the PPVII, helped promote fish consumption over the last two years. During one Open House event at the Catholic Bolivian University, 1,000 participants had the opportunity to taste farmed pacú/tambaqui and survey results from this event show that 35% people ate pacú fish for the first time and would eat it again. In 2017, the tenth Educational, Cultural and Gastronomic Fish Fair was held in Riberalta,¹⁹ led by 24 women from 7 fishing associations. Local Fish fairs are a very effective method for promoting fish consumption and have been supported by PPVII since phase one.

As assessed by PPVII’s market surveys, there were 112,957 new consumers of fish (including pacú/tambaqui and paiche) in Bolivia’s Urban Centres and Project intervention area between 2015 and 2017. Of these new consumers, 37% ate farmed pacú/tambaqui for the first time. When asked if they would continue to consume pacú/tambaqui, 91% responded in the affirmative. In total, paiche consumption increased by 20.8% and pacú/tambaqui by 37.9%. In the project’s intervention area alone, there were 19,410 new consumers of fish during this time, with the majority (17,097) consuming pacú/tambaqui and paiche. This demonstrates that the species promoted by PPVII are those primarily tested by new consumers, and results in an increase in dietary diversity for the Bolivian public with the incorporation of fish.

Another exit survey showed that by December 2017, the average consumption in 120 fish farming families had increased by 12kg/year, to 27,6 kg/yr (up from 15.6 kg/year in 2015), averaged over 4 municipalities (Yapacaní 35.7kg/year; San Carlos 21.4 kg/year; Entre Rios 29.3 kg/year; Puerto Villarroel 23.9 kg/year).

¹⁹ <http://www.ademaf.gob.bo/ntc.php?not=VkZaU1JrMVZOVkpRVkRBOQ>



The increased incorporation of fish in the diets of these low-income families demonstrates an increase in diet diversity with healthy fish and improved food security.

4.3.2.3 Better market opportunities for small business

Three medium and one small business, in addition to one indigenous market, improved their businesses thanks to PPVII support in creating business models, business plans, and capacity building. A transportation business buying fish from indigenous and *campesino* fishing communities, a model SENASAG-compliant processing plant, and diversification of paiche-based products of a female wholesaler were supported.

In addition, networking meetings between providers and clients, in each of Cochabamba, Santa Cruz, and Yapacaní, were organized by the PPVII, resulted in more than 30 new connections for participants.

These pathways to influence change have been based on a solid foundation of good research. Lessons learned about innovation, scaling-up, and sustainability are considered in a reflection document entitled “Strategies to improve fish production and commercialization, with the participation of public and private sectors” (Appendix 16).

4.3.2.4 Policy changes for standardized fish handling practices and fish quality instruments

At a national level, PPVII managed and supported the national Food Safety Authority (SENASAG) in creating adequate technical regulation,²⁰ based on the FAO Codex Alimentarius, Municipal regulations, and other research (Appendix 29). This was used in the project’s participatively developed training manual. Workshops in 6 municipalities with 119 vendors and producers included discussions of the draft technical regulation. 1000 copies have been printed for use by SENASAG, Municipal Authorities, and other civil society organizations for future training workshops, and have been enthusiastically received.

The promotional events for fish consumption also had significant positive impacts on municipal support of PPVII activities, which are likely to provide increased sustainability.

When PPVII team came together to evaluate the project (Appendix 17 a-c), some of the key positive factors identified were national policies that promoted fish consumption, as well as regulations and communication products that supported Best Practices for Hygiene and handling, though conflicts within the public sector seriously delayed activities and results. Access to new marketing channels helped address consumption barriers, which were better understood thanks to the comprehensive market study. Interestingly, 45% have a positive perception of the market for fish because of the increase in ponds and production, while 41% are preoccupied by the need for increased markets.

²⁰ "Sanitary requirements for handling, processing, storage, fractionation, transport and marketing of fish, their by-products, sea products and other hydrobiological products".

4.3.2.5 *Marketing initiatives*

The combination of effective market improvements with innovative promotion and marketing events and materials was fundamental in the improvement of sales of paiche and farmed pacú/tambaqui. Elements of product design, commercials (ex. La Rumba del pescado: <https://bit.ly/2I2Kod6>) and products for specific niches were important elements of ensuring that these products and events created lasting impact. Events and fairs focused on healthy fish, inclusive and intersectoral exchanges, gastronomy, marketing, and merchandizing. This included two events on paiche (Semana del Paiche in Cochabamba and a shorter event in Santa Cruz) and one on farmed pacú.

Business plans, value-added products, and labelling were developed with a female fish processor in Riberalta (Marvin) to promote her line of value-added products for sale in La Paz. While the effects on public recognition of fish and its consumption appears to have grown substantially with the project, including that of specialty products, changing consumer habits is very challenging. The project had set a very optimistic goal of 400,000 new fish consumers, which, though not demonstrably achieved within the short available time frame, shows strong tendencies based on a very substantial seed being set, consumer growth triggered, key players with improved marketing experience, a variety of fish products designed, and nutritional research initiated.

Objective 4. To continue to build and support a facilitating governance environment for accelerated development of sustainable small-scale fisheries and aquaculture sectors in Bolivia

4.4.1 *Objective overview*

PPVII recognized that to improve Bolivian food security and gender equality through fish required

- i. Providing quality information and engaging key actors
- ii. organizational strengthening of the fishers and fish farmers involved
- iii. partnerships (external and internal)
- iv. creating a positive political environment for their development.

PPVII's role in creating spaces for dialogue and relationship-building has helped us facilitate good governance in both sectors and at local and national levels during a time of significant political fluctuations and change.

4.4.2 *Results achieved and development outcomes*

Table 4. Indicators and results of Objective 4

Indicator	Base line	Target	Results to date
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Legislative instruments developed and/or created	1	3	5 (4 national, 2 regional) 1 Sustainable Fisheries and Aquaculture Law (N° 938/2017) 3 Normative instruments (Res. Adm. N° 13/2015; D.S. N° 3848/2017; Res. Adm. N° 60/2017)
Number of 1st level fishing organizations strengthened	1	8	12 aquaculture organizations; 14 fishing organizations 3 Sector innovation plans (1 fisheries, 2 aquaculture) to link to municipal budgets and planning
Number of 2nd level fishing organizations strengthened	0	2	4 2 Multi actor platforms in Entre Ríos and Puerto Villarroel; 1 CAOR; 1 FEUPECOPINAB
Level of satisfaction of W/M in associations			50% see few changes in capacities within directory, and 31 % see many improvements in capacities of directory
Legislative instruments developed and/or created	1	3	5 (4 national, 2 regional) 1 Sustainable Fisheries and Aquaculture Law (N° 938/2017) 3 Normative instruments (Res. Adm. N° 13/2015; D.S. N° 3848/2017; Res. Adm. N° 60/2017)
Gender equality within associations	0	20	21 9 fisheries associations register women fishers alongside men 40% of members of 12 aquaculture Board Directors are women

4.4.2.1 *Good governance by providing quality information and facilitating inclusion and participation*

Bolivia is in an active period of governance transformation, including defining public responsibility for fishing and aquaculture. PPVII has been supporting key issues such as the inclusion of indigenous fishers, economic opportunities for women, formalization of fishing rights, improved access to loans, improved equity in value chains and better distribution of returns, etc. To help policy-makers to make better decisions and have their support in the project's goals, the project ensured that key fishing stakeholders were present and engaged in workshops that related to their livelihoods, such as in developing the Sustainable Fisheries and Aquaculture Law (No. 938) and getting it passed. PPVII has also provided key information to help ensure good decision-making. Policy briefs were prepared on topics such as governance and management of fisheries, contributions of fishing to food security, paiche management, hygiene and handling practices, and mercury (Appendix 18a-c). Key results include:

- the legal recognition of women as fishers (the final article in the Law No938) marks a historic milestone and augments visibility of women's contribution in the fisheries value chain.
- women are increasingly official members and leaders of fishing organizations and associations. In 2017, the Association of Amazonian Indigenous Fishers of Trinidacito included 3 women as official members for the first time, while the Association of Fishers and Vendors Arbolito (created in 2016) is now made up of over 50% women (12 women, 10 men).
- In aquaculture, women now make up 40% of Board of Directors in 12 associations
- PPVII has helped promote fish consumption policies. As part of the 2017 national policy (agenda 2025 pillar N°8), the Ministry of Health included fish in the Prenatal and breastfeeding subsidy program. PPVII has prepared a policy brief which responds to questions about mercury content in paiche, offering good quality information to inform decisions.

- PPVII's close collaboration with SENASAG, municipal governments and local associations, helped create regulations, protocols, and training for appropriate fish handling. Infrastructure continues to be a barrier to implementation of best practices, and PPVII has created a policy brief to address this (Appendix 15).
- Regulating fisheries to guarantee sustainable access and development which improves fishing livelihoods has been an ongoing challenge. The new fisheries law is being implemented, but a large proportion of fisheries are operating outside of these regulations. PPVII helped bring together the Departmental Agriculture Service (SEDAG) and the FEUPECOPINAB to create a joint management plan to address and control this, starting in March 2018.
- The new law's reference to the use of non-indigenous fish, developed with inputs from PPVII, allows for differential management practices of the paiche resource, even in protected areas. Communities have been informed on the economic/environmental opportunity to make the best use of paiche for sustainable, improved livelihoods and maintaining the resource of native fish.
- The declaration of June 29 as "National Fisher's Day (men and women)", building on an event by PPVII in Riberalta, is a tribute to the contribution by this sector to food security in Bolivia.

"All of our member organizations ¹ received their legal status on May 30. Now we can say that all the Associations affiliated to our Federation are legal and now we can certainly start the process of strengthening FEUPECOPINAB". Luis Hurtado, Secretary General of FEUPECOPINAB

PPVII research to understand the dynamics of livelihoods in rural indigenous communities is important to formulating appropriate development policies. Fishing for subsistence in these communities is important to nutrition and food security, as well as providing supplementary income. Paiche and other fish can serve as a "bank in the water" (Béné et al., 2009) for use during times of seasonal or health-related shocks or stressors (see also Béné, Hersoug, & Allison, 2010), so are not necessarily a underutilized resource despite appearances. An on-going PhD will help enrich this knowledge, while related policy recommendations are on-going by the PPVII team.

"We have also approved our Institutional Strategic Plan 2017-2022 and our Economic Sustainability Plan 2017-2018. With these documents we will initiate management and institutional strengthening actions at the municipal, departmental and national levels. With our legal status, we will continue to promote the development of the commercial fishing sector throughout the North Amazon of Bolivia. It is time for the public and private authorities to renew and value the contribution of the fisheries and commercial sector to the food security of the Bolivian people. Our demands must be considered." Selin Trujillo, Executive President of FEUPECOPINAB:

4.4.2.2 *Organizational strengthening in fisheries*

The PPVII has pursued three main avenues for organizational strengthening of fishers and their organizations:



- a. Legalization of fisheries organizations (one fishing federation and 14 local fishing organizations were helped by the PPVII to obtain legal status), in part to become eligible for governmental funding, but also to legally participate in the fisheries and their management (see text box). Within these associations, women are included in the members list. Increasing awareness about gender inequalities and supporting women's ability to actively participate at the table has been a priority.
- b. Strategic planning (Appendix 19), one-year financial sustainability strategy, project development and Economic Viability Analysis (EVE) training of the FEUPECOPINAB²¹.
- c. Strengthened management and governance strategies for fisheries organizations. FEUPECOPINAB recently proposed to the departmental authorities an update of the departmental fisheries regulations under the new Sustainable Fisheries and Aquaculture Law and the collaborative monitoring of fishing as a planning tool for the sustainable exploitation of the fishery resources, leading to the agreements described in (d).
- d. Improved cohesion and sustainability of fisheries organizations, improving control over resources.

To address the sustainability of FEUPECOPINAB, the PPVII carried out an eight-month capacity building and outreach process culminated in the first ever "Ampliado" conference of its members in February 2018, with 30-60 participants, focused on a framework of collaborative fisheries regulation. National, regional, and local authorities were present. Two formal resolutions were created (Appendix 20 a-b), including action plans and the creation of an Inter-Institutional Northern Amazon Committee for Control for Fisheries and Commercialization (CONACO), coordinated by SEDAG. This could evolve into a co-management platform for fisheries, dealing with more complex themes identified in the Sectoral Innovation Plan for fisheries (Appendix 21).

"As part of the FEUPECOPINAB Board of Directors we have visited the departmental authorities in Trinidad. We have explained our needs as a sector and we want to continue strategic alliances with SEDAG to strengthen the control of fishing activity". Víctor Hugo Iriarte, President of the Association ASOCOPROPERI.

4.4.2.3 Organizational strengthening and Partnerships in the aquaculture sector

Though organizational strengthening processes take time, it was possible to create noticeable results in building local organizations and leaders in both public and private sectors, in particular through the fostering of partnerships in multi-actor platforms ("plataformas"). Fourteen aquaculture associations were part of a PPVII organizational strengthening process which included legalization, Economic Viability training and gender sensitization, as described above.

In parallel, plataformas were created in Puerto Villarroel and Entre Rios, including representatives from producer and social organizations, private entrepreneurs (fry producers), and Government and Municipal

²¹ Federation of Fishers, Vendors, Fish Farmers, of the Northern Amazon



Councils. In the Bolivian context, these multi-stakeholder groups are important mechanisms for public policy influence, improving lobbies, and coordination within productive sectors.

Operational regulations were developed participatively for each of the platforms, Boards of Directors were elected, and they were officially constituted in Puerto Villarroel (June 23rd, 2017) and Entre Ríos (June 30, 2017). Gender sensitivity aspects were included in the formation of platforms, focusing on recognizing the role of women in production, and working to improve women's participation.

The Technological Development and Innovation Plans (sector plans) for the municipal Fisheries and Aquaculture sectors were officially concluded and presented in the platforms, in coordination with the technical authorities of the two municipal governments involved. This is expected to result in resolutions, laws or municipal ordinances that allow the implementation of aquaculture and fisheries development plans through the platforms. The Annual Operational Plans (POA 2017 and later) of the two municipalities, have included such programs and projects.

However, municipal budgets have recently decreased considerably, which could delay projects with municipal funding. Skills in leveraging funds from other sources will be very important for the platforms and their ability to implement activities from their Sectoral Innovation Plans (Appendix 22).

Although coordinating with national government institutions has been a challenge due to instability and turnover, recent inroads have been made with EMAPA, the National Company for Food Production Support. At the end of the project (April 2018), EMAPA expressed interest in working with the PPVII. IMG is in the process of creating a "Technical Cooperation Agreement" to create and lead a platform in Chimoré (post PPVII funding), where the government is investing in a mega project for aquaculture production. EMAPA will also join the platforms in Entre Ríos and Ivirgarzama and work with participants to create a sustainability plan. Continuing to build and maintain the relationships and communication channels with local actors, Universities, technical municipal staff, and government entities (SENASAG, EMAPA, Ministries, etc) who were involved in PPVII will be important in maintaining sustainability (Figure 3). This sentiment was echoed by these actors during the final events in 2018, indicating the likelihood of good continuity after the current project of the PPVII.

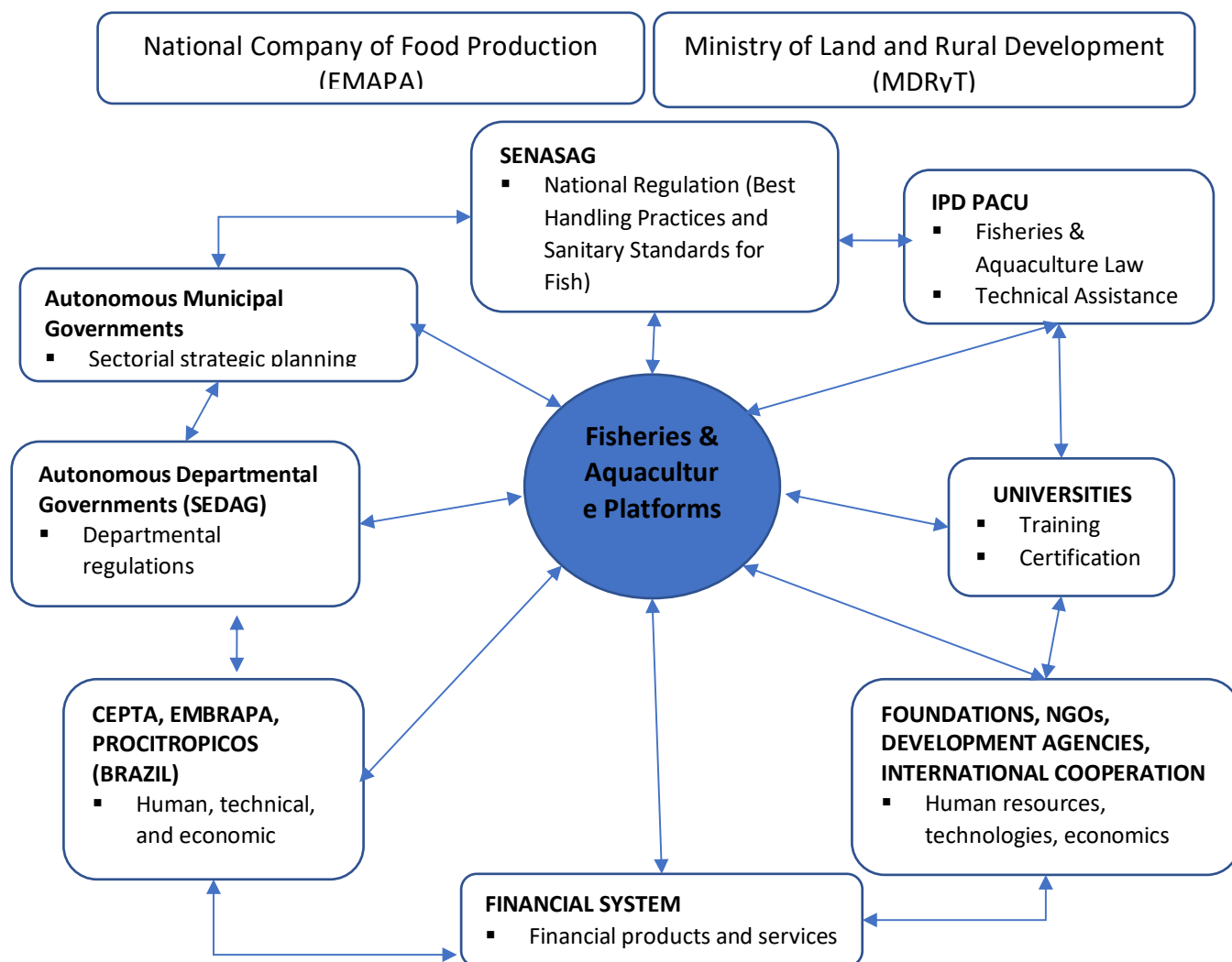


Figure 3. Extended multi-actor platform composition of the PPV
Lesson learnt from the Platform and Partnership development include:

- A difficult challenge is the participatory elaboration of strategies, tools, instruments, norms and other elements, including **both** local private actors and public regulatory entities. However, this is the right path for the development and scaling of fishing and fish farming in Bolivia
- A good relationship and communication between the different levels of authority is essential to achieve results. The situation is difficult in an environment that prioritizes vertical or asymmetric power relationships; in the platform horizontal dynamics between the actors needs to be developed
- The communal spaces (Multiactoral Platforms) for the fishing and fish farming sectors, have the great challenge of supporting economic, productive, social and environmental sustainability

- The construction of the platforms must consider the local social environment, including historical, political and social contexts. A prior identification of the genuine interests of the different participants is essential
- Identification of appropriate internal leaders and champions is essential for the success of a platform
- The participation, official recognition, and eventual financial support of the platforms by the local authorities is essential for their sustainability
- Finally, if there is no effective empowerment of all platform partners / actors and demonstration of its relevance and benefits for sectoral development, there is a great risk that other competing initiatives will duplicate efforts and burn out local actors with dispersed numerous individual interventions

4.4.2.4 *PPV internal partnerships*

Both phases of the PPVII projects were characterized by multi-lateral partnerships tailored to address the needs of scaling up fisheries and aquaculture in a holistic, integrated fashion, with research of the PPV Phase 1 informing the composition of the PPVII project. While the selection of partners clearly built on previous relationships, the partnership in many ways also faced the challenges of platform building described above. As a result, the fishing and aquaculture sectors were significantly advanced by the multi-faceted approach adopted, but future iterations of the PPVII are likely to be carried forward with different combinations of partners with more focused objectives.

4.4.2.5 *Information for policy decisions*

Good information helps make informed decisions. For this reason, PPVII supported conferences in collaboration with academic institutions: the II International Aquaculture Symposium in collaboration with UNIBOL (Dec 2016, 200 participants) and the I Bolivian Ichthyology Congress with the Mayor San Simon University, Museum, and other national universities (Nov. 2017, 250 participants).

In addition, a web-based Portal was developed that provides information on the suitability of areas for aquaculture activities (www.pecesvida.org/portal), both from a physical and social perspective. This can be used by municipalities for strategic planning. Gender-specific data is not yet available on this portal, pending inclusion of gender-disaggregation in public data collection. In general, improved access to adequate water, electrical power, and transportation routes will be required as the small-scale aquaculture sector grows. Likewise, potential environmental benefits and impacts will increase, so adequate planning to mitigate these should also be implemented. A joint Canadian-Bolivian evaluation of these impacts and their mitigation was prepared (Appendix 23) which describes environmental risks and Bolivian legislation associated with infrastructure development (impacts on water courses, responsible waste management, and destruction of sensitive and/or critical habitats) and operation (contamination of water courses, introduction of diseases or species).

By the end of the project, several policy briefs had been developed to outline elements of continuing and building supportive environments for growth of the sectors – including ones on the paiche fishery, migratory fish and multi-national migration recommendations (dorado), hygiene and handling, and managing dietary mercury levels from fish.

Objective 5. To develop and provide appropriate financial support mechanisms for scaling up small-scale family-based entrepreneurship in fisheries and aquaculture

4.5.1 Objective overview

PPVII focused on improving access to loans for fishing and aquaculture families, finding innovative financial services to address key bottlenecks – such as insufficient loan guarantees and missing production records. Building on their own experiences, as well as global trends and Canadian and Brazilian best practices, CIDRE was able to increase the:

- i. number of innovative services offered, and
- ii. number of producers and fishers who accessed credit by opening new agencies and finding ways to address current bottlenecks in credit access.

These lessons learned were consolidated into a CIDRE book (Appendix 29). It is worth mentioning that developing appropriate financial support mechanisms required CIDRE to enter a high-risk sector, including one as complicated as indigenous fisheries.

4.5.2 Results achieved and development outcomes

Table 5. Indicators and results of Objective 5

Indicator	Baseline	Target	Results to Date
Number of Fisheries/Fish Farmer families served by CIDRE IFD		100	196
Number of credit agencies in core area of project	3	5	5
Number of new, innovative financial services offered	1	n.d.	4

4.5.2.1 Innovating and researching new ways to reach clients

Based on information provided by project partners and key international exchanges in Canada (Oikocredit), with Canadian companies (VanCity) and in Brazil (Banco do Nordeste), CIDRE developed four innovative financial services.

a) Leasing

ACUAPEZ is a company which produces fish feed and includes many of the members of APNI – a model association of small-scale fish farming with strong female leadership. This pilot leasing tool helped them start up, getting around the traditional requirement for a minimum of one year of previous experience.

b) Structured credit contract



This innovation formalizes traditionally informal relationships within the value chain while also providing future opportunities for fishers and better-quality fish. A contract is made up between fishers and vendors/processors who act as a retention agent, and future income for the fisher qualifies as a guarantee. This improved “habilito” system ensures that the vendor pays a fair price for the fish (as per contract), and that fishers’ previously nonexistent fish capture registry is done by the vendor, which can then be used in the future as proof of income, thus enabling fishers to access individual loans. In addition, the quality of the fish is improved due to better hygiene and handling processes. Further work in disseminating this type of credit is important in addressing the social inequalities characteristic of traditional “habilito” systems in fisheries.

c) Comprehensive insurance

Insurance such as Tax relief insurance, Life insurance contracts (with 34.4% of credit clients), Property insurance contracts (4.3% of clients). A more comprehensive risk analysis in fish farming and fishing is needed to initiate the provision of insurance services for fishery products and fish farming.

d) Unconventional guarantees

A factor that has helped improve access to financial services, especially for rural and indigenous families who are unable to use their land as guarantee, is CIDRE’s acceptance of unconventional guarantees. For loans that CIDRE provides from governmental trust funds 91% use real estate as a guarantee, and only 5% use personal guarantee. On the other hand, for loans given from CIDRE’s own resources 9.5% are guarantee through mortgages, and 65% through personal guarantee. However, this complicates CIDRE’s ability to give favourable interest rates.

4.5.2.2 *More fisheries and fish farming families access credit*

Over the last three years, PPVII, through CIDRE IFD has disbursed 254 loans to 196 clients in fisheries and aquaculture, with a total value of \$1,420,130 USD. In addition to credits disbursed in existing agencies in Cochabamba state (Department) (Chimoré, Ivirgarzama, Entre Rios), CIDRE opened three new agencies in Yapacaní, Riberalta, and Cobija. Adding these new agencies resulted in CIDRE’s investment in fisheries and aquaculture increasing from 1.09% to 8.81% of their total portfolio (August 2017). After two years of operation, these branches have aggregately achieved financial equilibrium, with a combined portfolio of nearly 3.5 million USD. The Riberalta branch alone accounted for 66% of loans and 60% of clients in this sector, demonstrating a significant need.

Levels of default have been exceedingly low, with a maximum rate of 0.34%. Further research is required to better understand what sources of income are used to pay off the loans, considering the seasonal or temporal nature of fisheries and aquaculture. In addition, it is important to monitor fishing output, to ensure that loans do not induce unsustainable overfishing.

In terms of economic activities funded, aquaculture received 58% of the total loan value, while fisheries received 25%. However, some aquaculture clients had very large loans, some as high as \$ 330,000 USD.

Fisheries clients made up 74% of total loans and 69% of these clients used their loans in their fisheries businesses, especially operating capital for fishing.

Table 6. Distribution of loans provided during the PPVII

Economic activity	Loan value (USD)	N. of loans	N. of clients	Female clients	Female co-debtors	Complete primary	Complete secondary	N. of household members	Avg. age
Fisheries	351,197	188	135	9	128	82	51	3	34
Aquaculture	820,656	53	50	12	27	24	15	2	42
Fisheries Related Activities	177,942	1	1	0	0	0	0	1	31
Fish restaurants	70,335	12	10	5	2	7	2	2	41
Total	1,420,130	254	196	26	157	113	68	2	37

The target population for these loans were small scale fishers and fish farmers living in the Project's intervention area. Research suggests that most CIDRE clients had no previous debts when they applied for loans²². The median loan size was \$1,900 USD and the median total assets of our clients was \$6,850 USD, which is close to the 90th percentile of loan value of \$8,700 USD. The 75th percentile of total assets was \$16,600 USD and the 90th percentile of total assets was \$58,100 USD. Very few clients with such high net worth when compared to the rest, were able to obtain loans of up to \$330,000 USD.

Though higher earners ranged from \$7,669 USD to \$15,916 USD (75th and 90th percentiles), the median yearly profit of clients was just above \$4,000 USD (\$330 USD/month, very close to the poverty line)²³. CIDRE's target clients are rural young people who are near the rural poverty line in Bolivia, and likely have less than \$7,000 USD of net worth. A balance was achieved between loan value and volume among the different activities in both sectors, and part of the vulnerable population was able to access credit because of it. Of note is that rural Bolivian families dedicate a considerable amount of their production to family consumption, information that CIDRE does not gather, but an indication that local food security is enhanced by the loans beyond that indicated by income figures.

The participatory evaluation revealed that 50% of aquaculture association representatives were satisfied with credits, while 38% were neutral, and 12% unsatisfied. In fisheries, 35% were satisfied, 55% were dissatisfied and 10% neutral. Participants found interests high or fluctuating, and had issues with bureaucratic processes, but others appreciated the opportunity to access credits, especially for fishers who were able to benefit from more flexible requisites and the innovative Structured Credit Contract. These results reflect a need for a long-term process of educating around accessing financial services -

²² Net worth = Total assets – Total liabilities

²³ It is worth emphasizing that these figures represent profits from all of a client's income sources, and not only from the activity being funded by CIDRE (i.e. aquaculture or fisheries in this context). Unfortunately, CIDRE has faced constraints regarding the storage of digital client files and must aggregate income and expenses for all of a client's activities, making it impossible to identify profits from only aquaculture or fisheries



including financial literacy- and reviewing what additional barriers exist. In some cases, the existence of current loans from other institutions, or poor credit history during the timeframe of the project inhibited people's access.

4.5.2.3 *Female beneficiaries of credit*

Services for women as official holders of the loans has increased in all CIDRE branches, though the number of female loan recipients is still very low. Overall, loans were given to 26 women, with almost half of them (12) requesting a loan for river fisheries. For customers to qualify for credit, the client must be officially responsible for the economic activity within the family. This differentiation of roles between wife and husband, in general, is not explicitly recognized within the partnership, as many work together on the same productive activities though the husband is generally considered responsible. The number of credits given to women thus does not fully describe female participation in financial services, but while the number of explicit loans is growing, further work needs to continue to focus on the recognition and value of women's role in fisheries and aquaculture as they relate to access to credits.

The number of women who are "co-debtors" on the credits is an important statistic, reflecting that although the productive activity is considered to be carried out by the male in the household, the woman participates both in the decision to obtain a loan and in resource allocation decisions regarding loan repayment.

Another factor that skews statistics, is that loans for fish-related service activities in which women are more involved (for example fish selling or restaurant service) have higher interest rates than loans for production activities. In addition, these interest rates are less competitive in CIDRE compared with other financial entities. The families assisted by CIDRE thus tended to opt for loans on productive activities in which female participation as owners is lower than those of men, even if the money is used for service activities.

To facilitate the service to female clients, CIDRE ensured that two of the five agencies in the Amazon were led by women. This institutional commitment has helped create greater confidence in women as potential clients, and the policy will be expanded. In the coming years, as CIDRE turns into a chartered bank, its loans will have better interest rates, making its services competitive, and allowing them to better serve their clients with better conditions for both productive activities and services.

Objective 6. To improve understanding of how scaling up strategies in fisheries and aquaculture affect livelihoods and food security of participants, and what barriers exist for greater participation of women and those living in poverty

4.6.1 Objective overview

Reflection on why and how results are being achieved or not are in integral part of the whole project, though often it has been challenging to record these lessons from individual activities adequately, and step back to evaluate how they fit together to provide the larger picture for the whole project.

This research component of the project includes several aspects:

- i. background research on the different areas of the project,
- ii. engaging an advisory committee to review progress of the project,
- iii. graduate research to focus more closely on the underlying issues affecting the impacts of the project, and
- iv. a final review of how the scaling-up aspect of the project has worked, including a participative evaluation exit survey of participants.

4.6.2 Results achieved

Table 7. Indicators and results for Objective 6

Indicator	Baseline	Target	Results to Date
Review of scaling up process		1	1
Advisory committee report		2	1
Graduate theses		4	1
Conference presentations			
Publications		8	2?

- 1) Background research in the different areas of the project has been of variable intensity and focus, depending on the area. Overall, the research (including graduate theses, summarized in Appendix 24) has yielded numerous papers, books, reports, manuals, and brochures for distribution in Bolivia that have contributed substantially to the directions and profile of the project, as well as being integral to capacity-building, improved practices, and policy interventions. Some of these have/are being converted into conference presentations and international publications, but this is a long process that will extend well beyond the end of the project.
- 2) An advisory committee was composed in the project, but unfortunately only about at the half-way point of the project, due to difficulty encountered in agreeing to its composition and people's availability. A mid-point assessment report resulted from this committee, which was largely responded to by the project partners. However, subsequent engagement of the committee proved difficult, with complicated schedules and lack of consensus on expectations. Supplementary advisory functions were provided by Dr. Brian Davy on an on-going basis and by Mauro Ruffino on the fisheries components.



- 3) Graduate research is continuing at UVic Geography past the end of the project in the areas of fishing (A. MacNaughton), aquaculture (S. Irwin) and economics (A. Eid, Bolivia). All are expected to finish by the end of the 2018. Post doctorate research at WFT-UVIC (F. Carvajal, Bolivia) looks at paiche modelling and genetics, while undergraduate and graduate theses completed at UMSS (S. Villafán, Bolivia) helped better understand paiche feeding habits.

Alison Macnaughton is writing 4 articles describing the contributions of fishing to wellbeing in the northern Bolivian Amazon, while Sean will write an article about the role of family-based aquaculture in food security and effective pathways for scaling up local food systems in rural areas of the global South. *Ahmed Eid*, a Bolivian CIDRE staff member, is finishing his Master in Economic Geography at UVIC, looking at the impact of credits on men and women clients from family-based aquaculture and small-scale fisheries. *Sergio Villafán* demonstrated that paiche are more omnivorous than carnivorous in his undergraduate thesis and applied visual counting techniques to do a census of paiche in lagoons for his master's thesis. These results are included in the book on paiche published by the project with INIAF. Further information can be found in Appendix 25).

Several publications are being finalized for "April 2018" (Appendix 26), though many are delayed. Others publications are in lesser degrees of completion. While we hope these will continue to be developed, many of the authors no longer have financial support for this activity and will move to other projects or jobs. This will no doubt delay their completion. Eventual publication will prioritize open-source journals and books, but decisions may be dictated by availability of funds. In general, we found that three years is not enough time to do all of good development work, research, and publication, particularly if research training is part of the goal.

4.6.2.1 Review of scaling up:

The six principal investigators were asked to reflect on key events, context, people who influenced the development of aquaculture in Bolivia, since the project's inception. The aim was to pilot a simple events-based methodology for projects reflecting on scaling-up. The interviews were coded for internal and external factors (n=664 codes) - highlighting events, positive and negative factors, internal and external factors (politics, markets, financial aspects, etc.) (Appendix 27).

The results were also compared to three pathways for scaling-up discussed with IDRC's scaling-up team: Policy-based, market-based, and knowledge-based. Results from the interviews were pooled with project reflections, to describe elements of each pathway that PPVII utilized. Some of the key results are: Barriers to scaling-up, and lessons learned included:

- time was short for implementation
- vertical scaling-up is a challenge with the high frequency of political change-over
- new technologies must be innovated and adapted along the way
- information from PPV phase 1 was useful, but often more information was still required

- markets were useful in “pulling” the value chain forward
- it was necessary to use all three scaling up pathways to create systemic change. With shifting policy-makers at the national level, PPVII elected to re-direct policy influence on municipal government level in some areas, where there was greater accessibility and less political posturing. Nevertheless, it was necessary to work with municipal, departmental and national level governments to improve chances of success
- attractive knowledge-sharing “hooks” were useful (as in capacity-building in areas that were bottlenecks or of key interest, teaching about new and alluring ways to prepare fish (de-boning).
- international experts were useful in enticing participation, particularly with known engaging personalities, and legitimization of training through university certification was important
- more clarity and consensus from the beginning of the project on what scaling-up meant, how it will be implemented, and how to measure it would have helped in pursuing a clearer joint strategy

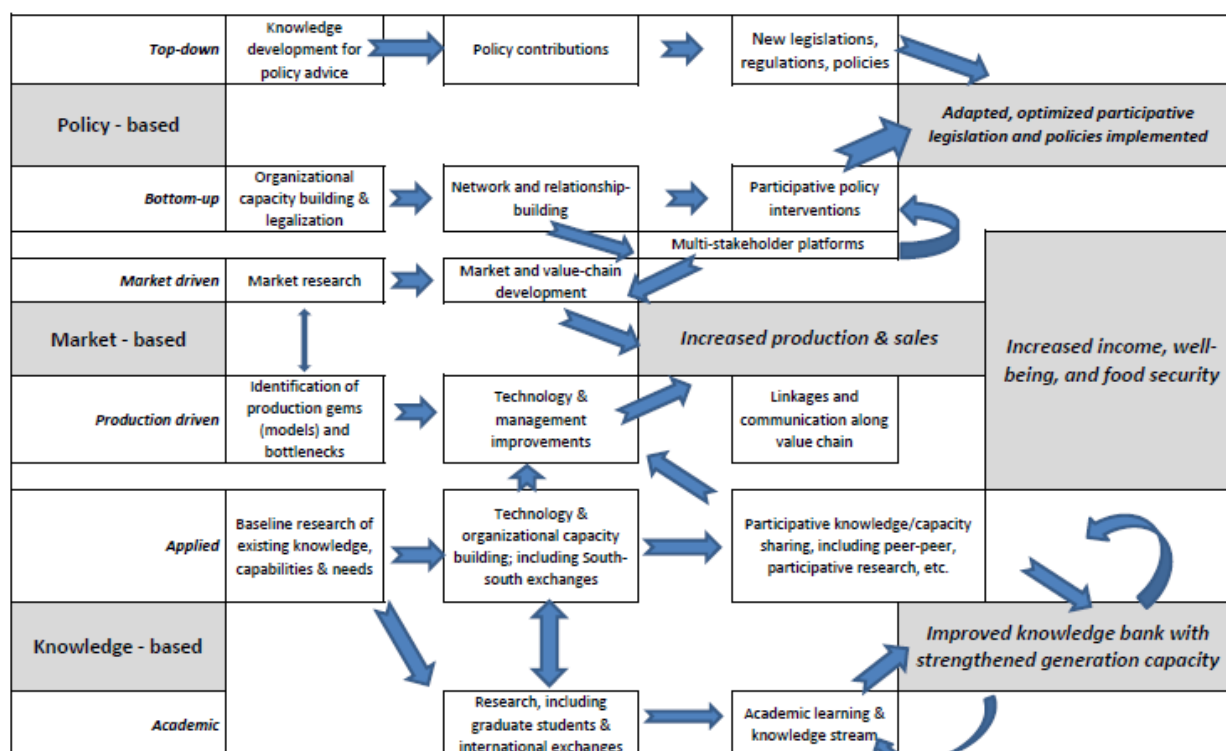


Figure 4. Scaling-up pathways used in PPVII project.

How does the project contribute to the field of study / research area?

Bolivia’s fisheries and Aquaculture sectors are now growing, and with it, the need for good information and research which can help make good decisions at a local and national level. Women and indigenous peoples play a key role in both sectors, though this is often undervalued and under recognized. PPVII has



provided quality information to decision-makers about fish biology, population, the value chain, evolving markets.

For example, research from graduate students and project researchers has demonstrated the following:

- Aquaculture is an important part of diversified livelihood strategies for rural families.
- Women's role in aquaculture is increasingly recognized and valued, as their main activity (fish feeding) is also the most expensive (70% total budget for growth cycle), demonstrating the need for capacity-building to specifically include women.
- Diversifying the fisheries value chain to include leather has also had positive impacts on income, reduced environmental impacts (reduced fish waste on riverbanks), and paiche meat quality
- Women's participation in decision-making in their organizations is increasing, especially in aquaculture.
- Fisheries development is complex, but organizational strengthening and supportive legislation is fundamental.
- 65% of people use fish quality (freshness, hygiene, smell, color, etc.) as the only factor in their decisions to purchase pacú/tambaqui or paiche. Other factors included price and quantity or size of the fish. 95% of consumers consider quality, price and quantity/size when they decide to buy fish. Improving fish quality and public perception are important in increasing consumption.
- Paiche's economic importance is growing in the northern amazon and will extend to new areas of the country as the fish expands its territory
- Improving access to markets continues to be an important factor for fish producers.
- Achieving gender equality is challenging in most societies, and Bolivia is not an exception. Focusing on organizational strengthening processes which include practical skills (which impact production and incomes), has been an opportunity to build gender sensitization. Framing gender equality within a context that includes these other elements has proven to be very effective.

How would you compare the intended and actual results of the project? Why did it happen that way?

The constant turn-over of government staff at departmental, municipal, and national levels and associated political maneuvering have been challenging, as building strong relationships and trust are key elements to effective partnerships. The project pursued both bottom-up and top-down strategies of scaling up, with diverse partners and stakeholders, thus having adequate options to move forward even in the absence of strong governmental partners. In certain cases, the project strategy had to shift focus significantly due to political impasse (eg. Politically-driven opposition severely hampered establishing an aquaculture platform in Yapacani).

More time, government investment and partnership is required to promote how fisheries regulations can benefit fishers, and fishers need to develop greater organizational strength for effective engagement in management. This process proved to be more complicated and slow than expected, though by the very end of the project the seed of a promising co-management agreement between the Fisheries federation



(FEUPECOPINAB) and the government (SEDAG) had been created, and the reach of the Federation into indigenous riverine communities had been enhanced, including discussion on better monitoring for adaptive, participative resource management and better definition of access rights. This situation will continue to evolve post-project. While the fisheries are largely male dominated, recognition of the role of women and equitable opportunities was a recognized component of discussions in the process but will continue to need championing.

Bringing six diverse partners together was a rich but challenging process that demanded human resources and key people in conflict management and team-building. Having a full-time coordinator was a key element for success, but not always sufficient. The full-time presence of a Canadian representative was also essential.

An initial stated objective of the project was to double fisheries captures. However, as we also proposed to promote sustainability of the fisheries, we needed to change the terminology to Maximum Sustainable yield, as we did not know if the resource could withstand doubling extraction rates. Considerable research was carried out by Bolivian and international researchers to better understand population and social dynamics (including several Bolivian theses, a PostDoc of FAUNAGUA staff with WFT/UVIC and a Canadian PhD out of UVic). A book on these findings was published, in collaboration with INIAF (Bolivian government research organization), and a provisional management model proposed that considers the socioeconomic returns of the paiche fishery, its potentially detrimental impact on native fish species, and a hypothesis on how the fish extend their range. Some of this research is ongoing, with the model meant to be adaptable to new findings. The paiche fishing value chain for food was unexpectedly strongly socially entrenched to modify readily and sustainably for improved equitable returns. While working with wholesalers for fish quality, product diversification, market promotion, and social responsibility proved to eventually have an impact, a new parallel value chain for fish leather was also launched as an alternative, supplementary pathway to equitable returns without increasing catch. This initiative is being led by Curupaú, a small family-owned business, also supported by Fundación Valles, FUNDESNAF, and Pro-Bolivia (part of the Ministry of Productive Development). Curupaú has trained female and male fishers and fish traders to prepare skins and has developed a semi-industrial, environmentally-friendly tanning technology. This has created more rapid improved returns to the fishers (especially indigenous peoples) and indirect benefits to the meat value chain.

For sustainability:

- public-private partnerships are key, as are trust funds (Fideicomisos) to be able to continue to provide credit and improve access to credit for those most vulnerable.
- information exchange and quality capacity-building of human resources with strong South-South collaboration is key.
- successful businesses will continue to push forward, ensure sustainability of the efforts to date.
- people adopted interventions (best practices, female leadership family-based model) when they recognized how implementing them influenced their bottom line (economic benefits).



- the market pull, and an increase of disposable income in Bolivia in general, means there are more opportunities to spend on fish. With good marketing of fish products, touting their health-benefits and ease of preparation, there is an opportunity to expand paiche and pacú-sales in Bolivian markets, hopefully replacing imported fish.

For food security:

PPVII proposed to approach food security by improving pathways for increased production and income, improving markets and market access to better quality fish using best practices for hygiene and handling, increasing diet diversity due to spending of increased income, and positioning fish as a healthy part of the Bolivian diet. *We learned that:*

- relating new income and diet diversity is not always clear nor correct; very situation-dependent
- increased knowledge about best practices and understanding their benefits (even if economic) does not guarantee implementation, because several other factors are at play (ex. inadequate infrastructure)
- increasing prices don't always mean increased income to fishers and fish farmers (or those traditionally more vulnerable)
- food security is very complicated, and not everyone from the PPII team (nor government and local partners) fully understood the concept or how project implementation would affect it
- empowering key government stakeholders, and ensuring they appropriated the co-created materials helped diffuse and communicate project results to a broader audience
- Being an aquaculture producer has a positive effect on reducing food insecurity, in both severity and frequency
 - Women usually are equal decision makers in the household when it comes to starting and expanding aquaculture, and they take on leadership roles in many aquaculture production tasks, and in some nodes of the aquaculture value chain. Aquaculture production is conducive to women's participation due to its relatively low physical labour requirements, low time commitment, and the tendency for ponds to be near the household. This allows women to lead an income generating activity at the household scale without too much disruption to their other typical responsibilities such as caring for the home and children.

For public policy influence:

- it is necessary to augment capacity in policy-makers and technical staff within government
- in the absence of strong governmental presence to address aquaculture and fisheries sectors, we must look for alternative strategies (e.g. platform, Direction of fisheries and aquaculture)
- specific communication products are necessary for different actors especially government, and need to be more adequately diffused
- be careful when basing project strategies on activities which require government participation and protagonism



- public policy influence should be done directly by local actors where possible, and based on good information which PPVII has provided and remains in their hands
- personal relationships and connections, while working at it from multiple angles are key

4.6.2.2 *Role of Canadian participation*

As the Bolivian partners are very capable, the project strove to maintain a horizontal relationship between Canadian and Bolivian partners. Canadians primarily provided collaborative research and support for Bolivian partners in all areas as needed – rather than developing more individualistic research themes as was done by the Bolivian partners.

World Fisheries Trust, the Canadian NGO partner, was the prime instigator of the project from the Canadian side, with a permanent team member in Bolivia to guide collaborative efforts, help manage the project, and lead collaborative research on gender equality, project implementation, theory of change, and scaling up. This proved essential for the effective implementation of the project, in particular for managing the interface between Canadian and Bolivian partners, team-building, and communication. WFT also provided research expertise for all areas and identified resource people (Canadian and otherwise) for specific contributions. In particular, appropriate Brazilian expertise was recruited and funded from the WFT budget for very effective south-south technical exchanges, drawing on a Brazilian network built during previous Canadian-funded projects in that country. WFT, together with UVic, also organized appropriate Canadian input on a technical exchange of Bolivians on the theme of microcredit and multi-actor roundtable processes, as well as inputs for a Bolivian post-doc.

UVic primarily hosted graduate students of the project (two Canadians and one Bolivian), as well as providing other specific expertise as needed. In this context, it helped guide significant research of the project, contributing to publications, conference presentations, and coordination of conference sessions (Appendix 24a-c).

5. Synthesis of results towards AFS themes

PPVII was able to **increase agricultural productivity (Availability)** which brought greater quantities of high quality fish to markets for Bolivian consumers, as well as for fish farming families. Indirectly, through the implementation of best practices for hygiene and handling, providing higher quality fish (and diminishing sales of poor quality fish) will help improve nutrition (**Utilization**) for consumers.

Through various events, such as fish fairs and fish weeks, PPVII was able to **improve access to resources, and/or markets and income (Accessibility)**. This not only provides additional avenues for consumers to access fish, but also helps generate new connections along the value chain. Additionally, highlighting paiche and pacú, and generating public and institutional interest in them, has brought these emerging sectors to the spotlight, thus increasing their value and recognition.



By influencing key legislation and regulations and providing quality information and science, PPVII has been able to **inform policy** which then helps support and guide developing fisheries and aquaculture sectors.

AFS theme: Informing policy

Building a legislative framework, governance systems and strategic management proposals with inputs from participative monitoring and research;

- I. Optimized participative legislation and policies implemented to support sustainable fisheries and aquaculture development.*
 - a. One new Sustainable Fisheries and Aquaculture Law (N.938)
 - b. Three Normative instruments (Res. Adm. N° 13/2015; D.S. N° 3848/2017; Res. Adm. N° 60/2017)
 - c. PPVII managed and supported the national Food Safety Authority (SENASAG) in creating adequate technical regulation,²⁴ based on the FAO Codex Alimentarius, Municipal regulations, and other research.
 - d. 14 fishing associations and 12 aquaculture associations were legalized, including organizational training that emphasized gender equality (particularly in aquaculture)
 - e. Agreement between fishing federation FEUPECOPINAB and governmental SEDAG on fisheries management and control and creation of CONACO²⁵ to implement it.
 - f. Sectoral Innovation plan for fisheries, FEUPECOPINAB Strategic Plan and Financial Plan supported by capacity-building and Economic Viability Analysis training.
 - g. The declaration of June 29 as "National Fisher's Day (men and women)" is a tribute to the contribution by this sector to food security.
 - h. Multi-stakeholder platforms created in two municipalities with Sectoral Innovation plans and expected municipal investment (aquaculture and market improvements) of 27.1 million bolivianos.
 - i. Informed policy through presenting rigorous scientific results in the II International Aquaculture Symposium in collaboration with UNIBOL (Dec 2016, 200 participants) and the I Bolivian Ichthyology Congress (Nov. 2017, 250 participant), and website and webportal (www.pecesvida.org/portal).
 - j. Book by CIDRE "Servicios Financieros para la Pesca y Piscicultura en la Amazonía Boliviana" to influence financial policy in Bolivia.

AFS theme: Increased agricultural productivity

Utilizing knowledge exchange and science to improve efficiency in fish productivity and management

- II. Improved efficiency in aquaculture production and fisheries management/production*

²⁴ "Sanitary requirements for handling, processing, storage, fractionation, transport and marketing of fish, their by-products, sea products and other hydrobiological products".

²⁵ Northern Amazon Committee for Control for Fisheries and Commercialization



- a. Aquaculture productivity increased by a factor of 6 (811 t/year to 4805 t/year), in the core region of 5 municipalities, while farmers in the adjacent region that received more limited project support still increased their number of ponds per producer from 3.4 to 4.6.
 - 75% satisfied or very satisfied with production and 84% satisfied or very satisfied with aquaculture as part of livelihood strategy.
- b. Fisheries (Paiche) production more than doubled after the start of the first Amazon fish for Food project (from 305 t/year to 724 t/year)
 - The new law's reference to the use of non-indigenous fish, developed with inputs from PPVII, allows for differential management practices of the paiche resource, even in protected areas.
- c. Strong South-South collaboration (thanks to Canadian relationship-building) with high-quality researchers (13 men, 4 women) from Brazil, Argentina, and Chile resulting in improved efficiency and pond management, diversified fish processing practices, and networks for future research and development.

III. Improved access to technology/capacities to control productive resources for women

- a. Women have been identified as legitimate owners of productive enterprises in 341 out of 1030 total aquaculture producers in the core region.
 - Participation of women as producers and leaders of their fish farm is much higher in the Core project region where our "model" has its roots (Yapacaní 48% women, San Carlos 60% women), but is increasing and approaching 30% in others (Chimoré, Shinahota, Puerto Villarroel and Entre Rios).
- b. Women as important leaders in aquaculture and fisheries value chains
 - 11 Demonstration fish farms and field schools performing peer-to-peer knowledge exchange with 972 producers (44.3% women).
 - 77 trained "Auxiliary Technicians" from 14 different municipalities of Bolivia, of which 45% were women and girls.

AFS theme: Increased access to resources, and/or markets and income

Market-driven upgrading of the fish value chain embracing gender equality, environmental, and fish quality considerations, resulting in economic, social, health and food security benefits.

IV. Increased access to resources, markets and income

- a. *Increased income for fishers and fish farmers from fish value chains*
 - Increased income from \$7,705 USD/year to 19,079 USD/year for aquaculture families.
 - Increased income for indigenous fishers (23% from skin and 47.5% from meat), commercial fishers (36%), fish processors (27%) and retailers (28%) due to the diversification of the value chain to include paiche leather.
- b. *Increased consumption of high quality fish in Bolivia*



- Increased fish meat demand by 32% in La Paz, Cochabamba and Santa Cruz through gastronomic events and other marketing strategies (see objective 3)
 - Increased fish meat demand in Riberalta by 17% through value-added product development and fish fairs
 - Growth of 20.8% in paiche consumption and 37.9% in pacú/tambaqui consumption nationally from 2015 to 2017. In the project intervention area, paiche and pacú consumers are increasing by 9,000 new people /year. Interestingly, fish farming families showed a significant increase in fish consumption as well, by 12 kg/family/year in an area with traditionally conservative dietary habits that did not include farmed fish.
 - PPVII has helped promote fish consumption policies. As part of the 2017 national policy (agenda 2025 pillar N°8), the Ministry of Health included fish in the Prenatal and breastfeeding subsidy program. PPVII has prepared a policy brief which responds to questions about mercury content in paiche, offering good quality information to inform decisions.
- c. Improved access and use of microcredit:
- Four innovative loan financial services offered through five credit agencies, resulting in 254 loans disbursed to 196 clients (26 women) in fisheries and aquaculture, with a total value of \$1,420,130 USD.
 - Four innovative financial services are: Leasing (based on strong Canadian leadership and learning opportunities), structured credit contract, comprehensive insurance, and unconventional guarantees.
 - Includes support to an entrepreneurial fish feed mill, constructed by the largely female-led aquaculture association APNI and partners.
- d. Improved hygiene and handling practices in fish stalls and markets
- 5 markets with vendors complying with fish quality and food safety standards
 - 63 points of sale selling fish with good hygiene and handling practices
 - 146 fish vendors and municipal staff trained in better hygiene and handling practices (101 women) and 70% satisfaction with training.

*Women's access to and control over income

"Aquaculture has allowed me to have income... the success of this activity has meant that my husband no longer needs to go work far from home, now we work together. I've been able to invest in better education for my children, and I've also changed. Before, I was very shy, and now my husband says, "you've really lived up". I have money to give myself small pleasures. Because of the growth of my activity, I now see it's important to learn more. I want to prepare myself technically and manage my business better. My life has changed in a way I never imagined thanks to this activity" (Ana Aguilera, APNI/Yapacaní)

*Women's Participation in Decision-making



- e. Women's participation on the board of 14 aquaculture associations in the Core Project Area increased by 28%, from 19% to 40%. Building women's capacity to take on the role in their productive organizations has helped them have a voice at the table.
- f. The legal recognition of women as fishers (the final article in the Law No938) marks a historic milestone and augments visibility of women's contribution in the fisheries value chain.
- g. Women are increasingly official members and leaders of fishing organizations and associations. Ex. the Association of Fishers and Vendors Arbolito (created in 2016) is now made up of over 50% women (12 women, 10 men).

6. Project Communication Outputs

The PPV projects have had a variety of outputs for communicating with different Bolivian and international audiences (Appendix 26), some of them still being completed. Within Bolivia, these have helped support a variety of training, engaged stakeholders, built consumer interest, enhanced lobbying for policies, and informed the Bolivian academic and public. Internationally, they have targeted academic audiences interested in how Bolivian examples contribute to our global knowledge and international development, as well as the Canadian public.

Of particular interest are:

1. a set of integrated outputs that we hope will provide sustainable support of the project's fisheries activities and goals, as well as being recognized internationally. These include a large, multi-authored book (in Spanish) with research chapters on paiche biology and fisheries and an accompanying photo-rich booklet in accessible language for the fishing communities and indigenous government, summarizing the research results to support appropriate development. A second summary booklet for policy-makers and researchers and a policy brief complete the integrated set of outputs. International publication of several chapters, and conference presentations, have and will provide inputs to the global academic community.
2. a series of accessible manuals and outreach materials, in print and on-line, for best practices in aquaculture and fish handling;
3. photobooks and short videos of the project achievements for both the Canadian and Bolivian development communities and the general public. These are being well received and should help the Canadian public appreciate their investment in the project through IDRC and Global Affairs. In this context, we are also working on a pair of publications for the Canadian popular press.
4. A pair of publications in IDRC-sponsored books on gender roles in fisheries and aquaculture;

5. Publications in international journals and books for the global academic community is an aspiration of the project team but takes time as the documents get perfected, some of the research is refined, and the long process of journal acceptance is pursued. Much of the project team has been learning new research approaches through the project, and often field and development conditions are not compatible with perfect research requirements, so a search for suitable publication venues (or additional trips to the field) has also been a challenge. Finally, the cost of publishing will be an upcoming issue, as project funds will no longer be available and few of the partners have their own funds to cover this.

A variety of research on the project is still on-going, including graduate research, which will provide greater insights on the Bolivian fisheries, aquaculture, and fish. So far, all publications and communications outputs have been open source, freely available on the internet (or available shortly). Publications on gender have appeared in IDRC-supported books. Upcoming publications will also strive to be open source, subject to availability of funds.

7. Problems, challenges, and Project responses

- The constant turn-over of government staff at departmental, municipal, and national levels and associated political maneuvering have been challenging. Building strong relationships and trust are key elements to effective partnerships. The project pursued both bottom-up and top-down strategies of scaling up, with diverse partners and stakeholders, thus having adequate options to move forward even in the absence of strong governmental partners. A focus on good research, impactful events, and a political bottom-up lobbying with community partners also helped to build collaborative links with key champions in more stable institutions, as well as making us appealing to transient staff.
- Participatory work takes time, with time for building trust, multiple priorities and limitations of government actors, differential community time, and restrictive availability of international participants. Manifestations and service blockades generally also interfered with any scheduled events. The project managed this with a multi-faceted action plan that allowed for progress in other areas if something stalled, as well as flexible timing of events.
- A context which prioritizes vertical and asymmetrical relationships (“top-down”) challenges PPV’s preference for horizontal and Bottom-up approaches.
- Ensuring economic, social, environmental and productive sustainability of actions and processes is a challenge in any development project. In the case of the PPV projects, we have built on prior progress in these aspects by project partners, moving the sectors along on trajectories of integrated growth, and improving the capacity of the partners to assist in this. Part of the focus of the project was to improve capacity for self-directed development in the sectors, and there is every indication that at least some of this will happen. As the Bolivian partners involved are also very capable, the expectation is that this development process will continue after the end of the project, either individually or in a variety of partnerships.

- In a participatory evaluation session with representatives from both sectors, market aspects showed up differently (Appendix 17b, 17c). In aquaculture, >50% were satisfied with their access to markets and mentioned that to improve a related aspect could be better access to transportation (freezer trucks) to get to market. When they dreamt of their future, they mentioned additional credits, knowledge, fish consumers, and markets would be needed to get there, along with capacities to work in more than one role within the value chain (Example, production and distribution and/or sales). In fisheries, participants recommended additional capacity-building in processing, and in negotiating in additional commercial meetings, especially for people straddling the producer/vendor line. They described less satisfaction with their Access to markets, principally due to problems with fish pricing and relationships between fishers and vendors. This information will be important for both strategic planning by the sector themselves and future development proposals.

8. Overall assessment and recommendations

- Bringing six diverse partners together was a rich but challenging process that demanded human resources and key people in conflict management and team-building. Having a full-time coordinator was a key element for success, but not always sufficient. A full-time presence of a Canadian representative was also essential. Transparent, good communication in support of overall management of the project was an underestimated challenge and was probably not really achieved until the end of the project.
- Achieving gender equality is challenging in most societies, and Bolivia is not an exception. Fourteen aquaculture associations were part of a PPVII organizational strengthening process which included legalization, Economic Viability training and gender sensitization. In the case of credit, where restrictive rules and cultural norms results in male-dominated loan statistics, even if women are significantly involved – a process that is gradually being addressed with special loan considerations and female branch leaders and loan officers. Framing gender equality within a context which includes these practical elements has proven to be very effective. Continuing and extending this work to other regions is recommended, as shifts are evident in terms of recognition and valuing of female leadership in aquaculture and productive family units.
- Applying business plans or market strategies is effective when focused on specific solutions to bottlenecks for scaling-up
- Innovation in publicity and promotion of new products and services in the markets should consider product design, infomercials (info about nutrition, consumption health), and niche markets (ex. Future recipe books for specific markets).
- Events benefited from attractive prizes and contests; fish fairs fit well into the Bolivian context and promote greater consumption; inclusive business roundtables between groups from the value chain helped create new links; focus on gastronomy is an excellent entry point into new segments of society and can include classes and contests; academic conferences helped spread the good research by PPV to students, producers and international researchers.



- Strategies for improved production and commercialization should be done in partnership with municipal and departmental governments
- Participatory development of tools, instruments, norms for fish handling and hygiene must include public actors who will implement them and private actors who will be influenced by them.
- Personal relationships and networks at all levels need to be pursued to find allies and champions
- Without effective empowerment of actors involved, and an understanding of how platforms can be beneficial and address their specific priorities and legitimate demands, there are major risks of duplicated efforts, fatigued participants, and ineffective platforms.
- Identifying leaders is key, as is understanding the social, environmental and political, context
- Getting local authorities involved as much as possible in the construction of platforms and other work is important to help them plan development initiatives.

Sustainability and Post-project challenges

- The market-based initiatives and improvements instigated by the PPVII project have largely been adopted by the beneficiaries and will be carried forward on their own without project support.
- The increased governmental focus on fish, as exemplified by the new Fisheries and Aquaculture Law, is also creating associated incentives to increase fish production. Based on an existing successful initiative where the FEUECOPINAB and its members sell 200-300 kg/week of paiche to a private company (supermarket Ketel) in La Paz, there are plans for a governmental public company in the northern Amazon to buy 500 kilos of fish per month, at a fair price, for further distribution to supermarkets in La Paz. There is also the suggestion of promoting fish in a new program for food security of pregnant women, giving them access to fish meat monthly.
- The paiche fishery is likely to continue to grow, with its continuing geographical expansion into indigenous and protected areas, as legal and cultural acceptance and facilities grow and the range of the fish extends into more rivers. The project's work on legal frameworks, research and management protocols will help guide this, and, in the case of the Manuripi reserve (for example) has helped secure financing from IUCN to implement management support.
- Further government investment is required to promote how fisheries regulations can benefit fishing organizations in terms of better monitoring for adaptive, participative management and control. These regulations must continue to include gender considerations which adequately address the needs of fishers (especially women whose work is often undervalued and overlooked).
- The Project has built capacity in fishing organizations to respond sustainably to these new opportunities, most recently through support for the construction of a regulative co-management and control agreement between FEUECOPINAB and SEDAG, the national fisheries regulator (set to begin in March 2018). On-going monitoring of the fisheries will be essential for the equitable adaptive management and development of the resource and is part of this new agreement. However, while tools and capacity have started to be developed for this during both PPV projects, ongoing support will be needed and a challenge.
- The capacity for regular and reliable fish production by indigenous communities is still rudimentary, compared to urban-based "commercial" fishers. Work is still needed to build business management



capacity, as well as collaborative planning to bridge the inherent unpredictability and limitations of small scale sustainable fisheries with the market demand for reliable supply.

- Many of the Amazonian fish, particularly those which are carnivorous, contain mercury from natural sources and gold-mining activities. The PPVII has carried out research on this topic and is developing guidelines and publications for use by decision makers. Preliminary findings indicate that paiche, despite being considered a carnivorous fish, generally has levels below limits of concern to consumption. Paiche fisheries are currently also favoring smaller individuals, which have whiter meat and are likely to have lower mercury. Nevertheless, improved information and guidelines are needed that protect the public but also consider the potential impact on fishing livelihoods.
- There is both national and international demand for paiche products – meat, leather, and scales. However, the species is listed in the Convention on International Trade of Endangered Species (CITES)²⁶, due to its near extinction in parts of its native range, which affects international trade of Bolivian paiche, even though it is abundant in Bolivia as an invasive species. A new Bolivian regulation, informed by the research of the PPV, was a first step towards legalizing this trade and improving market opportunities (particularly for leather and scales, focused on by the PPVII).
- The manuals and 5 posters highlighting the most important best practices for fish handling (Appendix 14 a-f) were given to municipal governments to use in their future training within markets. These are already scheduled for 3-4 times a year, and very likely to go ahead on their own and help guarantee the high quality of marketed fish. This will no doubt also drive needed infrastructure improvements.
- Improving gender equality has been a cross-cutting theme of the project, but generally integrated with other activities, such as Economic viability training, gastronomic fairs, technical aquaculture training, and organizational capacity building. Aquaculture associations that were part of the PPVII have responded well, with a significant level of female leadership in decision making roles. Continuing and extending this approach to gender equality to other regions is recommended, as shifts are evident in terms of recognition and valuing of female leadership in aquaculture and productive family units. While some of this is likely to occur spontaneously, continuing institutional support and funding for its facilitation will no doubt be needed.

²⁶ World Conservation Monitoring Centre. 1996. *Arapaima gigas*. The IUCN Red List of Threatened Species 1996: e.T1991A9110195. <http://dx.doi.org/10.2305/IUCN.UK.1996.RLTS.T1991A9110195.en>. Downloaded on 05 March 2018.)