FIGURE 8
Oyster landings in the Republic of Korea from 1950 to 2005

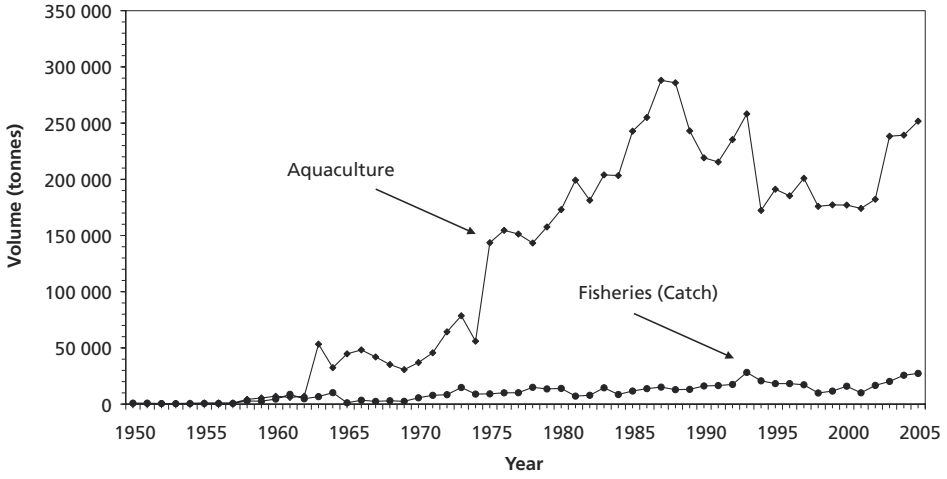


FIGURE 9
Oyster landings in the Republic of Korea from 1985 to 2004

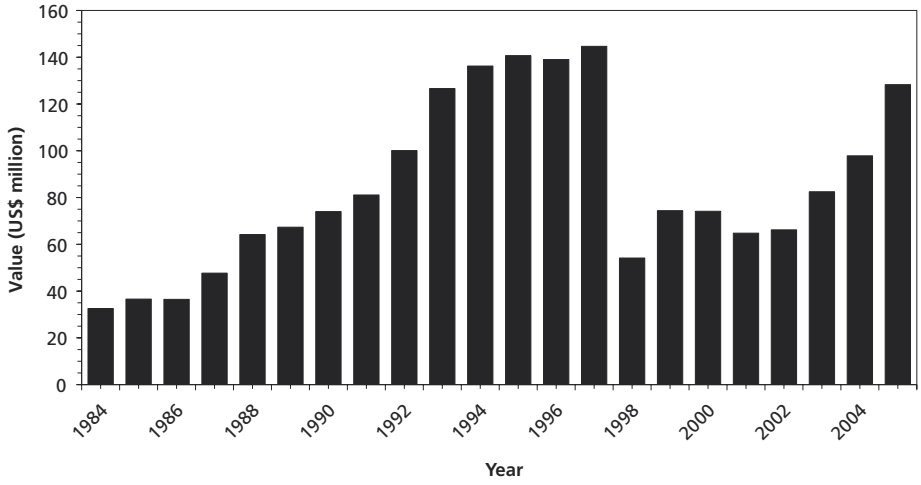


FIGURE 10
Suspended longline oyster culture cycle in the Republic of Korea

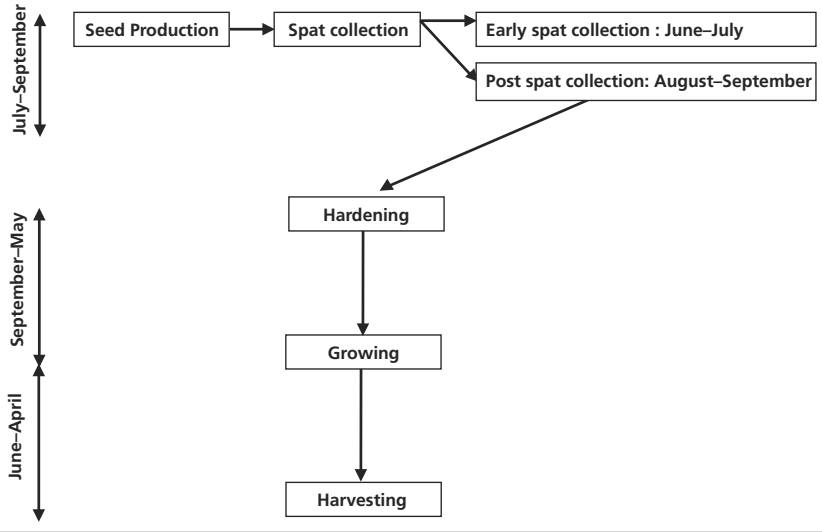


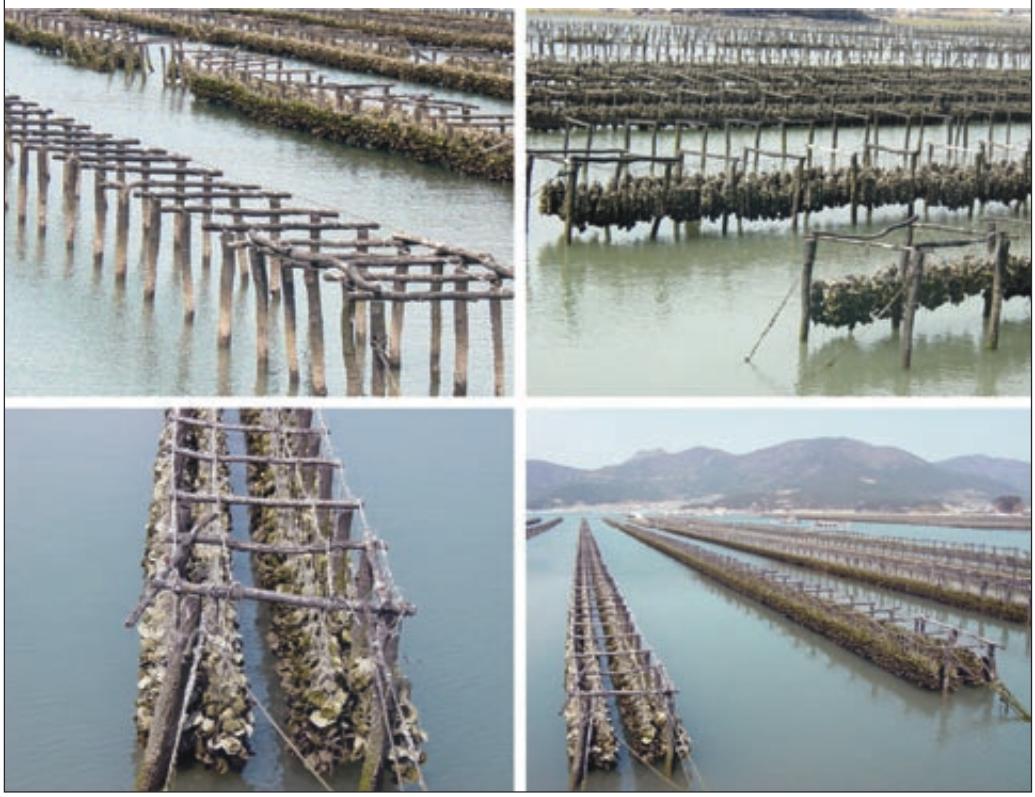
FIGURE 11
Assembling of oyster spat collectors using a plastic line and oyster shells

FIGURE 12
Oyster spat collection. (a) natural spat collection in the intertidal area; (b) wooden "rack" collectors; (c) oyster shell collectors; and (d) a barge carrying a load of collectors

Hardening phase

Ten days after settlement, the oysters attached to the collectors are transferred to the hardening ground, or directly to the longline culture system for grow-out. Since hardened oysters have a better survival rate, the oyster growers routinely undertake this culture phase. Hardening the seed oysters takes place in the intertidal zone where the area is exposed for 6–8 hours during the tidal cycle. As shown in Figure 13, a series of wooden racks are built in the intertidal area from where the collectors are suspended. The hardening period begins in September and continues until the following April, during which the seeds are periodically exposed to the atmosphere during low tide to eliminate unhealthy and weak individuals. In May, the hardened seed oysters reach

FIGURE 13
Hardening of newly settled oyster spats using wooden racks placed in the intertidal zone in Gosung Bay



COURTESY OF OYSTER FISHERIES COOPERATIVES OF THE REPUBLIC OF KOREA

1–1.5 cm in shell height and are ready for grow-out. At the end of the hardening period, the number of spat initially settled on the shell surface (40–60 spat/shell) drops to 20–30/shell. The stunted oyster seeds tend to grow faster and show a high survival rate during grow-out.

Grow-out phase

Approximately 90 percent of the Korean oysters come from farms located in small bays and off islands along the south coast. Figure 14 shows the location of the 7 major oyster culture sites in the south, where 258 oyster leases utilize approximately 1 983 hectares of sea surface for grow-out activities. These areas are protected, shallow (5–20 m deep) and have a high primary productivity. The oyster farms along the south coast exclusively use the longline culture system. The oyster stings are suspended on a submerged longline which is supported by numerous buoys (Figure 15).

In May, the hardened seed oysters collected from the previous summer reach 1–1.5 cm in shell height. For grow-out, the hardened seed oysters attached on the clutches and suspended on the hardening racks are harvested and the seed strings are disassembled for longline culture. Using a plastic wire (ø=3.8 mm) each cultch (i.e. oyster or scallop shells containing the hardened seed oysters) is strung on the wire at 20 cm intervals. The 5 m long oyster grow-out string may include 20–25 cultch.

Figures 16 and 17 illustrate a schematic view of a longline oyster grow-out facility. Each longline is a 100 m long rope (ø=22 mm) kept afloat by as much as 150 buoys (62 litres). On each longline, 200–250 strings of the hardened seed oysters are suspended. The grow-out for the seed oysters lasts for 6–10 months before harvest. During the grow-out period, the oyster seeds grow to 8–12 cm in shell height or 9–15 g in tissue wet weight (Han, 2005).

FIGURE 14
Map showing the major oyster farming regions off the south coast of the Republic of Korea

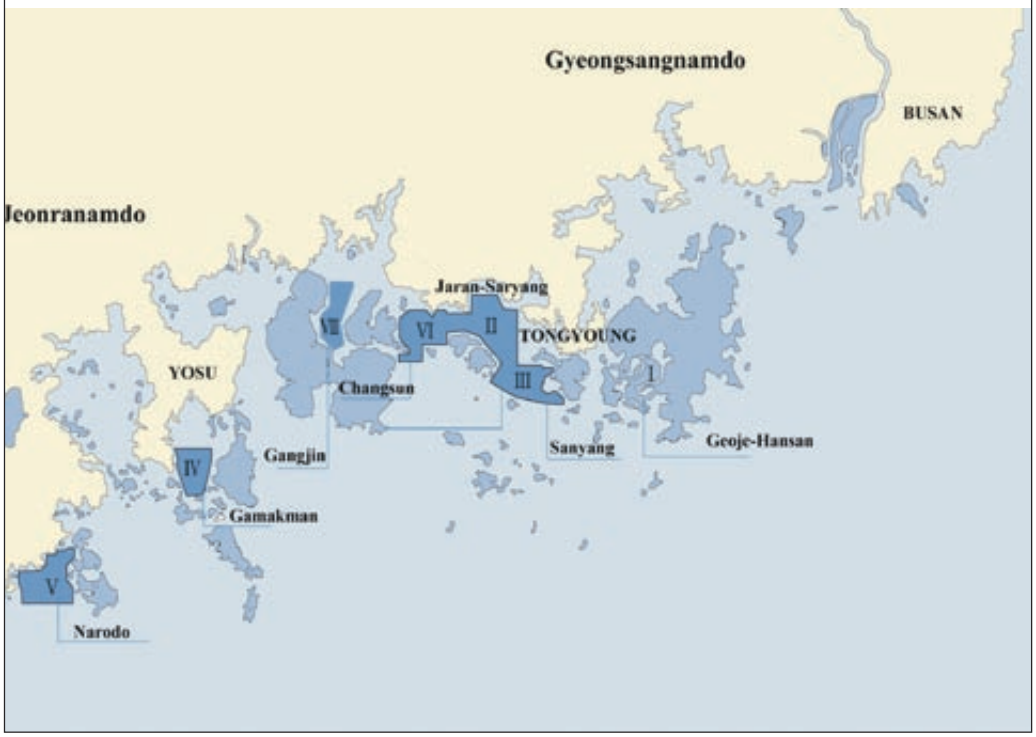


FIGURE 15
Fields of farmed oysters using suspended longlines

FIGURE 16
Side view of a suspended oyster culture longline system

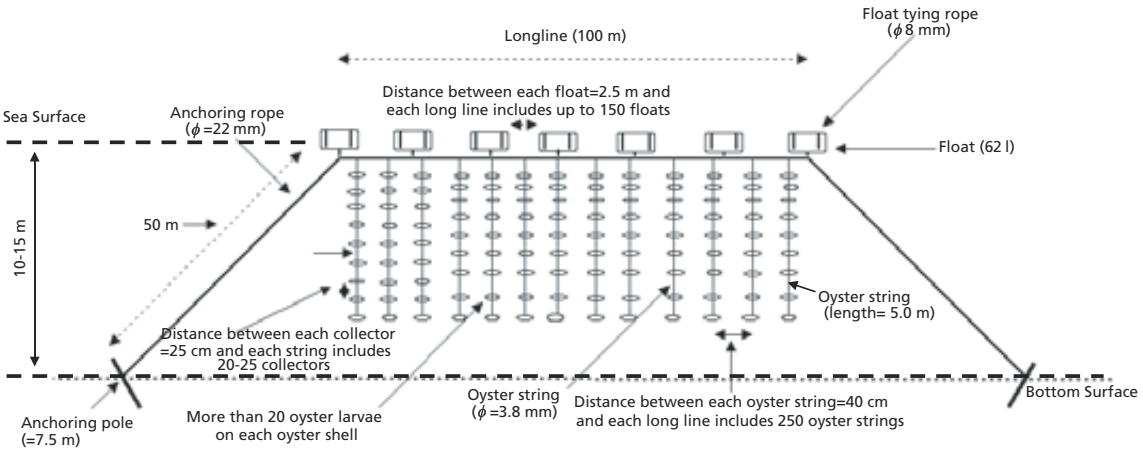
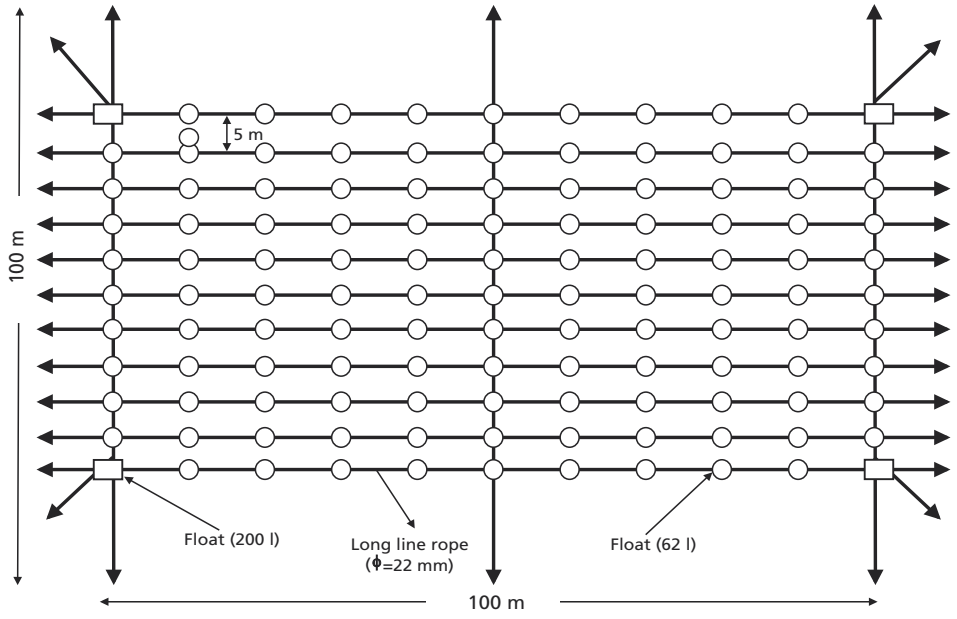


FIGURE 17
Top view of a suspended oyster culture longline system



Harvest

On the south coast, harvesting oysters from the longline begin as early as in September and the harvesting continues until the following April. The oyster strings suspended from the longline are lifted onto a work boat with the use of a winch installed on the side of the vessel. The oyster strings are then cut on the deck and dumped into plastic containers and sent to the local shucking factory (Figure 18). After several freshwater washing cycles the oysters are shucked and the flesh washed again with sterilized seawater before it is sorted by size for sale and further processing (Figure 19).

SOCIO-ECONOMIC ASPECTS OF KOREAN OYSTER CULTURE

As shown in Figure 14, the southern coast of the Republic of Korea is characterized by numerous small bays and islands and extensively utilized for oyster longline aquaculture. The coastal area off the two provinces of Gyeongsangnamdo and Jeonranamdo covers

FIGURE 18
Mechanized oyster harvesting in Gosung Bay, Republic of Korea

FIGURE 19
Oyster shucking and processing

7 districts and 34 385 hectares of sea surface. In 2005, a total of 784 oyster leases were issued by the Ministry of Maritime Affairs and Fisheries and the oyster farms located along the south coast utilized 4 479 hectares of sea surface (Table 2). Currently 90 percent of the total annual oyster landings are produced from longline culture in the south. In 2005, it was estimated that 226 535 tonnes of shell-on oysters (33 980 tonnes

TABLE 2
Number of leases, farm area, longlines and oyster strings in two southern provinces in the Reuplic of Korea in 2005

Province	Culture area	Number of leases	Area (ha)	Number of longline	Number of oyster strings
Gyeongsangnamdo	Dosan Bay	89	439	7 651	1 910 000
	Saryang Bay	40	189	3 374	843 000
	Sanyang Bay	29	113	1 737	434 000
	Hansan Bay	32	152	1 235	308 000
	Jinhae Bay	183	825	15 609	3 820 000
	Geoja Bay	67	542	6 545	1 608 000
	Chilchung Island	33	166	3 119	779 000
	Gosung Bay	18	66	1 057	274 000
	Jaran Bay	135	747	12 497	3 140 000
	Masan Bay	30	128	2 261	584 000
	Namhae	27	164	2 906	1 048 000
Jeonranamdo	Gamakman Bay Goheung Gangjin	101	948	11 930	4 167 000
Total		**784**	**4 479**	**69 921**	**19 015 000**

FIGURE 20
Oyster production from aquaculture and capture fisheries in the Republic of Korea from 1950 to 2005

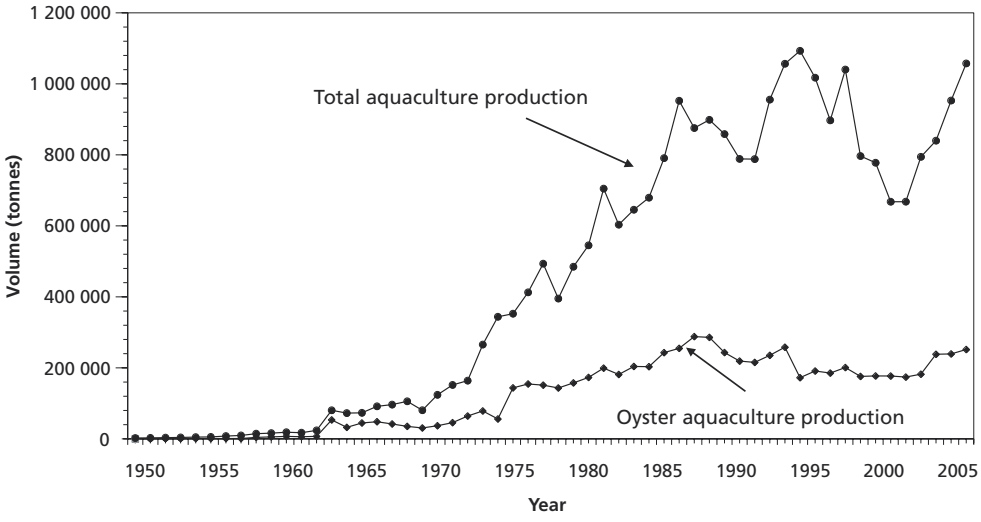


TABLE 3
Quantity and value of oysters exported from 2002 to 2004

Year	2002		2003		2004	
Product	Quantity (tonnes)	Value (US$)	Quantity (tonnes)	Value (US$)	Quantity (tonnes)	Value (US$)
Fresh Meat	3 143	16 316 000	2 813	14 225 000	2 222	12 585 000
Frozen	7 215	26 852 000	7 057	27 360 000	7 010	33 139 000
Canned	6 155	27 729 000	6 031	26 947 000	4 919	25 138 000
Other	704	5 225 000	710	6 165 000	510	5 778 000
Total	17 217	76 122 000	16 611	74 697 000	14 661	76 640 000

of oyster meat) were produced. From 2000 and 2005, oyster landings accounted for 23–28 percent of the total national aquaculture production (Figure 20).

According to the authorities of Gyeongsangnamdo Province, in 2005 approximately 3 000 families were engaged in oyster farming over an area covering 3 622 hectares while a further 406 families were involved in the industry off the southwest coast of Jeonranamdo Province. The Korean oyster longline culture cooperative estimates that there are 22 000 full-time employees engaged in the oyster industry from farming to processing.

The majority of the Korean oysters are exported to Japan and the United States of America. Table 3 lists the type of products exported, their quantity and value. In 2002 and 2004, 14 661 to 16 611 tonnes of oysters were exported, accounting for almost 41 to 63 percent of the total production.

In 2003, the Korean Fisheries Economic Institute analyzed the economic status of selected oyster farming companies. According to the study, an average oyster farm in Tongyoung operated 126 longlines for a grow-out period lasting 172 working days. Furthermore, the farm owner hired no permanent employees, but only temporary workers (≈230 persons). The production from one farm averaged 297 tonnes worth approximately US$134 000. The net profit was calculated at around US$33 000 (excluding wages, equipment repair and maintenance, and seed cost.

ENVIRONMENTAL IMPACT OF OYSTER LONGLINE CULTURE

Intensive oyster longline culture in small bays off the southern coast often resulted in anoxia on the sea bed due to the accumulation of pseudofaeces from the suspended oysters. These anoxic problems were more prominent in bays where the seawater

circulation was poor. Furthermore, the high density of oysters on the longlines also results in poor growth and, subsequently, poor profits. To overcome these problems, the distance between oyster farms, the distance between longlines and the number of suspended oyster strings on an individual longline has been regulated as shown in Figures 16 and 17. The regional office of marine extension and the oyster longline culture cooperatives provide information on the proper management of oyster farms, such as a standard model of longline culture system, through a newsletter and on the website. For example, the original styrofoam floats used in the longline culture which could not be disposed off have been replaced by the more durable and environmental friendly plastic floats.

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