UTILIZATION AND PROCESSING OF CARP*

By

GLORIA GUEVARA[1]
FLOR F. ABELLA[2]
EMMA A. MARFORI[3]

INTRODUCTION

Common carp, *Cyprinus carpio Linnaeus,* a freshwater fish, was introduced in the Philippines as early as 1915. Years later, it was stocked in Laguna de Bay and Camarines Sur. Carps are now found in Lake Lanao, Lake Buhi, Laguna de Bay, Ambuklao and Caliraya Dams and Angat Reservoir.

With the launching of the fish production program of the Bureau of Fisheries and Aquatic Resources, the objectives of which is to accelerate fish production, it is expected that carp would be produced more abundantly. This would help alleviate the present deficiency in animal protein supply. It would serve as a low cost fish product and a good protein source.

Carps in the market usually have a satisfactory flavor and a firm texture. During the hot summer months, however, some carps may have a musty flavor and soft texture but their food value remains. This decrease in palatability explains why carps have not become so popular among housewives.

The palatability, however, may be improved by special treatments such as soaking in brine mixed with spices or pickling in vinegar before drying. These methods of preservation not only improve the

---

* Read at the Fisheries Forum sponsored by PCAR on June 17, 1975, NSDB, Manila.

[1] Supervising Fishery Technologist, Fish Utilization Section, Bureau of Fisheries & Aquatic Resources, Manila.

[2] Senior Fishery Technologist, Fish Utilization Section, Bureau of Fisheries and Aquatic Resources, Manila.

[3] Senior Fishery Technologist, Fish Utilization Section, Bureau of Fisheries and Aquatic Resources, Manila.

flavor but also eliminate losses caused by spoilage of the highly perishable commodity.

This project is designed to make carp more acceptable to the great number of Filipinos. Government technologists were directed to devise different methods of processing it. The project is divided into two sub-projects namely, (a) studies on the keeping quality of smoked carp, and (b) freezing and packaging of carp, and preparation of convenience items from frozen carp.

EXPERIMENTAL PROCEDURES

A. *Materials:*

The common carp has double barbels at the mouth and heavy serrated spines in the dorsal and anal fins. Sometimes, carps are transported alive to different marketing centers to command better prices. (See Figure 1).

All samples used in these experiments were procured from commercial markets. They have an average length of 32.87 cm. and an average weight of 507 grams.

B. *Methods:*

1. *Smoking:*

The belly of the fish is cut to remove the internal organs and the blood along the backbone. The gills are removed. It is then washed thoroughly with water. After washing, it is soaked in concentrated brine solution for 2-1/2 hours and arranged in a wire tray to drain the excess brine.

The fish samples are then divided into two batches: one is pre-cooked in brine solution and the other is later smoked without pre-cooking. They are arranged in smoking trays to smoke for two hours depending upon the production of smoke. Figure 2 shows the flowsheet for smoking carp.

2. *Packaging and Freezing of Sticks:*

The fish is scaled, internal organs are removed and filleted. The rib bones and fins are trimmed away after the fillets have been separated from the skeleton.

After filleting, it is cut into fish sticks and samples are divided into three batches and packed into three different types of packaging materials such as aluminum foil, wax paper (Cut-rite Brand) and polyethylene bags, and stored frozen. Organoleptic test is done periodically based on the eye appeal, palatability and texture.

3. *Preparation of Breaded Carp from Frozen Sticks:*

Fish sticks are portions cut from frozen fish fillets. Fish fillets consist of flesh cut away from the backbone of the skinned and gutted fish. In the Philippines, it is now being introduced to housewives as a convenient fish product. It is now gaining public acceptance.

Carp fillets have advantages over other fish products in that:

a. They are intermediate products very convenient for consumers. Fillets save them the trouble of cleaning and skinning involved in preparing a whole fish.

b. They are given the right shape and size for packing into standard-sized boxes and containers so that the space available in storage can be used to best advantage.

c. They can be cut into standard weight which makes them easy to handle in shops.

The only disadvantage in fish fillets is the difficulty in preserving the natural extractive and aromatic substances in the fish flesh.

Figure 3 shows the flowsheet in the preparation of breaded sticks from carp.

The preparation of breaded sticks from carp involves the following procedures:

a. Preparation of fish fillets.

b. Freezing of fish fillets.

c. Cutting of fillets into sticks. The actual size of sticks is 3-3/4" length; 1/2" thickness and 7/8" inch width.

d. Coating of raw fish sticks. Batter used in this particular experiment consists of flour, salt, spices, monosodium glutamate and baking powder. Bread crumbs are used as breader material.

The batter is made by mixing two parts of dry batter to three parts water. The resultant smooth suspension coats the raw fish sticks evenly.

e. Pre-cooking of coated raw fish sticks by deep-frying.

After coating the fish sticks, they are manually rolled into bread crumbs, then pre-cooked by deep-frying. The pre-cooked carp sticks are then cooled and packed in polyethelene bags.

f. In this experiment, samples are divided into five groups: one group is frozen breaded raw and breaded raw stored in refrigerating temperature. The other group is pre-cooked breaded and pre-cooked breaded stored in refrigerating temperature; and one group served as control — frozen (unbreaded).

All samples are subjected to organoleptic test based on the eye appeal, palatability and texture.

RESULTS AND DISCUSSIONS

A. *Smoking:*

Table I shows the proximate chemical analysis of fresh and smoked carp.

	Moisture	Protein	Ash	Fat
Fresh	77.88	18.99	0.95	3.42
Smoked	77.12	21.12	1.91	3.42

Table II shows the quality obtained from smoked carp stored at refrigerating temperature 5°C to 7°C.

From the results of the subjective tests based on the color, odor, texture, and flavor, smoked carp stored at room temperature, exposed

TABLE II. TASTE PANEL SCORE RATING COLOR, ODOR, TEXTURE AND FLAVOR OF SMOKED CARP AT REFRIGERATING TEMPERATURE, EXPOSED AND SEALED CONDITIONS.

SMOKED CARP – REFRIGERATING TEMPERATURES																	
No. of Days: Stored:	With Precooking in Brine						Without Precooking										
	Exposed			Sealed			Exposed			Sealed							
	Eye Appeal	Palata-bility	Tex-ture	Eye Appeal	Palata-bility	Tex-ture	Eye Appeal	Palata-bility	Tex-ture	Eye Appeal	Palata-bility	Tex-ture					
Initial	7.8	8.0	7.4	7.9	8.0	7.6	7.7	7.4	7.0	7.7	7.4	7.0					
7	6.7	5.4	5.9	6.0	5.4	5.3	5.9	5.7	5.4	5.5	5.2	5.7					
28	6.0	7.0	6.8	6.0	5.4	5.3	6.3	6.0	5.8	6.8	6.8	6.8					
36	5.0	5.2	5.0	spoiled			3.8	3.8	3.0	spoiled							
44	spoiled						spoiled										

and sealed, with or without pre-cooking in brine became spoiled on the third day of storage. However, those stored at refrigerating temperature under the same conditions were still edible on the 28th day of storage with an average score of 7.0 to 6.0 which is "like moderately" to "like slightly". On the 44th day of storage, all samples were spoiled.

B. *Packaging and freezing of sticks:*

Results from the three different packaging materials used in the freezing of carp sticks show that samples packed in polyethelene bags were still quite fresh after the 126th day of storage. (See Table III).

Figure 4 shows the organoleptic assessment of frozen carp using different packaging materials.

C. *Preparation of breaded carp from frozen sticks:*

Tables IV, V, and VI show that frozen raw breaded carp sticks, on their 82nd day of storage have an average score of 6.0 based on the eye appeal, palatability and texture which is "like slightly," while those stored at refrigerating temperature have an average score of 6.9 to 5.5 in descending order from "like slightly to neither like nor dislike." (See Figure 5.)

Pre-cooked samples stored at freezing temperature became rancid and spoiled on their 82nd day of storage. Refrigerated pre-cooked samples were all spoiled after 33 days of storage. (See Figure 6).

CONCLUSION

Like most fishes, carp is a good protein source and can compare favorably with beef, pork and poultry. It can be processed in the same manner as big fishes. It can be utilized in many ways, making it accepted as a prime food commodity with a good product image.

Carp can be smoked, filleted and stored as frozen products, and can be used as raw material for the preparation of convenience items.

TABLE III. ORGANOLEPTIC ASSESSMENT OF FROZEN CARP USING DIFFERENT PACKAGING MATERIALS.

No. of Days Stored:	Aluminum foil			Cutrite			Polyethylene bag		
	Eye Appeal	Palatability	Texture	Eye Appeal	Palatability	Texture	Eye Appeal	Palatability	Texture
Initial	7.8	7.0	8.5	7.6	7.0	8.0	7.9	7.0	8.0
7	7.2	7.5	7.0	7.5	7.0	7.5	7.8	7.5	8.0
30	7.0	7.0	7.0	7.1	7.0	7.0	7.7	7.0	8.0
44	7.0	7.0	7.0	7.1	7.0	7.0	7.6	7.5	8.0
58	7.0	7.0	7.0	7.0	7.0	7.0	7.5	7.0	7.5
72	7.0	7.0	7.0	6.4	6.5	6.0	7.5	7.0	7.5
86	7.0	7.0	7.0	6.3	6.5	6.0	7.0	7.0	7.0
100	7.0	7.0	7.0	5.7	6.3	5.0	7.0	7.0	7.0
114	6.6	6.5	6.5	5.0	5.0	5.0	7.0	7.0	7.0
128	6.5	6.5	6.5	5.0	5.0	5.0	7.0	7.0	7.0

TABLE IV. ORGANOLEPTIC TEST OF FROZEN BREADED RAW CARP STICKS AND REFRIGERATED BREADED RAW CARP STICKS.

No. of Days Stored	FROZEN BREADED RAW			REFRIGERATED BREADED RAW		
	Eye Appeal	Palatability	Texture	Eye Appeal	Palatability	Texture
0	9.0	7.4	7.7	9.0	8.0	8.0
12	7.0	7.4	7.4	7.0	7.0	7.0
25	7.2	7.0	7.0	5.0	5.5	6.0
32	7.1	7.5	7.0	spoiled		
40	7.0	6.6	7.0			
53	7.0	7.0	7.0			
63	6.8	7.0	7.0			
82	6.0	6.0	6.0			

TABLE V. ORGANOLEPTIC TEST OF FROZEN PRECOOKED BREADED CARP STICKS AND REFRIGERATED PRECOOKED BREADED CARP STICKS.

No. of Days Stored	FROZEN PRECOOKED BREADED			REFRIGERATED PRECOOKED BREADED		
	Eye Appeal	Palatability	Texture	Eye Appeal	Palatability	Texture
0	7.4	7.2	7.4	8.4	7.2	8.0
12	7.4	7.0	7.4	7.0	7.0	7.0
25	7.5	7.0	7.3	6.4	5.8	6.2
32	7.0	7.0	7.0	spoiled		
40	7.0	7.0	7.0			
53	7.0	7.0	7.0			
63	4.5	6.8	6.0			
82	rancid and spoiled					

TABLE VI. CONTROL — FROZEN CARP STICKS.

No. of Day Stored	Eye	Palatability	Texture
0	9.0	8.0	8.0
12	8.3	8.0	8.2
25	7.2	7.3	7.2
32	7.0	7.4	7.0
40	7.0	6.7	7.0
53	7.0	6.5	6.5
63	6.3	6.2	6.5
82	6.0	6.0	6.0

BIBLIOGRAPHY

ARDIWATA, R.O. 1955. "The culture of common carp." Fish Culture Series No. 1, Bandung, Indonesia.

Carp production highly promising. 1968. Fishery Leaflet 1(8).

GRACIA, DEMETRIO M. and PIO, BERSAMIN. 1970. What you should know about carp culture. Fishery Leaflet. Manila, Bureau of Fisheries.

HOPKINS, E. et al. "Cooking carp." Fishery Leaflet. Wash., D.C. U.S. Dept. of Interior, Fish and Wildlife Service.

POTTINGER, S.R. Packaging of frozen fishery products. Fishery Leaflet No. 19. Wash., D.C., U.S. Dept. of Interior, Fish and Wildlife Service.

WATER, MELVIN. 1974. Home freezing of sea food. Marine Fisheries Review 36(1). MFR Paper 1026. Wash., D.C., U.S. Dept. of Commerce, Nat'l Oceanic and Atmospheric Adm., Nat'l Marine Fisheries Service.

WICKLIFF, E.L. The European Carp. Bull No. 26. Ohio, Dept. of Agr., Bureau of Scientific Research, Div. of Conservation.

U.S. Dept. of Interior, Fish and Wildlife Service, Bureau of Commercial Fisheries. Refrigeration of fish — Part 4: Preparation, freezing and cold storage of fish, shellfish and precooked fishery products. Fishery Leaflet 430. Wash., D.C.

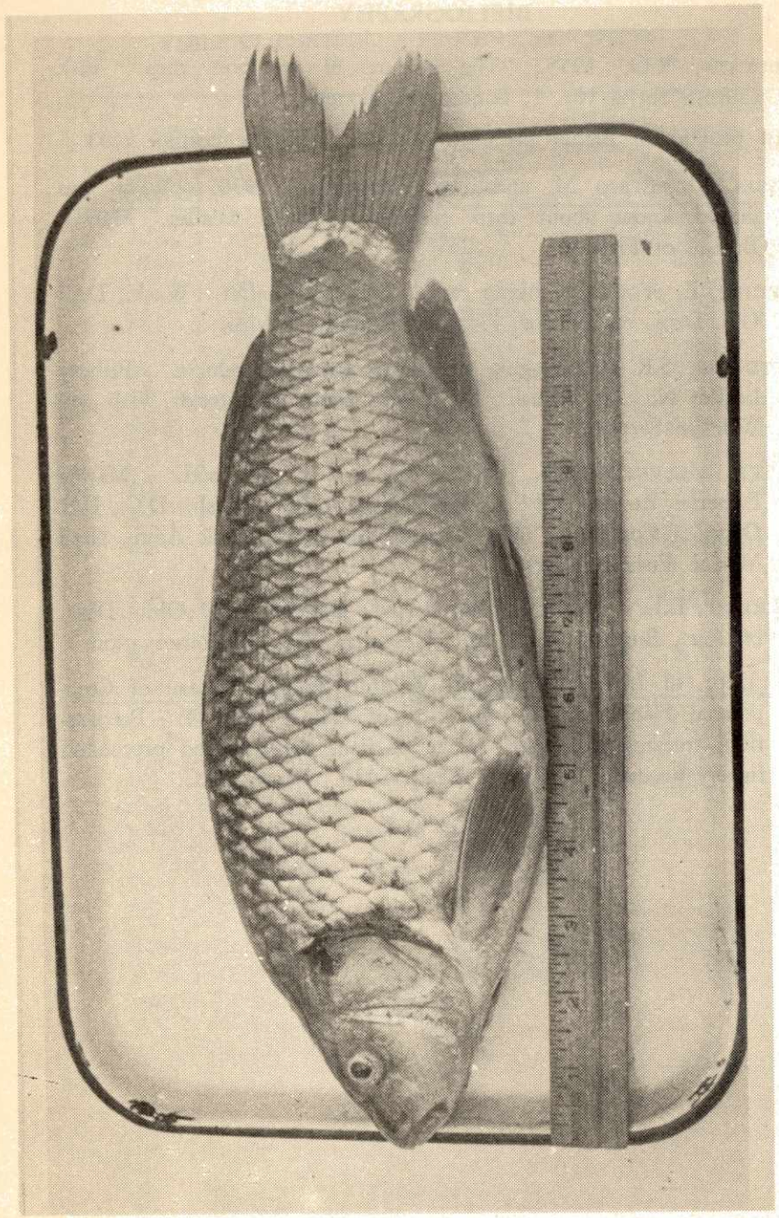

FIGURE 1. Common Carp (*Cyprinus Carpio*, Linnaeus).

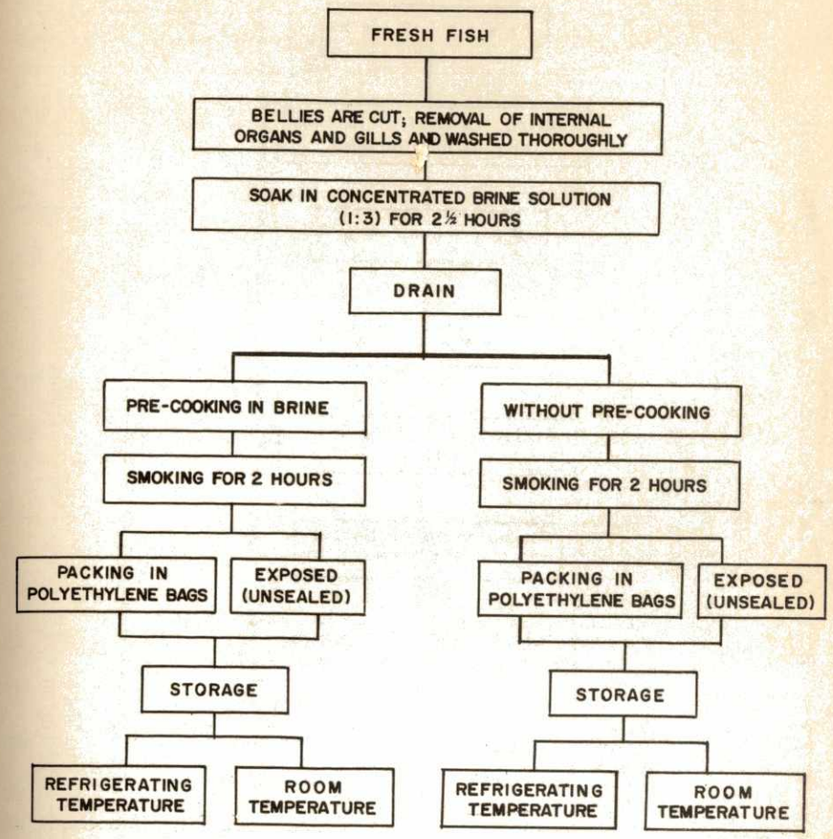

FIGURE 2. FLOWSHEET FOR SMOKING CARP.

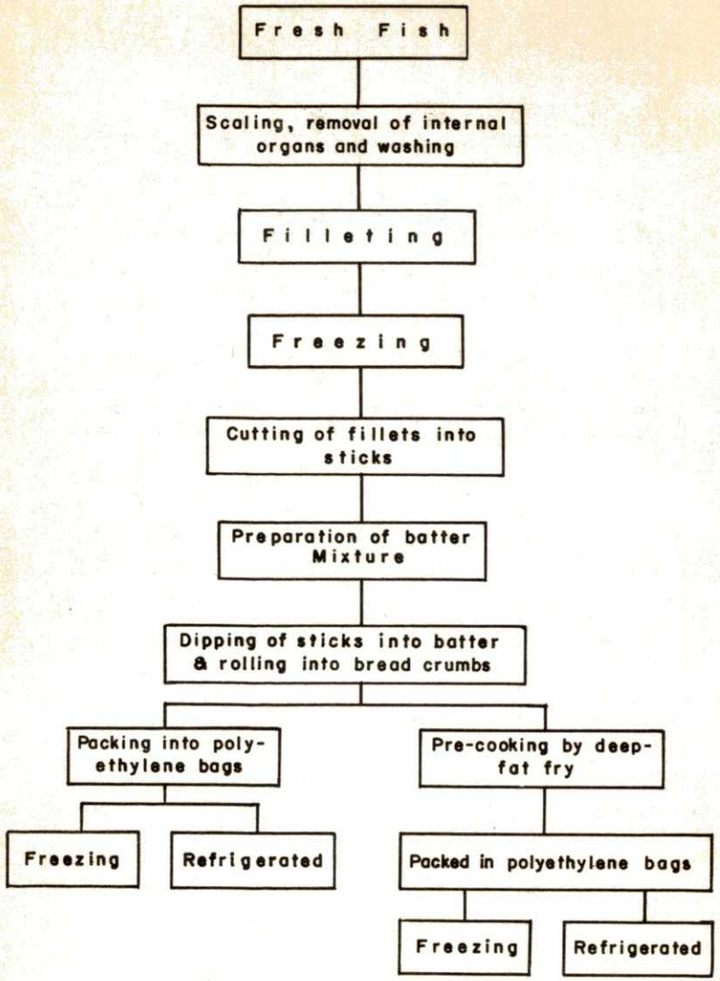

FIGURE 3. FLOWSHEET IN THE PREPARATION OF BREADED STICKS FROM CARP.

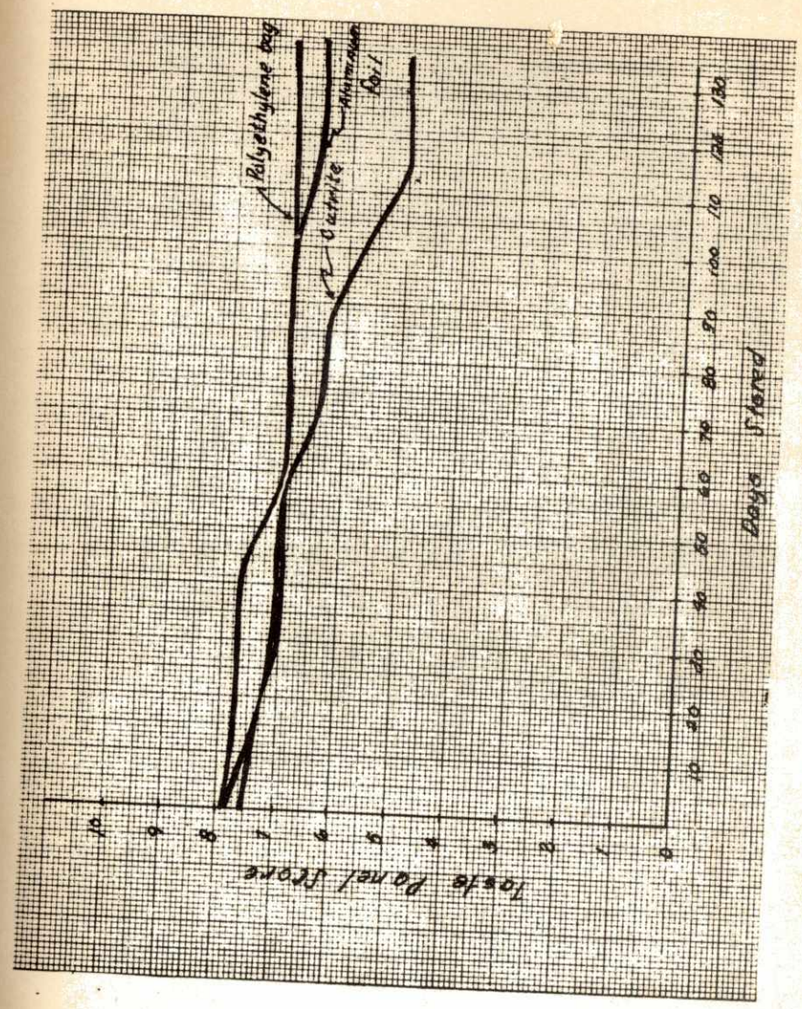

FIGURE 4. ORGANOLEPTIC ASSESSMENT OF FROZEN CARP USING DIFFERENT PACKAGING MATERIALS.

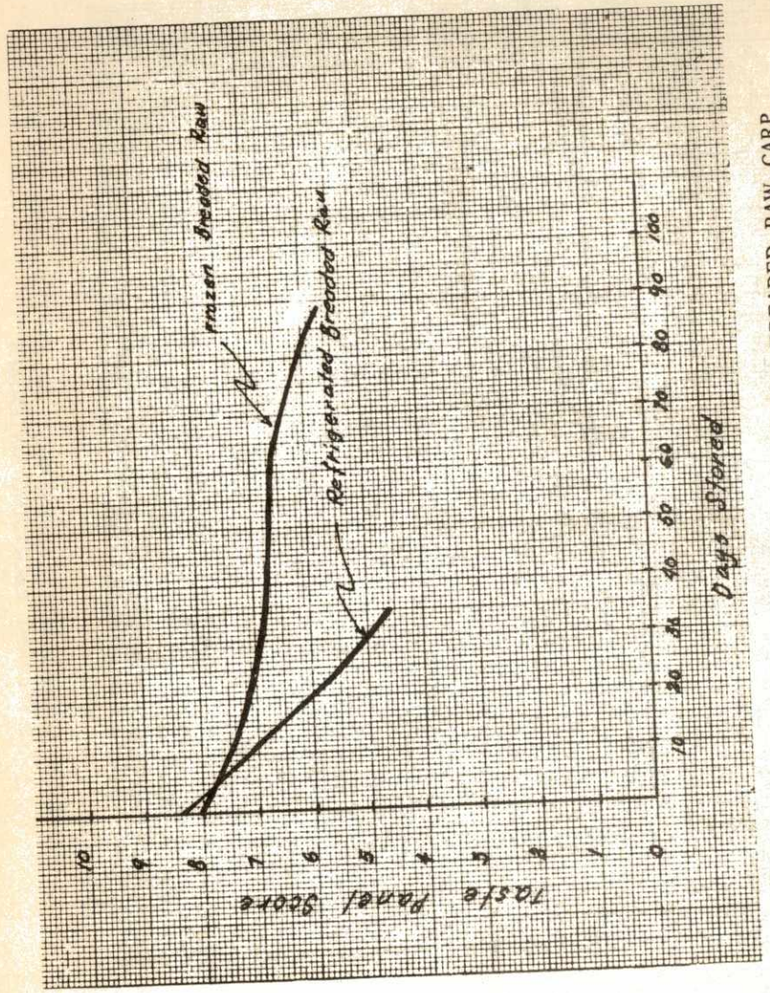

FIGURE 5. ORGANOLEPTIC TEST OF FROZEN BREADED RAW CARP STICKS AND REFRIGERATED BREADED RAW CARP STICKS.

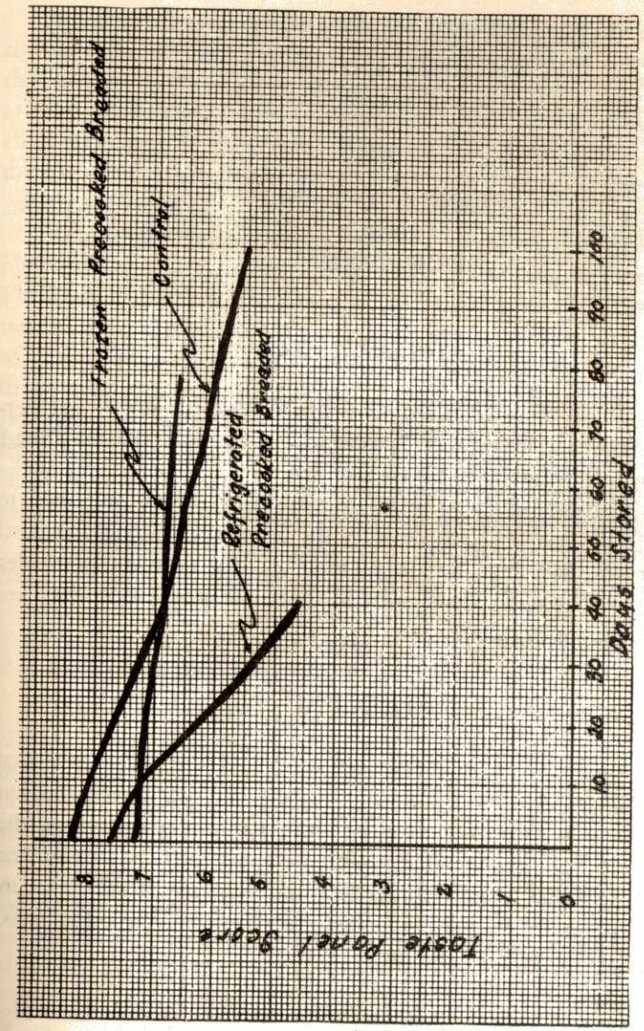

FIGURE 6. ORGANOLEPTIC TEST OF FROZEN PRECOOKED BREADED CARP STICKS AND REFRIGERATED PRECOOKED BREADED CARP STICKS

Table I. An Example of Food Chain Concentration of a Persistent Pesticide, DDT*

	PPM** DDT RESIDUES
Water	0.00005
Plankton	0.04
Silverside minnow	0.23
Sheaphead minnow	0.94
Pickerel (predatory fish)	1.33
Needlefish (predatory fish)	3.07
Heron (feeds on small animals)	3.57
Tern (feeds on small animals)	3.91
Herring Gull (scavenger)	6.00
Fish Hawk (Osprey) egg	13.8
Merganser (fish-eating duck)	22.8
Cormorant (feeds on larger fish)	26.4

* Data from Woodwell, Wurster, and Isaacson, 1967.

** Parts per million (ppm) of total residues, DDT + DDD + DDE (all of which are toxic, on a wet weight, whole organism basis.

organs in the body, the liver is the most extraordinary. It presides over so many vital activities that even the slightest damage to it may bring about serious consequences. The liver provides bile for the digestion of fats, receives blood from the digestive tract, stores sugar and replaces it as glucose in measured quantities to keep the blood sugar at a normal level. It also builds body protein, maintains cholesterol at its proper level in the blood plasma and is a storehouse of many vitamins. But a liver damaged by pesticides is incapable of functioning properly.

Carson (1962), states that through an infinite number of experiments on animals and by observation on human subjects as well, it is very clear that chlorinated hydrocarbons directly affect the nervous system.

Accumulation of chlorinated hydrocarbons have been discovered in the sex organs of a variety of birds and mammals.

Wurster (1969), evaluates the problems of chlorinated hydrocarbons as follows:

The chlorinated hydrocarbon insecticides, now among the world's most widely distributed synthetic chemicals, are contaminating a substantial part of the biosphere. They are dispersed throughout the environment in currents of air and water. Their movement and widespread distribution throughout the world is explained by their solubility characteristics and chemical stability, and especially their tendencies to absorb on organic matter, to be transported in air droplets, and to become concentrated in food transfers from plants to herbivores to carnivores. Their broad toxicity indicates a potential for biological effect on many kinds of organisms.

The chlorinated hydrocarbons are seriously degrading biotic communities in many parts of the world. They have been shown to destroy larval stages of valuable aquatic food organisms and to depress photosynthesis of marine phytoplankton (which could have grave effects on the gaseous balance in the atmosphere). While direct effects on the hormone balance in man have not yet been demonstrated, concentration levels in human tissues are now high enough that such effects, and also cancer and deleterious mutations, could occur in the future (since they have been demonstrated to occur in laboratory animals), especially if nothing is done to control and to monitor the further use of these potentially hazardous chemicals.

MAGNITUDE OF THE PROBLEM

Pesticides may enter the human body directly or indirectly. They enter directly when a person is exposed to the chemical. He may breath in the fumes, swallow it or absorb the chemical through the skin. They may enter the body indirectly when a person eats fish, meat or vegetables that have been directly or indirectly exposed to insecticides. Pesticides may also enter the body through drinking water. Increasing applications of pesticides in large-scale agriculture and in forest areas can contribute to the presence of these toxic materials in the water supply (Standard Methods, 1971).

The extent to which the use of chlorinated hydrocarbons and other chemicals have polluted and possibly contaminated the environment cannot be documented due to the lack of quantitative data. However, Alcala (1974), states the following: "In the Philippines, some studies have shown that levels of pesticides such as DDT and

related compounds, *Lindane, Heptachlor, Chlordane, Methexychlor, Dieldrin,* and *Endrin* in the tissues of freshwater fish from Laguna de Bay have increased 7.5 to 500 times between 1972 and 1973. It is worth-noting that residues of these pesticides in duck eggs were higher than in fish. x x x As of 1973, the quantity of these pollutants in the flesh of fish was below the generally accepted tolerance level of 20 ppm but will reach the critical levels if nothing is done to stop the increase."

Something must be done now to stop the saturation of the Philippine environment with harmful chemicals. With the increasing need for food, man will rely more heavily on pesticides. Using pesticides have provided a temporary solution to the problem. However, these substances have produced one of the world's most serious pollution problems (*Odum, 1971*).

Consider the farmer who uses *endrin* or another chlorinated hyrocarbon in his ricefield or fishpond. Of the many farmers using these chemicals, probably very few have ever used a great enough quantity to immediately kill fish in the nearby waters. However, continual use of these harmful substances will have an effect on the entire surrounding biological community because of the accumulative nature of the poisons. The end result will be devastating because it is not visible until it has affected many organisms including man.

An obvious consequence of the continued use of chlorinated hydrocarbons in Philippine waters could be the disappearance of *bangus* and *sugpo* fry upon which the inland fisheries development program depends. The mouths of rivers into which fishponds and ricefields drain are often near the fry grounds that support the fishponds with seedlings. When these chemicals are flushed from fishponds and ricefields downstream, the delicate fry will be one of the first organisms to come in contact with them.

Using chlorinated hydrocarbons to solve the immediate problem of pest control in fact creates greater problems when these chemicals eventually come in contact with organisms that are not targetted for control.

This problem is compounded by the fact that many insects may rapidly develop strains that are resistant to a particular chemical.

Different deadly chemicals or stronger doses of the same chemical will be required for successive applications.

CONCLUSIONS

There has been a long history of chemical pollution throughout the world. The general chemical contamination of vast areas of land and water can have a significant impact on the quality of life in the future.

Chemical pollution is a problem all people will have to face. There is no "one-shot" solution, nor will there ever be one (*Odum, 1971*). However, it is important that the Philippines start to look for and try some of the possible solutions to the problem.

It is imperative that our people do not pollute inland and coastal waters. Being a fish-eating country and a nation of islands, we are more dependent on fishery products than most countries. A few years of heavy pesticide use may cause decades of problems.

RECOMMENDATIONS

1. Endrin should be banned from all markets in the Philippines. This ban should be strictly enforced.

Endrin is the most toxic of all chlorinated hydrocarbons. It is 15 times as poisonous as DDT to mammals, 30 times as poisonous to fish, and about 300 times as poisonous to some birds. In the Pesticide Manual prepared by the Cooperative Extension Service of the Northeast Land Grant Universities, U.S.A., *endrin is not recommended for any purpose.*

2. Farmers should be encouraged to use pesticides that are less persistent in the soil and less toxic to human beings.

Two of the greatest enemies of our farmers in agricultural production are insects and weeds. Because of these enemies, most farmers have resorted to the use of pesticides to protect their valuable and needed crop.

Some agriculturists estimate that as much as 50% of a rice crop may be lost if herbicides were not used to control weeds that com-

pete with rice for nutrients in the soil. Some even estimate a 70% loss in a rice crop if pesticides were not used to control insects.

Due to the increasing demand for food, it is not feasible for farmers in the Philippines to discontinue the use of all kinds of pesticides. However, certain extremely toxic pesticides should be avoided. In many cases, once sprayed on rice fields, these harmful chemicals may be accumulating in the soil, creeks, rivers and other bodies of water. If less persistent chemicals were used, the chances of a large build-up of toxic residues would be lessened.

3. The Bureau of Plant Industry and the Bureau of Agricultural Extension should coordinate with the Bureau of Health in conducting seminars about the hazards of pesticides to farmers.

Many pesticides are extremely harmful to persons handling and using them. Many of these farmers are not aware of the hazards involved or the precautionary measures to be taken when using pesticides. There have already been a number of deaths reported that were caused from the improper handling and use of pesticides.

4. All farmers should be encouraged to use resistant varieties of rice like IR- 26, IR-28, and IR-32.

When resistant varieties of rice are used, pesticide use is minimized. At present, with the use of pesticides in agricultural production, the potential production of fishery products in inland waters can not be realized. Rice-fish culture is possible if IR-26, IR-28 and IR-32 were used.

5. The BFAR should mount an intensive educational campaign among fishpond operators on the use of certain chemicals in the control of pond pests and diseases.

Many fishpond operators are using *endrin* to kill pests and predatory fish in their fishponds. Some are even using *endrin* to harvest fish and shrimps.

6. All government agencies, schools and research institutions should share efforts in organizing seminars, classes and campaigns to create a general awareness about pesticides.

At present most people are not aware of the uses and effects of pesticides particularly, chlorinated hydrocarbons. These seminars should not be scare-campaigns but rather informative classes instructing

the general public on the types of pesticides used in the Philippines and their effects.

7. Research organizations should intensify their efforts to develop new resistant strains of rice and biological control of insects.

As stated earlier, pesticides, regardless of the type, provide only a temporary solution to the problem. The only good pesticide is one that is never used. If biological controls or newer and better resistant strains of rice were developed, there would then be little, if any, need for pesticides in agricultural production.

8. Research organizations should be encouraged to research more on the biodegradation of pesticides.

Information is now available about the biodegradation of pesticides in temperate regions. However, little is known about this area in the tropics. Some researchers report that many pesticides breakdown much faster in tropical climates than in temperate climates. If more were known about biodegration of pesticides, certain less persistent pesticides could be recommended until safer controls are found.

BIBLIOGRAPHY

ALCALA, ANGEL C. 1964. Suppl. Asia Foundation Journalism Seminar. (New Vision) Volume I, No. 45. July 24-30.

American Public Health Association and Water Pollution Control Federation. 1971. Standard Methods for the Examination of Water and Waste Waters. Washington, D.C. 874 p.

CARSON, RACHEL. 1972. Silent Spring. Houghton Miffin Co. Boston.

EHRLICH and EHRLICH. 1970. Population vs. Environment: Issues in Human Ecology. Freeman and Co., San Francisco. 383 p.

International Rice Research Institute. 1967. Annual Report. Los Baños, Laguna, Philippines, 302 p.

ODUM, E.P. 1971. W.H. Saunders Co., Philadelphia, Pa., 574 p.

WOODWELL, G.M., C.P. WURSTER, and P.A. ISAACSON. 1967. (As reported by E.P. Odum). W.H. Saunders Co., Philadelphia, Pa. 574 p.

WURSTER, CHARLES P. 1969. (As reported by E.P. Odum). W.H. Saunders Co., Philadelphia, Pa. 574 p.