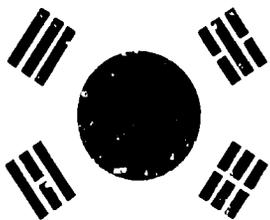


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KOREA

**shellfish
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1971**



EVALUATION OF SHELLFISH SANITARY CONTROL PROGRAM IN KOREA, 1971

J. D. Clem and D. A. Hunt

Report of the activities, recommendations, and conclusions of the FDA's shellfish sanitation evaluation Mission to Korea. The Mission was established at the request of the Government of Korea and conducted by the U. S. Food and Drug Administration with the assistance of the Agency for International Development, U.S. Dept. of State.

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Public Health Service
Food and Drug Administration ✕
Bureau of Foods
Division of Shellfish Sanitation

This Report has been prepared for a special audience. Distribution and availability of the Report has been limited. The Report should not be cited as a publication in the scientific literature. The Mission was supported, in part, by funds of the Agency for International Development, U.S. Dept. of State and Republic of Korea Government.

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FOREWORD

The Korean Government has been developing a sanitary control program for shellfish since the early 1960's which could be recognized by the United States Government as fulfilling the requirements of the National Shellfish Sanitation Program's Manual of Operations. In support of this undertaking, the U. S. Public Health Service has participated in numerous discussions, exchanges of information, and training activities with representatives of various Korean Government agencies and the Korean shellfish industry on the administrative and technical aspects of shellfish sanitation.

Laws and ordinances were reviewed as they were developed, and similar United States documents were furnished to the Korean Government. Analytical and other technical data were submitted for review and comment. In 1961, the Government of Korea assigned a technical staff member of the Fisheries Research and Development Agency to the United States for a 6-month period. He received in-service training in the sanitary aspects of the control of shellfish.

About December 1962, the Korean Government proposed to the United States that an agreement be concluded on the sanitary control of shellfish. Additional information on sanitary surveys of oyster-growing areas was presented to the United States on March 1963. Considerable exchange of correspondence then ensued between the U. S. Public Health Service and the Korean Bureau of Fisheries. Administrator Oh, Korean Office of Fisheries, met with United States officials in January 1967 to discuss possible conclusion of the agreement. A United States Mission was consequently formed September 1967 to visit Korea and provide technical consultation and advice in the development of an effective oyster production and sanitary program. Recommendations of the Mission were furnished the Government of the Republic of Korea with a view toward meeting the sanitary recommendations of the National Shellfish Sanitation Program. Administrator Koo, Korean Office of Fisheries, met with Ambassador McKernan, U.S. Department of State in March 1970 to seek an early conclusion to the proposed agreement. Further studies and sanitary measures were performed by the Korean Government during this period, and in July 1970 notified the United States Government as to the progress made.

The Korean Government on Sept. 1970 invited a United States shellfish survey mission to inspect sanitary conditions and discuss sanitary control measures taken with responsible

Korean Government authorities. A Mission was initiated composed of two U. S. Public Health Service officers for the period, September 15 to October 6, 1971, to honor the invitation of the Korean Government. The subject of this report covers the findings of this Mission.

The National Shellfish Sanitation Program, organized in 1925, is a voluntary cooperative triumvirate composed of State and Federal agencies, two foreign countries, and the shellfish industry. Program effectiveness is dependent upon close and interlocking cooperation between the industry and the responsible control agencies. It has a responsibility to the consuming public to assure the production of safe and wholesome shellfish. The program is based upon a concept of mutual trust in its members to follow agreed-upon sanitary guidelines of shellfish production, as promulgated in the Manual of Operations. The NSSP promotes the continued safe use of valuable shellfish resources and actively encourages water quality programs which will preserve coastal areas for shellfish culture.

The authors would like to express their sincere appreciation for the cooperation, support, and generous assistance received throughout Korea. Special thanks are extended to the staff of the Office of Fisheries, officials in Geong Sang Province, the staff at Pusan Fisheries College, personnel of Korea General Foods Company, and many others too numerous to mention, who gave so unselfishly of their time and personal attention.

Special acknowledgement is made for Miss Ah-ja Choi for technical assistance to the Mission in Pusan and for the assistance of Mrs. Alberta Edwards, Secretary of the Division of Shellfish Sanitation, FDA, in preparing this manuscript.

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INTRODUCTION

The note from the Embassy of the Republic of Korea, dated September 1, 1970, invited a United States Mission to "inspect sanitary conditions of shellfish in Korea and discuss sanitary control measures taken by the Korean Government with the relevant authorities." It was further noted that the U. S. Food and Drug Administration has the responsibility for evaluation and endorsement of the shellfish sanitation programs of States or foreign countries participating in the National Shellfish Sanitation Program (NSSP). Therefore, the basis and reference used by the Mission to evaluate and inspect the Korean shellfish sanitary control program was the Manual of Operations of the NSSP. The review and audit by the Mission was a comprehensive evaluation of the available information, records, files, and data. Field visits were made to the respective control laboratories and the site of the proposed oyster industry operations. The report attempts to document all pertinent technical and administrative aspects for sanitary control of oysters intended for export. Emphasis is placed upon program developments from 1967 through the time of this Mission's departure from Seoul, October 6, 1971.

The Mission considered laws, rules, and regulations covering the sanitary and production control of the export oyster industry. The personnel, facilities, and resources available to conduct and administer these controls were thoroughly reviewed. The shellfish industry and its proposed methods of operation were investigated with special note made of quality control measures to be instituted. The control over harvesting, transportation, shucking-packing plant, and sanitary surveys of growing areas were reviewed and evaluated. The report describes in detail these elements of the Korean shellfish program. During the Mission's visit to Korea, there were no commercial oyster operations being conducted.

The Mission was furnished a complete dossier of materials representing detailed reports and briefing data on what had been accomplished up through the date of arrival. Several briefing sessions were held to explain past and planned future activities of various Governmental agencies. Reports and background information received during the Mission have been referenced in the Appendix.

The Mission's report on "Sanitary Control of Shellfish in Korea" by C. B. Kelly, et al. (1967), contained 19 recommended

items presented for guidance in development of an effective shellfish sanitation control program. The Mission (1971) reviewed the progress that had been made toward accomplishment of the recommended items. Based upon information furnished the Mission, it was apparent that the Korean Government had completed more than 97 percent of the administrative and technical items recommended in 1967 and has plans to complete the remaining items in the near future.

CONCLUSIONS
AND
RECOMMENDATIONS



CONCLUSIONS AND RECOMMENDATIONS

The question the Mission considered throughout its review was whether the standards, criteria, and guidelines promulgated by the National Shellfish Sanitation Program were applicable to sanitary control of shellfish in the Republic of Korea. In view of the similarity of shellfish species involved, comparable sanitary conditions envisioned for each processing step, and relative food handler/enteric disease experience of the two countries, the mission concludes that the NSSP requirements will apply to all phases of the Korean shellfish sanitation control program.

The Mission further concludes that sufficient organizational responsibilities have been established within the national, provincial, and local Governments to administer a satisfactory program for the production and sanitary control of raw and fresh-frozen oysters for export. Adequate rules, laws, ordinances, and guidelines have been promulgated to control all phases of the anticipated oyster industry operations. Thus, the Mission recognized that the Republic of Korea had developed a shellfish sanitary control program equivalent to the requirements of the National Shellfish Sanitation Program.

Sanitary survey data and surveillance sampling indicate that the water quality of shellfish harvest areas designated for export meet or exceed the bacteriological requirements of the NSSP Manual of Operations. Chemical residue data on oyster tissue obtained from the designated areas are below the levels that have been found in United States shellfish and considered to be of no health significance. The presence of low levels of an unidentified marine biotoxin in shellfish meats from the subject areas in June and July 1971 indicate a need to study and identify the specific marine biotoxin, evaluate the ecology of the causative organism, and determine seasonal changes in toxicity levels. The lack of epidemiological evidence of paralytic shellfish poisoning indicates that this problem is of little health significance, particularly in consideration of the large volume of bivalved molluscs consumed raw by the Korean people.

Current regulations and agricultural practices have apparently abated the principal source of pollution emphasized by the 1967 Mission, use of night soil as fertilizer, to an insignificant level in the areas designated for export to the

United States.

The exclusion of heavy industry and establishment of the Geoje-Do Yosu, national park area to prevent industrial contamination of shellfish harvest areas is a highly significant sanitation and conservation measure taken by the Republic of Korea and deserves commendation. It is the type of land-use planning that will help protect the development of valuable national oyster and other marine food resources.

Based upon the food manufacturing experience of Korean General Foods Company, Ltd., with its quality control capability and highly trained food technologist, it is anticipated that the nearly completed oyster shucking-packing plant in Chung-Mu will be operated in accordance with the requirements and specifications of the NSSP Manual of Operations.

On the basis of the shellfish sanitation control capability demonstrated by the department heads and field personnel of the responsible agencies of the Korean Government and Korean General Foods, the Mission concludes that the Korean Government can and will fulfill its responsibilities as a member of the National Shellfish Sanitation Program in the production of fresh or frozen shellfish for shipment to the United States following the negotiation of appropriate trade agreements between the two Governments. Justification for these conclusions and recommendations are described, in detail, in this report.



ADMINISTRATION AND LEGAL CONTROLS

The agency of the Korean Government having primary responsibilities for sanitary and production control of shellfish is the Ministry of Agriculture and Forestry, Office of Fisheries. To execute these functions, the Office of Fisheries established the Shellfish Sanitation Control Subsection in the Aquicultural Section, Bureau of Production. This subsection has been charged with establishment, implementation, and supervision of plans concerning the sanitary control of shellfish and management of the sanitary control of shellfish.

Within the Office of Fisheries, Fisheries Research and Development Agency, a Shellfish Sanitation Survey and Research Center was established. This Center is in charge of formulation and implementation of a long-range experimental and survey plan for shellfish-growing areas and exchange of information on sanitary surveys with agencies concerned. The Center is located in The Fisheries Research and Development Agency Building in Pusan, Korea.

In order to properly coordinate Government-wide activities and programs which are of interest to the sanitary control of shellfish, a Memorandum on Interministerial Agreement was executed between four principal Ministries in the Korean Government on August 1971 (Appendic C). This agreement covers the major points of interest normally contained in State program documents of the National Shellfish Sanitation Program and, therefore, is deemed to be an adequate instrument to identify and coordinate Korean National Government program activities.

As a further measure in administering shellfish sanitation program activities, both Central and Provincial Shellfish Sanitation Control Committees were formed. The committees are charged with discussing and reviewing interministerial cooperation, examination of sanitary inspections, and recommending countermeasures to higher echelon or to members of the committee. The Central Committee consists of 20 members and the Provincial Committee consists of eight members as follows:

Members of Central Shellfish Sanitation Control Committee

Chairman: Deputy Administrator, Office of Fisheries

Asst. Chairman: Dir., Production Bureau, Office of Fisheries

Member: Chief of Aquiculture Section, Office of Fisheries

Chief of Construction Section, Office of Fisheries
Director, Central Fisheries Production Inspection
Station

Chief of Utilization & Processing Section, Fisheries
Research & Development Agency

Chief of Aquiculture Section, Fisheries
Research & Development Agency

Chief of Oceanography Section, Fisheries
Research & Development Agency

Chief of Special Production Section, Ministry of
Agriculture & Forestry

Director of Sanitation Bureau, Ministry of Health
& Social Affairs

Chief of Public Nisances Section, Ministry of
Health & Social Affairs

Chief of Food Sanitation Section, Ministry of
Health & Social Affairs

Director of Sanitation Division, National Institute
of Health

Director of Fisheries Bureau, Gyeong Sang Nam
Province

Director of Health & Social Affairs Bureau, Province

Professor in Charge of Poison & Parasitology on
Shellfish, Pusan Fisheries College

Professor in charge of Heavy Metal & Radiology,
Pusan Fisheries College

Professor in charge of Microbiology,
Pusan Fisheries College

Professor in Charge of Predator on Shellfish,
Pusan Fisheries College

Managing Director, Central Federation of
Fisheries Cooperation

Project Direct, Korea General Food Co., Ltd.

President, Oyster Hanging Culture Cooperatives

Member of Provincial Shellfish
Sanitation Control Committee

Chairman: Vice Governor, Gyeong Sang Nam Province

Assistant Chairman: Director of Fisheries Bureau, Gyeong
Sang Nam Province

Member: Director of Health & Social Affairs Bureau, Gyeong
Sang Nam Province

Mayor of Chung-Mu City

Chief of Geoje Gun County

Chief of Tong Yong Gun County

Director, Hygienic Laboratory, Gyeong Sang Nam
Province

Chief of Utilization & Processing Section,
Fisheries Research & Development Agency

Chief of Aquiculture Section, Fisheries Research
& Development Agency

Chief of Chung-Mu Branch Office, Central Fisheries
Production Inspection Station

To assist in directing needed research projects and investigations of shellfish sanitation problems, a Committee on Shellfish Sanitation Surveys and Research was formed in the Fisheries Research and Development Agency. The 11 members of this committee are as follows:

Members of Shellfish Sanitation
SURVEY AND RESEARCH CENTER COMMITTEE

Chairman: Director, Fisheries Research & Development Agency

Assistant Chairman: Chief, Utilization & Processing Section,
Fisheries Research & Development Agency

Member: Chief, Aquiculture Section, Fisheries Research &
Development Agency

Chief, Oceanograph Section, Fisheries Research &
Development Agency

Professor in Charge of Poisoning & Parasitology,
Pusan Fisheries College

Professor in Charge of Microbiology, Pusan
Fisheries College

Chief, Second Inspection Section, Central
Fisheries Production Station

Chief, Pusan Branch Office, Central Fisheries
Production Inspection Station

Chief, Chung-Mu Branch Office, Central Fisheries
Production Inspection Station

Chief, Health Sanitation & Social Affairs, Gyeong
Sang Nam Province

Chief, Production Section, Bureau of Fisheries,
Gyeong Sang Nam Province

Director, Hygienic Laboratory, Gyeong Sang Nam
Province

Manager, Oyster Hanging Culture Cooperatives

The Regulations Governing Sanitary Control of Shellfish, Their Growing Areas, Harvesting and Processing of Shellfish Products for Export were revised and promulgated on July 11, 1970, by Ministry of Agriculture and Forestry, Ordinance No. 422. This decree is issued under the authority of Article 4 of the Fishery Products Inspection Law and Article 5 of the Implementation Decree of the Fishery Industry Law. The majority of necessary sanitary control requirements are contained in Ordinance No. 422. The Ordinance is explicit to sanitary control and classification of growing areas, registration and certification of processors, establishment inspection standards and product quality standards, and requirements for certain records.

Other laws pertaining to shellfish sanitation control include the Food Sanitation Law which is similar in meaning and intent as the U.S. Food, Drug, and Cosmetic Act. The Public Hazards Prevention Law specifies waste water effluent standards for industrial and general sewage treatment plants. For example, the 5-day BOD requirement for a high rate trickling filter sewage treatment plant effluent is not more than 60 mg/l and the coliform shall not be more than 3,000 per liter. The Public Hazards Prevention Law, Garbage Cleaning Law, Law to Prevent Infectious Disease, Parasitic Disease Prevention Law, Building Law, Waterworks Law, Sewerage Law, and Atomic Energy Law are basic acts which promote the safety and well being of the citizens and environment of Korea.

It is concluded that Republic of Korea has an adequate legal basis for sanitary control of the export shellfish industry and

has the necessary Governmental organizations to administer the laws and regulations. The Mission determined that this element of the Korean shellfish sanitary control program is in compliance with the requirements of the National Shellfish Sanitation Program.

Since the shellfish industry was not operating during the Mission's visit to Korea, it was not possible to evaluate general administrative practices. However, sufficient preparation of forms, instructions to the industry, filing and record systems have been established that will allow initial industry operations to be accurately and systematically controlled and recorded.

A comparative summary of the 1967 Mission's recommendations and Korean Government actions taken follows this section.

COMPARATIVE SUMMARY OF 1967 RECOMMENDATIONS AND ACTIONS TAKEN

1967 PHS Mission Report Recommendations

Actions Taken by Republic of Korea

I. Administration

- A. Establish an organizational unit within the Office of Fisheries at a sufficiently high administrative level to be responsible for the interministerial and intraministerial administrative and technical coordination of the shellfish sanitation program.

- B. Develop an interministerial agreement between the Office of Fisheries and the Bureau of Public Health that would provide an adequate basis for cooperation and continuing exchange of information between the two ministries and their respective component units involved in the shellfish sanitation and control programs.

A.

1. Shellfish Sanitation Control subsection was newly established at the Aquiculture Section, Bureau of Production, Office of Fisheries on June 1, 1971, with 5 persons. The subsection is in charge of establishment, implementation, and supervision of plans concerning the sanitary control of shellfish, and management of the sanitary control of shellfish.

2. Central and Provincial Shellfish Sanitation Control Committees were established (the Central Committee consisting of 20 representatives from Office of Fisheries and agencies under the influence of the Office, the Ministries concerned, Provincial Government, Fisheries College, Korea General Food Co., and Oyster Hanging Cooperative on June 1, 1970. Kyengnam Provincial Committee consisting of 7 representatives from the Provincial Government, city and counties concerned, inspection and research agencies on 17 August 1970).

The Committees are in charge of reviewing interministerial cooperation concerning the sanitary control of shellfish and discussing counter measures.

3. Shellfish Sanitation Research Center was established (at the Fisheries Research and Development Agency consisting of 12 representatives from the agency, Fisheries College, Central Fisheries Inspection Station, Kyengnam Provincial Government and Oyster Hanging Cooperative on July 18, 1970). The Center will be in charge of formulation and implementation of research and survey plan for shellfish growing area and development of sanitary survey techniques and exchange of information on sanitary survey with agencies concerned.

- B. Memorandum on Interministerial Agreement concerning shellfish sanitation Control was exchanged on September 9, 1971.

1. Ministry of Agriculture and Forestry

To prohibit the use of excrement and pesticides having poisonous residue on farmland under cultivation in adjacent basin areas and promote the cultivation of designated crops.

2. Ministry of Construction

To consult with the Office of Fisheries with respect to coastal reclamation and sewer system which may affect the quality of water in the designated areas, and establish plans for supply of municipal water.

3. Ministry of Health and Social Affairs

To prohibit the use of excrement and prevent the pollution of waters by garbage, sewage and industrial waste disposal in the designated areas, and conduct the medical examination of employees, and take preventive measures against epidemics.

4. Ministry of Science and Technology

To prevent radioactive contamination and seek countermeasures in the event of any potential or actual danger.

5. Office of Fisheries

To conduct the sanitary control and patrol of, investigation, and studies on, the production and processing of shellfish.

C. Additional Administrative Activities

1. Oyster-growing areas for export were designated by Office of Fisheries (Office of Fisheries Notice No. 41 of September 4, 1971).

2. The areas in which the use of excrement is prohibited and special garbage cleaning areas in the vicinity of the oyster-growing areas for export were designated by Ministry of Health and Social Affairs, Tong Yong and Geoje County (Ministry of Health and Social Affairs Notice No. 12, Tong Yong County Notice No. 50, Geoje County Notice No. 105).

II. Laws and Regulations

A. Add to Article 14 of Ordinance No. 218 an additional item allowing harvesting of oysters only during daylight hours.

B. Revise Article 16 of Ordinance No. 218 to include the statement that "Only shellfish that have been harvested from designated areas or subjected to an approved purification treatment shall be processed for export in registered plants."

C. Revise Ordinance No. 218 and certain appendices of the ordinance to include references to important facilities requirements, processing standards, operational practices, and standards of shellfish quality, as discussed within the body of this report, so that the requirements of the Korean shellfish export program more nearly equal those of the U. S. National Shellfish Sanitation Program.

D. Develop, as indicated in the future, more detailed operational standards and guidelines for the shellfish industry and for use by governmental control agencies, based on experience obtained from the construction and initial operations of shellfish handling plants.

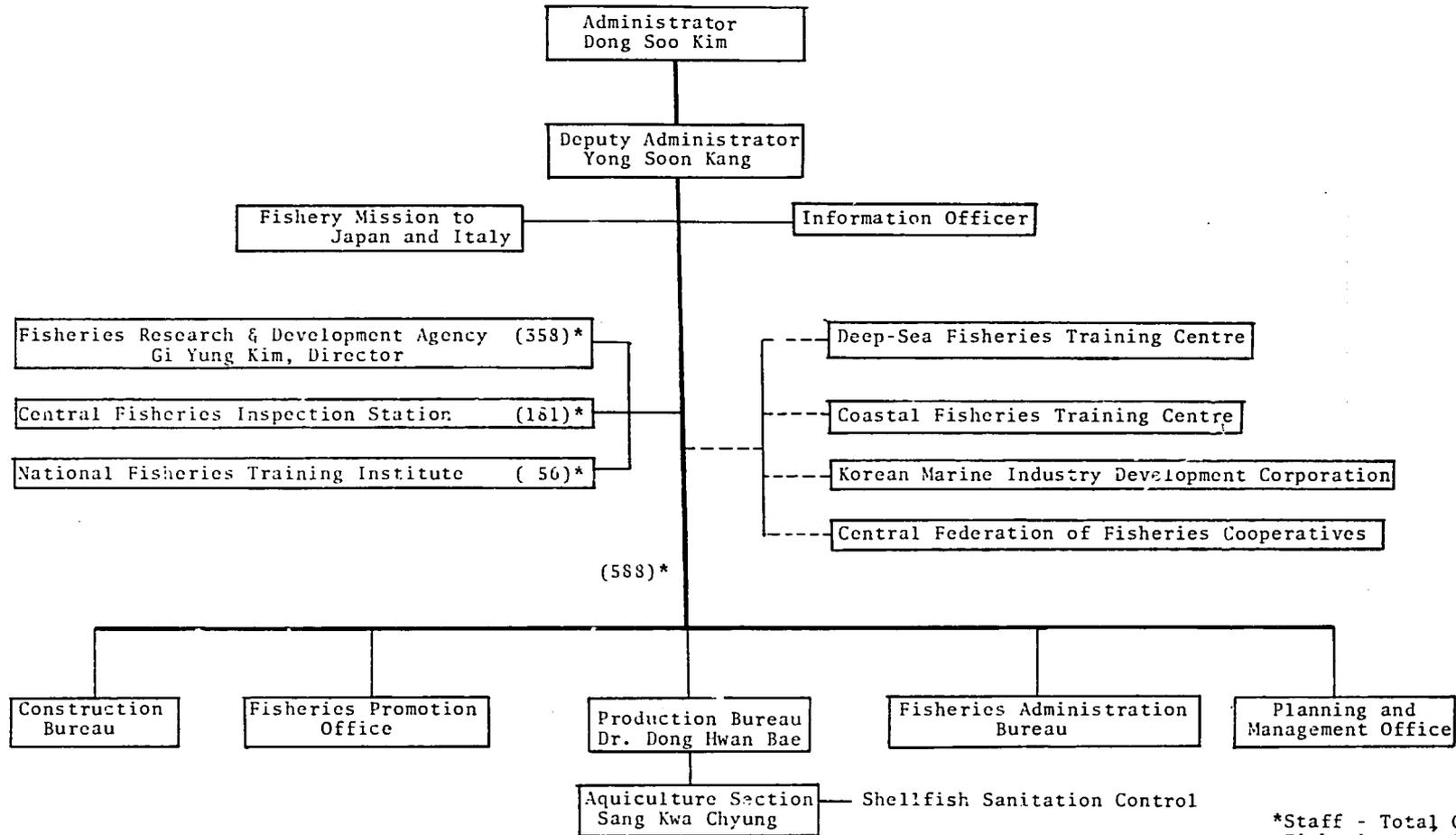
Article 14.4 (harvesting) of Ordinance No. 422 states that shellfish harvest operation is allowed only during daylight hours.

Article 16 (Processing of shellfish) of Ordinance No. 422 states that those engaging in processing of shellfish for export shall harvest only in designated sea water area by cultivated by rafting method and shall be processed at registered processing plants according to the standard specified in attached Appendix No. 3.

Ordinance No. 422, Appendices 1 through 5, outline sanitary requirements for shellfish processing establishments, boat sanitation, shellfish processing standards, personnel sanitation standards and quality standards of shellfish products. NSSP requirements are equalled or exceeded.

The Korea General Foods Co., Ltd. (established by presidential direction September 1, 1966) have issued a "Quality Management Regulation of Oyster Shucking Plant" effective September 1, 1971. This company intends to manage and operate the export oyster farms and certified shucking-packing plant in Chung-Mu City.

MINISTRY OF AGRICULTURE AND FORESTRY
OFFICE OF FISHERIES



*Staff - Total Office of Fisheries - 1,183

October 1971



Dr. Dong Hwan Bae
Director, Production Bureau
Office of Fisheries



Mr. Sang Kwa Chyung
Aquiculture Senior
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Office of Fisheries



Mr. Seong Jun Kim
Assistant Chief
Utilization and Pro-
cessing Section
FRDA



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LABORATORY EVALUATION

"Laboratory Procedures" is one of eight program elements which are routinely evaluated on an annual basis by the Food and Drug Administration for compliance with the requirements of the NSSP Manual of Operations and certification of the shellfish sanitation control agency in question. Dependable equipment, standard methodology, and competent professional technique are essential to the production of reliable laboratory results. Reliable bacteriological and chemical data are necessary adjuncts to the sanitary survey in determining types and levels of natural or manmade pollutants in shellfish harvest areas and in evaluating the public health significance of these pollutants.

A laboratory checklist was prepared by the Public Health Service in 1963 to assist in the evaluation of bacteriological laboratories. It is based upon recommendations and methods of analysis in "Recommended Procedures for the Bacteriological Examination of Sea Water and Shellfish, Third Edition, A.P.H.A., 1962. The checklist used in the present evaluation is the 1969 revision of the 1963 checklist.

There are three laboratory systems or subsystems available to the Office of Fisheries, Fisheries Inspection Laboratories, Laboratories of the Pusan Fisheries College, and the laboratory of the Pusan Fisheries Research and Development Agency's Utilization and Processing Section. The UPS Laboratory has the principal responsibility for providing laboratory support to the Korean shellfish sanitation program and is the only laboratory considered in this report.

This laboratory is under the capable administration of Mr. Ok-Sung Bae, UPS Section Chief, and supervised by Mr. Seong-Jun Kim, Shellfish Sanitation Project Leader. Mr. Kim has on two occasions participated in training activities at shellfish sanitation research centers in the United States and is well qualified to supervise the laboratory aspects of the Korean Shellfish Sanitation Program. Mr. Dong-Suk Chang, Bacteriologist, Mr. Kyeng-Sam Kim, Chemist, Mr. Jong-Gap Lee, Mr. Jeong-Yong Kim, Mr. Maeng-Ki Kim, and Mr. Sook-Hyun Chung are also assigned to this laboratory.

During the evaluation, minor deviations from recommended procedures were noted and the following recommendations are

submitted accordingly:

Evaluation Results

A. Laboratory Facility

The laboratory facility is well designed, well lighted and has adequate bench and storage space for current workloads. Equipment is conveniently located and easily accessible to laboratory personnel. Work tables are made of wood covered with varnish which had cracked and peeled in areas. It is recommended that all work surfaces in the laboratory be covered with a hard heat and chemical resistant material such as formica or a similar-type covering to facilitate easy sanitizing of work surfaces and to reduce possibilities of chance contamination of samples from poorly sanitized or contaminated work surfaces.

B. Procedures

Procedures observed by the evaluations officer conform to the procedures outlined in Recommended Procedures for the Bacteriological Examination of Sea Water and Shellfish, Third Edition, A.P.H.A., 1962. A Fourth Edition of this publication published in 1970 was presented to the Project Leader. Only minor changes in bacteriological procedures are noted in the new edition, but additional physical and chemical test procedures have been included.

C. Apparatus and Media

1. Records of temperatures in all incubation and refrigeration equipment should be maintained daily.
2. It was noted that pour plates were stacked so close together that circulation of air in incubators would be impeded. This is likely to result in "cold" or "hot" spots in the incubator interfering with proper incubation temperatures.
3. Thermometers should be checked against a "standardized" thermometer to assure accuracy. This is of particular importance in maintaining the water bath temperature of $44.5^{\circ} \pm 0.2^{\circ}\text{C}$ for the fecal coliform test.
4. The standard plate count is done on all water samples. This is a good practice during sanitary surveys, but is not justified in routine bi-monthly surveillance of water sampling stations after a sanitary survey is completed. Elimination of this practice would help relieve a slight overcrowding situation in incubator space.

5. It is suggested that periodic tests be conducted to evaluate the effectiveness of the sterilizing process.

6. Ten millimeter pipettes should not be used to pipette one or two millimeter volumes. It is recommended that wide tip two millimeters pipettes be purchased for this purpose.

7. All dilution blank bottles should be calibrated (a diamond point pencil can be used) at the volume routinely used for making dilutions.

8. Effectiveness of glassware rinse should be established by proper tests. Litmus paper is adequate for most alkaline detergents.

9. The distilled water used in preparation of media and buffered dilution blanks should be tested for bactericidal or inhibitory compounds.

10. pH records of all batches of media should be maintained.

11. Incubators should be checked for hot or cold spots under maximum load conditions.

D. Bacteriological Procedures

1. There was no standard shaking procedure of sample dilutions during the original inoculations into presumptive media. The sample or dilutions should be: "shaken vigorously 25 times in a 12-inch arc in 7 seconds." This procedure should be strictly adhered to by all laboratory personnel setting up samples.

2. In a practice session with the evaluations officer, laboratory personnel demonstrated an excellent knowledge of the use and reading of MPN tables. It is recommended, however, that no less than two individuals check final MPN results.

With the exception of minor deviations noted, the equipment, procedures and technique observed are in substantial compliance with official procedures sanctioned by the NSSP. There are plans for a field laboratory in the Chung-Mu area during 1972 and the Yosu area in 1973. The Office of Fisheries is commended for including laboratory support facilities in planning for the expanding oyster industry in the south coastal areas. The Mission strongly recommends that these laboratories be equipped and staffed with competent personnel to conduct bacteriological chemical and marine biotoxin examinations on shellfish and/or sea waters.

From observations of the incubator loads in the Pusan laboratory, the laboratory evaluations officer recommends that consideration be given to the construction of "walk in" type incubators in future laboratory construction. Generally speaking they are cheaper, are capable of greater loading capacity, and if properly designed, may provide better temperature controls than many of the commercial types.

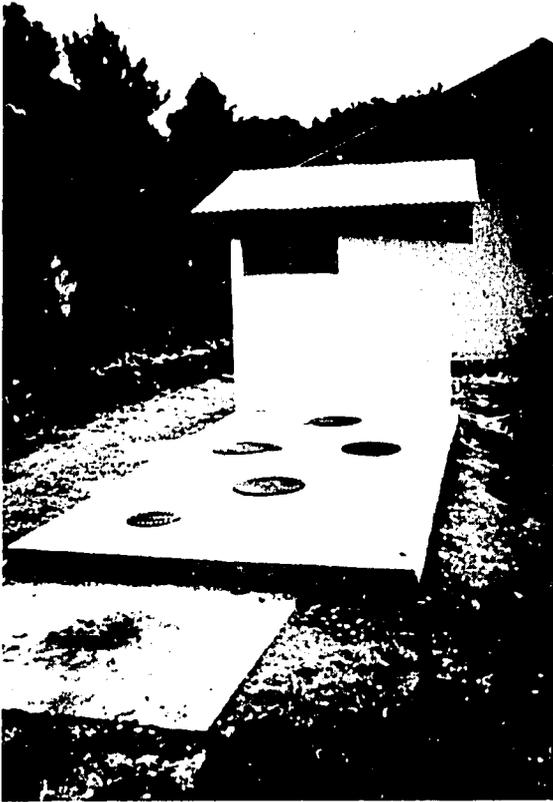
A supply of Paralytic Shellfish Poison Standard has been requested by the Mission and will be forwarded to the Pusan Laboratory as soon as available. It is recommended that the UPS laboratory develop a competency in bioassays for PSP in the immediate future and include PSP in the growing area surveillance program



FRDA Bacteriological Laboratory Staff Comparing MPN
Results with Member of Mission



Utilization and Processing Section Staff
Fisheries Research and Development Agency
Pusan, Korea and Mission Member



Night Soil Storage
Facility on Shore
Near Designated Area #2

FRDA's Water,
Sediment, and
Shellfish Sampling
Equipment



GROWING AREA SURVEY AND CLASSIFICATION

Bacteriological studies have been conducted on a limited basis in shellfish harvest areas on the south coast of Korea since 1961. Studies of these areas which include the Chingdon Region consisting of the Chinjen, Chingdon, and So Su areas; the Chung-Mu Region consisting of the Miruk Do, Hansan Do, and Puk Man areas; and two areas not assigned to any specific regions, Gaduk Do and Naro Do were reviewed for this report. The Puk Man area of Chung-Mu Region is subdivided into Puk Man, Pop Song Po and Tong Nae subareas. Of the four subdivisions of Hansan Do area, only Hansan Do and Geoje Man were evaluated in this report. In the remainder of this section of the report, Hansan Do and Geoje Man will be called Hansan Island and Geoje Bay. Although limited shellfish area surveys have been conducted in the shellfish harvest areas of the south coast since 1961, a very extensive survey was conducted by the Korean Government which included the subareas of Hansan Do and Geoje Man. The conclusions and recommendations of the mission concerning growing area quality were based upon two Office of Fisheries reports: "Sanitary Survey of the Oyster and Its Growing Areas on the South Coast of Korea," April (1970) and "Sanitary Survey on Oysters and Shellfish Growing Areas in Keojedo, Kyung Sang Province," (1971); growing area data compiled by the staff of the Fisheries Research and Development Agency's Utilization and Food Technology Section; and field observations of the growing areas in question. The second report concerning shellfish growing areas in Kyung Sang Province was the result of a survey conducted by the staff of the Marine Laboratory of Pusan Fisheries College at the request of the Office of Fisheries. The survey team is to be commended for its comprehensive coverage of potential pollution sources and the detailed information presented in the report.

Method of Classification of Shellfish Growing Areas Used for Shellfish to be Exported to the United States

According to the NSSP Manual of Operations, shellfish harvest areas may be classified as approved, conditionally approved, restricted, or prohibited. The Korean agency responsible for the classification of shellfish harvest areas uses the term "designated" to describe those areas which meet the approved growing area criteria as defined in the NSSP Manual of Operations.

"Designated" areas are defined under Article 3, Regulations

Governing Sanitary Control of Shellfish, Their Growing Areas, Harvesting and Processing of Shellfish Products for Export,
as follows:

"Administrator of Office of Fishery shall designate areas suitable for growing shellfish (called hereinafter "designated areas") from among areas meeting the following criteria:

1. The coliform median MPN of the water does not exceed 70 per 100 cubic centimeters and not more than 10 percent of the samples ordinarily exceed an MPN of 230 per 100 cubic centimeters in those portions of the area most probably exposed to fecal contamination during the most unfavorable hydrographic and pollution conditions.
2. Sea water is not so contaminated with radioactive matters, industrial wastes, or fecal material, to such a degree as to hazard the consumption of the shellfish.
3. Paralytic shellfish poison shall not be contained."

Although shellfish harvested from "nondesignated" areas are thermal processed and used for domestic consumption and export, only shellfish from "designated" areas will be shipped to the United States either as fresh or frozen products. The method and operation of patrolling these areas will be discussed in another section of this report.

Of the three types of Korean oyster culture common on the south coast, stone culture, long-line culture, and raft culture, only oysters from raft culture leases are being considered by the Korean Government at this time for export as fresh frozen products to the United States.

In consideration of the overall problem of sanitary survey and classification of oyster-growing areas, the Mission has evaluated the capability of the Shellfish Sanitation Control Agency to: (1) detect actual and potential sources of pollution which may effect "designated areas"; (2) evaluate the degree of water degradation resulting from these sources of pollution; and (3) establish area boundaries in locations most likely to produce safe and wholesome oysters at all times. The mission's principle objective in the consideration of growing area classification was to determine whether or not harvest areas defined as "designated" areas by the Korean control agency meet the physical, chemical, and bacteriological requirements outlined in the NSSP Manual for "approved" shellfish-growing areas.

Geography of the Study Area

The principal water mass of concern is Geoje Bay (also spelled Keoje) located on the southwest coast of Geoje Island. The bay is approximately 10 kilometers long and 6 kilometers wide and runs in a northeasterly and southwesterly direction. It is protected from the South Sea by Chuam Island to the south and Hansan Island on the southwest side of the bay. Large interisland passages run southerly to the sea and northwesterly to the city of Chung-Mu which has a population of 58,000 and lies approximately 10 kilometers from the growing area in question. Also located in Geoje Bay are Sandal Island, Song Island, Seojwa Island, and Bisan Island. The islands rise steeply from the water's edge to a height of 100 meters or more. Small vegetable gardens and rice paddies are located on the lowlands and on some areas of the higher slopes. Several small fishing villages are also located along the shore usually surrounding an anchovy processing plant. The Mission observed few people living within the immediate vicinity of the "designated" oyster growing areas.

There are 16 small rivers and streams which flow into the growing area. Only 5 of these, the Sucheon, Sanyang, Buchun, Oegan, and Dundook continue to flow during the dry season. The length of these streams ranges from 150 to 9,500 meters and their affect on the water quality of Geoje Bay depends upon the number of villages the streams pass through, the population of these villages, and the size of drainage area.

Hydrography

The mean sea level of the study area is 1.4 meters. Drouge studies indicate excellent tidal flushing of the area with flow rates varying from a speed of one knot in the passages of the lower bay to a speed of 1/3 knot in the upper bay areas on the flood tide. There are two complete tidal exchanges per day.

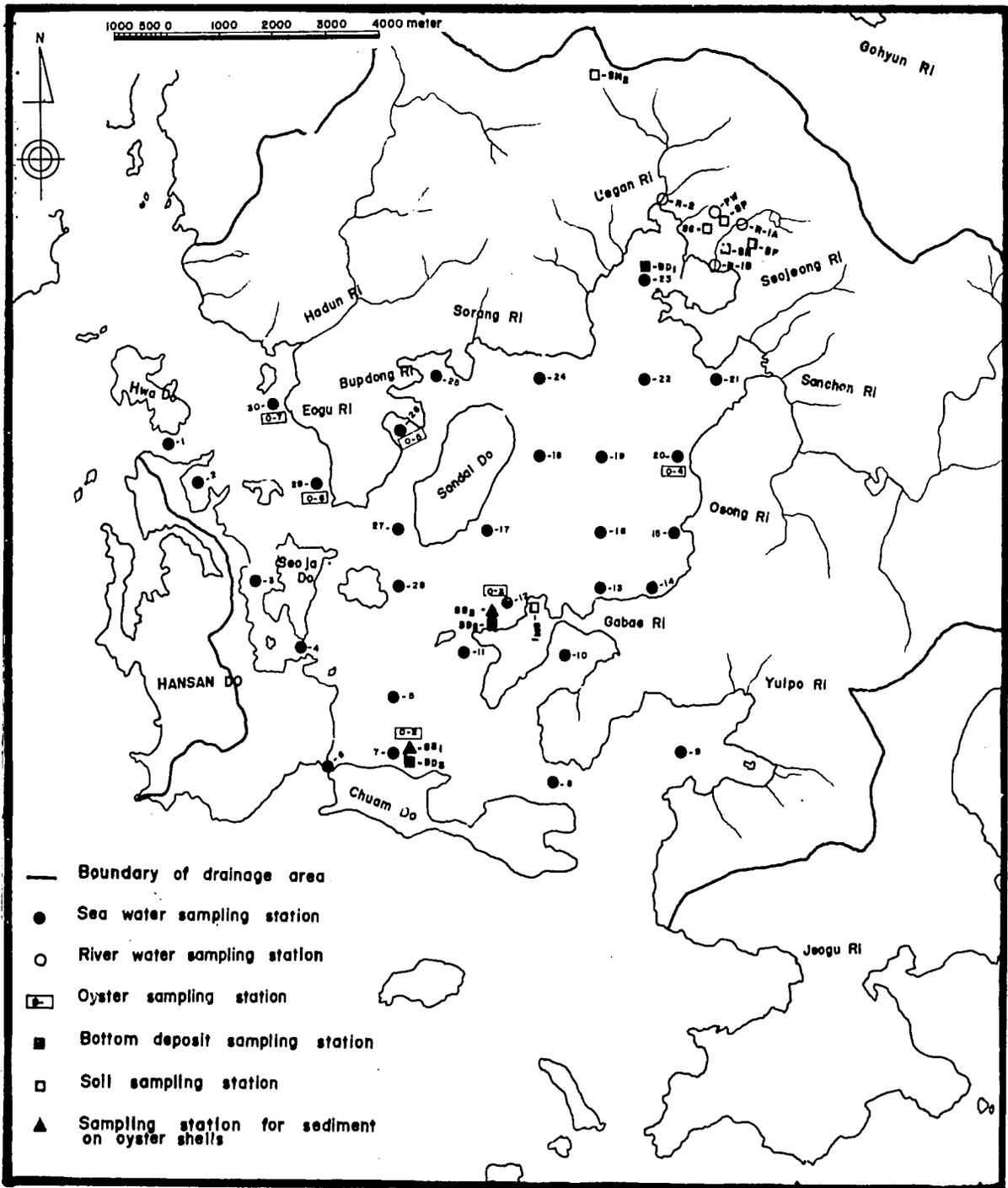
Meterology

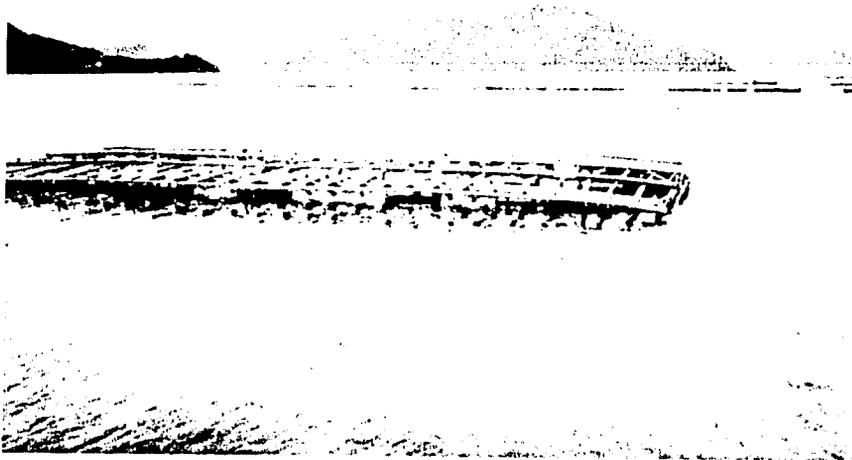
Rainfall data presented in the Korean Government sanitary survey indicate that the rainy season occurs during the months of June, July, August, and September. This data is supported by additional meteorological data from official U. S. Army records. It is important to note that the season for harvesting oysters, which may be exported to the United States, is from November to April, the dry season for the south coast of Korea. Therefore, shellfish will not be harvested from designated growing areas during the most unfavorable meteorological conditions. This is an important factor when considering potential influence of land wash and river basin drainage on the sanitary quality of the growing area, and more specifically, the pollution potential from agricultural use of night soil.

Monthly Rainfall in CHUNG-MU City
(1965-1971) in Millimeters

	1965	1966	1967	1968	1969	1970	1971	Average
Jan.	40.2	34.0	27.5	15.9	50.8	7.2	28.1	29.1
Feb.	69.7	76.1	49.1	15.1	47.8	57.2	50.7	52.2
Mar.	31.7	122.5	103.3	65.0	22.2	23.9	130.8	71.3
Apr.	106.5	125.4	119.9	63.8	225.2	136.7	60.4	119.7
May	89.0	124.0	35.7	76.4	141.7	224.0	67.2	108.3
June	65.2	117.5	267.2	59.3	141.4	221.9	234.3	151.8
July	484.2	164.0	126.8	118.9	293.1	460.3	367.1	287.8
Aug.	380.5	295.3	68.3	270.1	320.1	416.3	231.6	283.2
Sept.	19.0	32.2	56.0	94.8	449.5	380.6		160.2
Oct.	38.9	14.0	28.8	118.5	9.7	47.5		42.9
Nov.	147.8	113.3	75.3	55.6	33.2	15.9		73.5
Dec.	34.2	12.1	0.0	46.0	53.9	37.7		30.7
Total	1,506.9	1,231.3	957.9	999.4	1,788.6	1,957.2		

Location of sampling stations, HANSAN DO and GEOJE MAN area.





Oyster Rafts Owned by Korea General Foods
Company, Ltd., in Designated Area #4



Identifying Sign at Boundary of Designated Area #4

Pollution Sources

A. Night Soil

The agricultural use of night soil is the common method of sewage disposal in Korea, as well as other parts of the Orient. Commercial fertilizers are now available in many areas and compete economically with night soil as a fertilizer, but aged night soil is still commonly used in the agricultural areas adjacent to the shellfish harvest areas. The Mission agrees with the 1967 Mission that, ". . . Surface runoff from rice fields and other crops fertilized with night soil is the principal source of pollution of oyster growing areas. . . ." The Mission further attempted to evaluate the relative health hazard potential of chance incidence of harvest area contamination from night soil compared to an equal population equivalent of sewage from bypassed sewage treatment plant effluents. At best, the results are mere speculation. The incidence of enteric organisms and intestinal parasites are probably higher in fresh night soil than in waterborne sewage from an urban population in the United States, but aged night soil which has been diluted and impounded in rice paddies where additional decomposition occurs may be less hazardous than improperly treated sewage effluents from treatment facilities.

The survival of ova of nematode parasites, particularly *Ascaris* and *Trichuris*, reported in 80% of the population is another potential problem to be evaluated. The high incidences of parasitic infections are related to poor sanitary conditions, the use of night soil as fertilizer, particularly on fresh vegetables, and the consumption of raw foods by the general population. There are no records of transmission of intestinal parasites from oysters to man, although oysters and hard clams can serve as experimental hosts to the rat lungworm, *Angistrongylus cantonensis*, causative organism of eosinophilic meningoen- cephalitis in man. According to Cheng, this parasite is normally transmitted to man via paratenic crustacean hosts such as shrimp and crabs. The transmission of intestinal parasites by oysters, though not demonstrated, must be considered as a potential health hazard when night soil is used for agricultural purposes and a high incidence of infection exists in the local population.

B. Boat Wastes

Boat wastes are always a potential source of contamination to shellfish harvesting areas. Contamination from occasional fishing boats in the particular areas of concern is minimal considering the large dilution factor involved. However, the manner of harvesting and washing of shellstock from rafts poses a real sanitation problem and could be a potential source of contamination if not properly controlled. During the

harvesting process a floating platform is moored alongside the raft from which the shellfish are harvested. The strings of shellfish are hoisted aboard the raft and washed in sea water under high pressure to remove sediment and other extraneous material. Although the Mission did not have an opportunity to witness this operation, photographs taken of the operation indicate that 20 or more persons are involved in this work. If the responsible authority fails to exercise adequate control over sewage disposal on the working floats, serious contamination could occur. However, both the fisheries control personnel and the Korean General Foods quality control staff have assured the Mission that this potential source of pollution will be under control at all times. The Mission considers this possible source of contamination to be the most serious potential health hazard to the growing area, but one that should be easily controlled.

Marine Biotoxins

The sanitary survey conducted by the staff of the Pusan Fisheries College at Chubong, Gabae, and Eogu, which were the three stations tested, revealed the presence of low levels of a marine biotoxin. The survey report concluded among other things that, "toxicities . . . are less than 200 mouse units.." in shellfish meats, and ". . . oysters in the questionable areas seem to be safe for human consumption" It should be noted that a standard solution of paralytic shellfish poison was not available to the chemist conducting the tests. However, the Division of Shellfish Sanitation is currently in the process of obtaining a sample of the P.S.P. standard for forwarding to the Fisheries Research and Development Agency for use in investigations of marine biotoxins in the Geoje Bay area. In a study of the causes of "Red Water" at Chinhae Bay conducted by Park and Kim in 1961, only three species of dinoflagellates were identified. The species which include *Gymnodinium*, *Peridinium*, and *Ceratium* compose less than 1% of the total plankton population. Unfortunately, summer values do not provide evidence of the levels of marine biotoxins which may be present during the regular harvest periods.

In discussing marine biotoxins with health officials at the local and national level, the Mission was unable to document any incidences of paralytic shellfish poisoning among the population, although oysters, clams, and mussels are favorite food items of the coastal inhabitants and are eaten in both the raw and cooked state. The absence of definitive cases of paralytic shellfish poisoning or clinical manifestations of other marine biotoxins in a population which consumes large quantities of bivalved molluscs indicates that P.S.P. is of little or no health significance to consumers of shellfish from the south coast of Korea. In consideration of the positive results of the mouse bioassays, it is recommended that work be undertaken

to identify the specific marine biotoxin and the causative planktonic organism. Seasonal variations in toxicity levels found in shellfish should also be determined with special reference to the harvest season of November to April.

Paragraph 3 under Article 3 of the Regulations Governing Sanitary Controls of Shellfish state, ". . . Paralytic shellfish poison shall not be contained" The Mission recommends that this wording be changed to read as follows, "Paralytic shellfish poison and/or other marine biotoxins shall not be present in levels known to be toxic to consumers of shellfish."

Heavy Metals and Radionuclides

Sanitary surveys of the Geoje Bay area, confirmed by personal observations of the Mission, indicate that the area is free from any industrial complex which might adversely affect the "designated" growing areas. The Administrator of Fisheries informed the Mission that shellfish-growing areas on the south coast along the Hanryo Channel from Chung-Mu to Yosu, including the Geoje Bay harvest areas have been designated national parks by the Korean Government to prevent encroachment by industrial development. The areas will be developed as shellfish harvest culture and tourist resort areas. Accordingly, industrial pollutants should not be a health or resource hazard for the areas in question. Limited heavy metals and radionuclide data support the presumption that no health hazard exists from industrial chemicals in these areas. The Mission has no data on the agricultural use of chlorinated hydrocarbon pesticides in land areas adjacent to "designated" growing areas. It is recommended that analyses for pesticides in shellfish be included in future sanitary survey reports and that shellfish from the present "designated areas" be examined for this group of chemicals, as soon as trained personnel and laboratory equipment are available.

Additional Public Health Considerations

In discussions with public officials at local and Federal levels, the Mission attempted to answer a basic public question of major importance, "Does the bacteriological indicator group and criteria presumed by the NSSP to provide "safe" shellfish in the United States provide an equivalent safety factor to consumers of live shellfish harvested from designated waters in Korea?" Is the indicator/pathogen ratio in night soil reaching shellfish areas equivalent to the indicator/pathogen ratio of sewage effluents in the United States?

A number of facts were considered. Typhoid fever still remains a public health problem in Korea. Recent epidemics have been associated with contamination of public water supplies. The Mission was unable to confirm a single shellfish associated

outbreak. This is not to say that it has not occurred. Thirty million persons have been vaccinated for cholera in the last 2 years. Seven million cubic centimeters of vaccine were produced by the Biologics Division of the National Institute of Health compared to 6,000,000 cubic centimeters of typhoid vaccine and 3,600,000 cubic centimeters of smallpox vaccine in 1971.

Medical staff of the 11th EVAC Hospital, U. S. Army, Seoul (personnel communications) reported that there were 300 cases of cholera in the Republic of Korea in the past year among native peoples and 40 cases of hepatitis among U. S. personnel. It is estimated by the Ministry of Health and Social Affairs that 80% of the population are infected with *Ascaris* and *Trichuris*, human helminths with ova that can survive extremes of temperature and desiccation, and 90% of the population are estimated to be infected with one or more intestinal parasites.

The Mission concluded that the indicator/pathogen ratio is higher in raw sewage in Korea than in the United States, but there was no scientific base to conclude that properly aged and dehydrated night soil used in impounded rice paddies, exposed to sun and organic decomposition, would pose a greater health hazard from chance contamination of shellfish than chance contamination of raw or improperly treated sewage in the United States. The question of effectiveness of NSSP bacteriological criteria for Korean waters is scientifically unresolved, but administratively believed to provide adequate consumer protection. Although the bacteriological criteria for "designated areas" are equivalent to those of the NSSP, the water quality of those areas presently classified as "designated" are bacteriologically superior to representative shellfish-growing areas in the United States.

Designated Growing Areas

At the present time, only four areas in Geoje Bay have been classified as designated areas. These areas are used exclusively for raft culture at the present time. Oyster production per hectares of water surface is high compared to the volume of oyster meats produced for the same area in the United States due to the two dimensional use of water in raft culture. Total hectares of water surface included in the four areas are: Area 1 - 118, Area 2 - 184, Area 3 - 39, and Area 4 - 132, for a total of 473 hectares. Three additional areas, comprising 751 hectares in the Geoje Bay area are currently being evaluated and will be classified as designated areas if sanitary survey and surveillance data indicate that "designated" water quality criteria can be maintained.

In evaluating the sanitary quality of the "designated areas" of the Geoje Bay-Hansan Island area, several points were

considered. These are:

1. Bacteriological counts of water sampling stations in the designated areas meet and exceed NSSP approved growing area criteria.

2. There are no sewage treatment plants in the bay area providing a constant source of pollution.

3. Current regulations governing the storage and use of night soil for agricultural purposes and the change to chemical fertilizers will result in a minimum pollution potential from this source.

4. Few people live in the immediate vicinity of the "designated areas."

5. The harvest season, November to April, coincides with the dry season, the time of year that pollution from surface run off and river basin drainage is least likely to affect growing areas.

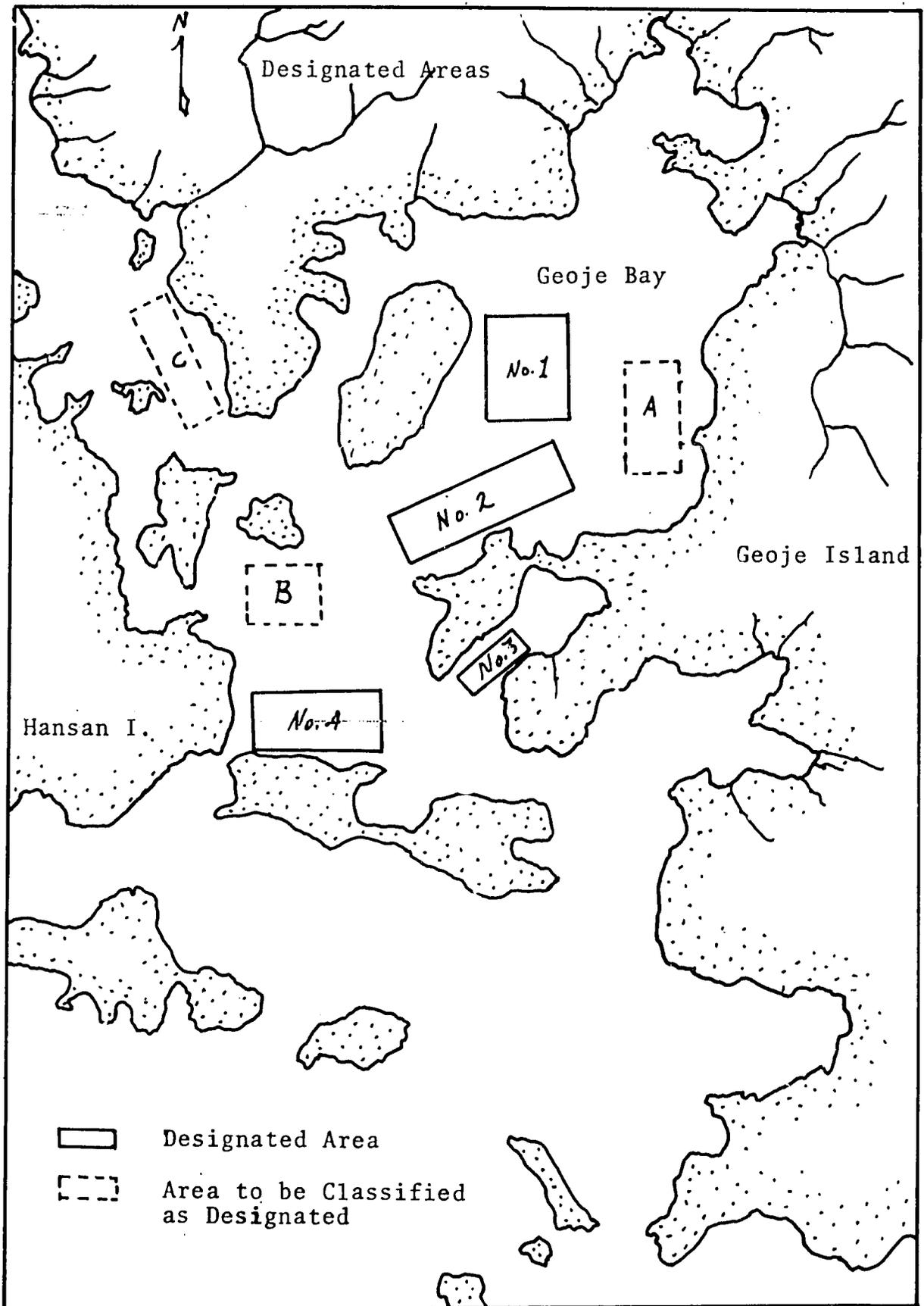
6. The "designated areas" are in relatively deep water with good tidal exchange from fresh sea water.

7. There is no industrial complex that could have an adverse effect on water quality in the immediate area of the "designated areas."

8. Limited heavy metals data show no abnormal levels for the metals tested.

9. Marine biotoxins have been demonstrated in low levels in shellfish in June and July. Additional investigations are recommended, but epidemiological evidence of paralytic shellfish poisoning is nonexistent on the south coast of Korea.

In view of the foregoing observations, the Mission concludes that the Korean Government has the technical capability and professional competency to survey potential harvest areas and to establish "designated areas" which meet or exceed the requirements of the NSSP Manual of Operations; and that the "designated areas" in Geoje Bay-Hansan Island subareas conform to the NSSP requirements for "approved" growing areas.



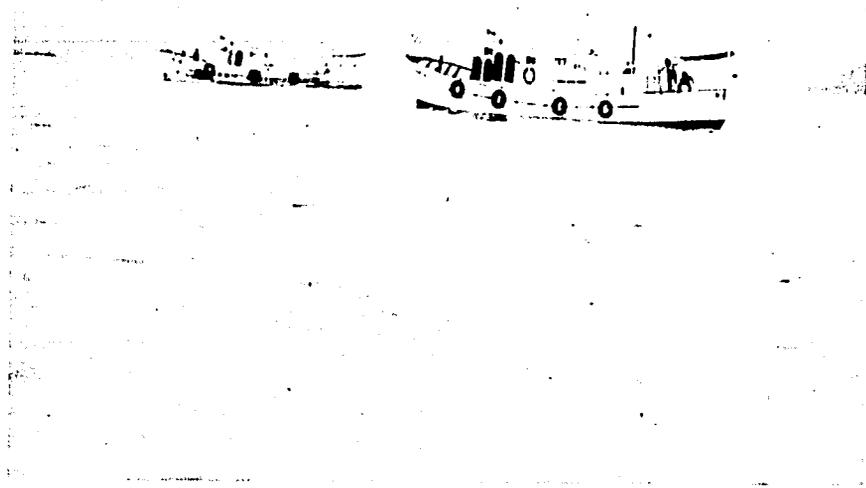
**LOCATION OF DESIGNATED AND PROPOSED OYSTER
GROWING AREAS FOR EXPORT**

AREA NO.	BEARINGS		DEMEINIONS		AREA (HA)	DEPTH OF WATER (M)	NO. OF LONGLINE SET	CAPAUY OF PROD- UCTION (M/T)	REMARK
	N.L	E.L	WIDTH(M)	LENGTH(M)					
DESIGNATED AREA									
1	34°49'04"	128°33'08"	1,000	1,180	118	8.2	1,180	1,416	1. REQUIRED WATER AREA FOR ONE SET OF LONGLINE 100 M ² 10 TIMES = 1,000 M ²
	34°48'04"	128°33'50"							
	34°48'28"	128°33'50"							
	34°48'28"	128°33'08"							
2	34°47'34"	128°32'13"	2,850	720	184	11	1,840	2,208	2. PRODUCTION OF OYSTER FROM ONE SET OF LONGLINE 1.2 M/T
	34°48'09"	128°33'43"							
	34°47'48"	128°33'57"							
	34°47'12"	128°32'24"							
3	34°46'23"	128°32'53"	1,000	390	39	5.6	390	468	
	34°46'45"	128°33'23"							
	34°46'37"	128°33'32"							
	34°46'12"	128°33'04"							
4	34°46'18"	128°30'58"	1,800	735	132	12.8	1,320	1,684	
	34°46'18"	128°32'11"							
	34°45'52"	128°32'11"							
	34°45'52"	128°30'58"							
SUBTOTAL					473		4,730	5,676	

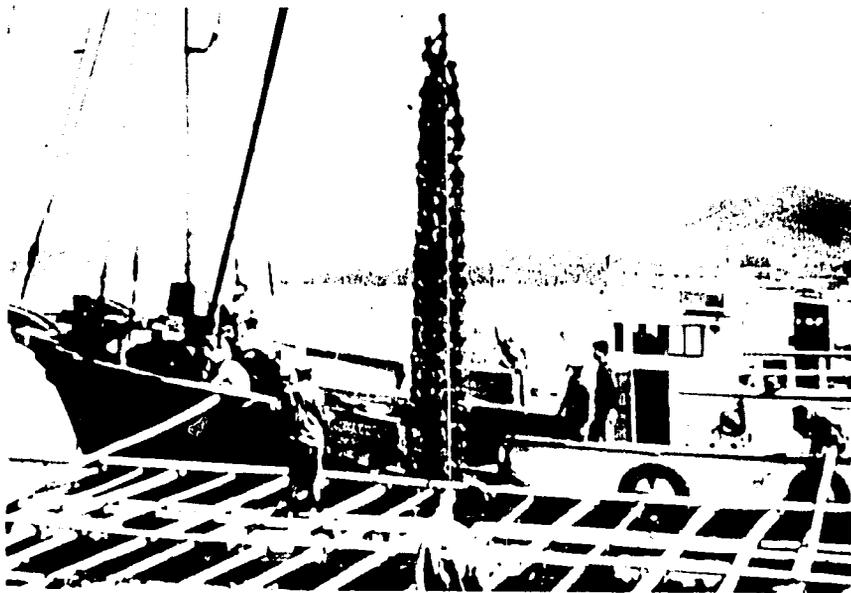
LOCATION OF DESIGNATED AND PROPOSED OYSTER
GROWING AREAS FOR EXPORT (CONT'D)

AREA NO.	BEARINGS		DIMENSIONS		AREA (HA)	DEPTH OF WATER (M)	NO. OF LONGLINE SET	CAPAITY OF PROD- UCTION (M/T)	REMARK
	N. L	E. L	WIDTH(M)	LENGTH(M)					
PROPOSED AREA									
A	34°48'46"	128°34'24"	710	1,500	107	7.8	1,070	1,294	
	34°48'46"	128°34'55"							
	34°47'57"	128°34'55"							
	34°47'57"	128°34'24"							
B	34°47'14"	128°30'52"	1,000	790	79	6.9	790	938	
	34°47'14"	128°31'35"							
	34°46'48"	128°31'35"							
	34°46'48"	128°30'52"							
C	34°49'05"	128°29'52"	570	1,620	92	11.4	920	1,104	
	34°49'14"	128°30'10"							
	34°48'22"	128°30'44"							
	34°48'14"	128°30'25"							
SUBTOTAL					278		2,780	3,336	
TOTAL					751		7,510	9,012	





Keojae and Tongyung County's Patrol
Vessels, Kaeryongsan and Tongyeong, 20-ton Class



Oyster Harvesting Operations Adjacent
to Raft Culture Areas .

CLOSED AREA CONTROL

Regulations governing the harvesting of shellfish for export have been issued under Article 14 in MAF Ordinance No. 422. Persons wishing to harvest shellfish for export must make application to the Director of the Fishery Products Inspection Service. Information as to species and quantity to be harvested, location of harvest (number of designated areas) and period of harvest is required on the application form. A certificate is then issued to the applicant by the Inspection Service and accordingly instructs its inspecting officer to be present during the certified harvesting period. The inspecting officer is required to attach a "Certificate Tag of Shellfish Harvest" to each lot of shellfish. The tag with the inspector's seal contains all relevant information about the lot. In addition, the harvester is required to maintain a record of harvested shellfish for export on a form designed by the Inspection Service.

Article 15 in MAF Ordinance No. 422 requires that all harvesting boats must be registered and conform to certain boat sanitation requirements. These include preventing bilge water contamination of shellstock, proper installation of a soil can (stool), and maintenance of clean decks and storage areas.

To prevent the illegal harvest of shellfish and to insure compliance of the shellfish harvesting activities with the aforementioned articles, regular patrols have been scheduled for appointed waters. The purpose of these patrols will be for:

Closed Area Control

- . Production control in the growing waters
- . Elimination of illegal harvesting from uncertified sources
- . Control handling and movement of shellfish
- . Prevent pollution of designated areas by educational measures

It is planned to operate two patrol teams consisting of personnel from Keojae and Tongyung Gun (counties), Marine Products Inspection Office and Hanging Oyster Cooperative. The provincial office will make continual confirmation over the patrol activities. Patrol schedules are made up according to

harvesting and spawning times. The two patrol teams are staggered yearly in accordance with 240 days for harvesting and 120 days for spawning. The patrol vessels will operate as follows:

Vessel	Month											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
<u>Kaeryongsan</u>	X	X			X	X			0	0		
<u>Tongyeong</u>			X	X			0	0			X	X

X - harvest time/8 hours per day

0 - spawning time/4 hours per day

Vessel Kaeryongsan - 20 tons, 90 hp, speed 8 knots and length 18.1 meters (59.5 feet)
Owner - Keojae County

Vessel Tongyeong 22 tons, 90 hp, speed 8 knots and length 16.5 meters (54.1 feet)
Owner - Tongyeong County

The Mission views the closed area control plans as adequate for initiating the 1971-72 season. As experience is gained in patrolling and the number of violators observed the work schedule and applicable regulations may need to be revised. The raft inventory system that has been adopted should prove to be an excellent means to control harvesting and production. In brief, the raft inventory system is a duplicate record account of each harvesting operation and purchase. The records are kept by the Inspection Service and the Harvester. These records identify the growing area, harvester, strings removed from each raft, and the purchaser. Validation of the records is performed by balancing the sales records and purchase invoices with the remaining raft inventories. Substantiation of these records can be conducted by direct field inspections of the rafts.

Korea General Foods Co., Ltd., will operate patrol boats of their own in and around their export oyster areas. Boats for these patrols include 5 - 1.5 ton class and ten one ton class.

SHUCKING-PACKING PLANT

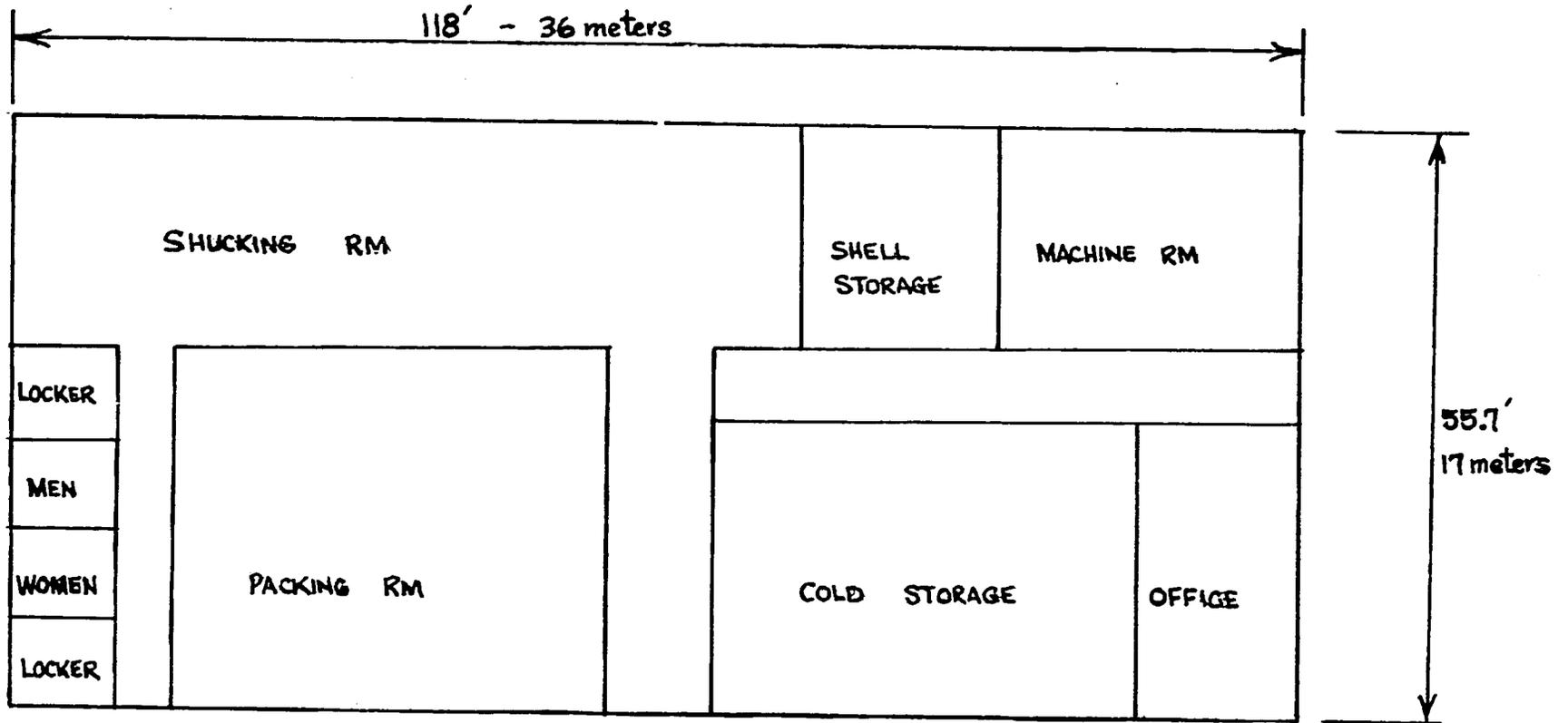
The Mission inspected Korea General Foods Co., Ltd., oyster shucking-packing plant in Chung-Mu City on October 1, 1971. The plant was built by the local Oyster Growers Cooperative and then transferred to Korea General Foods July 1971. It is anticipated that the plant will begin its first processing operations on or about December 1971.

The plant was conceived to be a model plant for other Korean oyster industry operations to pattern its processing establishments. The present plant was designed for 40 shuckers and to allow the shucking-packing operations to flow in the conventional method. The flow of raw product to packing operation in the plant design adequately separates all unit operations. The basic construction is steel reinforced concrete frame and concrete block. The finishes on walls are tile and keene cement and ceilings are all finished smooth with no exposed structures or overhead pipes. Lighting throughout the plant was by approved type safety fixtures, however, distribution of lighting might be improved with a few additional fixtures in the packing and shucking room.

The plant is located on a point of land sufficiently elevated above flood tide mark. A concrete apron and bulkhead is located on the side of the plant designed to receive the shellstock. A dependable source of power from the municipality supplies the plant. The Mission inquired as to frequency of power outages and were informed that Korea has an excellent network of dependable power. It is rare to have a power failure according to several sources questioned on this subject.

The floor space throughout the plant appeared adequate to perform anticipated operations in the spaces designed for such operations. The floors are of terrazzo finish, graded to drain, and apparently on sufficient foundation to prevent cracking or separation. The windows are all steel units, tight fitting and screened. The doors fit tight in most cases. A suitable shellstock conveyor system has not been installed. A system to remove the shucked shells remains to be installed.

The total floor space in the oyster shucking-packing plant is 739 square meters (7,954 ft²). It is estimated that the plant has a daily shucking capacity of 1.2 metric tons. The cold storage capacity of the plant is 150 metric tons and the

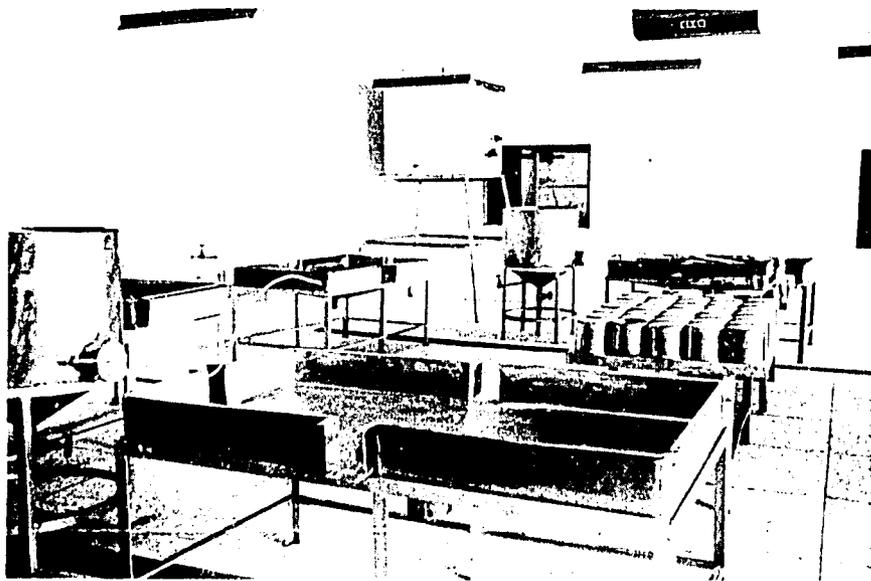


739 m² - 7,954 ft²

Korea General Foods Co., Ltd.
Chung Mu Oyster Shucking-Packing Plant



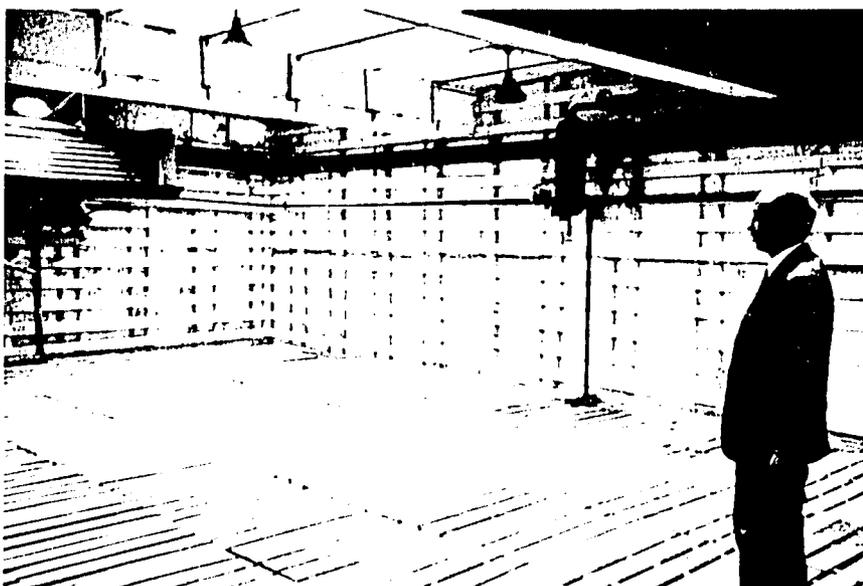
Shucking Room
Korea General Food's Oyster Shucking-Packing Plant
40 Shucker Capacity



Packing Room
KGF Oyster Shucking-Packing Plant



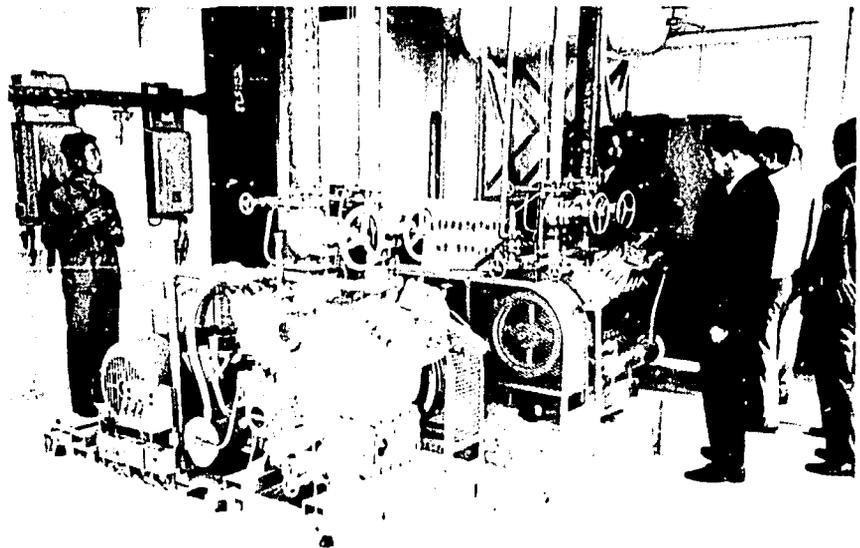
KGF Oyster Shucking-Packing Plant Constructed July 30, 1971,
Donam-Dong, Chung Mu City, Gyeong Sang Nam Province



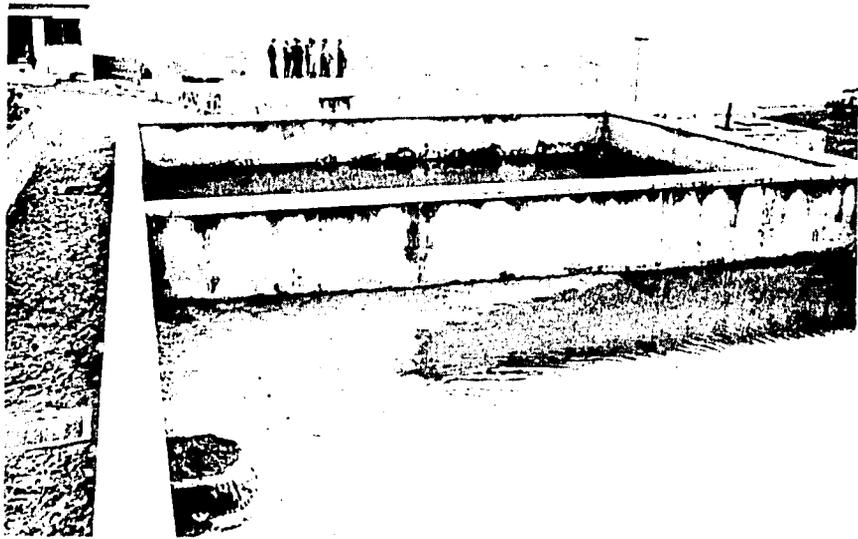
KGF Cold Storage Room Capacity of 150 Metric Tons



Shellstock Loading
Area Above Shucking
Room in Korea General
Plant



Mechanical
Equipment Room,
Korea General
Foods Plant.
Refrigeration
Unit, 3 Metric
Tons Per Day,
Ice-Making One
Metric Ton Per
Day



Water
Treatment Plant
Which Supplies Potable
Water to KGF Plant,
Chung Mu City
in distance



mechanical refrigeration units are of 3 metric ton capacity. Korea General Foods has plans to begin construction of an oyster canning plant adjacent to the present oyster shucking packing plant. The canning plant is to be 1,359.6m² (14,634 ft²) and warehouse and other facilities 1,897.5m² (20,424 ft²). The plant complex is expected to be operational in 1972 and produce fresh-frozen, smoked, and boiled oysters and other fisheries products.

The liquid waste from these oyster processing operations is planned to be disposed through a septic tank soil absorption field located on the limited plant property. This system and anticipated liquid waste flow should be studied very carefully. It was the Mission's opinion that the available area for a soil absorption field may be too small. Some pretreatment of the waste may be indicated such as screening and settling. A site investigation would be advisable to ascertain soil type and percolation rates for a soil absorption field and design accordingly.

The water supply to the plant is obtained from a high rate trickling filter water treatment plant located on the mountain side. The raw water supply is from a mountain storage reservoir of 100,000 metric ton (26.5 million gallon) capacity and water flows by gravity to the treatment plant. There are two outlets, at 3 and 7 meters, at the dam face. If high turbidities are encountered copper sulfate is added to the reservoir to control algae growth. The treatment units consist of a three (3) chamber wet well at the head of the plant where pretreatment with sodium hypochlorite is practiced. The water flows by gravity to two rapid sand filters designed to operate with 70 cm head (27.5 inches) and a filter rate of 5 meters per 24 hours (16.4 ft/day). Filtered water flows to the chlorine mixing chamber and then through a gate valve to the distribution system.

It is estimated that one sand filter has a surface area of about 900 square feet (83.6 sq. meters). Considering that the rate of filtration was designed for 5 meters per day, the flow through one filter would be 110,000 gallons per day (506 metric tons/day). This filter rate would be 0.085 gallons per minute per square foot of filter surface and is considerably below the conventional design flow rate for rapid sand filtration. In fact, this rate of flow approaches rates is designed for slow sand filters. The sense of these calculations is to document that the filtration provided is in accordance with good U. S. standards of engineering practice. The filters are backwashed once a month and new sand replaced every six (6) months. No mud balls or other malfunctioning of the filters were apparent.

The water plant has three service connections, a small village served for only four hours a day and Chung-Mu Tourist Hotel and Korea General Food's oyster shucking plant. The city of Chung-Mu has another source that supplies water and is not interconnected with this supply. The chlorine residual is checked frequently by the city officials at the service outlets. The water supply has been dependable according to local officials.

From the short tour made of the shucking-packing plant and site the Mission offers these suggestions:

Replace existing packing room equipment with approved type equipment constructed to NSP standards for blower tanks, skimmers, returnable shipping containers, and shucking buckets and pans.

. Install adequate sized wash sinks with approved type plumbing fixtures.

. Build a floor in the cold storage room graded-to-drain and install floor drain(s). Consider the installation of false walls which are easily cleanable in place of the present rough wood duck board lined cold storage room.

. Install a shell removal conveyor system in the shucking room and an easily operated mechanical shellstock loading system designed to minimize shell breakage.

. Install hand washing facilities in the packing room and convenient hand washing facilities in the shucking room.

. Consider periodic checking of chlorine residual in the water supply, especially as more water supply connections are made to the system.

. Improve the juncture between walls and floors by installing a cove to eliminate hard to clean joints.

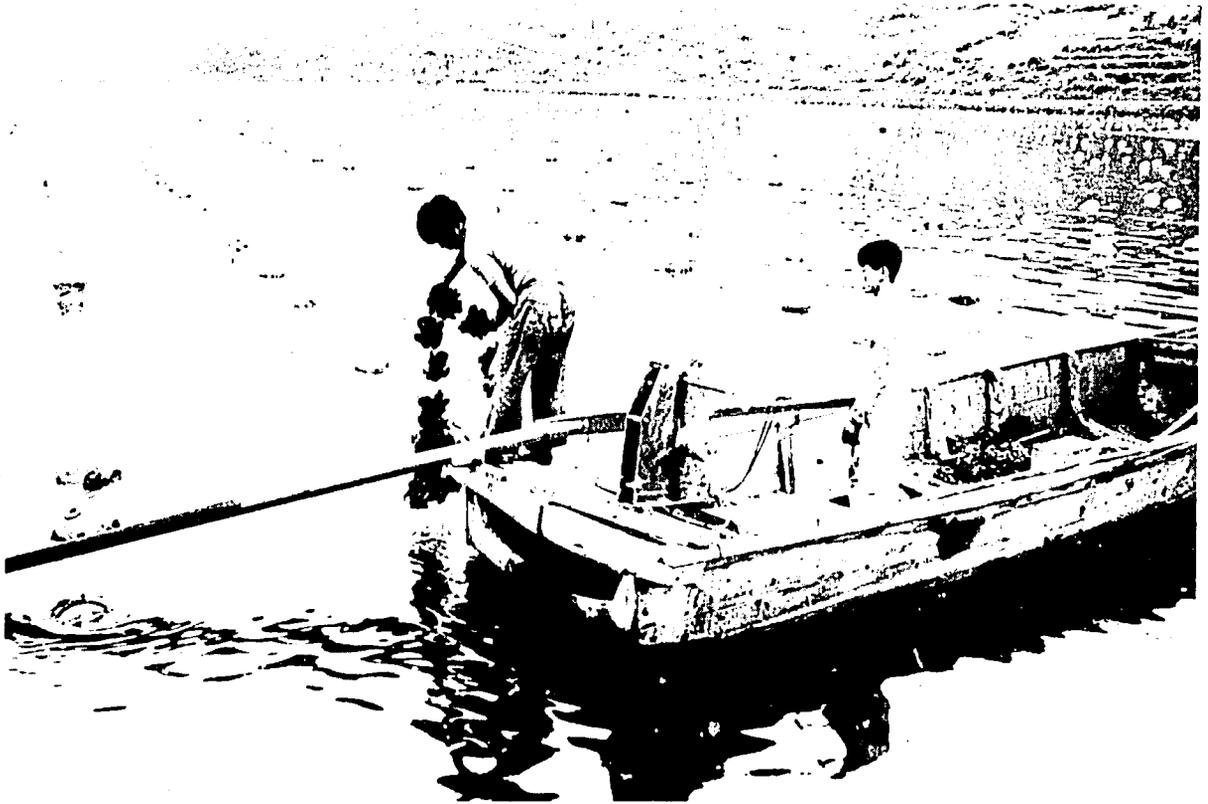
. Recheck all exterior doors to assure tight fitting and rodent-proof construction.



Dr. Byung Sun Chung
Director
For Technology
(includes Oyster Dept.)
Korea General Foods Company, Ltd.

Mr. Dong Ho Lee
Food Technologist
Training and Management Section
Korea General Foods Co., Ltd.





Removing mussels and other marine growth from oysters in "longline culture", Hansando area



Raft culture system in Korea General Food's designated areas, oyster growth in September 1971 season

OYSTER CULTURE AND PRODUCTION

The Office of Fisheries has as one of their major objectives the development of coastal and inland water aquiculture. Projects under this activity include formation of main producing areas for selected species, construction of co-operative fishing grounds and establishment of a mass production system for exporting oysters. Under investigation are hard clams, oyster long-line culture, laver collecting boats, dulse raft culture, sea weeds, pearl culture, and fish holding facilities. Much attention is being given these projects as they offer a desirable fishery industry to replace the declining coastal fishery and employment for the out of work fisherman. This is especially true for the greater Chung-Mu area where the Mission was told that catch per coastal fishing vessel had declined for the past several years.

Of the types of Korean fishery production in 1970, deep sea fisheries accounted for 10 percent, aquiculture 11 percent, offshore fisheries 21 percent, and coastal fisheries 58 percent. Aquiculture segment of the production statistics shows 109,000 metric tons from the total production of 935,000 metric tons.

The cultivation of oysters in South Korea is practiced by three principal methods: stone culture (intertidal zone), long line and rafting (hanging methods). The oyster of commercial importance, *Crassostrea gigas* Thunberg, grows and reproduces naturally in Korean coastal waters. An oyster seed industry thrives in Korea. The Korean Government is actively promoting the development and expansion of the oyster industry. Attention is now focused on the hanging culture areas of Gyeong Sang Nam Province where extensive surveys have documented growing waters meeting sanitary requirements and possessing excellent biological growth characteristics for oysters.

The preferred method for culturing is the raft method because of efficiency and production potential. The typical raft is constructed of bamboo poles imported from Japan. Corrosion resistant wire holds the raft secure at each joint through three tiers of poles. Flotation of the raft depends upon styrene cyclinders secured under the first tier of poles. Rather large concrete anchors hold the rafts in place.

The raft is about 40 x 20 meters (130 x 66 feet) and holds approximately 550 strings of cultch and oysters. The strings

are from 8 to 10 meters (26 to 33 feet) long and kept from 3 to 4 meters above the bottom. Each string has from 35 to 40 scallop or oyster shells spaced apart by a plastic tube. The spacers are about 20 cm in length. The string used is a special corrosion resistant wire. The estimated cost of materials and assembly is ₩600,000 (\$1,620) and each raft has a life expectancy of 3 to 4 years.

Korea General Foods Company, Ltd., became involved in oyster culture production in June 1969 when they established an oyster department for oyster raft culture. The following month they opened an oyster farm office in Chung-Mu City. During the period of July 1970 to June 1971, they managed the harvesting from 307 rafts and obtained 1,168 metric tons of shucked meats. This production was exported to Japan as shellstock and processed as smoked and boiled oysters. The value of the finished product from this production was placed at \$615,000.

For the period of July 1971 to June 1972, Korea General Foods expects to harvest 425 rafts with an expected production of 1,564 metric tons. The anticipated production will be sold as follows:

Shellstock	100 M/T	\$ 60,000
Smoked	728	\$676,000
Boiled	540	\$480,000
Frozen	100	\$ 80,000
Domestic Sales	96	₩14,400,000

The oyster seeding operations June through August 1971 collected sufficient spat to supply 600 rafts. At present, Korea General Foods owns 285 rafts and contractor's owned rafts amount to 140. This quasi-governmental food company was the primary industry representative with whom the Mission reviewed anticipated operations for consideration under the requirements of the National Shellfish Sanitation Program.

1971 Summary of Estimated Volume of Oyster
Production From Leased Areas in Hanson Do
and Geoje Man, Gyeong Sang Nam Province, Korea

Culturing method	No. of leased areas	Area leased	Possible area for operation	Production of oyster shucked (metric tons)
Longline	56	7,135,400m ² 1,760 acres	713,540m ² 176 acres	8,535
Raft	7	2,661,800m ² 659 acres	88,910m ² 22 acres	2,034
Stone	7	860,600m ² 212 acres	860,600m ² 212 acres	771
Total		10,657,800m ² 2,631 acres	1,662,330m ² 410 acres	11,340

Factors for Calculating Production

. Possible area for operation:

Longline: 1/10 of area leased

Raft Culture: 1/30 of area leased

Stone Culture: Whole area leased

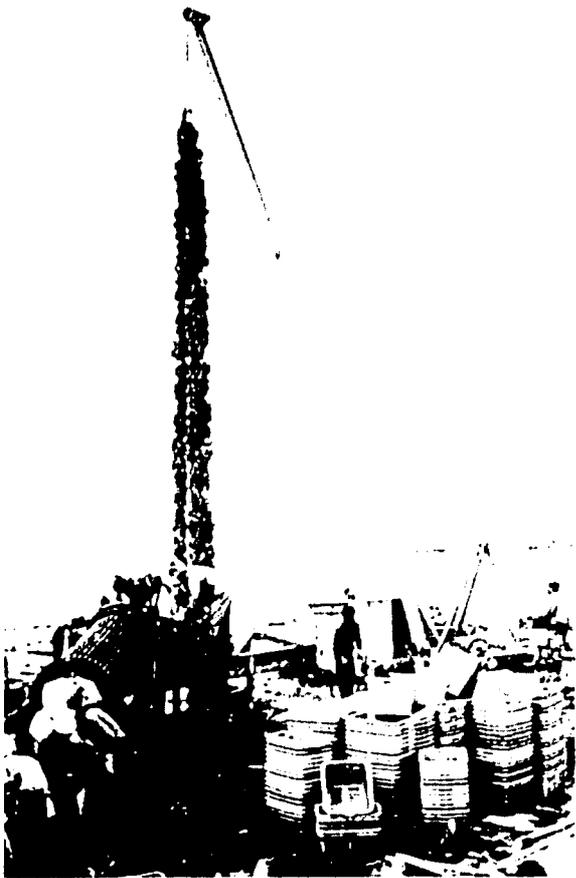
. Estimation of oyster production:

Longline: 12Kg (shucked) per square meter

Raft Culture: 32 Kg (shucked) per square meter

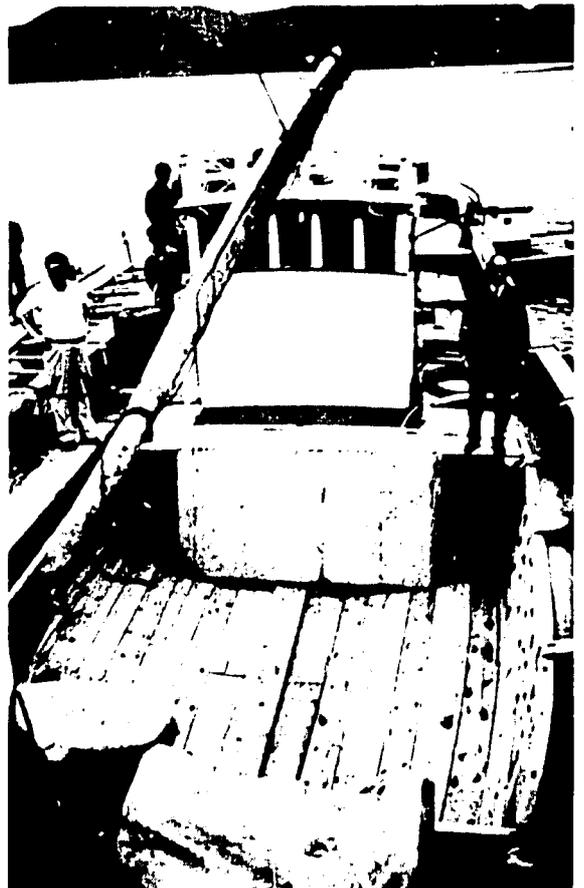
Stone Culture: 0.9 (shucked) per square meter

Source: Office of Fisheries



Korea General Foods
1970-71 Oyster Harvest
Operations, Note Rotary
Washer and Culling
Operation

Korea General Foods
Oyster Harvest Vessel

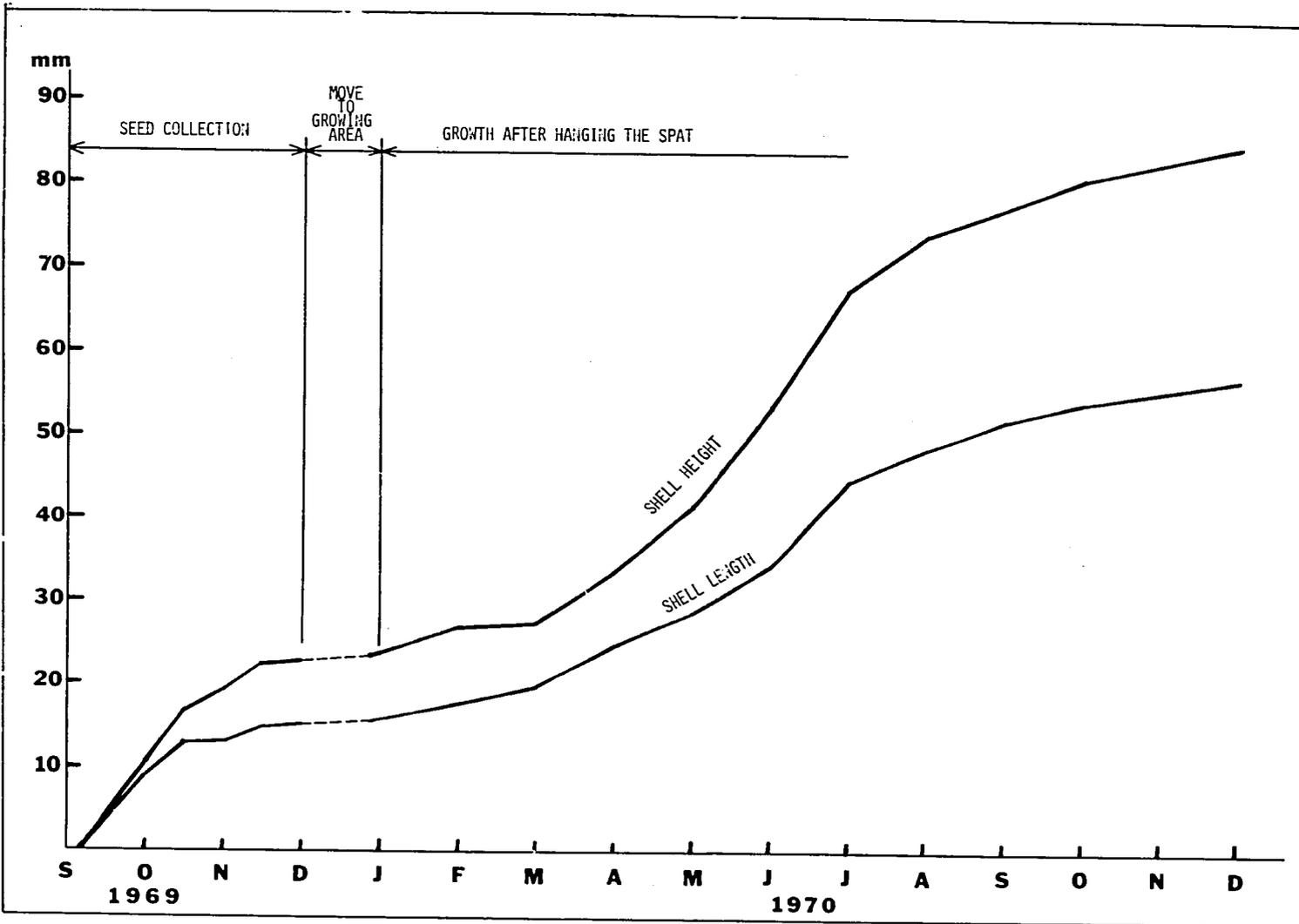


Oyster, *Crassostrea gigas*, Growth Rate by Hanging Culture in Korea
Office of Fisheries, Fisheries Research and Development Agency

	Measuring Date		Shell-height (mm.)	Shell-length (mm.)
Growing rate at seed stage	1969	Oct. 10	10.9	8.9
		20	16.9	12.4
	Nov.	10	19.2	13.1
		10	22.5	14.3
		20	22.9	15.0
		20		
Growing rate after hanging the spat	1970	Jan.	23.4	15.7
		Feb.	26.7	17.3
		Mar.	27.1	19.8
		Apr.	33.6	24.6
		May	41.8	28.4
		June	53.7	34.4
		July	67.8	45.2
		Aug.	74.3	48.4
		Sept.	77.8	52.3
		Oct.	81.4	54.3
		Nov.	83.5	55.8
		Dec.	85.1	57.2

Seed collection area: Jindong Bay, Gyeong Sang Nam Province

Growing area : Okgae, Geoje Do, Gyeong Sang Nam Province



FUTURE PROGRAM PLANS

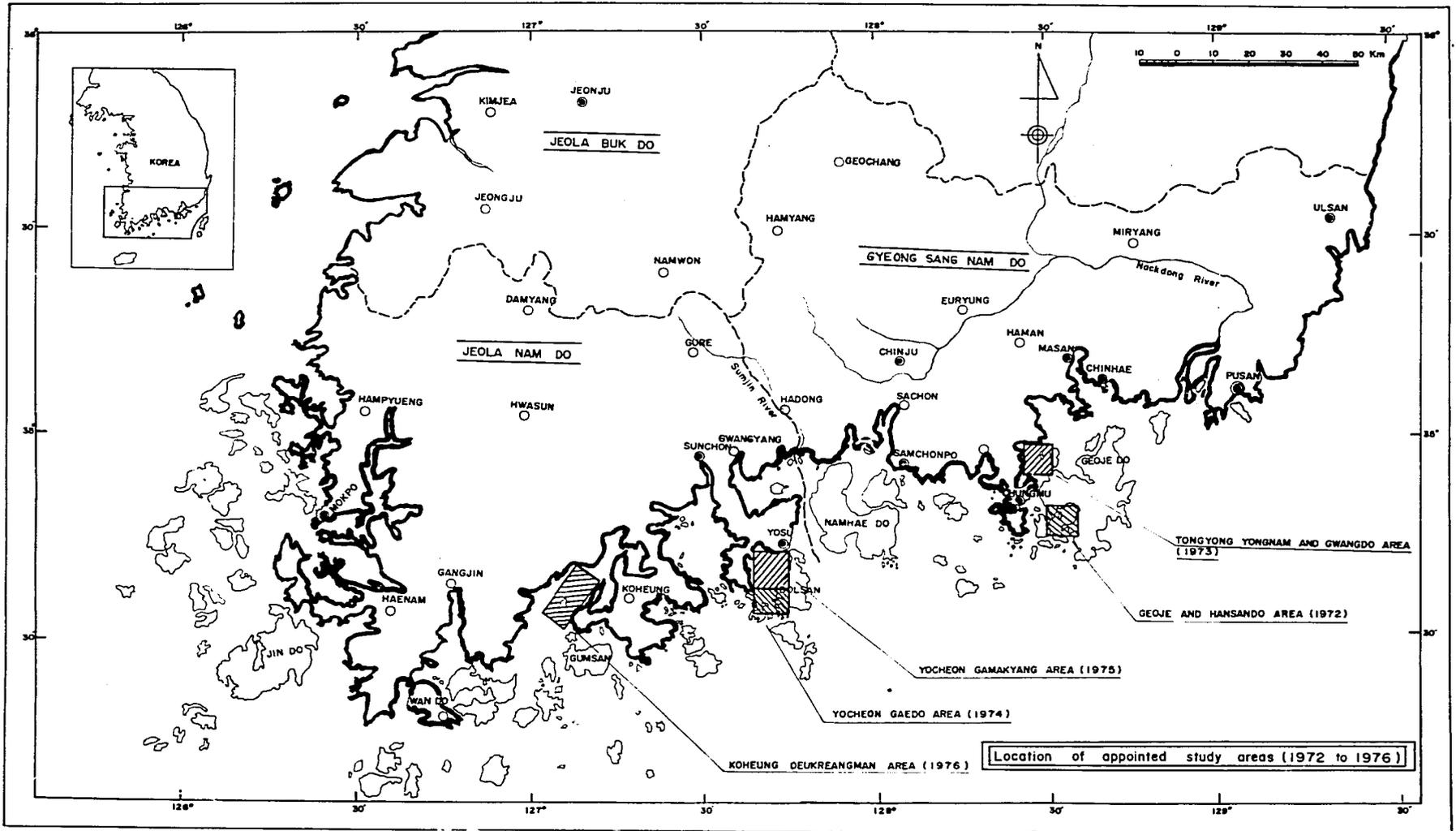
It is the desire of the Korean Government to expand their oyster export production and thereby become a leading oyster-producing country. Training and research plans have been developed by the Office of Fisheries and Korea General Foods Company, Ltd., with this objective in mind. Government planning is projected in 5-year increments with carefully defined goals. The success of expanding oyster exports is of national interest and figures in the economic strategy of the Office of Fisheries.

According to Gyeong Sang Nam Province plans oyster culture production expected in 1971 is 25,000 metric tons of shucked meats which will be harvested from 840 hectares (2,075 acres) cultivated leases. Between 1972 and 1976 investments in oyster culture production will amount to ₩ 3,179,000,000 (\$8,600,000) so that by 1976 production will be 144,000 M/T or an increase of almost six times the 1971 production.

Five areas have been selected for sanitary reconnaissance and shellfish-growing area surveys by the Office of Fisheries. To support these new activities field laboratories are planned to be established in Chung-Mu in 1972 and Yeosu in 1973. The Office of Fisheries will have 15 personnel to conduct such surveys with appropriate equipment, laboratory support, boat of 10 ton class, and other breeding and culturing facilities.

Appointed Study Areas - Office of Fisheries

Province			
Gyeong Sang Nam	Geoje Man and Hansan-Do	5,000 ha	1972
	Yongnam-Myven and Gwang Do - Tong Yeong County	6,000	1973
Jeola Nam	Gaedo in Yecheon County	3,000	1974
	Gamakyang in Yecheon County	7,000	1975
	Koheung Deukreangman in Koheung County	10,000	1976
Total	Five areas	31,000	



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and Social Affairs.

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23. Republic of Korea Government, Building Law, Law No. 2188, promulgated January 1, 1970, Ministry of Construction.
24. Republic of Korea Government, Waterworks Law, Law No. 1634, promulgated May 2, 1964 and Law No. 1824 promulgated August 3, 1966, Ministry of Construction.
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APPENDIX A
ORGANIZATIONS AND INDIVIDUALS CONTACTED

The individuals with whom the Mission held meetings and conferences, or who provided special services to the Mission, are listed below and are identified under their respective organizations.

JAPAN

Tokyo

Embassy of the United States of America

Mr. Clinton E. Atkinson, Regional Fishery Attache

Mr. Yoshio Nasaka, Economic Assistant to Mr. Atkinson

Embassy of the Republic of Korea

Dr. Myong Nam Ahn, Fisheries Attache

Mr. Koh Dong Jae, Assistant Fisheries Attache

Nichiro Gyogyo Kaisha, Ltd.

Mr. Sadahiko Ide, General Manager, Overseas Department

Mr. Tani

Ministry of Health and Welfare

Dr. Furasari, Food Sanitation Section

Dr. Takao Maki, Food Sanitation Section

Dr. M. Kanbayashi, Veterinary Sanitation Section

Tokyo Central Fish Market

Mr. Kawamura, Sanitation Office

Fishery Agency

Dr. Tomonari Matsushita, Director, Research Department

Seoul

KOREA

Office of Fisheries

Mr. Dong Soo Kim

Mr. Yong Soon Kang, Deputy Administrator

Mr. Han Mo Kim, Chief, International Cooperation Division

Dr. Dong Hwan Bae, Director, Production Bureau

Mr. Sang Kwa Chyung, Aquiculture Senior Officer
Mr. Chong Chul Kin, Central Fishery Products Inspection
Station
Mr. Sung-Woo Hong, Interpreter
Mr. Young Soo Sohn, Inspector, Central Fishery Products
Inspection Station

American Embassy

Mr. Laverne E. Wakefield, Chief, Fisheries Branch,
Rural Development Division, U. S. AID/Korea
Mr. Young, Assistant to Chief, Fisheries Branch
Mr. Francis Jones, Chief, Rural Development Division,
U. S. AID/Korea
Mr. Morton Smith, Counselor for Public Affairs
Mr. David Blakemore, Foreign Service Officer

Korea General Foods Company, Ltd.

Mr. Hyung Chull Lee, Vice President
Dr. Byung Sun Chung, Director, Research and Development
Mr. Dong Ho Lee, Food Technologist, Training and Manage-
ment Section

Ministry of Health and Social Affairs

Mr. Chon Won Bae, Director of Sanitation
Dr. Kwang Soon Shin, Food Sanitation Officer

National Institute of Health

Dr. Sung Hee Rhee, Vice Director
Dr. Chang-Hong Min, Director, Microbiology Department
Mr. Chung Bai Ro, Chief, Department of Hygiene

Korea Institute of Science and Technology

Dr. Jong Rak Chung, Head, Seafood Processing Laboratory
Dr. Moo Bae, Head, Applied Microbiological Laboratory

Ministry of Agriculture and Forestry

Mr. Bong-Soo Hahn, Assistant to Vice Minister

Inchon

Fisheries Cooperatives

Mr. Iim Jong Jin, President

Inchon City Government

Mr. Oh, Chief, Fisheries Section

Kyueng-gi Province

Mr. Kim, Assistant Chief, Fisheries Section

Pusan

Mr. Hae Sik Chung, Governor, Gyeong Sang Nam Do
Provincial Government

Mr. Soo Seung Kang, Vice Governor, Gyeong Sang Nam
Do Provincial Government

Fisheries Bureau

Mr. Tai Woo Kim, Director, Gyeong Sang Nam Do ..
Province

Fisheries Research and Development Agency

Mr. Gi Yung Kim, Director

Mr. Hack Kern Suh, Chief, Fisheries Technical Manage-
ment Division

Mr. Ok Sung Bae, Chief, Utilization and Processing
Section

Mr. Seong Jun Kim, Bacteriologist, Utilization and
Processing Section

Pusan Fisheries College

Dr. Jae Mok Yang, President

Dr. Byung Don Lee, Director of the Marine Laboratory

Dr. Sung Kyoo Yoo, Assistant Professor, Department
of Fisheries Biology

Dr. Seh Kyu Chun, Professor, Department of Fisheries
Biology

Dr. Chong Hun Won, Professor, Analytical Chemistry
Laboratory

Dr. Eung-Ho Lee, Associate Professor, Department of
Food Science and Technology

Dr. Kang Jue Won, Professor

U. N. Development Program Coastal Fishing Training Center

Mr. Erling O. Oswald, Project Manager

Mr. Keh On Kim, Co-Manager

U. S. AID/Korea

Mr. Grant K. Framstad, Rural Development Officer

Mr. Nahm, Assistant and interpreter

Korea Cold Storage Company

Mr. Chang Hee Lee, Director

Mr. Pil Won Nam, Deputy Director, Production Division

Cold Storage Plant

Mr. Chung Myong Lee, Director

Pusan Frozen Seafood Company, Ltd.
Mr. Yong Uk Kim, Managing Director

City of Pusan
Mr. Chan Woo Lee, Chief, Fisheries Section

Pusan Fish and Clam Guild
Mr. Cheul Yeung Cha, Manager

Pusan Fisheries Center
Mr. Jang Keun Jae, Manager
Mr. Seung Cheul Im, Chief, Administration Section

Chung-Mu

Mr. Chang Sup Koh, Mayor, City of Chung-Mu
Mr. Uh Chul Chu, Chief, Tong Yong Gun (County)
Mr. Hi Soo Back, Chief, Geoje Gun County

Office of Fisheries
Mr. Chin, Chung-Mu Branch, Inspection Station

Korean General Foods
Mr. Eun Shick Hong, Chief, Chung-Mu Office

Chung-Mu Health Center
Dr. Mun-Sun Kim, Director

Oyster Hanging Cooperative
Mr. Yeong Jae Lee, Director

APPENDIX B
ITINERARY OF THE MISSION

September 1971

- 11 Saturday - Depart Washington, D. C. via San Francisco
CROSS INTERNATIONAL DATE LINE
- 12 Sunday - Arrive Tokyo, Japan, 6:00 p.m.
- 13 Monday - Confer with Fishery Attache, American Embassy
Confer with Fishery Attache, Korean Embassy
Confer with officials of Nichiro Gyogyo
Kaisha, Ltd.
- 14 Tuesday - Visit Tokyo Fish Market
Confer with officials, Ministry of Health
and Welfare, Food Sanitation Division
- 15 Wednesday- Depart Tokyo and arrive Seoul, Korea
Confer with USOM/K, American Embassy officials
about Mission
- 16 Thursday - Confer with Director, Bureau of Production,
Office of Fisheries about Mission plans and
objectives
Briefing meeting with interministerial shell-
fish committee
Visit Vice Minister, Ministry of Agriculture
and Forestry and officials, Ministry of
Health and Social Affairs.
Visit Vice President, Korea General Foods
Company, Ltd.
- 17 Friday - Confer with officials, Office of Fisheries

Visit Korean Institute of Science and
Technology

Visit National Institute of Health

- 18 Saturday - Drive from Seoul to Incheon and visit
Fisheries Cooperative - clamming industry
- 19 Sunday - Depart Seoul via Korean A/L for Pusan
- 20 Monday - Visit Fisheries Research and Development
Agency
- Meet Governor of Gyeong Sang Nam Province
and briefing on oyster development plans
- Visit U. N. Deep Sea Fishing Training Center
- 21 Tuesday - Visit Korea Cold Storage Company
- Visit Pusan Cold Storage
- Confer with Scientists at Pusan Fisheries
College
- 22 Wednesday - Review Sanitary Surveys at Fisheries Research
and Development Agency
- 23 Thursday - Review Bacteriological Data on Shellfish and
Growing Waters at Fisheries Research and
Development Agency
- 24 Friday - Evaluate Sanitary Surveys of Shellfish Grow-
ing Areas and Designated Areas at the Fish-
eries Research and Development Agency
- 25 Saturday - Evaluate sanitary surveys of shellfish grow-
ing areas at FRDA
- 26 Sunday - Visit Dulce Culture Station, Il-Kwang, Pusan
- Visit Pusan Fisheries Market Centre
- Visit Fish and Shellfish Retail Market Centre
- Visit Pusan Frozen Seafood Co., Ltd.
- 27 Monday - Confer with Director, Oyster Hanging Coopera-
tive, Chung-Mu, Regarding Oyster Leases
- 28 Tuesday - Evaluate and review FRDA Bacteriological Lab

29 Wednesday - Review Available Information and Reports
at FRDA

30 Thursday - Depart Pusan via Hydrofoil to Chung-Mu
Confer with Mayor, Chung-Mu City
Visit Chung-Mu Fisheries Inspection Station
Tour Chung-Mu vicinity oyster-growing waters
aboard patrol vessel, viewed raft and long-
line aquaculture areas
Visit shrine to Admiral Yi

October 1971

1 Friday - Inspect Korea General Food Oyster Shucking-
Packing Plant - Chung-Mu
Visit Water Treatment Plant
Visit Inspection Station to Discuss Enforce-
ment and Public Health

2 Saturday - Depart Chung-Mu via Hydrofoil for Pusan
Write report at FRDA
Meet with Vice Governor, Gyeong Sang Nam
Province
Tour U. N. Cemetery

3 Sunday - Depart Pusan by Republic of Korea car for
ancient city of Gyeong ju
Visit industrial park of Ulsan
Tour Palace Grounds of Silla Dynasty,
Bul-Kuk Temple

4 Monday - View Rising Sun from Mountain Top
(Sukkul-Ahm)
Depart Gyeong ju by ROK car for Taegu
Depart Taegu via express train for Seoul
Brief Administrator, Office of Fisheries
on Findings of Mission

Brief Interministerial Shellfish Committee
on Findings of Mission

- 5 Tuesday - Brief U. S. Agency for International Development on findings of the Mission
- Prepared reports and information for mailing
- Reconfirmed travel and exchanged currency
- 6 Wednesday - Met at Airport by Delegation from Korean General Foods and Office of Fisheries
- Depart Seoul and arrive Tokyo
- Brief Fishery Attache, Mr. Atkinson, at United States Embassy on Findings of the Mission
- Depart Tokyo via PA 2
- CROSS INTERNATIONAL DATE LINE
- 6 Wednesday - Arrive Honolulu
- Lay over
- 7 Thursday - Depart Honolulu
- 8 Friday - Arrive Washington, D. C.

APPENDIX C

MEMORANDUM ON INTERMINISTERIAL AGREEMENT CONCERNING SHELLFISH SANITATION CONTROL

Memorandum on Agreement Among the Ministry of Agriculture and Forestry (Office of Fisheries), Ministry of Construction, Ministry of Health and Social Affairs and Ministry of Science and Technology (Office of Atomic Energy), concerning Cooperation in the Production and Handling of Shellfish

In order to smoothly fulfill the sanitation control on shellfish for export, to prevent pollution and contamination harmful to health and sanitation which may arise during the culture, harvesting, handling and processing of shellfish and in the course of distribution thereof, and to ensure the production and supply of shellfish products free from danger, we, the undersigned, have agreed to closely cooperate with each other, as follows:

1. In order to prevent the pollution of areas designated for the production of shellfish for export, the Ministry of Agriculture and Forestry shall prohibit the use of excrement and pesticides having poisonous residues on farmland under cultivation in adjacent basin areas and establish chemical fertilizer supply and demand measures for these areas; shall promote the use of chemical fertilizers and the cultivation of the designated crops; shall notify the Office of Fisheries of the kinds and quantities of pesticides used in the said areas each season; and when the pollution of shellfish growing areas through the use of fertilizer or pesticides is foreseen, shall take necessary countermeasures through consultation.

2. The Ministry of Construction shall consult with the Office of Fisheries with respect to coastal reclamation and sewer systems which may affect the quality of water in areas designated for the production of shellfish for export. If an emergency occurs in municipal water supplied to shellfish processing facilities, the Ministry shall promptly serve notice to the Office of Fisheries, and seek countermeasures after consultations therewith.

In the event of designating area for the culture of

shellfish, the Office of Fisheries shall consult with the Ministry of Construction in advance; publicly-owned water surfaces in the vicinity of the designated area shall be restricted after reaching an agreement with the Ministry of Construction in advance.

3. The Ministry of Health and Social Affairs shall take action to prohibit the use of excrement in certain areas where it may affect the quality of water in the designated area used for the production of shellfish for export and their processing facilities. The Ministry shall also render cooperation in providing guidance to prevent environmental pollution by garbage, sewage, and industrial waste water disposal, and by periodically conducting medical examinations of employees.

In the event of any situation harmful to public health or which requires the removal of causes of harm, the Ministry shall notify the Office of Fisheries of the fact, in detail, and seek countermeasures after consultation with the Office.

4. The Ministry of Science and Technology (Office of Atomic Energy) shall provide advice and counsel concerning radioactive contamination of shellfish-growing water and shellfish. If any potential or actual danger is expected due to radioactive waste, the Ministry shall immediately notify the Office of Fisheries of the fact and seek countermeasures and various other matters in consultation therewith.

5. The Office of Fisheries shall take charge of administrative and technical work on the export of shellfish, and shall notify the Ministries herein of the designation of areas for the production of shellfish for export, the location and extent of the designated areas and vicinity basin areas, registration status of processing plants thereof, status of controls on the harvesting of shellfish, and results of sanitary surveys. The Office shall also consult with the Ministries to coordinate survey and research on shellfish sanitation, development of sanitation control guidelines, and establishment of plans therefor.

6. Each Ministry concerned shall exchange useful scientific information concerning general affairs, development of guidelines, and survey and research which are related to shellfish sanitation control with each other so that the information may be utilized effectively.

7. Each Ministry concerned shall also take necessary steps so that close cooperation may be ensured even among its subordinate agencies and related departments in city and provincial Governments.

8. A budget required for fulfillment of the aforesaid

sanitation control over the production of shellfish for export shall be secured independently by each competent Ministry.

August 1971

Kim Bo Hyun
Minister of Agriculture and Forestry (seal)

Tae Wan Son
Minister of Construction (seal)

Lee Kyung Ho
Minister of Health and Social Affairs (seal)

Choe Hyung Sop
Minister of Science and Technology (seal)

APPENDIX D
WORLD LANDINGS OF OYSTERS
1964 - 1969

Country	1964	1965	1966	1967	1968	1969
	----- Million pounds -----					
Australia	12.8	14.6	15.0	16.1	16.8	16.5
Canada	15.2	14.8	16.1	12.6	10.4	12.1
China (Taiwan)	18.7	19.6	22.7	25.8	27.8	25.8
Cuba	5.3	6.0	6.2	7.1	5.1	5.7
France	137.2	145.1	137.4	153.2	98.6	87.1
Japan, ^{1/}	530.5	464.4	487.5	512.0	589.6	541.3
Korea, Republic of ^{2/}	93.9	101.2	114.0	97.9	84.2	73.2
Mexico	52.9	65.3	55.3	62.6	78.3	93.5
New Zealand	17.0	21.8	28.4	29.1	26.2	12.3
Portugal	22.5	.4	.7	10.6	21.2	20.1
Spain	2.4	2.0	1.5	2.0	2.2	3.7
United States	914.0	773.7	785.9	915.7	857.1	783.7
Other	7.8	2.8	5.1	7.5	12.7	.8
WORLD TOTAL	1,830.2	1,631.7	1,675.8	1,852.2	1,830.2	1,675.8

^{1/} Aquaculture

^{2/} Mostly aquaculture

Source: Food and Agriculture Organization of the United Nations

APPENDIX E
TABLE OF EQUIVALENTS

Measurements:

1 acre	equals	4,047 square meters
1 square kilometer	equals	0.3861 square mile
1 hectare	equals	2.471 acres
1 kilogram	equals	2,205 pounds
1 metric ton	equals	2,205 pounds
1 ton of water/24 hr	equals	0.16643 gal per min
1 inch	equals	2.54 centimeters
1 mile	equals	1.609 kilometer
1 liter	equals	1.057 quarts

Temperature:

$^{\circ}\text{C} + 17.78$	$\times 1.8$	equals	$^{\circ}\text{F}$
$^{\circ}\text{F} - 32$	$\times 5/9$	equals	$^{\circ}\text{C}$

Currency:

\$1.00 U.S. Dollar	equals	₩ 370 (Won) Oct. 1971 exchange rate
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