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TRANS-PACIFIC FISHERIES CONSULTATIVE COMMITTEE

TECHNOLOGY TRANSFER BETWEEN PACIFIC LATIN AMERICAN COUNTRIES

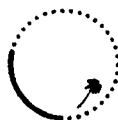
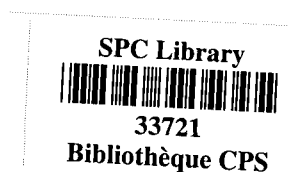
AND PACIFIC ISLAND NATIONS

IN

POST-HARVEST FISHERIES TECHNOLOGY

STUDY TOUR REPORT

April 1991



**South Pacific Commission
Noumea, New Caledonia**

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LIST OF ACRONYMS

CIDA	Canadian International Development Agency
CPPS	Comision Permanente del Pacifico Sur (Permanent South Pacific Commission)
IFOP	Instituto de Fomento Pesquero (Institute of Fisheries Development, Chile)
INP	Instituto Nacional de Pesca (National Fisheries Institute)
ITP	Instituto Tecnologico Pesquero del Perú (Institute of Fisheries Technology, Peru)
PECC	Pacific Economic Cooperation Conference
RTMF	Regional Technical Meeting on Fisheries
SPC	South Pacific Commission
TPFCC	Trans-Pacific Fisheries Consultative Committee

1. INTRODUCTION

A team from the Pacific Island region undertook a study tour to four Pacific Latin American countries to learn about and evaluate the expertise and the facilities available in post-harvest fisheries technology. The study tour took place between 2 and 20 April 1991. Countries visited were Mexico, Ecuador, Peru and Chile.

The aim of the tour is to foster co-operative activities in post-harvest fisheries technology between two neighbouring regions, that is, the Pacific Islands and Pacific Latin America. This study tour is the first activity under the Trans-Pacific Fisheries Consultative Committee (TPFCC), which was created at a meeting held in Port Moresby, Papua New Guinea, 4–5 July 1990, between representatives of countries from Pacific Latin America and Pacific Island Nations. The Secretariat of TPFCC is based at the headquarters of the Permanent South Pacific Commission (CPPS), Santiago, Chile.

The general objectives of the study tour were:

- (a) To identify areas of post-harvest fisheries technology expertise in Pacific Latin America which can be of benefit to Pacific Island countries and to utilise this expertise for short specialised technical courses;
- (b) To explore co-operative inputs into applied research and development projects of mutual benefit;
- (c) To identify technical literature in post-harvest fisheries technology from Latin America of potential value to the Pacific Islands, and to establish the need to translate these from Spanish to English.

The study tour participants from the Pacific Island region were:

- Mr Steve Roberts (study tour leader), Post-harvest Fisheries Adviser, South Pacific Commission, New Caledonia;
- Mr Maciu Lagibalavu, Acting Principal Fisheries Officer, Fisheries Division, Fiji;
- Mr Satalaka Petaia, Fisheries Extension and Development Officer, Fisheries Division, Tuvalu;
- Mr N. Rajeswaran, Senior Resources Development Officer, Department of Fisheries and Marine Resources, Papua New Guinea.

The tour was joined by Dr Gordon Munro, Coordinator PECC Task Force on Fisheries Development and Cooperation, and Mrs. Lola Dulanto de Soldi from Peru, who acted as interpreter. Full details of tour participants appear in Appendix 1.

The study tour was funded by the Canadian International Development Agency (CIDA).

2. BACKGROUND

At the Pacific Latin America Countries–Pacific Island Nations International Fisheries Conference held in Lima, Peru, from 26 September to 1 October 1988, one of the proposals adopted concerned technology transfer between countries of the two regions, with post-harvest fisheries identified as a potentially major area for future co-operation and technology exchange. It was recognised that a number of institutes in Pacific Latin America were more advanced in fish processing technology and that the transfer of this technology to Pacific Island countries could significantly enhance their efforts to develop and expand their fish processing capacities.

The Conference subsequently approved a proposal for SPC's Fish Handling and Processing Officer (now called Post-harvest Fisheries Adviser) to visit fish technology institutes in selected Latin American countries to identify and formulate co-operative programmes between the two regions.

This initiative was further discussed at SPC's Twenty-first Regional Technical Meeting on Fisheries (RTMF), 7–11 August 1989, in Noumea, New Caledonia. This meeting endorsed the idea of the study tour and further recommended that SPC identify suitably qualified Pacific Islanders to join the study team to experience and learn about the activities of these research institutions.

At the end of 1990, CIDA agreed to fund the study tour, to be undertaken by three qualified Pacific Islanders as well as SPC's Post-harvest Fisheries Adviser. Through the efforts of the TPFCC Director and the PECC Task Force Coordinator (Fisheries Development and Cooperation), detailed arrangements were made for the study team to visit Mexico, Ecuador, Peru and Chile in April 1991. The tour itinerary appears in Appendix 2, a list of people met in Appendix 3, useful addresses in Appendix 4 and literature received in each country in Appendix 5.

3. RESULTS AND CONCLUSIONS OF THE VISIT

3.1 Mexico (2–6 April)

3.1.1 Background

Mexico has a large and varied fishery based on its position between the Pacific and the Gulf of Mexico and the Caribbean. Mexican waters are tropical, with more than 200 species identified that are exploited commercially. The most abundant area for fishing is the North-East Mexican Pacific Zone. Resources elsewhere are not as plentiful. Total marine catches for 1989 were estimated at 1.24 million mt. The major species are Californian pilchards, Californian anchoveta, yellowfin tuna and shrimp. Seafood exports from Mexico in 1989 were valued at US\$485.7 million.

3.1.2 Description of visit

The study team was in Mexico from 2 to 6 April 1991. It visited the Ministry of Fisheries headquarters in Mexico City, and Mazatlán on the Pacific coast. Mazatlán is an important fishing port situated at the extreme south-east corner of the Gulf of California.

The Instituto Nacional de Pesca (INP) is the main body carrying out fisheries research, management and training in Mexico. The major areas of the Institute's activities are resources and environment, aquaculture, catch technology, coastal fishery management, food technology and public health aspects of fishery products.

There are five pilot plants for research on food technology, located in the regional centres of Ensenada, La Paz, Salina Cruz, Tampico and Ciudad del Carmen. The first three are on the Pacific coast and the others are on the Gulf of Mexico/Caribbean coast. A number of these pilot plants could have been of interest to the study team. However, none appeared on the itinerary.

It was only possible to meet briefly with officers responsible for research in post-harvest fisheries technology from INP during a short session at the Ministry of Fisheries on the first day in Mexico. The Food Section is working with FAO/UNDP on an integrated development programme for the utilisation of different species. Processing procedures evaluated include modernised canning procedures, freezing and smoking. The section is also working on the depuration of shellfish. Finally the section is in the last stages of implementing a national fish inspection and quality control programme.

The most useful visits in Mazatlán were to fish/shrimp processing plants. These included:

- Riomar (products: surimi, smoked sailfish and crumbed fish cakes);
- Productos Tropicales Industrializados del Pacífico (product: smoked tuna);
- Catarino/Celso (artisanal fish smokers) (product: smoked tuna);
- Guzón, S.A. de C.V. (products: canned smoked tuna (with vegetables), canned prawns, and canned clams);
- Atunes y Derivados, S.A. de C.V. (products: canned sardines and tuna, fishmeal);
- Los Quince (product: frozen headless prawns).

3.1.3 Results and conclusions

The study team was able to learn about and discuss a few projects being carried out by the National Fisheries Institute. One interesting area of research described concerned a procedure for processing tuna as an alternative to canning. It involves cooking, packaging (in plastic) and freezing. The technology is at a developmental stage. Because of the potential commercial application for the product, the Mexicans considered it premature to release the technical details. However, they expressed interest in transferring the technology once it is established.

Another processing technique of interest to the study team was the artisanal method of tuna processing seen in Mazatlán. This is a hot smoked procedure for yellowfin tuna loins involving treatment in a solution of common salt, sodium nitrate and sodium nitrite, and then smoking in a kiln over a hot fire (see Appendix 6 for details). The nitrite imparts an attractive reddish colour to the flesh of the tuna and probably helps to extend shelf-life. However, the product is not fully preserved and therefore still needs to be refrigerated or consumed within a day of smoking. It has a good flavour and could form the basis for a preserved or semi-preserved tuna ham. This could have applications in a number of Pacific Island countries after some product development work.

3.2 Ecuador (6–10 April)

3.2.1 Background

The oceanic resources of Ecuador are worth about US\$500 million to the country in exports. By far the most important resource is wild and farmed prawns. There is a large and very active tuna fleet, while sardines form the basis of a valuable canning industry.

The Instituto Nacional de Pesca (INP – the National Fisheries Institute) holds the key to the success of the export trade in seafood. All export consignments have to be analysed and an export certificate issued before the products are allowed to leave the country. In this respect the fisheries inspection and quality control responsibilities of INP are very well-developed. INP is also responsible for carrying out research on behalf of the fishing industry. It has its own well-equipped research vessel which frequently goes on research assignments lasting up to 25 days. Research in areas of post-harvest fisheries technology is also significant. INP is therefore a multi-disciplinary organisation with a staff complement of 150, 70 per cent of whom are qualified scientists.

At the time of the visit, a cholera outbreak in the country was causing great concern, in particular because of the economic threat to the valuable prawn exporting industry. The United States is the most important market and the Director of INP was having full discussions with the US Food and Drug Administration.

3.2.2 *Description of visit*

The study team met the Director and Assistant Director of INP and was shown around the Institute. The two areas of post-harvest fisheries technology of interest to the group were the analytical laboratories, where the quality assurance procedures and basic research are carried out, and the fish processing pilot plant.

The analytical section has two groups. One sub-section works every day on samples of seafood being exported and visits exporters and packers frequently to take samples to determine the quality of the processing procedures. This section issues appropriate certification and has the authority to stop shipments and hold up processing if the quality standards are not met. Standards for prawns are particularly strict.

The second analytical sub-section carries out some of the more specialised tests, e.g. histamine, mercury and metabisulphide. It is also responsible for carrying out basic research projects. These include histamine problems in various species of fish (mahi-mahi, tuna, mackerel and sardines), improved methods of testing for histamine, seasonal variations in the chemical composition of pelagic fish species, analysis of shrimp feed for nutritional value, etc. It also carries out analytical tests on request from the industry and works in collaboration with other institutes in Ecuador on such topics as the problems facing the artisanal sector in producing quality seafood raw materials.

The research work on product development from marine resources is carried out in the pilot processing plant. This pilot plant has been operational for about 10 years. The study tour group was provided with samples of processed fish; these were mostly different types of smoked fish. During the two days at INP a number of demonstrations and slide shows were given by the technical staff. They included:

- demonstration of salting fish in preparation for smoking or sun-drying;
- demonstrations of hot smoking of fish;
- demonstration of making tuna burgers and fish sausages;
- slide presentation on an artificial solar drier operating commercially in the North of Ecuador and the Galapagos Islands;
- slide presentation on the utilisation of waste shrimp heads;
- slide presentation on the manufacture of high protein biscuits for nutrition programmes.

Three commercial seafood processing companies were visited. All processed prawns, while two handled frozen fish (see Appendix 2).

3.2.3 *Results and conclusions*

The study team felt that the following areas of technical expertise available in Ecuador at INP would be of value to the Pacific Island region:

- *Quality assurance and inspection service.* Seafood exports provide a very important contribution to the country's economy. To protect its markets, Ecuador has developed an inspection service that ensures that all seafood processing plants meet international standards of hygiene practice. Each export consignment is analysed before an export certificate is issued to ensure that products meet the standards of the importing country. INP is the national body responsible for these activities.

Few Pacific Island countries have a fish inspection and quality assurance service for export products. An opportunity is potentially available in Ecuador for those countries wishing to improve their service or develop skills in this field to have their staff trained. Ecuador could offer training in all the appropriate technical, laboratory and analytical procedures as well as proven inspection

protocols (plant inspection, sampling, certification procedures, etc.). Trainees would also be able to see an industrial sector working hard to meet standards. This would give them a chance to experience the producer's view of quality assurance.

- *Artificial drying technology with solar driers.* INP has developed and worked with solar driers for a number of years. Although it was not possible to see a drier in operation during the visit, the study tour participants were encouraged to hear that such driers were being used commercially with fish in Northern Ecuador. The advantage of solar driers is that they are simple to operate, products dry quickly, and are protected from inclement weather and contamination from dust, birds and animals.

In the Pacific Island region, solar driers that have been developed have generally been unsuitable for commercial operation because they are too small. The drier used in Ecuador has a drying capacity of 500 kg per day for a 14 m long structure. Potential application is on outer islands developing export of quality dried fish, e.g. marinated dried tuna produced in Tokelau, and the outer island dried fish project in Tuvalu. Technical assistance could be provided by a specialist from Ecuador to Pacific Island countries interested in this technology.

- *Hot and cold fish smoking.* INP has developed expertise in smoking fish with mechanical smoking kilns and simple artisanal models. An impressive range of hot smoked products was tasted by the study team. All were suitable for delicatessen or hotel markets. None of them were preserved, and refrigeration would be essential for good storage.
- *Low-cost/simple technology products from minced fish.* Over the years INP has perfected formulations for making minced fish products such as fish burgers, fish sausage, tuna ham, etc. The technical staff provided the details of the methods of making some of the products. A few of these are described in Appendix 7.

On behalf of the Government of Ecuador, the Director of the National Fisheries Institute made formal offer to the study team of the following:

- An invitation for two Pacific Islanders to spend time at INP being trained in fish processing technology, quality control, chemical analysis, microbiology, etc.;
- Assistance from the Institute's technical staff for training, technical or advisory purposes in the Pacific Island region.

Both items were offered on the basis of staff time only; funding would need to be identified to cover travel and living expenses.

Support was also expressed of the idea of inviting representation from the Pacific Islands at regional meetings or workshops in Latin America on post-harvest fisheries technology. In the past these have been organised by either CPPS or FAO. Although simultaneous translation would be needed, this was not thought to be an insoluble problem.

3.3 Peru (10–16 April)

3.3.1 Background

The fishery of Peru is characterised by vast pelagic resources which make up 96.9 per cent of the country's total catches. In 1989, the total catch for Peru was 6.64 million mt. The important pelagic species are anchovy (*Engraulis ringens*), sardines (*Sardinops sagax*) and mackerels (horse mackerel, *Scomber japonicus*, and southern jack mackerel, *Trachurus murphyi*). Of these, anchovy constitutes over

57 per cent of the pelagic catch, while sardines are the next largest group at 40 per cent. The most important demersal species is the South Pacific hake (*Merluccius goyi peruanus*) with 1989 catches of 88,000 mt (1.3 per cent of total fish catch).

The export industry is based on fish meal production. The industry has been going through many changes, the first based on an *El Niño* which badly affected the anchovy stocks in the early and mid-1980s. With the return of the anchovy, starting in 1986, much of the effort in Peru has been directed towards reviving the fishmeal industry by improving the yield and quality. Peru's neighbour, Chile, is now the world's number one producer of fishmeal, but Peru is trying to regain its once dominant position as the world's largest exporter of this product.

3.3.2 Description of visit

The mission had a full and varied visit with meetings held with the Minister and Vice-Minister of Fisheries and Instituto Tecnológico Pesquero (ITP – the Institute of Fisheries Technology) in Lima. Most of the time was spent at ITP (see Appendix 2).

ITP is a large and very impressive facility. The Institute has been in operation for 11 years and was built with assistance from the Japanese Government. The facilities include four substantial pilot processing plants (each approximately 600 m²), fully equipped with every conceivable piece of processing equipment, including full canning lines, refrigerated storage, smokers, driers, packaging machinery, etc. ITP's very modern and sophisticated laboratories cover such specialised subjects as microbiology, chemistry, biochemistry, quality control, analytical services, product development (small-scale), product taste-testing, etc.

ITP's objectives are:

- to develop fisheries products for the domestic market, with the poorest members of the community in mind, and for export, utilising abundant, low-value fish species;
- to help improve industrial procedures in order to raise quality standards and yields of seafood products;
- to transfer the technologies developed to the private and public sectors;
- to disseminate technical information on a wide range of post-harvest fisheries subjects to public, private, national and international bodies.

At its most active period, ITP could boast a staff complement of 160 with about 90 professional staff. The Institute now has a scientific/technical staff complement of 41 (see Appendix 8). Most of them received their degrees and post-graduate training overseas (USA, Europe and Japan). ITP has 11 active sections: technical/general, biochemistry/nutrition, microbiology/biotechnology, fisheries by-products, canning, curing and packaging, fish pastes, frozen products, fresh fish handling, analysis, and marketing.

The Institute undertakes basic and applied research in all these sections. It also runs co-operative projects with other institutes in such countries as the United States of America, the United Kingdom, Germany and Japan. In the past, technical co-operation officers and funding for research projects have been provided to ITP from the United Kingdom, Germany and Japan.

ITP has its own training department. Training is provided for national and international students, mainly from Latin America. Courses are organised with funding from the Japan International Co-operation Agency (JICA) on various post-harvest fisheries technology topics. The eighth international course is scheduled for October 1991, on the topic of 'Frozen Fish and Fish Pastes'.

While at ITP, the study group was involved in the following activities:

- lectures on salted fish processing, quality and packaging of fishery products, and the fisheries resources of Peru, by the Instituto del Mar del Perú (Institute of the Sea of Peru);
- practical demonstrations on wet and dry salting of fish, mechanical drying of salted fish, low temperature smoke-drying of salted fish, and making fish hamburgers;
- sampling of minced fish products, including marine beef (fish burger, textured by freezing to resemble beef), fish burgers, fish crackers, fish sausage, and scallop adductor muscle analogue.

In addition, visits were made to a wholesale fish market next door to ITP and a processing plant on the same site (Frescopez) which produces salted dried fish and frozen fish fillet blocks. The group also visited a Government-run industrial facility, Pesca Peru, in Pisco, and a Government-owned fishmeal plant next door.

3.3.3 Results and conclusions

The following were thought by the study team members to be appropriate for use in certain situations in the Pacific Islands:

- *Fish smoking and salting technology.* The techniques developed could be of interest to isolated communities and are appropriate to the artisanal level of fisheries. Some of the products are high-quality, low-value products, particularly the salt cured fish. Papua New Guinea (PNG) may be able to use the technology to help provide low-cost marine products for its Highland communities, in the same way that Peru produces these products for communities living in the Andes.
- *Minced fish processing technology.* This technology may not have a wide application in the Pacific Islands because it needs large volumes of low-priced fish to be viable. One country that does have good volumes of low-value fish is PNG. These are the by-catches from the prawn trawlers. The study tour member from PNG collected much information on this topic, in the hope of utilising some of the technology for the benefit of his country.
- *Qualified scientists and technologists of very high calibre.* The Institute has an impressive list of capable, well-qualified scientists and technologists. Much of the research work may have application to the Pacific Islands. Although there are presently no trained or experienced scientists working in post-harvest fisheries technology in the Pacific Islands, the situation will change in the next few years when the SPC establishes the regional post-harvest fisheries centre in Suva, hopefully by 1993. This will provide the opportunity for scientists at ITP to work on collaborative projects with the staff of this centre, and a programme to develop an exchange of scientific staff should be encouraged at this time.
- *Training opportunities at ITP or the provision of trainers to training assignments in the Pacific.* ITP indicated its willingness for individuals from the Pacific to spend time on attachment-type training, working side by side with these scientists and technologists on various projects or being trained in some of the routine analytical procedures that may be useful to them in the area of a quality assurance. A list of these experts and the sections which they come under is shown in Appendix 8. Furthermore, ITP expressed its willingness to release technical experts to assist with projects in the region. One such activity discussed was the provision of a technical expert for a workshop being organised by SPC for the chilled fish sector.

3.4 Chile (16–20 April)

3.4.1 Background

Chile has one of the longest coastlines in the world off one of nature's richest fishing grounds. Presently it is among the top five fishing countries and the largest fishmeal exporter in the world. In 1989 total catches in Chile were 6.5 million mt, with exports of 1.5 million mt worth US\$900,000. Like Peru, the pelagic species dominate the catch, with jack mackerel (*Trachurus murphyi*) and anchovy (*Engraulis ringens*) leading the catch statistics. In addition to this valuable resource which supplies the raw material for fishmeal plants and canneries, Chile has an abundant array of other marine resources which are exploited commercially. These include salmon (ranchered Atlantic and Silver salmon), swordfish, snow crab, top shell, krill, hoki, whiting, octopus, etc. Aquaculture is another rapidly growing sector which in 1989 produced 11 to 12 million mt of produce. This is projected to grow to 20–30 million mt by the year 2000.

3.4.2 Description of visit

The study team had its fullest travel itinerary in Chile. Useful meetings and contacts were made at the ministerial level with the National Fisheries Department and National Service of Fisheries, which wished to provide every possible assistance in developing co-operative activities between the two regions.

Visits were also made to a number of processing operations in the Santiago, Concepción and Valparaíso areas. These included fishmeal/fish oil plants, canneries (one a supplier of canned fish to Papua New Guinea), prawn processors, fish filleting and freezing operations, and salmon smokers. The visits of most value and interest to the team were to the Institute of Fisheries Development (IFOP) and Fundación Chile (both in Santiago), and the Catholic University of Valparaíso (see Appendix 2 for itinerary and Appendix 3 for the persons met).

The Institute of Fisheries Development

The Instituto de Fomento Pesquero (IFOP) was established in 1964 and has a strong research programme in a range of fisheries activities including resource assessment, fisheries management, oceanography, aquaculture, fishing technology, and processing technology.

The processing technology section undertakes scientific research in the transformation processes of marine products in general. The aim is to develop new methods of utilising the resource, to improve productivity and quality, and then transfer the technology to the private or public sectors. The transfer of technical information is primarily in Chile, but overseas countries can benefit too.

The processing technology section has a staff complement of 15 professional staff, including food technologists, biochemists, microbiologists, food engineers and even a civil engineer. Research work is linked to the needs of the commercial sector in the areas of fishmeal production, frozen and chilled fish processing, etc. New areas of research activity include smoking of salmon, fish mince utilisation and by-products of minced fish. Much of the work is carried out on a joint-venture basis with commercial companies.

In summary, the following are the main active research areas within the processing technology section:

- *The development of new, low-cost products for the poorer sections of the community.* The artisanal sector is the least developed sector in Chile and needs much more support. The products are based on salted minced fish flesh obtained from cheap pelagic species. The minced fish is highly salted

and pressed and the resulting salted mince can be bulk-stored in large sealed plastic containers for four to six months without refrigeration. A number of high-protein products can be manufactured from this mince.

- *The development of alternative products from pelagic species that are higher in value than fishmeal.* Again the project is based on minced fish technology, but at a more sophisticated level. The Institute has perfected a method for making surimi from pelagic species (normally surimi is made from white fish with good elasticity). The technology has been transferred to the commercial sector, with good results.
- *The development of added-value products from the surimi made from pelagic species.* These include products such as burgers, croquettes and fish balls, plus a substitute ingredient for sausage manufacturers.

Another important activity at IFOP is analytical services in the area of quality control. This is a commercial activity in which the Institute competes with the private sector. It provides certification for export products, in particular, fishmeal.

IFOP has a training base in Concepción which primarily provides training for the artisanal sector. Although the study tour team visited Concepción and met with officials from the training base, it was not possible to visit these facilities.

Fundación Chile

This is a unique institution formed about 14 years ago with a large funding input from the Chilean Government and the American communications company, ITT. It is a non-profit organisation, whose aims are to promote development in Chile by introducing different technology. Its approach is to vet project ideas carefully to see whether they are likely to be implemented successfully and to provide a significant income-generating opportunity for the country. The key elements are quality products, products with good demand on the world market, and careful research in marketing, product standards and promotion.

One successful area of involvement is salmon ranching and the manufacture of smoked salmon. Fundación Chile, for example, builds small enterprises of its own such as a salmon-smoking plant. Once the enterprise proves its viability, it is sold. Offers are accepted from national and international sources. Income generated from such sales is used to fund future activities. The study team visited one recently sold salmon-smoking enterprise in Santiago (FINAMAR) and was impressed by the very high standards of the processing environment.

Other projects being evaluated concerned aquaculture of turbot (a valuable fish in Europe), growing red abalone (a joint venture with an American company) and the culture of sturgeon. The foundation is also involved in product development of marine resources and provides research and analytical services to fishmeal producers.

School of Food Science, Catholic University of Valparaíso

Although the School of Food Science offers undergraduate courses involving all types of foods, students choose to specialise in a particular food sector in their final year. The choice is between fruit and vegetables, meat and meat products and fisheries products. Of the 150 graduates who joined the food industry as professionals, 60–70 per cent work in the fisheries sector. The University takes on students from all over Latin America and is involved in international training courses.

3.4.3 Results and conclusions

The most impressive aspect of the visit to Chile was the emphasis on inspection and quality control of seafood products and the control of product standards. Much of Chile's success in marketing its marine products is based on its commitment to attain the highest quality, consistent standards and the best yields. This pays dividends in the long term in that the country has a good overseas reputation as a supplier of quality products and importing countries are frequently prepared to pay a premium for such products.

Any Pacific Island country wishing to learn about the fish inspection and quality control aspect of a fishery industry would gain much by studying the Chilean approach and philosophy in this important area.

Specific activities that the study tour team felt could be of value to the Pacific Island region were:

- *Fish inspection and quality control.* Any country in the region wishing to set up a fisheries inspection service should visit Chile. IFOP and Fundación Chile would be the appropriate places to visit and both have indicated their willingness to provide training. One Pacific Island country, Papua New Guinea, is endeavouring to improve its inspection service of all exported marine products.
- *Smoking technology.* Much work has been undertaken on the development of smoked salmon products. Much of this technology could be modified to work on fish species more abundant in the Pacific islands, such as tuna, Spanish mackerel, marlin, etc. More importantly, the exceptional hygienic conditions in which the salmon processing, smoking and packaging occurs are worth seeing and experiencing.
- *The Fundación Chile model.* The study considers this unique organisation an operational model worth emulating by other developing regions. It is a highly motivated and professional organisation that concentrates its activities on commercial enterprises. Its success lies in the multi-disciplinary approach to developing a new industry, which uses a wide range of people, from marketing and technical experts to promotional specialists. Virtually all angles are covered to ensure that potential ideas have the best chance of being successfully implemented.

3.5 General comments and conclusions

- The various Institutes in Latin America and the study team (on behalf of regional organisations and institutions in the Pacific Islands) committed themselves to keeping each other informed of activities in each region by general exchange of information. This, for example, would include placing the main institutions visited in Latin America on mailing lists for newsletters, special interest groups' bulletins, etc., and providing information on training courses and technical meetings in post-harvest fisheries technology.
- In each country visited the study team collected scientific literature and technical papers on many topics in post-harvest fisheries technology. A list of these documents is provided in Appendix 5. Pacific Island countries wishing to obtain copies of any of these papers should first make contact with the Post-harvest Fisheries Adviser at SPC, who has a copy of each document. Some documents are available in English. However, on request through TPFCC, any document currently available only in Spanish can be translated into English.
- Training opportunities in many areas of post-harvest fisheries technology are available in virtually all the countries the study tour visited. One of the potential problem areas in sending trainees to Latin America is obviously the language barrier. This would certainly be a factor if Pacific

Islanders were to participate in formal workshops and courses. However, it was also felt that if such activities were supported by TPFCC, a translation service could be provided. In other forms of training, such as on-the-job training for individuals in specific institutes, it was evident that English was a language that technical people understood and used very well. This was certainly true in Ecuador, Peru and Chile.

- Collaborative activities between the two regions will be valuable when the Pacific Islands establish their own post-harvest fisheries centre some time in the near future. Approval has been given for SPC to establish such a regional centre in Suva, Fiji. Its objective would be to provide technical services to countries of the region in applied research (product development, novel processing technology, etc.), formal training courses, short specialised training workshops suitable for the commercial sector, and analytical and quality assurance services to processors. The facility should be operational by the beginning of 1993. Once in place it will provide a focal point for institutes in Pacific Latin America to initiate programmes of collaborative research and exchange of experts to undertake specific activities of mutual benefit. All institutes visited considered this initiative very positive and were keen to make a contribution at the appropriate time.
- This report has identified and briefly described many areas of activities in post-harvest fisheries technology that are potentially of value to the Pacific Islands. In this respect, the tour may be considered a success. However, a better measure of success would be to see some of these suggested ideas followed through. One such activity where there is likely to be follow-up is the provision of a technical expert from ITP, Lima, to be tutor at a workshop being organised by SPC for the chilled fish sector. The funding for this expert is likely to be available from the same source as the study tour itself, i.e. CIDA. Requests from countries in the region for other activities may be similarly funded. Countries wishing to pursue any activity of particular interest should make requests initially through SPC, which can then channel them through TPFCC.

APPENDICES

LIST OF STUDY TOUR PARTICIPANTS**South Pacific Commission**

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STUDY TOUR ITINERARY

LOS ANGELES

- Sunday, March 31** – Study tour team meets up in Los Angeles
Monday, April 1 – Organise visas and travel funds
Tuesday, April 2 – Depart Los Angeles for Mexico City

MEXICO

Tuesday, April 2

- 18.00 Arrival in Mexico City from Los Angeles

Wednesday, April 3

- 10.30 Meeting with Under-secretary of Fisheries (Organisation and Administration), Ministry of Fisheries, Mexico City
 11.00 Working group discussions with section heads of the National Fisheries Institute
 12.30 Break
 12.45 Meeting with representatives from other scientific and technical institutes related to fisheries activities and technological training
 14.30 Lunch
 16.30 Transfer to Puerto de Mazatlán, Sinaloa

Thursday, April 4

- 09.30 Visit to the Regional Fisheries Research Centre in Mazatlán (INP)
 12.30 Visit to RIOMAR, Alimentos Kay S.A. de C.V. (private company processing surimi, smoked sailfish and frozen fish cakes)
 13.00 Visit to tuna/sardine canning and fishmeal plant: Atunas y Derivados, S.A de C.V., Mazatlán
 15.00 Visit to the Fisheries Training Centre, Ministry of Fisheries, Mazatlán (lunch)
 16.30 Visit to artisanal smoked tuna processor: Productos Tropicales Industrializados del Pacífico, Mazatlán
 18.00 Watch unloading of tuna purse-seiner

Friday, April 5

- 08.30 Visit to frozen prawn packing company: Los Quince, Mazatlán
 10.00 Visit to artisanal smoked tuna processor: Mazatlán
 12.00 Visit to prawn, smoked tuna and clam canning plant: Guzón S.A. de C.V., Mazatlán
 15.00 Lunch
 17.00 Return to Mexico City
 20.00 Final meeting with Lic. Arturo Peralta, Ministry of Fisheries, Mexico City

Saturday, April 6

08.00 Departure from Mexico City for Guayaquil via Miami

ECUADOR**Saturday, April 6**

21.20 Arrival in Guayaquil. Airport welcome by representative from the National Fisheries Institute (INP), Guayaquil

Sunday, April 7 Free

Monday, April 8

09.00 Meeting with Director and Sub-Director of INP

09.30 Visit to the laboratory and pilot plant facilities of INP

14.00 Demonstrations of non-traditional fish products produced by INP – salted fish

Tuesday, April 9

08.30 Continue demonstrations of non-traditional fishery products produced by INP – salt fish, minced salted fish, smoked fish, fish burger and fish sausage, plus slide show and lectures

12.30 Lunch

14.00 Continue demonstrations

15.30 Break for discussions

16.30 Continue demonstrations with slides and talk on design and application of solar driers and simple fish smokers

Wednesday, April 10

08.30 Visit to frozen prawn and fresh fish exporting company: Cepromar–Ecuamaron, Guayaquil

10.30 Visit to frozen prawn exporting company: Granmar S.A., Guayaquil

12.00 Lunch

15.00 Final discussion with Mr. Ramón Montaña, Fisheries Research Technologist, INP, Guayaquil

20.00 Departure from Guayaquil for Lima

PERU**Wednesday, April 10**

21.45 Arrival in Lima. Reception at the airport by authorities of the Fishery Ministry and the Institute of Fisheries Technology (ITP).

Thursday, April 11

08.30 Interview with the Vice-Minister of Fisheries

- 09.30 Welcome and visit to the Institute of Fisheries Technology (ITP), Lima
- 10.00 Salted fish processing – theoretical lecture by Ing. Edgar Rado
- 10.30 General statement on fishing sea resources of Peru
- 11.00 Wet salted fish processing – hands-on practical demonstration
- 14.30 Lunch hosted by ITP
- 16.00 Continue wet salted fish processing – hands-on practical demonstration

Friday, April 12

- 08.30 Laboratory analysis of salt penetration in salted and dried fish products
- 10.30 Processing of cold smoked salted fish
- 14.00 Lunch
- 15.30 Continue practicals and analysis, plus discussions and product demonstrations of minced fish products produced at the Institute

Saturday, April 13

- 09.00 Visit to wholesale fish market and dried fish processing plant (*Frescopez*) next door to ITP
- 10.00 Smoked dry fish processing, plus general discussions on conditions in the Pacific Islands that affect fish processing and marketing
- 15.30 Travel to Pisco

Sunday, April 14

Pisco: visit Pesca Peru industrial facilities. Return to Lima in the afternoon.

Monday, April 15

- 08.30 Processing of fish hamburger (plus visits to other laboratories of the Institute by the study tour team leader)
- 13.00 Lecture on 'Quality and Packaging of Fishery Products' by Ing. Miguel Gallo
- 14.00 Lunch at ITP's canteen utilising fishery products developed at the Institute
- 15.30 Closing meeting with the ITP President, Executive Director and technical staff to discuss the outcome of the study visit to Peru

Tuesday, April 16

- 08.30 Visit to the Minister of Fisheries, Peru
- 17.20 Departure from Lima for Santiago

CHILE

Tuesday, April 16

- 21.40 Arrival in Santiago. Airport welcome by delegations from TPFCC, Foreign Ministry and Chilean Fisheries Under-secretariat

Wednesday, April 17

- 09.00 Visit to the Institute of Fisheries Development (IFOP), Department of Technology. Presentations by technical staff of the various sections, plus details of processing technologies developed by experts at the institute (accompanied by video and slide show)
- 11.00 Visit to the Institute's facilities
- 13.30 Lunch hosted by IFOP
- 15.00 Visit to smoked salmon processing plant (FINAMAR)
- 16.30 Visit to Fundación Chile. Meeting with director and staff from the Department of Marine Resources and tour of the facilities

Thursday, April 18

- 08.30 Travel by road to Valparaíso
- 10.30 Meeting with Fisheries Under-secretary, National Department of Fisheries, Valparaíso
- 11.00 Interview with the Director of National Fisheries Service
- 12.00 Visit to the School of Food Technology at the Catholic University of Valparaíso. Pilot plant, laboratories, display on product formulation
- 13.30 Lunch hosted by the Fisheries Under-secretary
- 16.00 Visit to the University of Valparaíso, Institute of Oceanography and Marine Science
- 17.30 Visit to the construction site of 'Francis Drake' processing plant (prawns and salmon)
- 18.30 Return to Santiago

Friday, April 19

- 07.00 Fly to Concepción
- 08.30 Met by Head of IFOP Training Technology Base. Visit to frozen prawn processing, fish canning and fishmeal company, CIA Pesquera Camanachaca S. A., Tomé
- 11.00 Visit to Tomé fish landing
- 12.30 Lunch hosted by IFOP Training Technology Base
- 14.30 Visit to canning and fish meal plant, CIA Pesquera San Pedro SACI, Concepción
- 16.30 Visit to frozen fish processing operation, Congelados del Pacífico, Concepción
- 20.45 Return by plane to Santiago

Saturday, April 20

- 10.00 Meeting with staff at the Trans-Pacific Fisheries Consultative Committee to discuss the study tour throughout Pacific Latin America

Sunday, April 21

End of study tour and departure

PERSONS MET DURING THE STUDY TOUR

A. Mexico

- Dr. Oscar González Rodríguez, Under-secretary of Fisheries Organisation and Administration, Ministry of Fisheries, Mexico City
- Lic. Francisco Sosa Y Avila, Sub-director International Fisheries Agreements and Policies, Ministry of Fisheries, Mexico City
- Lic. Arturo Peralta, International Fisheries Policy, Ministry of Fisheries, Mexico City
- Biol. Myrna Wong Ríos, Director of Fisheries Analysis, National Fisheries Institute (INP), Ministry of Fisheries, Mexico City
- Ing. José Gabriel Suárez Toriello, Sub-director of Food Technology, INP, Ministry of Fisheries, Mexico City
- Lic. Javier A. Escalera Leandro, Director of Training, INP, Ministry of Fisheries, Mexico City
- Lic. Carlos Craviito C., Director of Regulations and Control, General Fisheries Administration Department, INP, Ministry of Fisheries, Mexico City
- Sra. Helen Collard de la Rocha, Federal Fisheries Delegate, Mazatlán, Sinaloa
- Sra. Esperanza Kasuga Koshii, RIOMAR, Alimentos Kay, S.A. de C.V., Carretera International Km 1192 Sur, 82180 Mazatlán, Sinaloa
- Ing. Ernesto Flores, Plant Supervisor, RIOMAR, Alimentos Kay, S.A. de C.V., Carretera International Km 1192 Sur, 82180 Mazatlán, Sinaloa
- Ing. Armando Coppel Azcona, Atunas y Derivados, S.A de C.V., Estero de Urias S/N A.P. 82070 Mazatlán, Sinaloa (tuna canning plant)
- Ing. J. Alfredo Gómez Rubio Lemmen Meyer, Productos Tropicales Industrializados del Pacifico, Mazatlán, Sinaloa
- Sr. Oscar Guzon Jover, Director General, Guzon S.A de C.V., Carretera International Km 1,192 Sur, Mazatlán, Sinaloa
- Sr. Catarino Perez Tostado and Sr. Celso Tostado Garate (artisanal tuna smoking), Camino al Conchi, Frente a Boyas, Mejicanas, Mazatlán, Sinaloa
- Sr. Jose Maria Valdez Padilla, Processing Supervisor, Los Quince (Prawn Packing Company), Mazatlán, Sinaloa

B. Ecuador

- Biól. Luis Arriaga O., Director, National Fisheries Institute, INP, Guayaquil
- Dr. Efrén López León, Sub-Director, NFI, Guayaquil
- Dra. Lucia Solórzano Constantine, Head of Basic Research, INP, Guayaquil
- Ing. Enrique Reyes A., Head of Department of Fisheries Products, INP, Guayaquil
- Sr. Ramón Montaña Cruz, Fisheries Research Technologist, INP, Guayaquil
- Sr. Germán Ramón Villalta Morales, Fish Technologist, INP, Guayaquil
- Sra. Bertha Leonor Andrade Barcia, Fish Technologist, INP, Guayaquil
- Ms. Deirdre King, Economist/Planner, INP, Guayaquil
- Dra. Nelly Camba C., Head of Chemistry Section, INP, Guayaquil
- Dr. Glenda Pin, Microbiology Section, INP, Guayaquil
- Ing. Roberto Cheing G., Plant Manager, Granmar S.A., Guayaquil
- Sr. Silvio Rendón, CEPROMAR-ECUAMARON, Guayaquil
- M. Bernard Pascal Marot, Président-Directeur Général, Select Marée, Malville, France

C. Peru

Sr. Félix Canal, Minister of Fisheries, Lima
 Ing. Ricardo Segura Romero, Vice-Minister of Fisheries, Ministry of Fisheries, Lima
 Ing. Heinz Schmidt F., Chief Adviser, Ministry of Fisheries, Lima
 Dr. Ulises Munaylla Alarcón, Adviser, Ministry of Fisheries, Lima
 Ing. Roberto Shirasaka Kanno, President, Institute of Fisheries Technology (ITP), Peru, Lima
 Ing. Fernando Alvarado Pereda, Executive Director, ITP, Lima
 Ing. Melva Pazos Hamm, Director of Training, ITP, Lima
 Sr. Leonardo Gushiken Gushiken, Technical Director, ITP, Lima
 Ing. Edgar Rado Huere, Researcher, Cured Products Division, ITP, Lima
 Ing. Miguel Gallo Seminario, Packaging Specialist, Cured Products Division, ITP, Lima
 Sr. Guy Carbajal Carranza, Head of Microbiology, ITP, Lima
 Sr. Jorge Palma Estrada, Head of the Analysis Division, ITP, Lima
 Dr. Jose Miguel Alemán Polo, Analysis Division, ITP, Lima
 Sr. Gonzalo León, By-products Section, ITP, Lima
 Ing. Amelia Aguilar, Sensory Analysis Section, ITP, Lima
 Pisco: Fish Meal Plant and Seafood Processing Plants (Pesca Peru)

D. Chile

Sr. Andrés Couve Rioseco, Sub-Minister, Department of Fisheries, Valparaíso
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 Dr. Patricio A. Bernal, Executive Director, Fisheries Development Institute, Santiago
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 Ing. Nora Au Diaz, Production Manager, CIA Pesquera San Pedro SACI, Concepción
 Sr. Juan Alarcón Soto, Plant Manager, Congelados del Pacifico, Concepción

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**LITERATURE PRESENTED TO THE PARTICIPANTS
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Mexico

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* Most of this literature is in Spanish only. When this is the case, the English equivalent is given in square brackets [] at the end of the reference, to assist readers in determining whether the document is of sufficient interest for them to request a translation. However, in some documents the full text is given in both Spanish and English. In this case, the English title is in round brackets ().

Ecuador

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ARTISANAL TUNA SMOKING PROCEDURE OBSERVED IN MAZATLAN, MEXICO

Introduction

The artisanal processing procedure used for smoking tuna in Mexico is simple, relatively cheap and the equipment used can be manufactured in the Pacific with local material. In addition to this, the shelf-life of the product, which is presently estimated to be only around 30 hours at ambient temperature, can be improved with additional processing and more hygienic packaging. The shelf-life of smoked tuna was said to be around one month at chill temperatures.

Processing procedure

The raw material used was frozen tuna from the local purse seine fleet. This was first allowed to thaw at ambient temperature. The tuna was then loined, the skin removed and the dark red muscle carefully cut out.

The loins were then soaked for three hours in a curing salt solution which was made with 4 kg of curing salt (for 500 kg of loins) consisting of common salt plus 10 per cent sodium nitrate and nitrite in equal amounts, in 200–300 litres of water.

The tuna fillets were removed from the salt solution and allowed to stand to drain excess water and to develop the reddish colouration typical of the product.

The loins were arranged in single layers on smoking trays and lightly brushed with vegetable oil, and left to stand for two hours.

The tuna loins were hot-smoked for 1 hour and 20 minutes over a carefully prepared fire. Some mangrove wood was first burned until it had reached charcoal stage. This was spread around the bottom of the smoker and green mangrove wood was placed on top. The tray of fish was then pushed into the smoker. Care was taken to keep the smoking temperature constant throughout the process.

After the first smoking stage, the loins were turned over and lightly brushed again with vegetable oil. The tray was returned to the smoker for a further 20 minutes.

The final smoked tuna product was allowed to cool and then packed in paper and put into cardboard boxes.

**PRODUCT FORMULATIONS FOR FISH BURGER, FISH SAUSAGE AND TUNA HAM
DEVELOPED AT INP, ECUADOR**

Fishburger

To minced fish meat add:

Garlic (ground)	0.3%
Salt	0.2%
Pepper	0.1%
Coriander and parsley	0.2%

Mix or blend all ingredients, then make fishburgers weighing approximately 50–60 g each.

Fish sausages

To minced fish meat add:

Pork meat (minced)	5%
Pork fat	5%
Flour	9–10%
Salt	2.5%
Sugar	1.6%
Garlic and onion	0.15%
Spices mixture (oregano, cumin, pepper, paprika or red pepper)	0.4 %
Chilled water and/or ice	

Using a sausage maker, fill sausage casing to the length required, and tie off with a piece of string. Cut off the sausage and make the next one. The sausages are then ready for cooking.

Tuna ham

Cut tuna meat into chunks of 4 cm³.

Add:

Salt (containing nitrite @ 0.1% of meat)	3 %
Sugar	2–3 %
Seasoning materials	0.5%
Smoke liquid (not essential)	50 ml
Pork fat (rectangular pieces)	10%
Flour	5%

Mix ingredients slowly for 1–2 hours (keep at a low temperature).

Steam at 90°C for 30 minutes, then reduce temperature to 80–85°C for 60 minutes.

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