

THE STATUS OF INLAND FISHERIES IN KOREA

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An outline is given of the results of investigations of the potential productivity of Korean inland waters. The management and economics of fish culture are discussed with notes on fish diseases.

The development strategies for inland fisheries are reviewed and the use of pesticides and fertilisers in agricultural farming lands, the restrictions of species and the shortage of water in dry seasons were identified as the main bottlenecks in Korean inland fisheries development.

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1. POTENTIAL PRODUCTION OF INLAND WATERS

An investigation was carried out, between June and September 1970, to provide basic data on the potential production of Korean inland waters. The results of this investigation were intended to aid in the establishment of a development programme for Korean freshwater fisheries (see Tables 1, 2, 3 and 4).

2. SPECIES CULTURED

The major freshwater species are eel, common carp, loach and trout.

2.1 Culture of eels

Culture of eels began in 1968. Eels were first exported in 1969. The value of these exports have now reached U.S. \$4 million per year.

From March to July eelers migrate to the rivers and are collected from streams and estuaries for rearing in 82 nursery ponds.

2.2 Culture of common carp

Carp are grown for the food market or for sale as fry for stocking. There are 257 (103 hm²) hatching and nursery ponds. Fry purchased by the Government have been released into suitable artificial dams and reservoirs. Carp are raised for market in flowing and static water ponds.

2.3 Culture of trout

Rainbow trout in Korea are mainly cultured in cold water at 12 locations (4.3 hm²). Management techniques for mass production are now being developed.

2.4 Other species

Loach and freshwater turtle, collected as young from natural waters, have been exported. Successful introductions have been made of grass carp, bluegill and bass. The introduction of these fish into inland waters is expected to increase their production.

2.5 Release of salmon fry into natural waters

To increase salmon stocks, which migrate up rivers in south-eastern parts of Korea from September to November, experiments involving the release of salmon fry have been carried out since 1924. Salmon stocks are now reduced due to environmental changes and 3 modern hatching facilities were built to increase the production of salmon fry.

3. MANAGEMENT OF NATURAL LAKES AND WATER RESERVOIRS

3.1 Present status

The total area of inland waters amounts to 182 000 hm², of which 55 852 hm² (13 percent) are lakes and reservoirs.

As part of the national long-term programme for the development of inland waters, plans have been made for the rational utilization of natural lakes and reservoirs. The main species considered are common carp, grass carp, bluegill and bass which are to be introduced after basic environmental surveys.

In all natural waters there are loach, snakefish, catfish, eel and golden carp. In order to avoid loss of production, carnivorous fish, for example catfish and snakefish, should be removed.

3.2 Organization of "Cooperating Communities"

For the continuous development and effective management of the available fish resources of artificial dams and reservoirs, neighbouring villages combine in a "Cooperating Community"

The fishing is regulated with seasonal restrictions and the protection of breeding areas. Sport fishing is encouraged and developments such as cage culture are encouraged.

4. POND CULTURE TECHNIQUES AND MANAGEMENT

4.1 Types of pond

The following ponds are required for rearing fry and growing-on for market :

(a) Spawner ponds (also used as winter ponds)

- 2 or more ponds are necessary to separate the sexes
- depth 1.5 to 2.0 m
- rectangular with a length : width ratio of 3 : 2
- water area approximately 500 to 1 000 m²

(b) Fry rearing ponds (also used as nursery ponds)

- should comprise 70 percent of total farm area
- each pond area is from 660 to 1 320 m²
- the bunds made of concrete or soil
- shape rectangular
- depth 1 m, length 3 m, width 2 m.

(c) Spawning ponds (also used as hatching ponds)

- concrete lined to reduce turbidity
- water area less than 100 m², about 20 to 35 m²
- depth 1 to 1.5 m
- shape rectangular
- comprises 3 to 4 percent of total farm area and located at the middle of the farm site.

4.2 Management

4.2.1 DISINFECTION

- (a) The growing-on ponds should be allowed to dry out more than once a year to allow disinfection of the pond bottom by the action of sunlight.
- (b) After drying out, the pond should be treated with lime at an application of 1 g per m². This neutralizes the soil, exterminates parasites and helps to recycle nutrients.
- (c) Disinfectants can be used: Diptrex applied at a concentration of 2 ppm for more than 48 hours; calcium chloride (CaCl₂ · H₂O) 10 ppm for more than 24 hours. These applications will kill disease organisms after an irrigation.

4.2.2 ADDITION OF FRESH SOIL

Soil can be brought in to upgrade pond bottom soils that have been undisturbed for a long time.

4.2.3 TURNOVER OF BOTTOM SEDIMENTS

This should be done every two years.

4.2.4 MAINTENANCE AND REPAIR WORK

Supply and drainage canals should be maintained and pond walls and bottom examined for leaks and repaired as necessary. Earth ponds should have weeds removed and the bank maintained.

4.2.5 WATER INFLOW

Water can be supplied through steel or plastic pipes (diameter 10 m). Sometimes it may be necessary to filter the inflow water through a container filled with sand and gravel.

4.2.6 POND DRAINAGE

Various types of drainage sluices are used, i.e. dam-board, standpipe, sluice-gate and pipe connections. The dam-board and standpipe type are the most common. Dam-boards are used in running water ponds, sluice-gate methods in static ponds.

4.3 Economics of fish culture

Fish culture was not developed as a stable farming industry owing to the unsophistication of freshwater fish culture techniques, lack of suitable species, and low investment due to the small-scale of the enterprises. Among the cultured species, eel and freshwater turtle are very profitable. Efforts have been made, since 1969, to develop techniques of eel culture. It is now possible to culture the species through nearly all its life cycle. The adult eels are all exported to Japan and Formosa. The culture of loach and turtle by means of the irregular collection of wild seed, makes little progress.

Fish culturists are showing interest in the production of common carp fry. Evidence shows that this could be profitable.

Eels have been cultured at Daewha nursery, Songpo-Myun, Goyang-Gun, Kyeong ki-Do. In 1975, a stock of 200 kg of elvers were collected from the nearby river and placed in ponds (4 000 m²). A harvest of 2 700 kg was obtained after 3 months rearing. This harvest was exported to Japan and Formosa with a value of U.S. \$ 60 000, of which net profit amounted to U.S. \$ 14 000.

Common carp cultured at Yang Ji farm, Sundan-Myun, Pothun-Gun, Kyeong ki-Do, produced 2.7 million carp fry and 7 000 one-year-old golden carp fry in a 16 000 m² pond. Total income was U.S. \$ 20 000 with a net profit of U.S. \$ 10 000.

4.4 Guidelines for the expansion of the market

- (a) Establish a marketing chain from producer to consumer.
- (b) Improve fish quality by the development of better feeds.
- (c) Increase overseas markets by mass production of valuable species.
- (d) Discover new methods of fish processing (dried or canned foods).

4.5 Problems

- (a) Water pollution caused by industrial waste and agricultural chemicals.
- (b) Lack of technical improvements.
- (c) Stocks decrease in the drought season due to inadequate water supplies.
- (d) Poor development of compounded foods.
- (e) Marketing difficulties.
- (f) Little progress in the development of fish culture.

4.6 Counter-measures

- (a) Establish a monitoring system for inland water pollution
- (b) Establish zones for the regulation of use and the protection of the resources.
- (c) Encourage investigation into compounded food suitable for eel rearing.
- (d) Rational extension of fish culture techniques and the use of profitable fish species.
- (e) Rationalization of the marketing chain by establishing a direct sales agency and publicising methods of cooking.
- (f) A programme of research projects should be carried out to further improve inland water fish culture.

TABLE 1
POTENTIAL PRODUCTION (t YEAR⁻¹)

<i>Rivers</i>				<i>Artificial Dams and Lakes</i>	<i>Reservoirs</i>	<i>Impounded water</i>	<i>Total</i>
9062	...	...	...	16 703	22 783	2 243	50 791

TABLE 2
POTENTIAL PRODUCTION OF RIVERS

<i>River</i>				<i>Length (km)</i>	<i>Production potential (t year⁻¹)</i>
Han River	...	...	...	831.3	2 767.65
Ansung Stream	...	...	...	76.2	114.3
Samchuk ohsib Stream	...	...	...	42	78
Kum River	...	...	...	401.6	1 204.8
Mankyung River	...	...	...	98.5	147.75
Dongjin River	...	...	...	44.8	67.2
Youngsan River	...	...	...	115.8	173.7
Sumjin River	...	...	...	332.2	816.9
Makdong River	...	...	...	1 347.7	4 378.65
Hyungsan River	...	...	...	62	93
Total	...	...	...	3 412.6	9 601.95

TABLE 3
PRODUCTION OF ARTIFICIAL DAMS

<i>Dam</i>	<i>Inflowing River</i>	<i>Area at high water (hm²)</i>	<i>Potential production (t)</i>
Hwachun	Bukhan River	3 895	3 895
Chuncheon	Bukhan River	1 432	1 432
Ouiam	Bukhan River	1 720	1 720
Cheongpyung	Bukhan River	1 760	1 760
Unam	Sumjin River	2 651	2 651
Namkang	Namkang River	3 492	3 492
Goisan	Sumjin River	1 753	1 753
Total		16 703	16 703

TABLE 4
POTENTIAL PRODUCTION OF RESERVOIRS (STATIC WATERS, NATURAL LAKES,
PRIVATE POND NURSERY, SPRING WATER)

	Total Area		Exploited Area		Potential Production		
	<i>No.</i>	<i>Area (hm²)</i>	<i>No.</i>	<i>Area (hm)</i>	<i>No.</i>	<i>Area (hm)</i>	<i>Production (t)</i>
Reservoirs	1 045	23 155.02	10	371.1	1 035	22 753.92	22 783.92
Static waters	111	1 681.96	5	85	106	1 596.96	1 596.96
Natural lakes	14	631			14	631	631
Farmed area	184	168.5	161	155.88	23	12.69	15.08
Spring waters	15				15		
Total	1 369	25 636.48	176	611.98	1 193	24 994.57	25 026.96

TABLE 5
FISH CULTURE PRODUCTION (t)

<i>Species</i>					1972	1973	1974	1975
Eel	...	...	...	...	139	131	146	251
Common carp	...	...	...	...	249	142	150	840
Loach	...	...	...	...	71	159	230	657
Other	...	...	...	...	699	862	605	742
Total	...	...	...	...	1,158	1,294	1,131	2,490

TABLE 6
NUMBER OF EGGS PRODUCED AND SALMON RELEASED ANNUALLY (1969-75)

	Coho Salmon		Chum Salmon (imported)		Chum Salmon (domestic)		Total	
	<i>Eggs</i>	<i>Release</i>	<i>Eggs</i>	<i>Release</i>	<i>Eggs</i>	<i>Release</i>	<i>Eggs</i>	<i>Release</i>
1969	500 000	275 005	100 000	70 520			600 000	343 52
1970	500 000	414 047	100 000	94 902	70 000	54 911	670 000	563 80
1971	1 000 000	934 009			171 750	137 006	1 171 750	1 071 015
1972	1 000 000	965 707	360 000	345 200	338 900	298 917	1 698 900	1 609 824
1973	3 000 000	2 492 000			155 800	121 770	3 155 800	2 613 770
1974	500 000	460 000	1 400 000	1 285 200	102 700	87 137	2 002 700	1 832 337
1975	800 000	719 000	1 520 000	1 469 500	285 500	249 800	2 605 500	2 438 300
Total	7 300 000	6 259 768	3 480 000	3 265 322	1 124 650	949 541	11 904 650	10 472 631