Handbook on the Processing of Fish in Palau

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Message

Part of the research outputs of a project on "Product Development for Food Security in the Republic of Palau" which was funded by the Hatch Act of 1887 administered by the National Institute of Food and Agriculture-United States Department of Agriculture (NIFA-USDA), is the processing of fish.

Fish greatly abound in Micronesia as well as the Pacific region, and serves as a nutritious food resource for the growing population.

I appreciate the efforts of College of Micronesia Land Grant researchers to come out with this hand book, which can benefit families and provide potentials for food business development.

Dr. Singeru Singeo
Executive Director
College of Micronesia Land Grant Programs

Foreword

Focusing R & D efforts on the processing of local foods will help the country by way of creating food microenterprises. Because of its very strategic location surrounded by ocean resources, Palau depend on fish as the main source of food, creating food industry in this country.

The Palau Community College-Cooperative Research and Extension (PCC-CRE) has implemented researches of fish processing funded by the Hatch Act of Pacific Land Grant. Results of such researches are taught in the outreach programs of PCC-CRE, such as the Expanded Food and Nutrition Education Program (EFNEP) and Food Technology Classes.

Food processing activities are needed for self-reliance, rural development, and food security. This initiative strives to improve the nutritional status of the Pacific islanders like Palau. The food products and skills learned from the extension programs provide product ideas for business opportunities. Consumers and tourists recognize the availability and affordability of processed foods from local resources such as fish.

PATRICK U. TELLEI, EdD
President
Palau Community College

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LYDIA M.MARERO
THOMAS TARO

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INTRODUCTION

Researches are now focused on catalyzing rural development by creating technologies that serve the needs of fishermen and rural folks. Locally processed aquatic products will benefit the people, tourists, as well as the Pacific countries, having access to fish and crustaceans as these are surrounded by ocean waters.

Food processing activities are needed for self-reliance, rural development, and food security. This initiative strives to improve the nutritional status of the Pacific islanders like Palau. Food security problems are expressed in individuals, but they must be solved by working with communities and societies. In spite of the efforts of a variety of government and community-based programs to address food security, many problems are worsening, like the importation of foods which drains the economy. One strategy to combat this problem is to increase collaboration and community-based research planning to better utilize resources and promote self-sufficiency.

Focusing R & D efforts on the processing of local foods will help the country by way of creating food microenterprises. Because of its very strategic location surrounded by ocean resources, Palau depend on fish as the main source of food, creating food industry in this country.

The manufacture of aquatic food products provide nutritional and health benefits to the consumers. Degenerative diseases like obesity, hypertension, diabetes, and cancer among others are prevalent and the problems are worsening.

Fish and crustaceans are one of the best sources of omega-3 fatty acids, a polyunsaturated fatty acid which is unique in their ability to lower levels of triglycerides in the blood. In addition, omega-3 fatty acids function as blood thinners, lessening the likelihood of a heart attack and stroke (Palmer, 1998).

Utilization of fish will help reduce food imports, increase GDP from the agriculture sector, provide food security in the country, boost the tourism industry, and provide nutritious and healthy foods for the population. The processing of local foods also opens the way to create food microenterprises, which in turn result to a chain reaction of economic benefits, such as creation of job opportunities, increasing tax revenues, and helping fishermen add value to their aquatic produce.

NUTRITIONAL VALUE OF FISH

Diet has been shown to have a positive impact on an individual's health, physical well-being, and mental state. Balanced meals that includes all the nutrients needed by the body will not only help us function better and more effectively in many aspects of our lives, but also help us directly in the prevention and treatment of illness and disease.

Diet is believed to play an important role in the four major diseases of our society– cardiovascular (heart and artery) diseases, cancer, hypertension, and obesity.

In the Republic of Palau, obesity is a leading preventable cause of death with increasing prevalence in adults and children. The World Health Organization rated Palau as having the 7th fattest people in the world (WHO, 2006), with 78.4% of the citizens aged 15 and over have an unhealthy weight. Obesity and diabetes are fast becoming a growing concern in Palau.

In 2002, the World Health Organization stated that overeating is the fastest form of malnutrition, and estimates that the number of people that are overweight are affecting about 1.1 billion people (WHO, 2002). Poor diet, Western style junk food, and lack of exercise had put Palauans at risk of premature death from weight-related illnesses.

The use of fish oil supplements to reduce damages caused by atherosclerosis, i.e., heart attack, strokes, and occlusive peripheral vascular disease (Leaf, 1991) has been investigated.

Fish and crustaceans are one of the best sources of omega-3 fatty acids, a polyunsaturated fatty acid which is unique in their ability to lower levels of triglycerides in the blood. In addition, omega-3 fatty acids function as blood thinners, lessening the likelihood of a heart attack and stroke (Palmer, 1998). Moreover, research findings show that omega-3 fatty acids protect against certain forms of cancer, and because

they have anti-inflammatory powers, may be effective against rheumatoid arthritis (Ames, 1990). Besides, these aquatic resources contain high amounts of good-quality protein and they supply B-vitamins and potassium as well (FCT, 1986). Rabbitfish contains 568 mg omega-3; crab,320 mg.; and shrimps, 480 mg. per 3-1/2 oz. (ca. 200g) samples (Leaf, 1991).

Table 1 shows the nutritional composition of various species of fish. Fish proteins are deemed healthier than animal meats like pork, beef, and poultry. Palau has been importing a lot of animal products like meats when fish is an abundant local resource for proteins and many other nutrients like omega-3 fatty acids.

Table 1. Nutritional composition of fish.

Nutrient /100g	Grouper	Milkfish	Mackerel
Edible portion,%	49	65	69
Water, g	83.6	72.8	79.7
Energy, kcal	63	80	136
Protein, g	14.9	19.8	21.6
Fat, g	0.4	6.4	1.1
Carbohydrate, g	0.0	0.0	0.0
Crude fiber, g	0.0	0.0	0.0
Ash, g	1.1	1.1	1.6
Calcium, mg	55	44	23
Phosphorus, mg	173	194	236
Iron, mg	0.6	1.2	1.0
Retinol, mcg	20	135	250
Beta-carotene, mcg	Trace	22	90
Total Vit. A (RE)	20	139	265
Thiamin, mg	0.04	0.02	0.03
Riboflavin, mg	0.04	0.10	0.08
Niacin, mg	4.3	7.8	5.7
Ascorbic acid, mg	0	0	0

Adapted from FNRI, 1997.

Fish is a good source of protein, comprising of about 20%. Of the three species, milkfish contained the most fat (6.4%) as compared to grouper (0.4%), and mackerel (1.1%).

All three kinds of fish contained good amounts of minerals like calcium and phosphorus. Mackerel has the most amount of phosphorus (236 mg%), followed by milkfish (194 mg%), and grouper (173 mg%). Calcium and phosphorus are the chief minerals used to make hard cells in bones and teeth. Phosphorus occurs in food as phosphate which is absorbed into the blood stream, where 85% goes to skeletal formation and the remainder to soft tissue. It is needed in smaller amounts than calcium. Anyone who has sufficient calcium in daily meals will also have enough phosphorus (Parkinson, 2004).

Fish are also good sources of vitamins, particularly niacin and in the case of mackerel, Vitamin A. Niacin, also known as nicotinic acid, is involved in the conversion of carbohydrate into heat and energy within the cells (Parkinson, 2004). A disease called pellagra is caused by lack of niacin, which causes rough dark skin on the parts of the body exposed to sunlight, sore red tongue, diarrhea, and mental confusion.

PROCESSING OF FISH PRODUCTS

FISH BALLS

Fig. 1. Fish balls.

Ingredients:		
1	cup	fish flesh, white meat
1	cup	all-purpose flour
1	cup	corn starch
1	Tbsp	baking powder
1	tsp	salt
1	cup	cold water
1	cup	oil for frying

Procedure:

- Clean, debone, get fish flesh, and chop.
- Place chopped fish in a blender, add cold water, and blend until smooth.
- Mix flour, starch, baking powder and salt and add blended fish to make a soft dough.
- Shape into balls and fry in hot oil.

FISH TEMPURA

Fig. 2. Fish tempura.

Ingredients:

2	lbs	fish, any variety
1	cup	all-purpose flour
1	pc	egg
½	cup	water
1	cup	oil for frying

Procedure:

- Clean and debone fish, remove skin and cut into serving pieces.
- Mix flour, egg, and water to a smooth consistency.
- Dip each piece of fish into the batter.
- Fry in hot oil.

PROCESSING OF FISH PRODUCTS

FISH JERKY

Fig. 3 Fish jerky.

Ingredients:

2	lbs	fish , any variety
1	Tbsp	salt
4	Tbsp	sugar
½	tsp	prague powder
1	tsp	ground black pepper
1	cup	oil for frying

Procedure:

- Clean, debone and remove skin of fish.
- Mix salt, sugar, Prague powder, and ground black pepper sprinkle on the fish, and mix well.
- Cure in the refrigerator overnight.
- Fry in deep oil until brown.

PROCESSING OF FISH PRODUCTS

FISH SAUSAGE

Fig. 4. Fish sausage.

Ingredients:

2	lbs	fish, any variety
1	Tbsp	salt
8	Tbsp	sugar
½	tsp	prague powder
1	cup	oil for frying

Procedure:

- Clean, debone, and remove skin of fish and chop or grind.
- Mix salt, sugar, and Prague powder, sprinkle on the ground fish and mix well
- Cure in the refrigerator overnight.

PROCESSING OF FISH PRODUCTS

CORNED FISH

Fig. 5. Corned fish.

Ingredients:

2	lbs	fish, any variety
4	cups	water
2	Tbsp	sugar
¼	cup	salt
½	tsp	prague powder

Procedure:

- Clean, debone, remove skin of fish and cut into cubes.
- Dissolve salt, sugar, and Prague powder in 4 cups water.
- Soak fish cubes in the curing solution overnight in the refrigerator.
- Wash fish, drain, and place fish in a cooking pan. Add 1 cup water and simmer until fish is tender.
- Flake fish with fork tines and add cooking water to fish.
- Refrigerate. Corned fish may be eaten at this stage, or sautéed in oil with chopped garlic and onion.

PROCESSING OF FISH PRODUCTS

FISH TOCINO

Fig. 6. Fish tocino.

Ingredients:

2	lbs	fish
1	Tbsp	salt
8	Tbsp	sugar
½	tsp	prague powder
1	cup	oil

Procedure:

- Clean, debone, remove skin of fish, and cut into 5 x 3 -inch pieces.
- Mix salt, sugar, and Prague powder, sprinkle on the fish and mix well.
- Cure in the refrigerator overnight.
- Fry in hot oil.

PROCESSING OF FISH PRODUCTS

GRILLED MARINATED FISH

Fig. 7. Grilled marinated fish.

Ingredients:

2	lbs	fish
¼	cup	salt
4	cups	water

Procedure:

- Clean fish , remove internal organs and gills.
- Dissolve salt in water and soak fish for 30 minutes.
- Wrap fish in tin foil and store in the freezer.
- To cook, thaw frozen fish and grill on open fire.
- Remove wrapper, and serve with pickled papaya.

PROCESSING OF FISH PRODUCTS

FRIED MARINATED FISH

Fig. 8. Fried marinated fish.

Ingredients:

2	lbs	fish
¼	cup	salt
4	cups	water
1	cup	oil for frying

Procedure:

- Clean fish, remove internal organs and gills.
- Dissolve salt in water and soak fish for 30 minutes.
- Wrap fish in tin foil and store in the freezer.
- To cook, thaw frozen fish and fry in hot oil.

PROCESSING OF FISH PRODUCTS

SOUR FISH SOUP

Fig. 9. Sour fish soup.

Ingredients:

2	lbs	fish
4	cups	water
1	Tbsp	salt
3	pcs	ripe guava or tamarind powder
5	pcs	pechay or napa
3	pcs	green pepper

Procedure:

- Clean fish, remove internal organs and gills.
- Place in a pot , add water, and boil for 15 minutes.
- Add other ingredients and simmer 5 minutes.

PROCESSING OF FISH PRODUCTS

STEAMED FISH

Fig. 10. Steamed fish.

Ingredients:

2	lbs	fish
1	Tbsp	salt
2	pcs	eggs
1	pc	carrot
1	stalk	celery
½	cup	mayonnaise

Procedure:

- Clean fish, remove internal organs and gills.
- Sprinkle salt on fish.
- Arrange fish in a steamer and steam fish for 25 minutes.
- Transfer fish on a serving plate and spread mayonnaise on top of fish.
- Boil egg, separate white and yolk and chop finely.
- Arrange alternately chopped egg white, yolk,celery and parsley.

PAN- GRILLED FISH FILLET

Fig. 11. Pan-grilled fish fillet.

Ingredients:

1	lb	fish fillet
1	tsp	salt
½	tsp	ground black pepper
1	pc	spinach or any greens
10	pcs	shrimps
½	cup	mayonnaise

Procedure:

- Clean fish, make fillet, and cut into 3-inch pieces.
- Rub salt and ground black pepper on both sides of fillet.
- Grill fish fillet on slightly greased pan until brown.
- Place mayonnaise on a serving plate, Arrange boiled shrimps and fish and top with blanched spinach or greens.

PROCESSING OF FISH PRODUCTS

DRIED FISH

Fig. 12 Dried fish

Ingredients:

2	lbs	fish
½	cup	salt
4	cups	water

Procedure:

- Wash and cut fish butterfly style. Debone and remove gills and internal organs.
- Dissolve salt in water and soak fish for 30 minutes.
- Arrange fish on drying trays and dry in the sun for 8 hours.
- Pack dry fish in plastic bags, seal, and label.

FISH IN COCONUT MILK

Fig. 13. Fish in coconut milk.

Ingredients:

2	lbs	fish
1	cup	thick coconut milk
1	pc	garlic, chopped
1	med	onion, chopped
2	Tbsp	oil
4	pcs	hot pepper

Procedure:

- Clean fish, debone, and remove skin. Slice fish into small pieces.
- Saute garlic and onion in oil, Add fish, coconut milk, and hot pepper.
- Simmer until sauce is thick.

STEAMED GROUND FISH

Fig. 14. Steamed ground fish.

Ingredients:

1	lb	fish, ground
1	tsp	salt
½	cup	sweet dill pickles, chopped
½	cup	raisins
3	pcs	egg, boiled, sliced lengthwise
½	pc	processed cheese, sliced lengthwise
3	pcs	hotdog, sliced lengthwise
½	tsp	black pepper

Procedure:

- Clean fish, debone, remove skin, internal organs and gills and chop or grind. Add salt, pepper, raisins and mix well.
- On a piece of aluminum foil place 1 cup fish mixture, flatten, arrange sliced cheese, hotdog, and egg at the center and fold over, roll foil, and seal ends. Steam for 30 minutes. Slice crosswise 1/2 inch thick and serve.

PROCESSING OF FISH PRODUCTS

FISH IN TOMATO SAUCE

Fig. 15. Fish in tomato sauce.

Ingredients:

1	lb	fish
½	cup	tomato sauce
2	Tbsp	mayonnaise
1	tsp	salt
½	tsp	ground black pepper

Procedure:

- Clean fish, remove internal organs and gills.
- Mix tomato sauce, mayonnaise, salt and black pepper.
- Arrange fish in a pot and pour sauce on top.
- Simmer until fish is tender.

FISH ROLLS

Fig. 16. Fish rolls.

Ingredients:		
1	lb	fish, chopped
1	med	onion, chopped
1	tsp	salt
½	tsp	black pepper
3	sprigs	cilantro, chopped
1	med	carrots, chopped
10	pcs	wrapper
1	cup	oil for frying

Procedure:

- Clean fish, debone, and remove head, skin, and chop flesh.
- Mix all ingredients together. On a wrapper, place 1/4 cup fish mixture and roll thinly. Cut 2 inches long and fry in hot oil.

PROCESSING OF FISH PRODUCTS

FISH AND CHIPS

Fig. 17. Fish and chips.

Ingredients:

1	lb	fish
1	cup	all purpose flour
1	pc	egg
½	cup	water
1	tsp	salt
1	lb	sweet potatoes, sliced lengthwise
1	cup	oil for frying

Procedure:

- Clean fish, debone, separate flesh and slice lengthwise.
- Prepare batter by mixing flour, egg, water, and salt.
- Dip fish slices in batter and fry until both sides are brown.
- Fry sliced sweet potatoes and serve with fried fish.

PROCESSING OF FISH PRODUCTS

FISH SOUP WITH TITIML

Fig. 18. Fish soup.

Ingredients:		
2	lbs	fish
4	cups	water
2	Tbsp	oil
1	tsp	salt
5	sprigs	titiml young leaves

Procedure:

- Clean fish, remove internal organs and gills.
- Arrange fish in a pot.
- Dissolve salt in water and add to fish.
- Boil fish and add oil and sprigs of titiml. Put off fire.

TARO- FISH MAKI

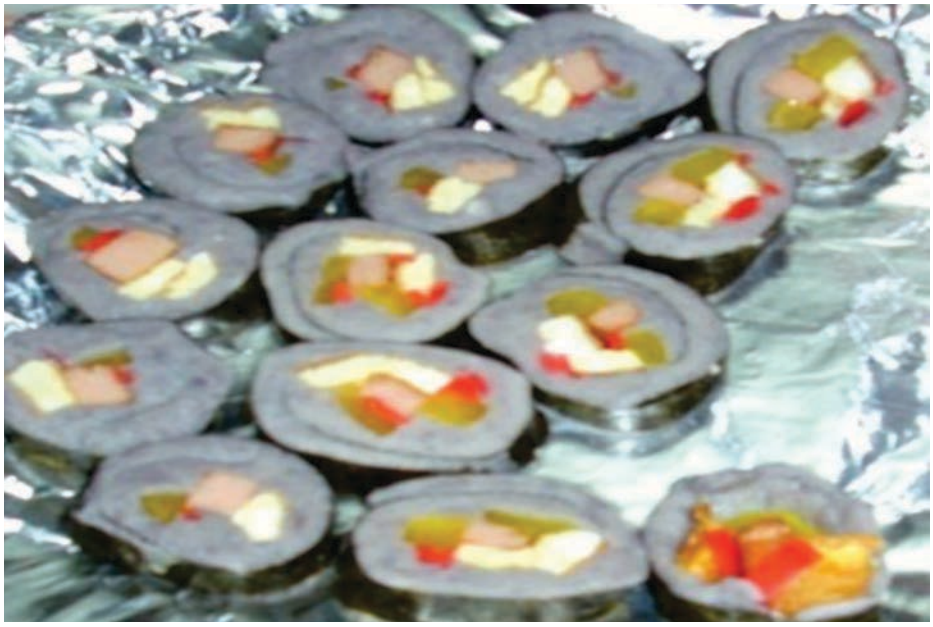

Fig. 19. Taro fish maki.

Ingredients:

1	lb	taro, boiled and ground
1	cup	fish strips
1	cup	takuan strips
½	cup	fermented red ginger
1	cup	cucumber strips
10	pcs	nori (seaweed) wrappers

Procedure:

- Boil taro for 2 hours, peel, and grind.
- Flatten ground taro with a rolling pin 1/2 inch thick.
- Lay nori on top of rolled taro and trim off excess. Arrange strips of takuan, fish, red ginger, and cucumber at the center and roll.
- Slice into serving pieces.

PROCESSING OF FISH PRODUCTS

FERMENTED FISH

Fig. 20. Fermented fish.

Ingredients:		
1	lb	fish
½	cup	salt

Procedure:

- Clean fish and grind.
- Add salt to fish and macerate well.
- Ferment for 1 month.
- Bottle, seal, label, and store.

FISH IN BUTTER SAUCE

Fig. 21. Fish in butter sauce.

Ingredients:		
1	lb	fish, sliced crosswise
2	Tbsp	butter
10	sprigs	green onion
1	tsp	salt
1	tsp	chopped ginger
1	cup	oil for frying

Procedure:

- Clean and slice fish crosswise. Sprinkle with salt and fry in deep oil.
- Prepare sauce by melting butter , add chopped ginger and minced green onion. Simmer a few minutes and add fish.

FRIED MINCED FISH

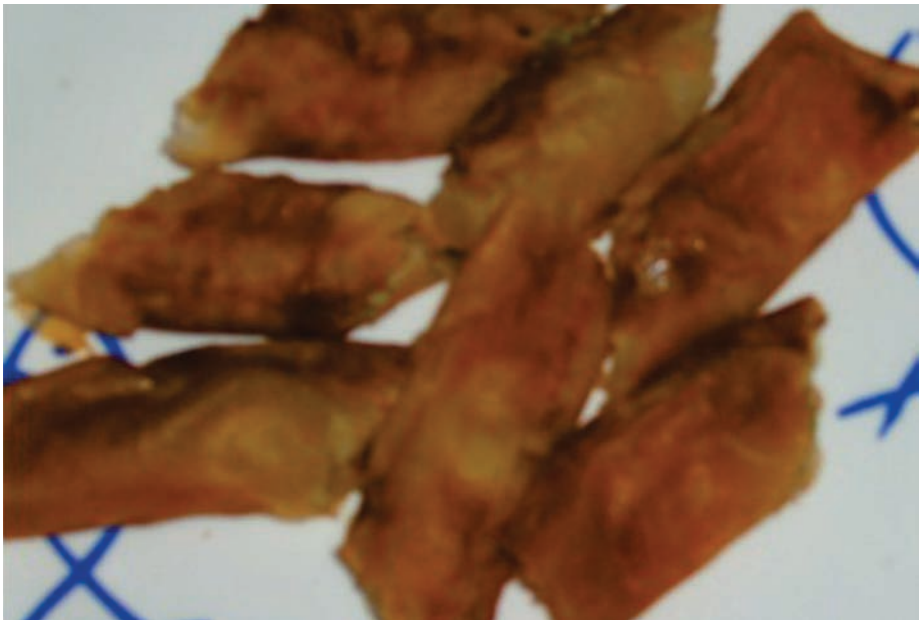

Fig. 22. Fried minced fish.

Ingredients:

1	cup	fish, minced
1	tsp	salt
4	Tbsp	sugar
1	cup	chopped jicama
1	cup	oil for frying

Procedure:

- Clean fish, debone, separate flesh and chop or mince.
- Mix minced fish with salt, sugar, and chopped jicama.
- Wrap with wrapper, steam, and fry.

PROCESSING OF FISH PRODUCTS

FISH APPETIZER

Fig. 23. Fish appetizer.

Ingredients:

2	lbs	fish flesh, sliced 1 cm thick
1	tsp	salt
3	pcs	lemon juice
1	Tbsp	kimchi base
1	med	tomato
1	tsp	peanut oil
1	Tbsp	chopped onion
2	pcs	red chili

Procedure:

- Clean fish separate flesh and cut into cubes.
- Mix all ingredients with cubed fish.
- Refrigerated and serve.

PROCESSING OF FISH PRODUCTS

FISH BURGER

Fig. 24. Fish burger.

Ingredients:		
2	lbs	fish flesh, chopped or ground
1	tsp	salt
1	tsp	ground black pepper
1	med	onion, chopped
2	pcs	eggs
1	cup	oil for frying
4	pcs	sliced cheese

Procedure:

- Mix all ingredients and blend well.
- Shape into balls, flatten and fry.
- Top with cheese.

PROCESSING OF FISH PRODUCTS

FISH KROEPECK

Fig. 25. Fish kroepeck.

Ingredients:

2	cups	cornstarch
2	cups	all purpose flour
1	cup	fish flesh, ground
2	tsp	salt
1	tsp	ground black pepper
4	cups	water
1	cup	oil for frying

Procedure:

- Mix cornstarch, flour, fish, salt, and pepper.
- Add water and mix well.
- Transfer 1/2 cup mixture into greased trays and tilt thinly, about 1/2 cm thick.
- Steam for 2 minutes.
- Cut into 1 square inch and arrange in drying trays.
- Dry in the sun for 8 hours.
- Fry in hot oil, drain and pack in plastic bags, label and seal.

CRISPY ANCHOVIES

Fig. 26. Crispy anchovies.

Ingredients:

2	lbs	anchovies
1	Tbsp	salt
6	pcs	egg yolks
6	pcs	hot pepper, crushed
1	cup	cornstarch
4	Tbsp	sugar
1	cup	oil for frying

Procedure:

- Mix anchovies and salt, transfer to drying trays and dry for 8 hours. Toast until crispy.
- Beat egg yolk, add salt, sugar, crushed hot pepper. Add dried and toasted anchovies to this mixrure and dredge in corn starch.
- Deep fry in hot oil.
- Drain. Cool, and pack in plastic bags, seal, label, and store.

PROCESSING OF FISH PRODUCTS

FISH DUMPLING

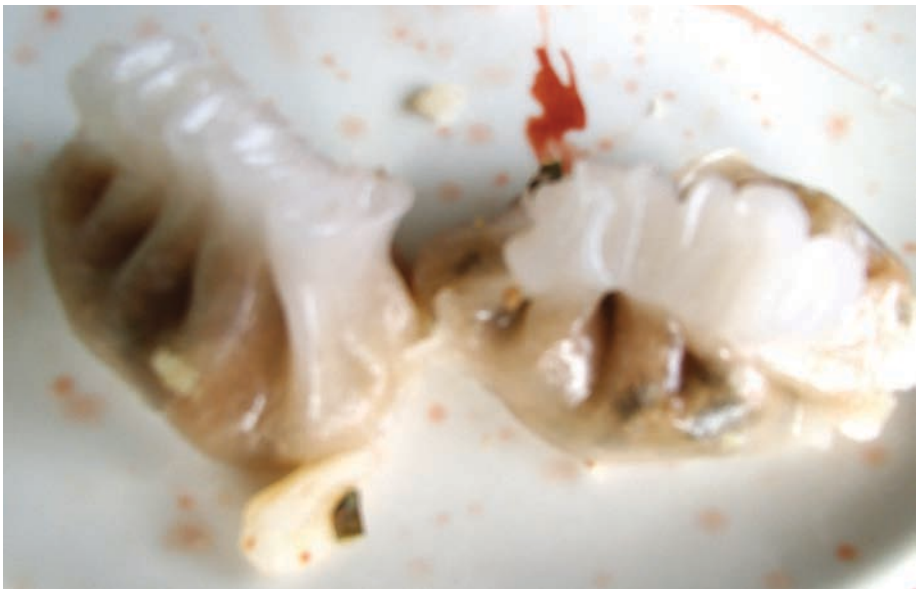

Fig. 27. Fish dumpling.

Ingredients:

1	lb	fish flesh, chopped or ground
1	cup	shrimps, finely chopped
2	pcs	green onion, chopped
	tsp	salt
½	tsp	ground black pepper
1	tsp	sesame oil
1	Tbsp	soy sauce
20	pcs	wonton wrappers
1	cup	oil for frying

Procedure:

- Mix all ingredients and wrap 1 Tbsp mixture
- Drop in boiling water until wonton floats.
- Fry in hot oil.

GRILLED GROUPER STEAK

Fig. 28. Grilled grouper steak.

Ingredients:

4	pcs	grouper steak
1	Tbsp	soy sauce
½	tsp	black pepper
1	tsp	grated ginger
¼	pc	chopped onion
2	Tbsp	olive oil

Procedure:

- Marinate grouper steaks in a mixture of soy sauce, black pep per, ginger, onion and olive oil for 1 hour.
- Remove steaks from marinade, pat dry and grill on heated pan.

PROCESSING OF FISH PRODUCTS

FRIED RABBIT FISH

Fig. 29. Fried rabbit fish

Ingredients:

1	lb	rabbit fish
1	cup	oil for frying
1	tsp	salt

Procedure:

- Add sult to clean rabbit fish.
- Fry in oil until brown.

SNAPPER STEAK

Fig. 30. Snapper steak

Ingredients:

4	pcs	snapper steak
1	Tbsp	soy sauce
½	tsp	black pepper
1	tsp	grated ginger
¼	pc	chopped onion
2	Tbsp	olive oil

Procedure:

- Marinate snapper steaks in a mixture of soy sauce, black pepper, ginger, onion and olive oil for 1 hour. Pan-grill the snapper steaks.
- Remove steaks from marinade, pat dry and grill on heated pan.

PROCESSING OF FISH PRODUCTS

SWEET-SOUR FISH

Fig. 31. Sweet-sour fish.

Ingredients:

1	lb	grouper
1	cup	cornstarch
1	tsp	salt
¼	cup	sugar
2	Tbsp	catsup
¼	cup	vinegar
4	slices	pineapple
1	cup	oil for frying

Procedure:

- Clean, scale, and eviscerate fish. Slice the flesh portion intact to the bone. Sprinkle with salt.
- Coat fish with cornstarch and fry in hot oil.
- Prepare sauce by mixing sugar, catsup, vinegar and pineapple.
- Pour sauce over fried fish and simmer 5 minutes.

FISH-STUFFED PEPPERS

Fig. 32. Fish-stuffed peppers.

Ingredients:

1	lb	fish flesh, chopped
1	tsp	salt
½	tsp	ground black pepper
1	pc	carrot,chopped
1	tsp	minced ginger
1	med	onion
2	pcs	eggs
4	pcs	bell peppers
1	cup	oil for frying

Procedure:

- Clean and debone fish and chop or grind.
- Mix all ingredients together and fill into halved peppers.
- Fry.

CONSUMER AND MARKET TESTS

Fish food products were evaluated by visitors of R & D Station (see Fig.33)and during food exhibits in civic events like Olechotel Belau Fair, Independence Day, Earth Day, Career Awareness Week, and many other occasions.

Tourists were able to taste the products during a "Taste of Palau" event sponsored by the Palau Visitors' Authority and they signified their interest to buy the products if sold in the market.

Fig. 33. School children tasting fish products.

TECHNOLOGY TRANSFER OF PROCESSED FISH PRODUCTS

Selected fish food products were taught to more than 636 participants of Food Technology Classes in a 24-hour training period, usually done in a three-week, 2-hour per day sessions.

Fig. 34. Participants of Food Technology Class in Peleliu State.

Table 2. Number of participants and places where Food Technology Classes were held.

Place	Number
Ngeremlengui State Old Age Center	23
Melekeok State Old Age Center	17
Airai State Ked Center	19
Airai State Abai	17
Koror State PCC Campus	18
Koror State Ngarachamayong Cultural Center	16
Koror State Maibrel Center	18
Ngeremlengui State Old Age Center	9
Ngeremlengui State Training Center	23
Ngiwal State School Cafeteria	23
Ngatpang State	12
Ngerbeched, Koror	23
Kayangel State	17
Peleliu State	19
Airai State	11
Ngardmau State	12
R & D Station	3
Angaur State	23
Ngeremlengui Elementary School	53
Emmaus High School	24
Palau High School Special Education	12
Upward Bound Math- Science	18
Palau Parents Empowered	16
Bethania High School	27
Ngarchelong Head Start Parents	19
Meyuns Head Start Parents	24
Madalaii Head Start Parents	14
Peleliu Head Start Parents	19
Ngerbeched Head Start Parents	24
Expats Group I	22
Expats Group II	26
Cafeteria Staff	20
Ngaraard Ongall Group	15
Total	**636**

IMPACT

Fish products can be used to benefit the food industry development in Palau. The economic value that the products can contribute is to support the aquaculture sector, despite being a subsistence system at present. This initiative contributes to the Gross Domestic Product (GDP) from agriculture, which declined from 9.9% in 1983 to 2.9% in 1992 (LGP-COM). The project also help reduce the consumption of imported foods which has led to an overall decline in food production in Palau, resulting in trade imbalance. Moreover, the processing of fish products can lead to microenterprise development with sound market potentials. Bringing the technologies to the farm level in PCC-CRE outreach programs can bring about an increase in fishermen's household income, leading to countryside development. Fish processing can bring down retail prices of food products in the rural areas, while increasing fishermen's share in the prices of their value-added produce. Such endeavors employ women workers in the community, increasing their productivity and improving their entrepreneurial skills. The initiative can boost the nutritional status of fishermen, their families, and children by making available nutritious products for their table. The development of processed food products from fish help support the tourism industry, the lifeblood of Palau economy, by making available local foods for tourists.

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Lydia Marero worked as Researcher-Food Technologist at the Palau Community College-Cooperative Research and Extension (PCC-CRE) for ten years. She developed about 150 processed food products from taro, cassava, sweet potato, fish, coconut, and banana and taught food technology classes as an extension program of PCC-CRE. She obtained three USDA grants for her projects on the utilization of root crops and product development of local foods and rabbit fish. A food scientist, an educator and a scholar, Lydia earned a Bachelor's Degree in Food Technology at the De La Salle-Araneta University Foundation, graduating cum laude. Under a PCARRD scholarship, she pursued a Master's Degree in Food Science at the University of the Philippines in Los Baños. She obtained her Doctoral Degree in Food Science from the Ochanomizu Women's University in Tokyo, Japan as a Monbusho scholar and JSPS fellow. She further obtained a Post-Doctoral Degree in Food Science as a KOSEF fellow at the Seoul National University in South Korea.

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