

3 Capturing and Culturing the Commons

Public-Private Dynamics in the Dutch Oyster and Mussel Industry

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But then came the explosion. The sleeping Giant, later known as the Consumer, awoke with a yell, and the cry for oysters and more oysters was heard across every civilised land (Clark, 1964: 43).

Nature is seen by humans through a screen of beliefs, knowledge, and purposes, and it is in terms of their images of nature, rather than of the actual structure of nature, that they act. Yet, it is upon nature itself that they do act, and it is nature itself that acts upon them, nurturing or destroying them (Rappaport, 1979: 97).

Introduction

It has almost become conventional wisdom that unlimited entry to the marine domain leads to over-fishing and that state intervention or privatisation provide solutions to this problem. Yet there is overriding empirical evidence that users of marine resources held as common property in many cases have developed rules and rights leading to their sustainable use. Access to common-pool resources is rarely open to all. This is not to deny that 'tragedies of the commons' exist. While overexploitation will occur under certain conditions, this is not necessarily attributable to the rapacious behaviour of fishermen. What is needed is a careful reconstruction of the factors that occasion resource abuse (see also Van Ginkel, 1996).

In recent discussions on how to tackle the problems of declining harvests and overexploitation of marine resources, fish and shellfish farming is often being hailed as a solution to the limitations nature poses. The underlying idea is that interventions in resource management regimes and, therefore, manipulation of nature will bring about greater control of production and increased output.

Sedentary marine resources such as mussels and oysters seem to offer excellent opportunities for the development of sustainable resource use under certain types of management regimes. Shellfish stocks can be assigned to specific owners and user groups and cultivation or semi-cultivation is possible by collecting oyster brood or mussel seed and replanting these on plots that provide optimum ecological conditions for growth and reproduction. In theory, the owners-cum-culturists will reap the benefits of good governance. As James Acheson hypothesises: 'where property rights exist, there would be less likelihood of overexploitation of resources, larger catches, more efficient use of capital, and higher wages to fishermen' (1981: 301). Therefore, the incentives to invest in governance structures are strongest among owners and weakest among authorised users (Schlager and Ostrom, 1992: 257).¹

The idea, and the practice, has a long history that goes back centuries. In the Netherlands, it was from the mid-nineteenth century onward that the cultivation of European flat oysters (*Ostrea edulis*) and blue mussels (*Mytilus edulis*) on privatised plots was attempted at a large scale. This comparative case history attempts to throw light on developments in the oyster and mussel fisheries in two distinct settings in the Netherlands. It devotes special attention to the transition from capture to culture fisheries, which failed in one place (the isle of Texel), but succeeded in another (the province of Zeeland).

Detailed case histories covering a fairly long time span can throw light on the ways in which people understand their natural and social environments and how they relate and adapt to them. They can also show the diversity and complexity of adaptive dynamics in maritime settings. Through comparison of these cases, it will become clear that there are no easy solutions to complex problems. It should make those who believe privatisation to be an easy solution aware of the intricacies of the enclosure of the marine commons.

Complexity, Diversity and Dynamics: A Conceptual Appraisal

Fisheries are economically, socially and culturally complex, diverse and dynamic systems of interactions between humans and the natural environment (cf. Hamilton *et al.*, 1997). Often enough, however, fisheries management deals with single fisheries, reducing the complexity factor, while ignoring the factors of diversity and dynamics. These factors are often regarded as 'nasty' complications. Dealing with socio-political situations and developments 'as if' they were simple, homogeneous and static indeed provides for easier management tools (Kooiman, this volume). If you forget that you have simplified the issue, serious complications may be the upshot of resource management schemes.

Therefore, it seems appropriate to dwell a little longer on the concepts of complexity, diversity and dynamics in order to fully understand and appreciate their scope and importance. Fishing is an 'evolving system', a historical, economic and political process (Durrenberger and Pálsson, 1985: 120). Therefore, we need to take a diachronic perspective, explicitly in some instances, devoting attention to endogenous and exogenous forces impinging on the system or subsystem. There can be intricate patterns of relationships between forms of resource exploitation and the socio-cultural composition of communities, making for quite diverse ways of humans interacting with the biophysical environment. In that connection, the homogenising view of people's behaviour inherent in 'Tragedy of the Commons' scenarios grossly underestimates the importance of socio-cultural diversity. The use of communal natural resources in complex, diverse and dynamic socio-ecological systems cannot simply be explained by such simplistic and deterministic models as the 'Tragedy of the Commons' model. It should be interpreted in a much broader contextual framework. Though this will certainly complicate things for the student of common-pool resource utilisation, it would be unwise to simplify for the sake of parsimony. Besides being an oversimplification, the social consequences of departing from such a model are enormous and probably irreversible. It is well known that human behaviour, including conscious behavioural strategies, often have far-reaching unforeseen and unintended consequences. The same goes for fisheries management. Therefore, it is pertinent that we devote attention to the wider context of the fisheries and make sure that we incorporate as many contextual factors as possible in the models underlying fisheries governance structures. However, it is still important to allow for flexibility, lest rigidity hinder short-term responses to management failures. Enabling adaptive performance is a key issue here.

Adaptive strategies and processes result from positive and negative feedback loops. Adaptive strategies involve conscious decision-making. Adaptive processes are feedback loops operating outside of cognitive awareness. Adaptive dynamics are the sum total of strategies and processes (cf. Bennett, 1976). There are individual and collective adaptive strategies. Sometimes, these crosscut each other, giving rise to tensions that in turn may develop into conflicts. As the heterogeneity of a group of resource users increases, and as resource constraints increase, 'use rules' may become more difficult to maintain (cf. Runge, 1986: 630). An irreversible transformation of the system of resource utilisation - for example, through enclosure of the commons - may occur. It is this type of transformation that this Chapter will focus on.

Claiming the Commons: Texel Oysterers

To the southeast of the Dutch Frisian Isles, in the western part of the Wadden Sea and the northern part of the Zuyder Sea, oysters and mussels were caught from at least the early 1700s onward. The fishermen of the isle of Texel caught or gathered considerable amounts of oysters in the waters near their island, using dredge nets or small rakes when the receding tides left the flats exposed.² In principle, entry to these waters was free to all and so was the exploitation of resources in them. By the mid-eighteenth century some 60 Texel vessels and another 85 from the islands of Schiermonnikoog and Terschelling were involved in oyster fishing. Although access was open, Texelians claimed special use rights to certain locations in the vicinity of their island, which they considered communal grounds. The islanders replanted the oysters they had gathered or caught in the public domain on these plots, which were located in a shallow cove on the island's northeast side. Each oysterer had a parcel, demarcated with branches on the corners. The bivalves were fished and gathered in the public domain (*res publica*) throughout the year. These mature and immature oysters were then replanted on the plots, where they were tended and cared for until they could be marketed.

Thus, part of the waters of the western Wadden Sea and the northern Zuyder Sea was considered *res communis* and there was a quasi-form of oyster cultivation. Even when the fishery was free in a formal sense, there were informal regulations in which access and usufruct of these plots by Texelians were arranged, and agreements to exclude outsiders: each plot was 'habitually respected as someone's property'.³ The Texelians' ambition to claim access to and use of certain locations for themselves amounted to the exclusion of outsiders; in other words, to obtain 'privileged space' (Acheson, 1981: 281), not so much to protect or conserve the resource. However, the communal use and management of the nursery beds had the unintended consequence of advancing oyster reproduction. The cove where these beds were located provided excellent conditions for oyster reproduction and growth. Moreover, the technological means available to fishermen were rather simple; gear efficiency was concomitantly low; often oysterers could not sail due to storms and ice drift, they did not market oysters between April and October, and they refrained from sailing on Sundays. Moreover, the vessels had but a small range of action.

By and large, this complex system of capture and culture fisheries worked out well. There appeared to be no excessive fishing until the mid-1840s. The Texelians shipped from one to eight million oysters annually. However, from then on, catches declined year after year and the oyster banks

seemed nearly exhausted. To keep their trade going, Texel oysterers began to import oysters from France and England and they also had to fish oysters in Zeeland waters to stock their plots. Catches in the vicinity of the island declined from several million oysters to a few hundred thousand. The image of an inexhaustible supply of oysters faded rapidly when the oyster crisis persisted in the following years. Eventually, this crisis even turned out to be an irreversible tragedy.

What caused this tragedy? A number of factors seem to have been at play, one reinforcing the other. In the 1820s and 1830s, the oyster banks were very productive. Oysters could be distributed to markets further afield with the rise of steam navigation and railroads. But increased catches at the same time meant lower prices and falling incomes. To keep their earnings at an acceptable level, the Texelians were forced to harvest even more oysters. The number of vessels and fishermen rose quite sharply between 1836 and 1846: from 60 to 80 boats, each manned by a crew of three. In the same period, the catching technology also changed. The dredge nets were improved and used more widely and more often, replacing the small rakes. Although total catches increased initially, catches per boat declined - a fair indication of excessive fishing.

State officials began to worry and considered measures to protect the oyster banks. However, the state did not intervene. It was afraid that regulating one fishery would disadvantage another. In the 1850s the state had appointed a committee to investigate the state of the fisheries, and this committee proposed to leave all fisheries unregulated. The Texel oysterers themselves were opposed to any regulation because oyster prices, which had risen again due to the scarcity, kept their income up to the desired level. It was precisely because of these high oyster prices that the fishermen marketed all oysters they were able to harvest, both mature and immature ones. But higher prices could not make up for lower catches, and eventually the income of Texel oystermen fell. Although their behaviour was damaging to fishermen as a collective, it was perfectly rational for each individual to catch as many oysters as he could. The mechanism of subtractibility applies: almost all of the gain would go to each individual fisherman, whereas the costs (over-fishing and ultimately exhaustion of the oyster banks) were passed on to the collective of users. The fishermen were also caught in a zero-sum game: if a fisherman would throw immature oysters back into the sea, another might catch and market them.

But the decline of the oyster fishery cannot be attributed to the fishermen's behaviour alone. Natural circumstances also contributed to it. Oysters are very sensitive to changes in the ecosystem. Even slight

fluctuations in water temperature, salinity, seabed features and food supply can cause considerable mortality. Severe winters caused marked oyster mortality, and cold summers had a negative impact on reproduction. Moreover, storms and changing currents also had consequences for the oyster staple. More importantly, a land reclamation project in 1835 resulted in the loss of more than three-quarters of the cove situated on Texel's northeast side as a location for replanting and tending oysters. Texel fishermen could henceforth only deposit their oysters in what was left of the cove which, to make things worse, silted up. Thus, the natural *milieu* for the reproduction of oysters deteriorated.

This ecological deterioration is important, since the increasing scarcity implied that, relatively speaking, the level of exploitation of the oyster staple rose, for initially catching efforts did not decrease. To eke out a living, the fishermen had to catch as great a share as possible from the declining stocks. This mode of behaviour had little to do with an innate rapacious mentality, but everything with the fact that the fishermen's economic existence was endangered. Debts to shopkeepers and suppliers had to be paid and the costs of living met. The fishermen's short-term interests indeed prevailed, not because they were purblind and greedy per se, but because other options were lacking as yet.

But the oyster fishermen did not seek to continue their activities until they had caught the very last oyster. They were diligently looking for alternatives. They could no longer exist from oyster fishing alone, and the Texel fishermen shifted away from the pursuit of oysters to other fisheries. They still caught oysters but only during a short season, and then only as a marginal part of a varied seasonal cycle in which they switched between various fisheries. Thus, they opted for diversification. From the 1850s onward, fewer and fewer fishermen pursued oysters.

Some efforts were made to counter the oyster crisis. Following the example of French oysterers in Arcachon, attempts were begun to farm oysters on leased plots near the isles of Texel and Wieringen. Since 1859, this was first done on the initiative of the Board of Sea Fisheries (*Collegie der Zeevisserijen*), and later by three private individuals hailing from Amsterdam. This form of oyster farming differed from the Texelian system of quasi-cultivation in that the lessees tried to catch spat using 'collectors' (usually shells) to which the spat could attach and grow. Previously the Texelians had only gathered or fished young bivalves and replanted them on parcels they had staked out. However, the experiments with oyster farming failed for several reasons. Severe winters, storms and deteriorated ecological conditions caused poor results, and on top of that oysters were frequently

stolen from the plots because of insufficient policing. Most Texel fishermen did not regard this form of privatisation as an attractive alternative. Despite their often destitute situation, they were still opposed to government intervention. When the Board of Sea Fisheries in 1859 asked the Texel fishermen to voice their opinion on oyster farming, they answered: 'The Texel oysterers are very satisfied with the destiny which is afforded them by nature, and they also think that no one is powerful enough to lay down the law for nature in this respect.'⁴ In their Calvinist world view, they perceived nature as a God-given entity in which earth dwellers should not intervene except through hard labour. Only a small number of Texel oyster traders perceived advantages in oyster farming, but they have never been very successful.

From Capture to Culture: Oystering in Zeeland

In the southern Dutch province of Zeeland, fishermen applied similar strategies to claim exclusive use rights to certain fishing grounds as Texel fishermen did. But here, territoriality led to conflicts and clashes between fishermen who either claimed the same locations for their exclusive use or did not respect others' claims and encroached on what others believed to be their 'communal grounds'. As a report stated about the situation in the early nineteenth century: 'it was the denial of this usufruct which caused most quarrels'⁵. Due to developments that were to some extent similar to the ones described for the Texel case, oyster catches diminished. The decline continued even after the State expropriated the Zeeland estuaries in the 1820s and assigned the fishery management to the Board of Fisheries for the Zeeland Streams (*Bestuur der Visserijen op de Zeeuwse Stromen*). This Board regulated fishing-gear, methods, seasons, and the size of marketable oysters. Yet these measures did not prevent or stop overexploitation. By the mid-nineteenth century similar problems beset oyster fishermen the world over: 'the natural banks were close to exhausted ... in most ... places where there had been any commercial exploitation of the oyster' (Clark, 1964: 43). Oysters are particularly prone to overexploitation because they are an immobile species and thrive in shallow waters where they can be harvested fairly easily.

However, in Zeeland waters ecological conditions (water temperature, salinity, the availability of food - i.e. phytoplankton) favoured the reproduction of oysters. The shallow and relatively warm Eastern Scheldt basin was an especially productive location. Though experimentation with oyster farming near Texel had not been very successful, some wealthy urban

capitalists were undaunted and tried to lease plots in the Eastern Scheldt basin from the state. They had studied oyster cultivation methods in the French Bay of Arcachon and intended to apply similar methods in the Eastern Scheldt basin. In 1870, they succeeded in convincing the state to enclose a large part of this basin, which was divided into small plots. These plots were leased to the highest bidders at a public auction for ten-year periods with the possibility of renewal for another five years.⁶

This state measure brought an end to time-honoured and deeply rooted systems of customary tenure. Oyster farming required more security of underwater tenure and the state perceived the lease system as its 'rational' economic interest, granting ample opportunity to the forces of capital to capture the commons. In an agrarian society like the Netherlands, the idea that the productivity of tenure-based farming would by far exceed that of common-pool resource exploitation easily gained acceptance in state institutions and among its representatives. For example, the State fishery advisor P.P.C. Hoek was an early advocate of the enclosure of the marine commons: 'It goes without saying that an owner (even a temporary owner) will care more about the maintenance or even growth of the value of his oyster grounds than can be expected under a system of common exploitation. Under the latter, each fisherman will strive to catch as many oysters in as short a time as possible, being convinced that each oyster he will leave in the sea will not lead to his future prosperity, but will only extend the profit of the one who will come next and catch it' (Hoek 1878, 390-391). However, it was not the fishermen who reaped the benefits of oyster cultivation, but mainly newcomers investing in the industry.

The independent Zeeland oysterers vehemently contested the enclosure of the commons – but to no avail. Many wealthy newcomers, most of whom were not fishermen but urban capitalists looking for investment opportunities, bid with alacrity and succeeded in obtaining the majority of the plots. Consequently, most oysterers saw themselves excluded from the best locations and had to find employment with one of the newly established oyster companies. Though they lacked the capital to work independently, they possessed the sailing and dredging skills the newcomers needed. Those who cherished their independence exploited the still free grounds or turned to musseling, a far less capital and labour-intensive enterprise than oyster farming. Obviously, the political process of defining and enforcing property rights was socially divisive because of its distributive implications (cf. Libecap, 1989: 4). Capitalist entrepreneurs from without became the captors of the locations that until the introduction of the lease system had been commons. As a consequence incipient class divisions came to show, a

consequence which also followed the enclosure of the commons elsewhere (e.g. Taylor, 1983). However, there are few instances of local industries that were captured so immediately and totally by outside entrepreneurs as the Zeeland oyster industry.

Following the privatisation of oyster fishing grounds, the Zeeland town of Yerseke became the centre of oystering. Most entrepreneurs established their companies here because the town was near the privatised plots and linked to an international railway network. The technique of oyster farming was laborious; the entrepreneurs used limed roofing tiles ('collectors') to obtain spat. These tiles were placed in inter-tidal zones in the summer, the spat which stuck to the tiles had to be removed, and before the oysters reached a marketable size after six years, they had changed many hands and had been dredged up and replanted several times. Oyster farming proved a success. Before 1870, the number of marketed oysters hardly ever exceeded one million. By 1875 it was approximately 35 million. Still, supply could not keep up with demand, prices remained high and investors in the industry made considerable profits. Many were attracted to the oyster industry and at ensuing public auctions of plots the lease fees skyrocketed because prospective lessees began outbidding each other to gain access. By 1886 nothing remained of the free oyster fishery.

Among the newcomers were some of the Texel oyster traders who had previously attempted to farm oysters near the island. Though their attempts there did not yield good results, they were convinced of the advantages of the privatised system. Therefore, they moved to Zeeland where ecological conditions were better. Near Texel itself there were new efforts to stimulate oyster farming following the Zeeland successes. In 1884, the state also introduced the lease by public bidding in waters to the island's south. Nearly all the lessees were successful and wealthy Zeeland oyster farmers.

The lease system contributed tremendously to the boom in production and to the industry's capitalisation. At the same time, it led to a transformation of the social relations of production. From a relatively egalitarian business – all oyster fishermen were independent, had equal access rights and possessed similar means of production – it became strongly stratified. In the process, many formerly independent oysterers were proletarianised. Capital replaced labour as the most important factor of production.

Yet it was the transformation in the mode of production that led to problems. The large planters, companies and shippers as well as the newcomers of the 1880s had unreasonable expectations. In their competitive struggle for plots, they lost sight of potential risks. They restricted their view to earlier experiences and were too optimistic about the future. Hence, many

over-invested, especially companies which were financed by extra-local shareholders who hoped to make quick money. Due to the heavy lease burdens, considerable labour costs and increased bivalve production, the high profit margins began to shrink or even turned into losses. With a meanwhile saturated market, the industry was assailed by a prolonged depression. The crisis was exacerbated by a deterioration of the oysters' quality caused by overproduction and severe winters. The oyster stocks exceeded those that could be sustained by the amount of phytoplankton in the Zeeland estuaries. A fishery biologist exclaimed: 'Oyster farming is cultivation, not fabrication'. The entrepreneurs tried to save on costs by switching from tiles to cockle shells as 'collectors' - a far less labour-intensive method. It was too little, too late. Many companies and large planter-shippers went bankrupt or withdrew from the oyster industry and a dwindling number of newcomers tried their luck in it. By the turn of the century, the image of oyster farming as a lucrative occupation had vanished.

Near Texel, oyster farming never really took off. By 1886 - two years after the introduction of the lease by public auction - most Zeeland lessees had given up their attempts to farm oysters near the island. The ecological conditions were too poor, the leaseholders did not give sufficient care to the plots, and policing and supervision were inadequate. The severe winter of 1890-91, which had also caused serious problems in Zeeland, dealt a lethal blow to oyster cultivation near Texel. Five years later, oyster farming was abandoned there altogether and under mounting pressure from Texel and other fishermen the privatised plots were returned to the public domain. A dwindling number of fishermen continued to dredge oysters, until after the building of an enclosure dike in the Zuyder Sea in the early 1930s the bivalves disappeared completely. In fact, most Texelians had switched to other fisheries long before.

In Zeeland, there were participants who benefited from the withdrawal of outside investors in the oyster industry. With fewer people interested in farming oysters, the lease fees dropped. This enabled petty planters and family firms to obtain a greater share of the plots. Family labour provided a 'shock absorbing capacity'. By curtailing consumption and/or expanding production, these planters succeeded in surviving bad times. For them, the rationale of capitalist production for the market did not imply that they quit as soon as their firms suffered losses; they would try to weather a depression as long as they could eke out a subsistence. In their worldview, oystering was as much a way of life as a way of making a living.

Domestication: Mussel Fishing into Mussel Farming

The versatility of family firms was also apparent in the Zeeland mussel industry⁷. In 1865, the Zeeland Board of Fisheries privatised several mussel banks in the Eastern Scheldt and other Zeeland waters. The Board demarcated plots and allocated these for the duration of ten years to cocklers by the drawing of lots. It also provided for police patrols to prevent theft and poaching. Henceforth, mussel fishermen gained exclusive access rights in return for a modest rent of a few florins. The plots were re-allotted on a ten-yearly basis. Capture fisheries gradually turned into culture fisheries, though there were still grounds where free mussel fishing was permitted. However, by 1886 all Zeeland locations suitable for mussel farming had been privatised. Only the fishing of mussel seed that was replanted on rented plots remained free. Besides, the cocklers could still catch mussels in the Zuyder and Wadden Seas, where access was open, and replant these mussels on Zeeland plots. The transition from fishery to semi-culture led to an increase in output, but did not bring about dramatic changes in the social structure of the occupational community of cocklers and labour remained the most important factor of production. The economic risks were smaller, but musseling was not as lucrative as oystering. Therefore, the big capitalists refrained from investing in the mussel industry.

A number of Texel fishermen specialised in mussel fishing or temporarily caught mussels as a part of their annual fisheries cycle, switching to other species when these fetched comparatively better prices. Unlike the Zeeland cocklers, Texelians did not sell their mussels in the consumer market. Instead, they exported mussels to England, where they were used as bait in the offshore fisheries. Texel mussel fishing took flight between 1873 and 1890, when the Texelians landed between 3.5 and 13 million kilograms of mussels annually. Though some Texelians attempted to establish market outlets in Belgium, they were unsuccessful since Zeelanders already operated there. After 1890, the demand for 'bait mussels' diminished sharply and most Texelians gave up musseling for the time being.

Following the growth of the Zeeland oyster industry, the number of cocklers also increased. Given the lower capital investment required, many former oyster fishermen, labourers and newcomers turned to musseling. Whereas the oyster industry became strongly stratified, the occupational community of cocklers remained fairly egalitarian. All mussel fishermen operated independently in family firms, possessed similar means of production, and had equal opportunities to rent plots by participation in the drawing of lots. Even though the profits were considerably smaller than those

to be obtained in oystering, those who possessed little money but valued their independence became cocklers. Since the vessels were relatively small and cheap, it was feasible for every crew member, given reasonable luck, arduous labour, and a degree of thrift, to aspire for his own boat. Many mussel farmers were also fishmongers; they sold their bivalves mostly in Belgian cities. Several planters combined musseling and oystering when it became financially feasible for them to rent oyster plots.

In the early decades of the twentieth century, fierce competition for a share of the market resulted in ongoing overproduction of mussels. A similar process had also occurred in the oyster trade. Given the imbalance between supply and demand, prices dropped. As a result, most cocklers tried to increase production to maintain or improve their standard of living. This solution to the 'peasant dilemma' of course only exacerbated their situation. A brief recovery followed during the First World War when the demand for mussels seemed unlimited. Even Texelians took up musseling again during this period. But after the war ended overproduction was the rule once more. Things became even worse when due to the motorisation of the fleet the supply of mussel seed shipped home from the Wadden Sea increased. Many cocklers were quick to adopt the new technology of mechanical power.

Interlude: Comparative Analysis of the Capture to Culture Transition

In comparing the Texel and the Zeeland cases, it is striking that Texel oysterers developed a kind of quasi-cultivation of oysters in the early eighteenth century, whereas Zeelanders continued to catch the bivalves in the watery commons. Nonetheless, the oyster stocks in Texel's vicinity were nearly exhausted by the 1840s and were never to recover from this blow. Several factors contributed to this decline. Ecological changes were important, as were the effects of human agency in the form of greater gear efficiency, a growing fishing fleet, and market expansion, leading to an increased extraction of the resource. The situation was exacerbated in subsequent years when sharp price fluctuations and impoverishment and indebtedness of the Texel fishermen led to intensified harvesting.

The introduction of oyster farming in Zeeland as from 1870 was - at least initially - quite successful, but attempts to introduce oyster farming near Texel were hardly successful or failed altogether. What seems to have caused this failure in the Texel case is an irreversible deterioration of the ecological conditions for oyster reproduction. Even large-scale attempts to replant immature Zeeland oysters on Zuyder Sea plots that had been very productive until the 1840s, failed. Though I do not mean to reason destructive human

behaviour away, I think changing currents and water temperatures and silting up of some locations were important factors as well. Even when the pressure on the resource was alleviated because most Texel fishermen diversified their activities, switched to other fisheries or abandoned fishing altogether, there was hardly any improvement in the oyster stocks⁸. I believe this to be a fair indication of structural changes in the natural environment.

Ecological conditions were much better in the Zeeland area. Here, oyster farming was quite successful in the initial stage after the transition from capture to culture fisheries. That is, human intervention in nature brought about a larger production of oysters. It would seem that there was an increased control of nature. But success had its paradox. Soon, production went beyond the carrying capacity of the Zeeland inlets, and the quality of oysters deteriorated. Nature had set its limits to cultivation. On top of that, over-investments and market gluts led to problems for many oyster farmers who had been newcomers to the industry in the 1870s or 1880s. A large number gave up oyster farming again in the 1890s.

The enclosure of the commons had formidable social consequences, too. The marine commoners were excluded from the marine domain. The lessees had to pay dearly for entry and use rights, and fishermen usually lacked the capital to become leaseholders. They lost access and became wage labourers for the newly established companies or for the large planter-shippers. Consequently, the enclosure of the commons led to the marginalisation of the original fishermen and to the rise of a maritime proletariat. Women and children were also recruited as wage workers. Unlike their Texel compatriots, Zeeland oysterers had fewer opportunities to diversify their activities. Almost all of the Zeeland waters were enclosed by the mid-1880s, so alternatives were few. As we shall see shortly, even musseling became a privatised business. In contradistinction, access to a large proportion of waters near Texel remained free and the island fishermen had ample opportunities to switch target species. It was only due to the oyster crisis and the concomitantly falling lease fees that former oysterers or their offspring were able to regain the entry and use rights of oyster plots. They usually worked with agnate kinsmen aboard ship and household budgets were often augmented by the income of female family members. This 'logic of the peasant fishermen' enabled them to withstand fluctuations in the industry and to continue oyster farming.

Compared to oyster culture, musseling was far less labour and capital-intensive. The required means of production consisted of a boat and relatively inexpensive gear. The fees for the rent of mussel plots remained modest. In contradistinction to the oyster trade, the mussel industry did not undergo a

phase of rapid capitalisation because the monetary rewards were smaller and plots were not up for public bidding but allocated by lot. Besides, a free mussel fishery was permitted in the Zuyder Sea and Wadden Sea. Nonetheless, overproduction also began to hamper the mussel industry in the early decades of the twentieth century.

Self-Regulation and State Intervention in Shellfish Farming

Although the state had privatised large parts of the Dutch, and especially the Zeeland inshore waters, to enable oyster and mussel farming, it refrained from intervening in the industries concerning production. In this respect, the state believed in and pursued a *laissez-faire* policy. It was up to the planters and companies themselves to arrive at some form of regulation or to let the market's 'invisible hand' rule. In the 1910s and 1920s, both oyster and mussel farmers experienced a need to limit their output and through voluntary associations they attempted to arrive at a collective agreement to do so. But time and again, these agreements were undermined by free riders who did not join organisations established with this aim and by those who did join, but evaded the organisations' rules and regulations. It became clear to most planters that self-regulation would only work if an external authority enforced and supervised the rules. This happened in the 1930s, when mussel and oyster planters and shippers experienced the consequences of the economic crisis in the capitalistic world. On top of that, Zeeland oyster shippers were ousted from the English market by French and English oysterers. In response, the state established the Dutch Fishery Marketing Board (*Visscherijcentrale*), and the planters and shippers had to join this state organisation. Among many other measures, it set quality standards, quotas and regulated prices for mussels and oysters.

In the oyster industry, there was an additional reason for the State to intervene. A serious outbreak of shell disease and the proliferation of the slipper limpet (*Crepidula fornicata*), a food competitor, caused huge problems and decimated the oyster population. Both plagues were facilitated by the presence of huge quantities of cockle shells, which were scattered on the plots by the oysterers to collect spat. These shells hardly disintegrated and were a seat of diseases. The government imposed a ban on the use of cockle shells and imported French yearling oysters to aid planters who had lost a large percentage of their stocks. In order to secure a sufficient supply of oyster spat and yearling oysters, the state provided financial support to unemployed labourers who wished to collect brood by using limed tiles. The local

government supplied them with roofing tiles and credit, while the state gave them access to plots near the shore which had not been used since tile farming was abandoned in the late nineteenth century. The reintroduction of tiles as collectors was hardly successful. The leading oyster planters began to use mussel shells as collectors and they also imported young oysters from Brittany to stock their plots. This considerably reduced the bargaining power of the petty 'tile farmers'. They usually had to accept the low prices offered by planters and planter-shippers that shoved the risks of the trade on to the petty oysterers. As one man stated: 'We could only lease those plots that were suitable for catching spat, not those fit for growing marketable oysters. So, eventually, you just had to sell. And there were many of us. When supply was large, prices were low, you just had to accept that. If you didn't want to sell for the money a planter offered, he would say: "Well, you'll come back when you're hungry"'. Meanwhile, the situation in the oyster industry had generally turned for the better and the state soon repealed its price regulations.

This was not the case in the mussel industry. The Fishery Marketing Board set minimum prices for mussels for export. The home market remained free, however. Soon Belgian dealers began to work with Dutch middlemen to evade the price regulations. To counter this situation, in 1935 the Central Sales Bureau of Mussels (*Centraal Verkoopkantoor van Mosselen*) was established, partly at the insistence of the planters, who suffered most from the evasion of the price regulations. Henceforth, all transactions between planters and shippers had to be made via the Bureau. Subsequently, it set quality standards and introduced fixed prices, both for mussels the Bureau bought from the producers and for the bivalves it sold to the dealers in turn. Moreover, it regulated the admittance of newcomers in order to curb the expansion of the number of mussel culturists and introduced a licensing system for shippers, thus reducing the number of cocklers who were allowed to ship their own merchandise. This management regime was still not quite successful; soon a new boom in output followed. In 1938, the Bureau responded by allocating production quotas, known as standard capacity numbers (*standaardcapaciteitscijfers*), to all individual cocklers, based on their estimated production in earlier years. Alternately, each planter was allowed to supply a certain quota to the Bureau. This rigid regulation of the industry, aimed at balancing supply and demand, proved adequate and the position of the planters improved. It had a stabilising influence, though it also brought about a fixation of the industry's structure and limited the expansion of individual firms. The quotas were fixed and non-negotiable. The only way to expand a firm was to buy another firm. The number of cocklers who kept sailing to Belgium started to fall, not only due to restrictions imposed by the

Bureau, but also because the transportation of bivalves was gradually taken over by trucking companies.

The oyster and mussel firms that had survived the economic crisis and other problems of the 1930s were faced with the consequences of war and occupation in the first half of the next decade. Many boats were confiscated, damaged or destroyed, fuel soon became scarce, musseling and oystering came to a near standstill, and export was impossible. The German occupying forces demanded the best part of the landings. In the oyster industry, the Germans replaced the lease system by a fixed yearly rent, calculated in terms of the estimated value of the plots. It was further regulated that the entry rights could not be transferred to other oysterers, as was the practice heretofore, other than by the agreement of the Secretary General of the Department of Agriculture and Fisheries. Lastly, the allotment of plots became based on the need of individual oysterers and companies. The Dutch government adopted these regulations after the liberation of the country in 1945. It also reduced the rent of oyster and mussel plots to stimulate the shellfish industry's recovery and to enhance the food supply in the Netherlands. Gradually, the industry managed to recover from the disruption of these years, although the position of small planters continued to be difficult. The organisations of planters and shippers gained a foothold in state-level fishery institutions so that they could defend their interests. Potential newcomers to the oyster industry could only gain entry if a firm relinquished its plots, a measure that had already been in place in the mussel industry since the late 1930s. The mussel trade continued to be much more tightly regulated than the oyster industry.

Myticola Intestinalis: A Blessing in Disguise

Following two good years, things appeared to get even worse. In 1950, a parasitic copepod, *Myticola intestinalis*, killed a large proportion of Zeeland mussels. Some cocklers lost over eighty per cent of their stock. The shippers were consequently unable to supply customers. The planters and dealers were powerless against this ecological disaster and feared that it presaged the end of musseling in Zeeland. Paradoxically, however, this catastrophe preluded a phase of capitalisation and expansion. Some enterprising planters gained permission to cultivate plots in the Wadden Sea, until then a location mainly used for seed fishing.⁹ Soon all Zeeland cocklers relocated parts of their production areas to the Wadden Sea. Moreover, the mussel parasite vanished from the Zeeland inlets within a few years. Thus, there was an enormous expansion of the total area of plots available, which gradually increased from 4,000 to 10,000 hectares. Since the demand for mussels had also risen, the

Bureau considerably extended the individual quotas.

But other problems loomed large on the horizon. In 1953, a flood disaster struck Zeeland that was to have grave consequences for the oyster industry. Five years later, the government decided to dam up all inlets but one in the province. This would render mussel and oyster cultivation impossible. The Eastern Scheldt was scheduled to be shut off from the North Sea in the 1970s. In anticipation of the Zeeland delta being dammed up, the relocation of mussel farming to the Wadden Sea was speeded up.

However, growing opposition by fisher folk and environmentalists led to a reconsideration of the government decision to dam up the Eastern Scheldt. In 1976, Parliament approved the construction of a storm-surge barrier that would maintain the tidal regime. This meant that mussel and oyster farming in the Eastern Scheldt would remain possible. Thus, the total available area for mussel cultivation increased, though the acreage of mussel beds in Zeeland decreased.

In the meanwhile, in 1967 some of the most successful planters and dealers had persuaded the Ministry of Agriculture and Fisheries to withdraw most of the protective measures that had been introduced in the 1930s. The quota system was abandoned and henceforth mussels were sold at a free auction in Yerseke. This did not imply that the industry returned to a *laissez-faire* situation. The State retained formal jurisdiction over shellfish grounds, it still polices the waters, monitors the sanitary condition of shellfish farming areas and finances a department of the Netherlands Institute for Fisheries Investigation in Yerseke, which carries out biological research and provides the shellfish farmers with information and advice. However, the involvement of the industry's participants increased. The Industrial Fisheries Board (*Produktschap voor Vis en Visprodukten*), an organisation for the fishing industry as a whole, together with representatives of all branches of the mussel industry - planters, dealers and canneries, united in the Mussel Advisory Committee (*Mosseladviescommissie*) - now determined quality standards and maintain minimum prices. In order to make this work, a fund (*Mosselfonds*) was created. The planters deposited a small percentage of each sale with this fund. If their mussels did not meet with the quality standards, or could not be sold at the bottom price at the minimum, they are compensated by the fund. The mussels are bought by the fund, planted on plots and sold at a later date. Thus, this system is quite flexible. The Industrial Board and Advisory Committee also negotiate with the Ministry of Agriculture and Fisheries regarding the replacement of plots that had become unproductive, for example due to silting. In general, this co-management regime has been successful so far. Production has boomed, but supply could not keep up with

demand and, concomitantly, prices have increased sharply.

However, there were some disadvantages as well. The expansion of mussel farming in the Wadden Sea was at the expense of shrimp fishermen in the north of the country, who saw their shrimping territory drastically reduced. Some fishermen of the isle of Texel, for example, tried to gain permission to rent plots in order to start mussel cultivation, too. Their efforts did not bear fruit. The Ministry of Agriculture and Fisheries refused to give them access to such plots because Zeeland mussel planters had to be compensated for a loss of mussel beds as a result of the damming up of several inlets in the Zeeland delta. Most shrimpers, who only received nominal indemnification for the diminution of fishing grounds, bitterly resent the fact that Zeelanders plant mussels in what they consider to be 'their' territory. In recent years, there has been a scarcity of seed mussels, and the cocklers have exploited many natural banks to satisfy their needs. Environmentalists have waged a battle against the cocklers because they catch the mussel seed birds also prey on. Apparently, the environmental movement grants birds more rights than cocklers.

The expansion of the mussel industry also implied demerits for certain categories of cocklers. The relocation of many production areas to the Wadden Sea necessitated larger boats. This changed the balance of forces of production from labour being more important to capital becoming more important. A period of rapid modernisation, increases in scale and mechanisation ensued. These changes worked to the advantage of the large mussel culturists and to the detriment of the petty planters, who were unable to keep pace with the process of growth because they lacked the funds to modernise. Many could no longer compete and especially those without successors had to sell their business to large-scale planters and dealers. The number of firms decreased from 143 in 1960 to 80 in 1985. This development, encouraged by the Ministry of Agriculture and Fisheries, aimed at fewer but more profitable enterprises. Today, the state follows a very restrictive policy with regard to the admittance of newcomers and the number of participants in the mussel industry has hardly changed. Only those inheriting a family business or experienced employees who want to set up their own enterprise can get a license, provided that the total number of firms does not increase. Thus, the expansion of the mussel industry as a whole brought about the demise of small enterprises. Nonetheless, the industry's social organisation is still predominantly based on family firms.

The Demise of the Oyster Industry

The historical trajectory of the oyster industry took quite a different route than that of the mussel trade. The 1958 decision to dam up the Zeeland inlets had much more drastic and especially negative consequences for oysterers than for cocklers. Unlike mussel cultivation, oyster farming was only possible in Zeeland waters. As we have seen, the dike that enclosed the Zuyder Sea in 1932 implied that this marine domain turned into a fresh water lake where oysters could not survive. On top of that, ecological conditions in the Wadden Sea deteriorated following the dike's construction. So much so that by the 1930s the oysters disappeared from the Wadden Sea. Attempts to farm oysters there during this decade failed time and again. Whereas the cocklers could relocate their production areas to the Wadden Sea, this alternative was not available to the oysterers. Those who combined oystering and musseling were in a favourable position because they could invest more in musseling or switch to this branch of trade altogether. The state developed a compensation programme for the oysterers. They acquiesced in their fate, going about their work as usual, in an effort to make the best of the situation. There were still many years to go before the Eastern Scheldt would actually be dammed off.

Then, in 1962-63, an extremely harsh winter decimated the oyster stocks.¹⁰ Only an estimated five per cent survived. This dealt a lethal blow to the majority of oyster firms. The bivalve producers and dealers suffered great financial losses and on top of that the prospect was that the Eastern Scheldt would be dammed off in the near future. Most oysterers deemed it senseless to continue their occupation. The majority of planters and all small tile farmers decided to quit and accept state indemnification, amounting to approximately fifty per cent of the real damages. Some retired, while others set up new ventures. The wage labourers could usually find industrial employment, since it was a time of rapid industrialisation in the Netherlands. The planter-shippers also collected financial compensation. Only some of them continued to rent a few plots. Since the native bivalves were virtually wiped out, they imported large quantities of four-year old oysters, replanted them and marketed them one year later. Because supply was scarce and competition minimal, they could make a comfortable living. The enterprise, however, was not without its risks. The bivalves, mostly imported from France, did not adapt to the lower Zeeland water temperatures in winter and mortality rates were high.

For this reason, the majority of those still renting plots began to refrain from using them. They consequently had to relinquish the parcels because a law passed shortly before forbade lessees to let underwater grounds lie fallow. Only ten planter-shippers persevered, and they cheaply rented the relinquished

plots in addition to the ones they already leased. As a consequence, they gained access to extensive underwater grounds and accounted for 99 per cent of the oyster production. Thus, as a result of the ecological disaster following the winter of 1962-63 and the Delta Plan, the social structure of the industry that arose in the 1930s, suddenly came to an end. In contrast to the ten affluent planter-shippers who intended to continue oystering as long as possible - that is, until the enclosure dike was to shut off the Eastern Scheldt from the North Sea, the small tile farmers and petty planters had neither the means nor the energy to stay in the industry.

But as we have seen, in 1973 the government altered its policy and decided that the Eastern Scheldt would not be dammed up completely. Instead, a storm-surge barrier was to be built. This left the remaining planter-shippers in an extremely strong bargaining position. Firstly, they rented nearly all the oyster plots. Secondly, they had established an association and as the sole organised representatives of the oyster industry, they advised the civil servants of state institutions. Of course, they highlighted their own interests. Therefore, they virtually controlled the industry. Though some former planter-shippers (or their sons) attempted to regain entry to the plots, they were unsuccessful. The monopolists continued to play the game of import and export, seeking a quick turnover. But they had grown careless. Against the advice of fishery biologists, they imported and replanted French oysters that turned out to be infected by a parasitic disease, later named *Bonamia ostreae*. In 1980, it was established that this disease had affected the oyster stocks in the Eastern Scheldt. Thereupon, the state banned the cultivation of the European flat oyster in the inlet.¹¹ It was only in another inlet, the Grevelingen, that the cultivation of *Ostrea edulis* could be continued. In the second half of the 1980s, an annual yield of approximately ten million oysters was harvested there. However, in 1989 it was established that *Bonamia ostreae* had spread to the Grevelingen and since that year harvests had declined to 0.5 million oysters. This miserable situation has continued until today. For decades, the economic importance of the mussel industry has exceeded that of the oyster trade by far.

Conclusion

This Chapter has shown that captors can be turned into culturists. However, privatisation does not necessarily provide shellfish farmers with incentives to maintain their harvests at an ecologically sustainable level. Some of the consequences of privatisation of the Zeeland oyster banks were

overproduction, resource deterioration, overcapitalisation, marginalisation of the original fishermen, the creation of social divisions and maldistribution of incomes. On the other hand, privatisation in the Zeeland mussel fishing and farming industry provides an example of successful fisheries management and sustainable use. Under certain conditions, certain forms of privatisation may be viable resource management instruments, but not all forms of privatised management regimes are necessarily successful. There are no easy solutions leading to the sustainable use of marine common property resources. As we have seen, one serious problem is not depletion of resources, but overproduction.

For each individual shellfish farmer it is 'rational' to increase production, and this can bring about overproduction at a collective level. If overproduction occurs, lower prices will be fetched in the market, creating incentives for individuals to produce even more, which can undermine the ecological carrying capacity of the marine environment. Following such experiences, shellfish planters have often opted for collective action to solve resource management problems. But time and again, these strategies failed as a consequence of free riding and evasion of the rules and regulations. Therefore, the planters asked the state to wield its authority and enforce the rules and regulations. But again, their attitude was ambivalent; when they perceived advantages in state involvement, they were in favour of state intervention; when they felt their freedom to act was stifled too much, they would try to circumvent the rules or ask the state to withdraw certain measures. However, the co-management scheme which developed in the mussel trade and in which the interests of the state, the producers and the dealers are balanced and constantly negotiated seems to have been successful so far.

Though mariculture, and the farming of shellfish in particular, implies greater control of nature - at least in comparison with capture fisheries - and increased production, a caution is in order. Increased control at the same time enhances vulnerability, since people become more dependent upon the resource being controlled and the means by which it is controlled. If successful, farming a single marine species will be promoted either by the producers and/or by state agencies and this can eventually lead to a kind of mono-mariculture. Shellfish farming often leaves little room for multiple use, and a successful branch of shellfish farming usually expands at the cost of other fisheries and other forms of mariculture, taking up much space formerly used by many other fishermen. Moreover, privatisation often leads to marginalisation of the commoners and protects the interests of participants once they have gained access. It also creates tremendous barriers for potential

newcomers to the industry. These conflicting interests and equity problems have to be solved or frictions will ensue. Apart from these social problems, monocultures can lead to ecological and economic problems.

There are many examples of diseases assailing specific branches of the shellfish industry, for example *Bonamia ostreae* (or MSX) in oystering and *Mytilicola intestinalis* in musseling. These diseases spread rapidly and can hardly be fought. Although the commons may be divided up for human use, carelessness of one or a few users or sheer forces beyond man's control can be destructive for the common resource and hence for the collective of users. When in 1980 *Bonamia ostreae* was discovered in the Dutch oyster industry, a ban on the farming of *Ostrea edulis* was installed and the plots lay fallow in anticipation of the disappearance of the disease. This situation has lasted for many years now, much to the dismay of cocklers who were not allowed to use this extensive area and at the time were in need of and applied for more plots, to no avail however. Therefore, it would seem unwise to place all one's eggs in a single basket. It is probably preferable to maintain diversity so that if a disaster or a disease strikes one species, it does not bring about a disaster of the magnitude often seen in monocultures.

For the same reason, switching species should not be ruled out beforehand. If lessees have to pay dearly to get access to plots and if they do not have alternatives, resource deterioration may not prevent them from harvesting their stock. They are likely to take the oldest year-classes necessary for the reproduction of a species. They may even have to, for their short-run economic survival. It is therefore necessary that an external authority - for example the State or some co-management body - closely monitors the industry and has the power to intervene in it. As Greenpeace International campaigner Mike Hagler warns, one should not be too optimistic regarding the viewpoint that farming the seas 'necessarily brings with it sound husbandry'. He goes on to state that '(e)nthusiasts of farming the seas should reflect that upon land, what has often grown back after repeated attacks upon wilderness has not been rich diverse forests, not even a sustainable monoculture, but degraded woodland, scrub, poor grazing land and ultimately desert' (1995: 78). Though Hagler's view is a grim one, it is worth reflecting upon. In this respect, the tragic story of *Ostrea edulis* speaks volumes. The dilemma, then, is that shellfish cultivation can enhance production, but only at the cost of ecological diversity. How to steer a clear course between this Scylla and Charybdis remains one of the major challenges for the management of shellfish farming in the future.

As John Bennett observes, 'human systems are not unitary, but are dynamic and proliferational: when needs cannot be satisfied by one system, a

subsystem is likely to form through the adaptive actions of individuals; or, the individual may switch his behaviour from one system or subsystem to another, seeking out more congenial alternatives' (Bennett, 1976: 25). A common strategy of fishermen is to switch target species once it has become unrewarding to catch a species which was pursued previously; it is a 'normal tendency of fishermen to switch away from declining stocks' (Townsend and Wilson, 1987: 323). This may bring about a dispersion of pressure on marine resources, a consequence that was neither intended nor foreseen. If not tied to a single resource (for example when one 'owns' this resource as a tenant or as a person entitled to a certain quota), fishermen are likely to take optimal advantage of the variety of marine ecosystems, choosing to utilise niches as they see fit.

However, one should not consider these adaptations as cybernetic processes automatically leading to homeostasis. Nor should one mistake them for evidence of control over nature or signs of ecological wisdom. We are still in need of a theoretical perspective that can account for 'the shaping and constraining forces of ecological adaptation, but sees them as operating through systems of cultural meanings and social relationships, that sees internal conflict and contradiction within social systems, as well as adaptation to material circumstances, as dynamic forces' (Keesing, 1981: 171-172). These adaptations themselves are often quite diverse. As Orvar Löfgren rightly observes, 'ecological variations combined with local demographic and economic factors and changing national government policies have generated a diversity of adaptations among the coastal populations' (1979: 85-86). Socio-cultural factors could be added. Unless we take these integral dynamics into account - that is, the interdependencies and interactions of factors and actors in a system of resource use and the processes and transformations they bring about - we will be unable to get a full grasp on the complexity, diversity and dynamics of renewable resource utilisation.

Notes

- 1 According to Schlager and Ostrom's conceptual scheme, 'owners' have the rights of access and withdrawal, management, exclusion and alienation; 'proprietors' have all of these except the right of alienation; 'claimants' have the rights of access and withdrawal and management; and 'authorized users' only have the right of entry and withdrawal (1992: 252).
- 2 For a more comprehensive account of this case history, see Van Ginkel 1996.
- 3 *Verslag van de Staat der Nederlandsche Zeevisserijen* [Annual Report on the State of Dutch Sea Fisheries] (1860: 36). Henceforth: *Sea Fisheries Report*.
- 4 Appendix to a letter, dated 23 January 1859, from the *Collegie voor de Zeevisserijen* [Board of Sea Fisheries] to the Mayor and Councillors of Texel regarding the cultivation of oysters (Texel archives, no. K-853).
- 5 *Sea Fisheries Report* 1861: 16.
- 6 The transition from capture to culture oyster fishing and later developments in oyster farming is described in more detail in Van Ginkel (1988, 1989).
- 7 On developments in the Zeeland mussel industry, see Van Ginkel (1990, 1991a).
- 8 On these and other adaptive dynamics, see Van Ginkel (1994b, 1995).
- 9 This led to upheaval among those who were initially excluded from access to the Wadden Sea. On the contest between those who could go and those who could not, and the prolonged conflicts which ensued in the Zeeland community of Yerseke, see Van Ginkel, 1991b. On the idiom and ideology of Yerseke shellfish planters, see Van Ginkel (1994a).
- 10 Oysters are quite vulnerable to changes in the natural environment. Much more so than mussels, which can for example withstand low water temperatures for long periods of time. The 1962-63 winter had 71 consecutive days with water temperatures below minus 1.5 degrees Celsius.
- 11 That is, the cultivation of *Ostrea edulis*. Another species – known as the Japanese oyster, introduced in the 1970s – has proliferated in Zeeland waters and is exploited by 30 oyster firms and permit holders. In recent years, catches have gone up from approximately 5 million to 12 million. This is partly a capture fishery, partly a culture fishery. For a more comprehensive description of developments in shellfish cultivation after the construction of the storm surge barrier, see Dijkema (1988).