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KOREA'S COASTAL WETLANDS: PROBLEMS AND CONSERVATION MOVEMENTS

Yu, Keun Bae

Seoul National University, Department of Geography

1. INTRODUCTION-COASTAL GEOGRAPHY

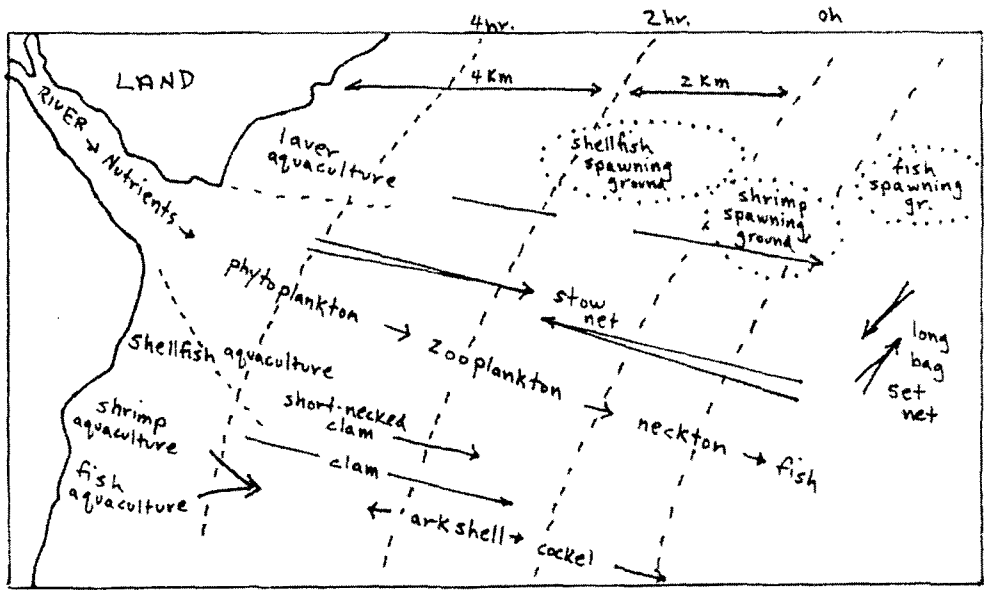
Undulating hilly landforms and low-erosion surface types are widely developed in the western coastal areas of the Korean Peninsula. The low-lying coastal plain is mostly connected to wide tidal flats gentle in slope. The coast is "ria" type, and so complicated that the actual shoreline exceeds more than ten times its estimated straight line length.

Wetlands, mostly tidal flats, are extensively developed along the western and southern coasts, especially inside the large embayments, such as Kyonggi and Chunsu Bays. Conditions here for the formation of tidal flats are amply fulfilled by the great tidal ranges, the gently sloping topography and an abundant supply of silt. The macro tidal range reaches up to approximately 8.5 m in spring at Asan Bay. From this Bay the tidal range decreases both towards the south and the north: i.e. 8.1 in Inchon, 6.2 m in Kunsan, 3.1 m in Mokpo, etc.

An evaluation of Korea's tidal flats performed in 1979 estimated that they covered an area of about 300,000 hectares. Huge tidal flats have formed particularly in large embayments such as at Kyonggi Bay, into which large rivers flow. In the vicinity of the rivermouth, tidal flats of larger-sized particles such as sand and gravel are formed, while further away from the rivermouth where waves are peaceful are distributed tidal flats made of clay particles. The tidal flats are 5 to 40 m in thickness and 2 to 4 km in width. They are mainly composed of coarse material transported by rivers - some 4 billion tons of sediment are carried down by rivers annually.

The coastal waters are generally shallow: the depth is mostly less than 40 m, and the mean depth within 5 km from the shoreline is around 20 m. Waters shallower than 20 m are estimated to cover about 1.5 million ha.; these areas have been regarded as reclaimable by the Government.

EXPOSURE DURATION: 4 HOURS



WATER USE PATTERNS

2. ECOLOGY OF KOREAN TIDAL FLATS

Wetlands are one of the richest ecosystems in Korea. Abundant nutrients are supplied through more than 200 rivers of various sizes on the west coast. Tidal flats are composed of coarse material, mostly silt and sand, and their productivity is estimated to be high. Water temperature is also favorable to benthic organisms; temperatures warmer than 10℃ last more than 7 months. The dissipative structure is well maintained due to fast tidal currents.

Together with tidal wetlands, shoals act as spawning grounds and nurseries for fish and shellfish. They are also used for aquaculture of fish and shellfish species, as well as for edible seaweed. Along the west coast there are 230 species of fish, 193 of crab, 74 of shrimp, 58 of shellfish, and so on.

Traditionally, these areas have been the foundation of fishers' livelihood and way of life. Fishing and aquaculture techniques have been developed which reflect the physical setting peculiar to the west coast. Fishing nets are structured and set with a deep-seated regard for the large tidal range.

Wetlands are breeding grounds for birds and also provide major rest stops for migratory birds.

Tidal flats in Chunsu Bay and around Kangwha and Yongjong Islands in Kyonggi Bay, where large industrial parks including Incheon International Airport have been constructed on the reclaimed lands, are typical.

Table 1: Birds Observed at Tidal Flats around Yongjong Island, May 11 - 12, 1991

SPECIES	NO. OF BIRDS
Haematopus ostralegus	1
Charadrius alexandrinus	16
Charadrius mongolus	305
Pluvialis squatarola	567
Arenaria interpres	70
Calidris ruficollis	203
Calidris acuminata	38
Calidris alpina	23,000
Calidris ferrugeiena	2
Calidris canutus	4
Calidris tenuirostris	3
Tringa erythropus	3
Tringa nubularia	225
Tringa guttifer (int. protected)	28
Tringa ochropus	3
Tringa glareola	218
Tringa brevipes	2
Tringa hyporelucos	2
Xenus cinereus	260
Limosa lapponica	250
Numenius arquata	150
Numenius madagascariensis	145
Numenius phaeopus	630
Gallinago stenura	8
Gallinago gallinago	3
Gallinago sp.	1
Egretta eulophotes (int. protected)	44
Total	26,181

3. THREATS TO WETLANDS

Wetland ecosystems are damaged by many causes, such as water pollution owing to waste water from the land, shipwrecks, especially oil tanker accidents, reclamation projects and so on. Reclamation, however, has been the biggest threat in Korea. Historical records show that reclamation

projects date back to the Koryo Dynasty: the first one known was in 1248. This and other similar projects were carried out on a small scale for securing foodstuffs.

Large scale reclamation projects were launched since the Japanese invasion. During the Japanese colonial period, wetlands amounting to 40,880 ha. were drained and filled up. Most salt marshes, which are critical in terms of biological diversity and productivity, were depleted during this period.

In recent decades, not only tidal flats, but also shallow coastal areas up to about 20 meters deep have also been reclaimed. Some 53,223 ha. of tidal flats and shallow waters have been reclaimed during the last 30 years and currently huge areas of land reclamation projects including Saemankeum are under construction. Reclaimed lands are utilized mainly for agricultural uses, manufacturing, urban development, etc.

Table 2: Reclaimed Tidal Flats in South Korea

Period	No. of Projects	Reclaimed Lands (hectares)
1917 - 1938	178	40,880
1946 - 1960	177	6,329
1961 - 1970	1181	17,864
1971 - 1980	194	18,856
1981 - 1989	57	10,427
Subtotal 1946 - 1989	1608	53,476
Total	1786	94,356

(Data: Guide for reclamation projects)

4. VARIOUS TYPES OF DAMAGE DONE BY LAND RECLAMATION

The construction and completion of land reclamation projects are accompanied by social and environmental problems in the coastal area. Dramatic declines occur not only in the variety of fish, shellfish, and seaweed species, but also in the numbers of remaining species, resulting in a variety of serious impacts on local fisheries. In some cases where fishing grounds and aquaculture areas have been lost, whole fishing villages and their cultural traits vanish. Most fishers are under-educated and financial compensation is insufficient for them to find and adjust to decent jobs after abandoning fishery. Some of them flow into urban slums.

In the 1980s, because the military government declared land reclamation as one of the important achievements of the state. Even some marine biologists agreed to the idea and supported the land

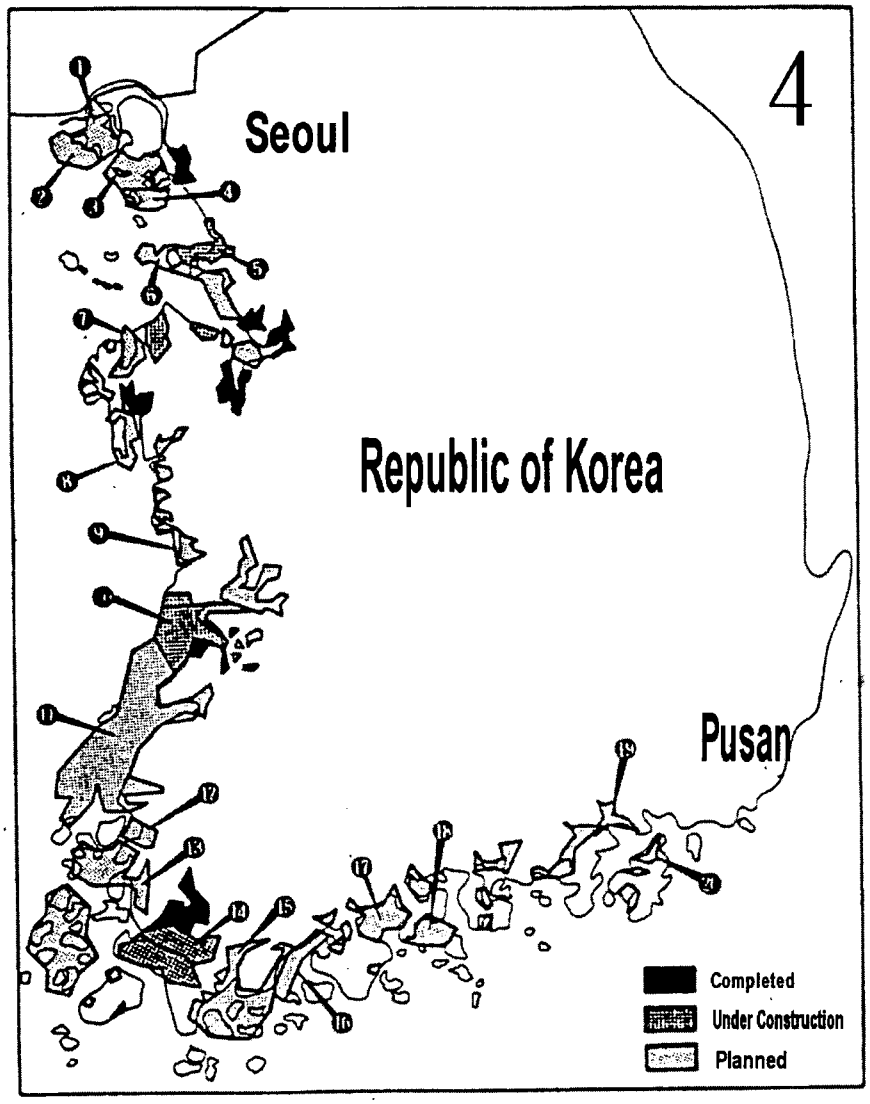
reclamation projects with thier biased knowledge. The following shows their viewpoint on the wetlands.

> "Untill recent, the intertidal zone was worth as salt farms as well as for biological ... However, it becomes to be evaluated as lands to meet the shortage of industrial grounds. ... Therefore, lots of reclamation projects have been under way and the stream of reclamation projects will be maintained. ..." (Interim Environmental Assesment Report of Saemakeum Project, Nov. 1988)

Thus tidal flats were largely viewed as wastelands and thought of as a way to expand limited living space, or as objects for the speculation of real estate agents. Wetland conservation movements were misinterpreted as antigovernment activism until 1980's. Around mid 1990's, however, the value and importance of coastal wetland ecosystems began to be more widely recognized.

These projects are great profit-makers for the project owners. Some 93.1 billion Won were invested for the Seosan A- and B-districts Reclamation Project in Chunsu Bay, in which 15,593 ha. were reclaimed. The land reclaimed was worth roughly a trillion won around the 1990s. The residents of the afflicted areas asked the enterprise to pay some 50 billion Won compensation. However, only 2 billion Won was offered.

Fishery production has undergone dramatic changes in Chunsu Bay. Catches had been increasing with advances in aquaculture techniques and the modernization of fishing implements. However, the catch dramatically dropped after the completion of dikes in 1987. Especially laver edible seaweed and shrimp aquaculture were severely damaged.



Sketch Map of Reclaimed Land (Completed, Under Construction & Planned) in the Republic of Korea (1996)

Table 3: Fishery Products of Seosan County (tons)

Year	Total	Fish	Shellfish	Mollusks	Seaweed
1977	35069	6481	5850	19696	2630
1980	41011	10441	5617	17545	7408
1984	42057	13742	3402	18309	604
1986	35528	12146	3226	13367	5991
1987	45174	14874	4345	20102	4841
1989	24391	16580	336	4592	1484
1991		4570	160	4070	640

There is no complete cost-benefit study on reclamation projects in Korea. However, just the profit from laver seaweed breeding before the reclamation project was compared with that of rice production from the reclaimed land after the project was completed. It was found that laver seaweed aquaculture yields 1.5 times more profit than rice cultivation. When other fishery products and the ecological functions of the wetland such as wastewater treatment and provision of a buffer zone during storm surges are added, it seems clear that the tidal flats are of much greater benefit than reclaimed land.

Table 4: Comparison of benefits from rice production on reclaimed land and laver seaweed aquaculture - Kyewha District, Chollabukdo (ROK)

Environment	Produce item	Amount Produced (m/t)	Gross Profit	Production Cost	Net Profit
Reclaimed rice field	rice	4.9	3,938	2,128	1,510
Tidal Flats	laver	4.5	6,896	5,856	2,310

(Data from: Chung, 1987)

Naturally maintained small traditional harbors and waterways suffer from malfunction due to sedimentation near reclaimed lands. However, the interaction between such harbors and reclaimed land is not clear. Some beach resorts have also deteriorated due to the erosion of beach sand or the accumulation of muddy sediments. Dongho Port in Gomso Bay, Chollabukdo, was deep enough for anchorage of ships of 100 tons or even larger. However, the Bay has been degraded: clay materials have been deposited so that the depths has become less than 5 m. Dongho Beach near

the Port has been closed due to the same reason. Such environmental degradation results in the decline of the community.

A large number of freshwater reservoirs have been constructed to secure agricultural water for reclaimed lands. In many cases, these reservoirs suffer from eutrophication problems immediately after the completion of the dikes, since the dissipation process is hindered due to the water body standing still with only small amounts of inflowing water. The water impounded thus become of little use.

Siwha Lake, completed early this year, is typical. The COD (Chemical Oxygen Demand) of the waters measured 4.1 ppm in 1991 and 5.2 ppm in February, 1994 immediately before completion of the impoundment. Afterwards, red tides took place locally in April and all over the lake in June.

Some waters near the dike have experienced changes in the level of the tides and the velocity of tidal currents in Chunsu Bay. The level is elevated by approximately 50 cm and the velocity is reduced by half after the completion of the dike. In the estuary of the Youngsan River, the level rose by about 40 cm: drainpipes flow backward and so low-lying areas are inundated about 40 times a year in nearby Mokpo City. The Youngsan Dike reduces the velocity of the tidal currents from 5.1 m/s to 4.1 m/s, which aggravates water quality problems since the dissipation structure does not function properly.

5. VALUE ATTACHED TO WETLANDS CHANGING

Wetlands were mistaken for wastelands and reclamation projects were advertised as governmental achievements until the mid 1980s. The importance of coastal wetlands is not still well known in Korea. Wetlands are till misunderstood among agencies as well as NGOs: even their definition is not clearly addressed: sometimes wetlands are confused with coastal sand dunes.
The wetland conservation movement was confronted with various difficulties: at one time it was considered to be as good as antigovernmental activism. However, the government's attitude has changed in many respects since the late 1990's; critical comments against land reclamation are welcomed by some Ministries, such as Ministry of Environment.

Since early 1990's environmental organizations, together with residents who have been adversely affected by reclamation projects, initiated a wetland conservation movement, but they cannot avoid the resistance of the public or government-owned corporations and large enterprises carrying on land reclamation schemes. Several years ago the Korean Environment Agency published a plan designed to establish a coastal "Blue Belt" which would conserve coastal wetlands and shallow coastal waters. However, legal and administrative regulations on coastal wetlands are not properly maintained: each governmental ministry takes charge of it's own matters, blocking comprehensive management of these valuable coastal resources.

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