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Aquaculture in the Netherlands
an overview

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1 Shellfish culture

Culture of bivalve shellfish in the Netherlands encompasses culture of the blue mussel (*Mytilus edulis*), the European flat oyster (*Ostrea edulis*) and the Pacific oyster (*Crassostrea gigas*). Regular culture of oysters and mussels is practiced since 1870, when wild fishery for these molluscs was banned. All species are cultured in bottom culture. Culture practice is closely related with and, in the case of oysters culture, often mixed with fishery on wild banks, import and export. This complicates interpretation of production (landing) figures. A quantitative summary of the production, the industry and markets is given below

SPECIES	PRODUCTION IN 94' (Tonnes)	PRODUCTION IN 1980 (Tonnes)	NUMBER OF PRODUCERS	VALUE '94 (ECU x 10^6)	MARKETS
Mussels					
M. edulis	73 000	50 000	80	45	Bel, NL,Fr,Ger
Oysters					
O. edulis	77	800	27	0.6	Bel, Fr
C. gigas	1350	nil	27	3	Bel, Fr

1.1 Mussel culture and processing of fresh mussels

1.1.1 The culture

Mussels are cultured in the Wadden Sea (60% - 75% of the national production), and the Oosterschelde (Eastern Scheldt) estuary (Fig 1). Culture concessions (plots) are generally located on the banks of tidal channels, from the intertidal range to a depth of 10 - 15 m below low tide level. Culture plots are demarcated with wooden poles and measure between 7 and 25 ha. In total, 80 mussel growing firms rent a total area of about 10,000 ha from the Government. An average grower works 60 - 80 ha, from which area he generally harvests between 900 and 1,500 metric tonnes of mussels per year. In the period between 1988 and 1992, the prices at landing of one kg of mussels varied roughly between 0.3 and 3 Dutch Guilders (HFL) per kg, which, at that price level, means an average gross result between 400,000 and 2,250,000 HFL. One HFL equals 2.01 ECU.

1.1.2. Production

Mussel culture, as a bottom culture, is often considerd a fishery. Indeed, its main activities: dredging for mussel seed on wild banks and for adult mussels on culture plots for re-seeding and harvesting, have rather characteristics of fishery than of aquaculture. Suspended culture, on longlines, only exists on a very limited scale in Zeeland, with a production of 200 tons per annum. This culture method can not be widely applied due to a lack of suitable sites.

The potential production of the Dutch mussel culture is about 100,000 tonnes per year. In many years, this potential is not attained as a result of mortality caused by storms (Fig. 3). The raw material (mussel seed) is obtained from wild banks. Mussels reproduce by releasing their eggs and sperm in the sea in spring. After fertilisation, a free-swimming larva floats around 2 - 3 weeks in the sea, at the mercy of the currents. After that period, the 0.3 mm long larva forms a shell, becomes heavier and eventually settles on a suitable solid underground on the sea bottom. The young mussels finally aggregate into so-called "banks". There a part of the mussel seed is dredged in next October.Most of it, however, is fished after the winter storms in May of the next year. Seed mussels of 2 - 3 cm long or half-grown mussels of 3 - 4 cm are usually fished in the Wadden Sea. Yearling, half-grown mussels of 3 - 4 cm can also be captured on wild banks. One year after seeding of the spat, the yearling mussels are often dredged from the shallower culture plots and re-seeded onto plots which are more suitable for their size. Also, mussels from the exposed Wadden Sea are moved to the more sheltered Oosterschelde before winter. Mussels generally reach the required market size in 1.5 - 2 years after seeding of the spat. Mussel seed from subtidal banks which is sown in May, can reach marketable size (35% longer than 50 mm) by the end of the year on the most productive, deeper plots, where the currents provide sufficient food. Most of the mussels, however, are harvested in the course of the following season, which starts in the last week of June and is closed in the first week of April. As an average, one ton of mussels is harvested from one ton of mussel spat, and 1 - 2 tons from 1 ton of half-grown mussels. The stocking density of the spat ranges between 3 and 8, sometimes up to 10 kilograms per m^2, the latter often happens in years with an abundance of wild seed or half-grown mussels. At harvest, the density of the mussels is 6 - 8 kg per m^2. Fig. 2 gives a view of the position of the culture plots which have been in use in the western part of the Wadden Sea since 1950.

1.1.3 Fishing techniques

The mussel fleet comprises about 82 ships, which dredge and transport mussels and mussel seed. The ships as average measure 30 - 35 m long and 6 - 8 m wide. They draw 0.6 - 0.9 m and mostly have two holds. They can load 120 - 150 metric tonnes of mussels. The ships built during the last decade are much larger: they measure up to 42 m, are 8 - 9 m wide, draw not more than 0.5 - 0.6 m, which is useful for fishing on banks high in the tidal range. They can load up to 180 tonnes. A shipload of 140 tonnes can be fished in 4 - 5 hours with 4 dredges of 1.9 m wide. Bow thrusters ensure maximal manoeuvrability on the culture plots. The steel dredges, if necessary reinforced with detachable blades for fishing on hard bottoms, are operated with a 8-drum hydraulic or pneumatic winch, operated from the wheelhouse. To unload the mussels on the plot, water is pumped into the holds, until the contents are washed out by gravity through holes in the side of the ship. To this end, the ships have double bottoms and sides. This system enables the grower to unload his ship in about half an hour time without manual labour, while minimal damage is done to the mussels.

1.1.4 Auctioning, rewatering and processing of fresh mussels

After harvest, all mussels are shipped to Yerseke in the southwest of the Netherlands, at the Oosterschelde (Fig. 1), where the central mussel auction is located, (which is unique

in the world). Upon arrival at the auction, the cargo of each ship is sampled. Size, weight, meat yield, amount of tare and of fouling organisms on the mussels are determined and registered. Subsequently, the mussels are auctioned and sold to the highest bidding merchant. After he has bought a cargo of mussels (generally 40 - 100 metric tons), and prior to processing, he has to relay these mussels on his own plots. On these "rewatering plots", the mussels pass a compulsory rewatering period of minimally 14 days. Weak and broken mussels are eliminated by seagulls, crabs and fishes, whilst the survivors recover from stress, contracted during dredging and the 12-hours lasting transport per ship from the Wadden Sea to the Oosterschelde. Without this rewatering period, the shelf life of the mussels, which under normal conditions is about 4 - 5 days after packing, would be unacceptably low and too much sand would be present in the mussels.

After rewatering, the mussels are dredged up carefully, to minimise breakage and to prevent the mussels to ingest sand. Once on shore, the mussels first pass a rotating rinsing sieve to remove mud and sand. Some companies discharge the mussels directly from the dredge into containers on the fishing ship. In other firms, the mussels are put into containers on shore., In the containers, the mussels are given a final de-sanding treatment. The containers are connected to a sea water distribution system and a vertical water flow is led through the layer of mussels in the container. This water is UV-sterilised to ensure microbiological purity. During a period of 4 - 6 hours, the mussels excrete the last sand and mud, which may have remained after dredging. The next processing steps are aimed at making the mussels "pan-ready" for the consumer: They pass a de-clumping machine which breaks up the clumps of mussels, attached to each other with their byssus threads, with rotating blades or brushes. Then they pass a blower, which removes algae (mostly sea lettuce (*Ulva lactuca*) and empty shells, and the byssus threads are mechanically removed. Mussels destined for the fresh market (65%) are chilled to a temperature of 7 - 10^{o}C, which is compulsory during storage and transport. Finally they are packed, either in 20 kg bags for the wholesale trade or in 1.2 or 2.5 kg perforated plastic bags for home consumption, on which the date of packaging is indicated.

1.1.5 The mussel conserve industry

About 30% of the mussel production is processed by about 4 processing plants, all but one based in Yerseke. There medium-sized mussels, after being de-sanded, de-clumped and de-byssed like fresh mussels, are cooked in continuous, conveyor-belt pressure cookers, and shucked on vibrating screens. After passing a belt on which shells, stones and discoloured mussels are sorted out by hand and, in some companies, special equipment to detect remaining sand and small shell fragments, they are either deep-frozen (In blocks or Individually Quick Frozen) or pasteurised in glass jars or cans in a variety of more than 15 different products for home consumption or for the wholesale market.

1.1.6 Sanitary pureness of shellfish water and product

Purification of live bivalves in purification systems prior to marketing, which is compulsory in most other countries in order to reduce the numbers of human pathogens, is not necessary in the Netherlands. All Dutch shellfish waters meet the

official EU "A" standard for waters where bivalves are fished, cultured or stored. They are intensively monitored bij RIVO-DLO for coliforms, Salmonella and for potentially toxic algae and phytoplankton toxins. This monitoring programme, also encompassing an early warning system for offshore phytoplankton blooms, is jointly financed by the industry and the Government. There are a small number of EU- certified purification systems, which are used to receive imported mussels from non-"A" waters abroad. These systems are additionally equipped in a way that all effluent is filtered at a mesh of 20 µm, which prevents introduction of cysts or cells of non-indigenous, potentially toxic phytoplankton species, which may be present in the shellfish or the attached mud. Not having to purify nationally produced means a lower cost-price and a gain in product quality and shelf-life, as no chemical products need to be used and handling is reduced.

1.1.7 Limits and constraints

Mortality, caused by a variety of factors, is the principal hazard in the mussel industry. Its most important form is caused by strong wave action and tidal currents occurring during winter gales. This affects relatively shallow plots (1.5 - 6 m) in the western part of the Wadden Sea, causing mussels to be swept away. One or two of such storms can decimate the cultured stock. Such losses have been relatively heavy during the last decade. This is clearly demonstrated in Fig 3, showing the difference in production fluctuations between the Wadden Sea and the sheltered Oosterschelde. The mussel growing industry seeks to use deep and sheltered culture areas. However, these are scarce and are generally fished by shrimp beamtrawlers, which claim rights of use. As per 1995, 450 ha of new plots in deeper areas will replace a number of the most hazardous plots, thus increasing the stability of the production and improving the continuity of the companies. Fluctuations in production are further caused by variations in reproduction success (recruitment) of mussel seed and by predation by Eider ducks (*Somateria mollissima)* in the Wadden Sea. These predators can inflict serious damage to the mussel growers with a total loss of 20,000 - 30,000 tonnes per annum. Failing recruitment of mussel seed can, in some years, limit mussel landings 3 - 4 years later. This may entail compensatory imports, mainly from Germany and Denmark, as happened in the period 1989-1992. Such imports may bring about risks of introduction of toxic algal species, pathogens, parasites and exotic organisms which may go wild. Also, the removal of the internal economic borders in the Europeàn Union in 1993 has caused that national legislation, aimed at protection of the Dutch coastal waters from introduction of non-indigenous organisms, had to be lifted. This has resulted in imports of seed mussels and seed oysters from France, the United Kingdom and Ireland. This is considered to increase the risk of introduction of exotic organisms or undiscovered diseases or parasites, attached to or among the imported shellfish. Recent studies have proven that such organisms are numerous, and some of them may be capable to become pests, as has repeatedly happened in history.
Legislation (national, EU) and guidelines (e.g. the I.C.E.S Code of Practice for the introduction of non-indigenous organisms) exist, but are not sufficient at present. They are being improved to minimise risks for the ecosystem and the aquaculture.

The last years, mussel seed fishery (together with hydraulic cockle (*Cerastoderma edule)*and clam(*Spisula subtruncata*) dredging has been accused by nature conservation organisations of competing for food with soverwintering eabirds in certain years and affecting wild mussel banks, which are considered to be valuable natural assets. This has

resulted in new regulations and a ban on the fisheries for mussel seed and cockles on most of the tidal flats. This restriction is expected to affect mussel landings after years with low seed recruitment. For this reason, efficient use of mussel seed on the culture plots has become more important. The present ratio between the amounts of seed seeded and mussels harvested of 1:1 - 1:1.5 is considered relatively low and can be improved by adaptation of fishing and seeding techniques.

1.1.8 Assets and advantages

-An expanding market, certainly for quality products.
-Problems with water quality and toxic phytoplankton which causing poisoned mussels and interrupted production in competing countries: Spain, France, Scandinavia, Ireland, Canada. Near absence of such problems in this country.
-The relatively low cost price of the Dutch mussel compared with other cultured mussels, due to mechanisation and large-scale production.
-High and stable meat quality in comparison with the fished product.
-Proximity of te Belgian market and and good transport and distribution.
-High product quality and guaranteed sanitary pureness, no need for artificial purification.
-Good and often certified hygiene management by the industry, intensive sanitary surveillance compared with other EU countries.

1.1.9 Developments

The Dutch Ministry of Agriculture, Nature Management and Fishery has, together with the mussel growing industry, developed in 1993 a new scheme for coastal zone and fishery management. This scheme comprises fishing plans and catch quota for mussel seed and cockle fishery, as well as improved or new legislation for fishing effort, methods,and gear to be used. Also quality improvement, e.g. shell damage reduction, is envisaged. A system of closed areas for fishing has been agreed upon, as well as additional area closures for reservation of mussel and cockle stocks, in order to cater for 70% of the food requirements of over-wintering seabirds in years of scarcety. In the Wadden Sea, culture plots with a high risk of mortality by storm and tidal currents, are replaced in 1995 by deeper and more stable plots, thus decreasing the year-to year fluctuations between landings. The market for mussels is gradually developing (See next chapter). Quality management during the entire production chain is becoming more and more commonplace, as, increasingly customers require information on and control over the product and the process conditions in all links of the chain between the culture plots and the final consumer.

1.1.10 The international situation

Edible mussels of different species are fished and cultured worldwide. Fresh mussels have a shelf life of 4 - 5 days and can be marketed after road transport within a radius of roughly 1000 km. Air freighting of fresh mussels is only economically feasible in exceptional cases. The culture of fresh mussels in Europe is growing gradually: in the UK (still slowly increasing), Ireland (bottom and suspended culture and France (gradually

expanding suspended culture towards deeper water). Some of the French market is lost to Ireland due to active marketing and lower prices. Until now, the increased production meets the rise in demand.

Cooked mussels can be produced deep-frozen in a large number of countries, independent of nearby markets. As, however, mussels are filtrating organisms and able to accumulate toxic phytoplankton, and micro-organisms, strict health regulations and restrictions exist in most importing countries, the most important markets being the US and Japan, with which many large producing countries can not (yet) comply (e.g. in Asia). This situation will change in the future, when sanitary and pollution control measures will be gradually implemented in countries desiring to export. Increasing competition with such countries on the growing world market for processed mussels can be expected in the future.

1.2. Oyster culture

1.2.1 Description of the culture

The flat oyster (*Ostrea edulis)* is cultured in the SW Netherlands, on plots in the southeastern part of the Oosterschelde (1,700 ha) and in Lake Grevelingen (380 ha) (Fig 1). Oysters reproduce by releasing their eggs and sperm in the sea during summer. After fertilisation, a free-swimming larva floates around 2 - 3 weeks in the sea, at the mercy of currents. After that period, the 0.3 mm long larva forms a shell, becomes heavier and settles on a suitable place on the sea bottom. Spat is collected artificially by offering the larvae a suitable hard substrate to settle on. During summer, mussel shells (from the processing industry) are seeded on special, shallow plots on the bottom. After two years, the settled spat has grown to seed oysters of 20 - 30 g, is then fished up and is re-seeded to deeper plots where the growth rate is higher. Market size is reached after 4 - 5 years from spatfall at a weight of 50 - 90 g. The biggest oysters are marketed at a weight of 100 - 120 g.

After the introduction and following outbreak of the disease bonamiasis, caused by the microsporidean *Bonamia ostreae,* introduced from France in 1980, mortality of adult oysters has reached rates of 40 - 90% . Production has plummeted from 750 tons per year to less than 200 tons in recent years. As most cultivated stocks in western Europe are now affected, the prices of flat oysters have risen dramatically. The wholesale price of a 70 g flat oyster in 1994 was about HFL 1.00 - 1.50 . To satisfy the market demand, flat oysters are imported, mostly from Ireland and the U.K .

The Pacific oyster (*Crassostrea gigas*), locally known by its French name "*creuse*", has been cultivated in the Oosterschelde since the late seventies, after it had been introduced from Japan in 1964. In 1992, the production was about 1000 tonnes, and is gradually rising. Spat or half-grown oysters are either fished on wild banks, oyster spat is collected on the plots, similar to the flat oyster.

There are 27 oyster culture firms, most of which produce both species and practice wild fishery. Mainly due to the vicissitudes of oyster culture in the Netherlands: disastrous cold winters in 1963 and 1979, threatening closure of the culture grounds by a flood safety scheme, and the outbreak of bonamiasis, most of the oyster growers quit in the

sixties, the remaining firms have mixed their activities with other business in the shellfish branch, such as fresh mussel trade and processing and. lobster trade. After a culture ground repartition to be carried out in 1996, most firms will work 40 ha, a few large companies more. Plot size is 5 ha. Most of the ships used by the growers are former mussel dredging ships which had become too small for the mussel growers.

1.2.2. Trends and perspectives

Although, before 1950, culture of the flat oyster was the most important Dutch shellfish production branch, it has now been curtailed after the outbreak of the disease bonamiasis. Recent trade is dominated by imported and re-exported oysters from the UK and Ireland. Production of the Pacific oyster has almost replaced that of the flat oyster in the Oosterschelde. A problem is formed by the low prices of this oyster on the European market (retail prices in France almost equal the Dutch cost price). Thanks to a very good meat quality, export to Belgium and France remains possible.
Diseases are not giving problems in this species.The increased transport of oysters and the inherent risk of introduction of diseases, harmful exotic animals and cysts of toxic phytoplankton species, is considered as a threat, despite existing legislation. It is felt that former, national legislation was more adequate than present EU rules.

2 Fish culture

Fish farming in the Netherlands started in the beginning of this century, with salmonids. for restocking. This culture is now restricted to one farm. Due to climate (too warm in summer, too cold in winter) and bad quality of surface water, comercial fish farming is now restricted to closed, recirculating systems with heated water. Since 1980, culture of catfish (*Clarias gariepinus*) and eels (*Anguilla anguilla*) in recirculated systems has developed successfully, although on a relatively small scale. There are experiments with other species.

2.1 Production and numbers of farms

SPECIES	PRODUCTION IN 94' (T)	PRODUCTION IN 1980 (T)	NUMBER OF PRODUCERS	VAUE (ECUX10^6)	MARKETS
Eels	1 500	1	30	12	NL, exp
African Catfish	1 250	0	20	4	90% exp
Rainbow trout	600	600	13		NL
Turbot	10	0	1		?
Pike					
Pike-perch					
Trout					
Roach	For restocking, 75 tonnes per annum of all sizes				

2.2 Culture of the African catfish

Culture of the African catfish (*Clarias gariepinus* (Burchell, 1822),(family: *Clariidae*) did not exist in the Netherlands before 1980, neither there existed a market for this species. African catfish proved to be an exellent species for educational and research purposes. General enthusiasm for the culture of this species was raised in 1985, after gourmet restaurants had paid fancy prices for the first experimentally reared fishes. Politicians then propagated catfish farming as a successful supplementary activity for dairy farmers, to diminish over-production of milk. Within one year, 60 catfish farms had started. However, Clarias was a totally unknown species to the Dutch consumers and it appeared impossible to sell all of the harvest. In spring 1986 the market collapsed. Half of the catfish growers desisted. The total production, however, soon resumed its growth, thanks to successful efforts to expand , inland consumption and to create an export market. Active market development and product diversification, in most cases by the growers themselves, have developed a market, mainly based on export.
The development of the number of farms and the production is depicted in fig. 4.

African catfish is reared at a temperature of 25 ^{o}C in recirculating systems, using Fig 5
trickling filters, settling tanks and other treatment equipment. Fry is obtained from 3 hatcheries, producing year-round. Advantages of *Clarias* as an aquaculture species are its high growth rate, (from 5 to 700 grams in 6 months), high stocking densities (up to 300 kg/m^{3}), low incidence of diseases and a favourable food conversion rate (1:0.9 - 1:1). Disadvantages are its unattractive appearance and its unfamiliarity to the public, which makes considerable effort necessary for marketing and product diversification. Production is expected to grow further at a slower pace, but expansion at present is hampered by a shortage of fry. Further rationalization of the culture, as well as further genetic improvement of the species, are expected for the future.

2.3 Culture of the European eel (*Anguilla anguilla)*

Eel farming first developed in the early 1980's. Heated, recirculating culture systems are a necessity in the Dutch climate. Development of the culture occurred much more gradual than that of catfish. It was also stimulated to a great extent by the FEOGA subsidies from the EU and the national Government. These subsidies have stopped since a few years, but the number of farms and production are still rising. The number of farms in 1994 was 30, producing 1 500 metric tons. Glass eels (0.3 g) are mainly imported from France or the UK and are reared to fingerling size, often by specialised growers. The fingerlings are then reared to market size (180 g) in about 8 - 9 months at a temperature of 25^{o}C. This species has higher water quality demands than *Clarias*, which means that more expensive equipment is necessary. This renders investment costs for eel farming higher than for catfish farming. The product is exported (Germany) or sold on the inland market, mostly for smoking.

2.4 Research and development

Research and development of recirculated culture systems, feed and culture methods, as well as fish health research and disease screening, is carried out by research institutions: RIVO-DLO, ID-DLO (the DLO institute for veterinary research) and the Department for fish culture nad fishery of the Agricultural University in Wageningen, as well as a number of consultants. Together with the industry, these have achieved a gradual development of equipment, methods and fish health, of treatment methods for both culture water and effluent. Rearing of glass eels is also subject to research, resulting in a decrease of mortality and better growth. Research into fish health and disease prevention is of great importance for the development of the sector.In 1995, a reearch and extension project was started, jointly financed by the industry and the Government, to study and solve common problems in eel and catfish farms.

2.5 Constraints and advantages

Disadvantages of *Clarias* are its unattractive appearance and its unfamiliarity to the public, which makes considerable effort necessary for marketing and product diversification. Production is expected to grow further at a slower pace, but expansion at present is hampered by a shortage of fry.
Problems with the imported swim-bladder parasite *Anguillicola crassus* of eels have almost been overcome. Gill parasites are still a recurring problem in the culture, as are increasing costs for effluent treatment, due to ever stricter regulations. In general, introduced exotic pests, such as skin and gill parasites, and the swim bladder parasite, are considered a threat. In view of the decreasing catches of wild eels, natural recruitment of glass eels shows an alarming downward trend. Although the need of the eel farming industry is still much lower than the amounts, fished for direct human consumption of glass eels in South-European countries, this trend is considered alarming at the long term.

2.6 Perspectives

Both catfish and eel culture are expected to grow further, albeit at a slower pace. Market perspectives are rather good for eels, and the market for catfish is still gradually expanding. In most farms of either species, there is still scope for optimalisation of the culture process. Genetic improvement of the catfish and experiments with culture of other catfish species, are under way. The future for eel farming in recirculated systems in the Netherlands is considered sound, and the sector is expected to expand gradually.

2.7 Other cultured species

Turbot (*Scophthalmus rhombus*)is in 1995 cultured in two farms, using recirculation. One of these is on a pilot scale. the other one also produces sea-bass (*Dicentrarchus labrax*). Culture of turbot in recirculated systems has been demonstrated to be economically feasible. A constraint is the number of available sites. Research by RIVO-DLO and subsequent trials have shown that recirculation systems can work well with sea water, which opens the way for other marine species. Experiments are under way with a

number of, partly exotic, commercial marine and fresh water species. These trials are done by individual growers.

A number of fresh water fish species are produced for restocking of inland waters by the Organisation for Improvement of Inland Fisheries (OVB) in Nieuwegein. This organisation, partly financed by angler's contributions, produces in total 75 tons of fingerlings and adult fishes. Grass-carps (*Ctenopharingodon idella*) ans silver carps (*Hypochthalamichthys molitrix*)and indigenous species are produced. The organisation also catches glass eels.and sells them to commercial inland fishermen. Fingerlings are sold for sport angling purposes (purchased by professional and angler's associations, but are also used in projects of the Government to improve the species composition (e.g. ratio between predator and prey species) of certain inland waters in order to mitigate effects of eutrophication.

3 Figures

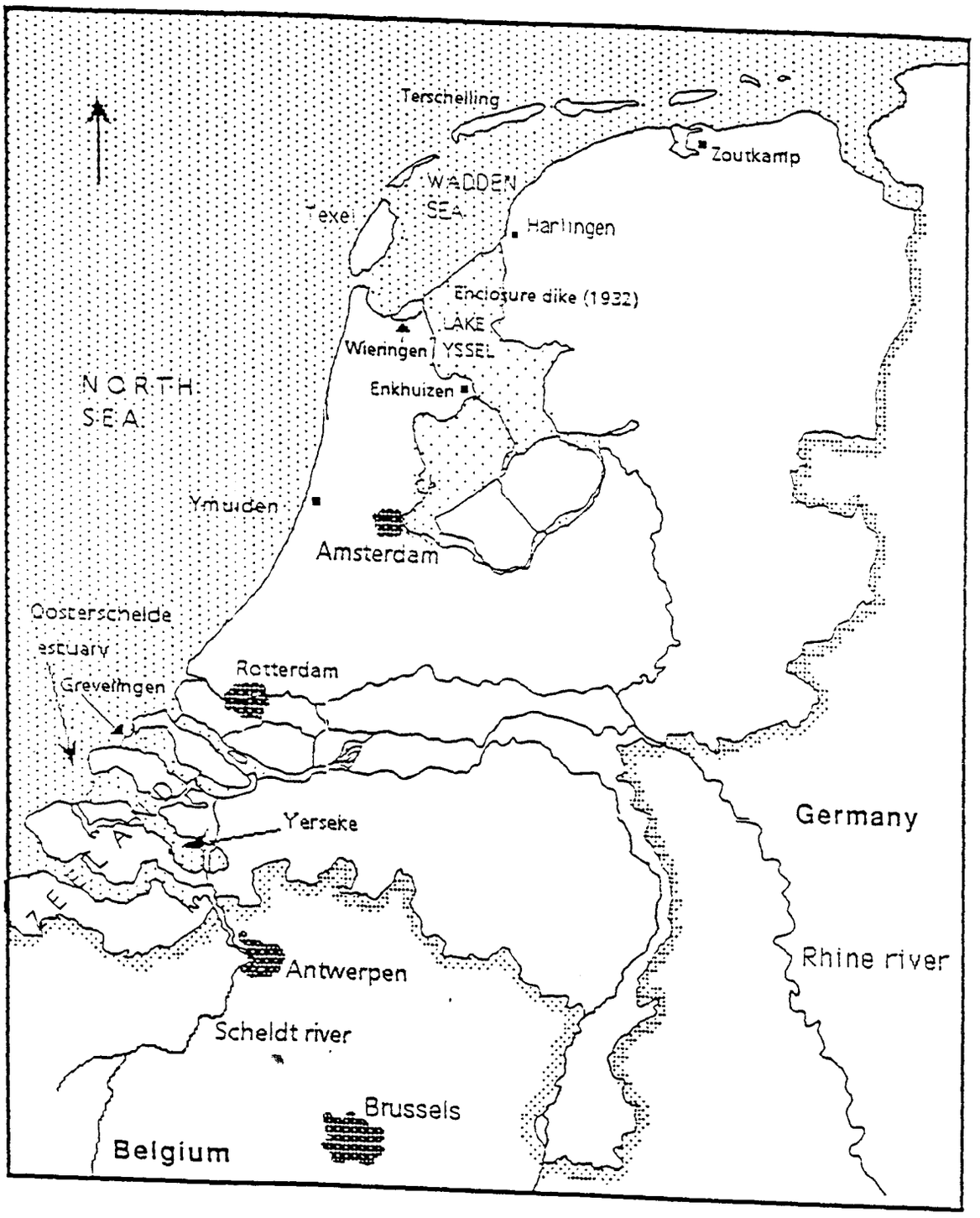


Fig. 1 The Netherlands with the shellfish productions areas.

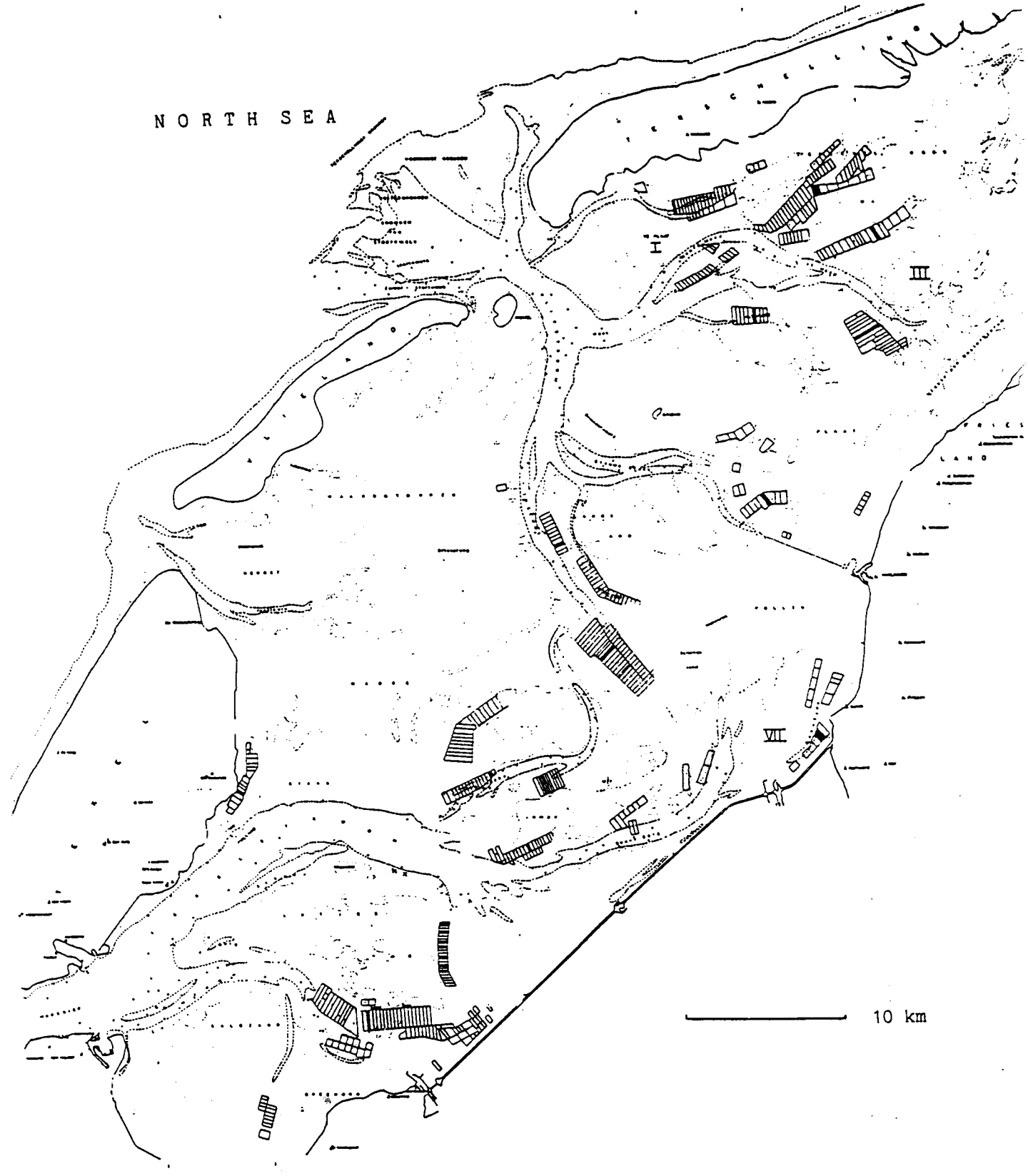


Fig. 2 Western Wadden Sea with the mussel culture plots.

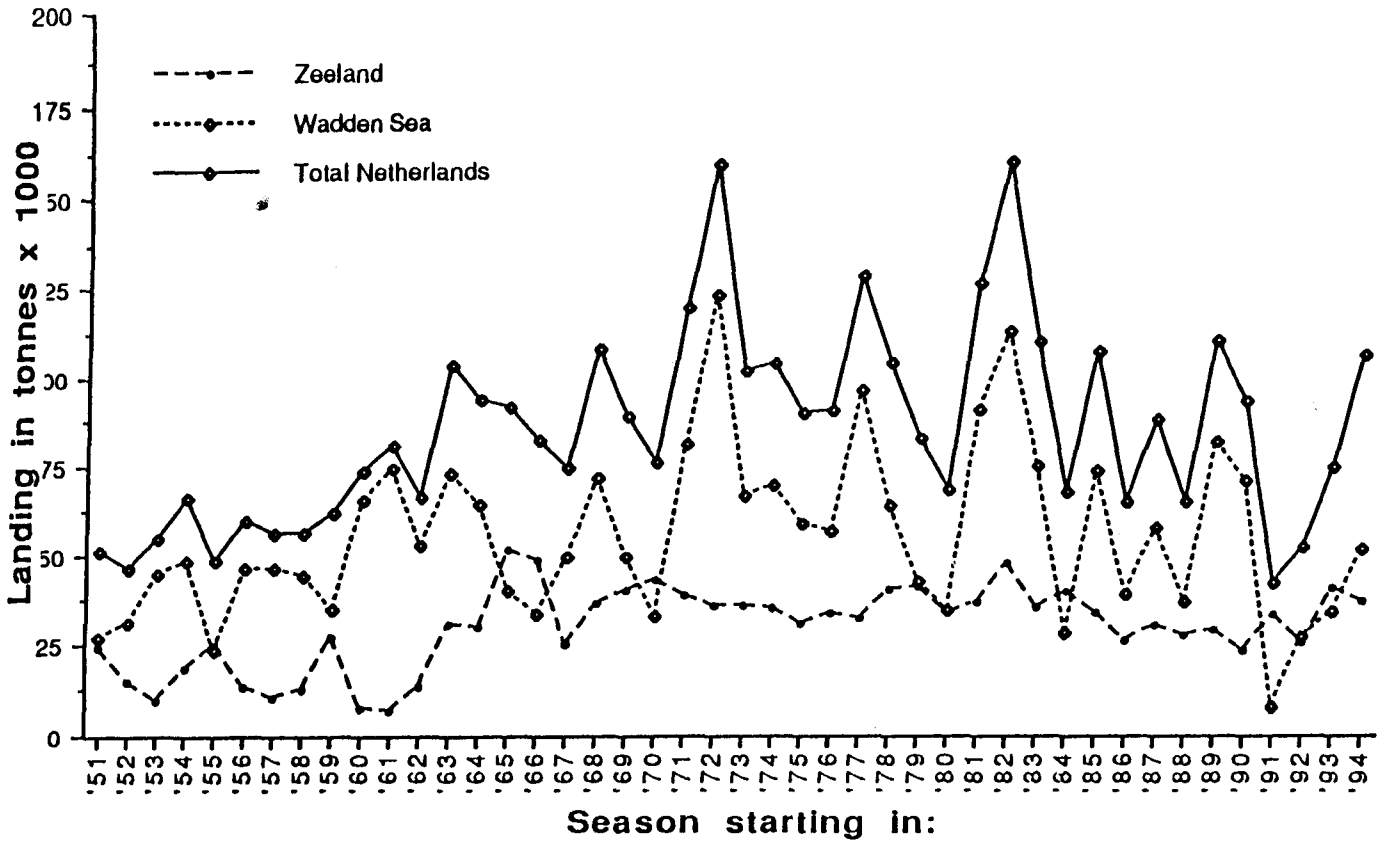


Fig. 3 Mussel landings in the two Dutch production areas, 1951 - present.

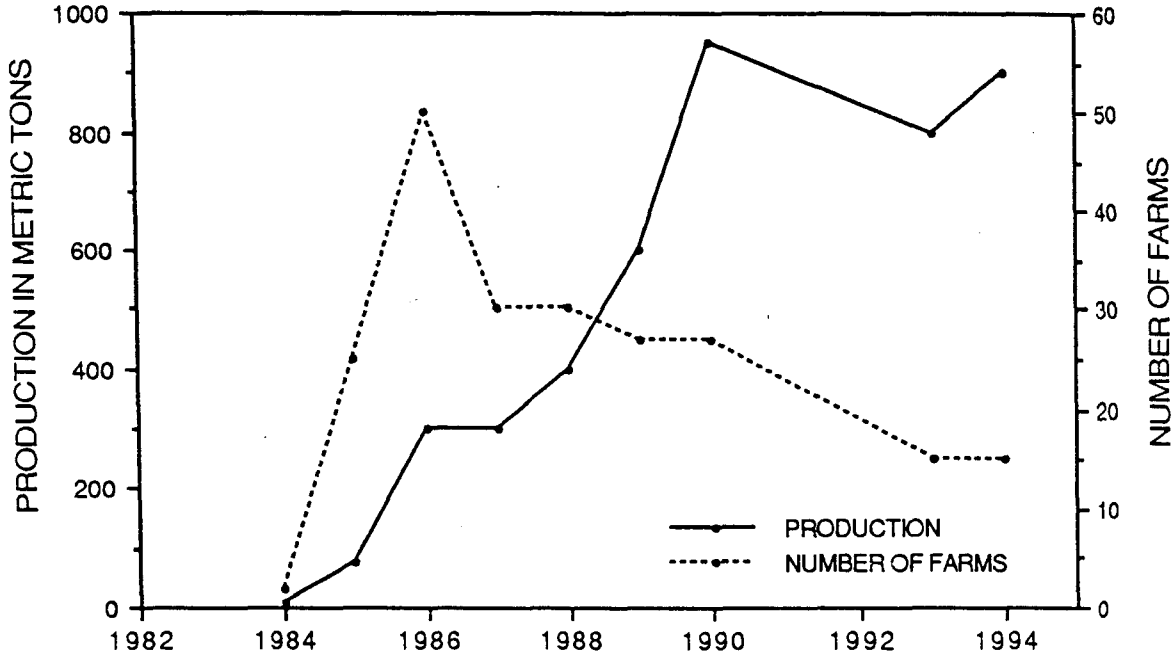
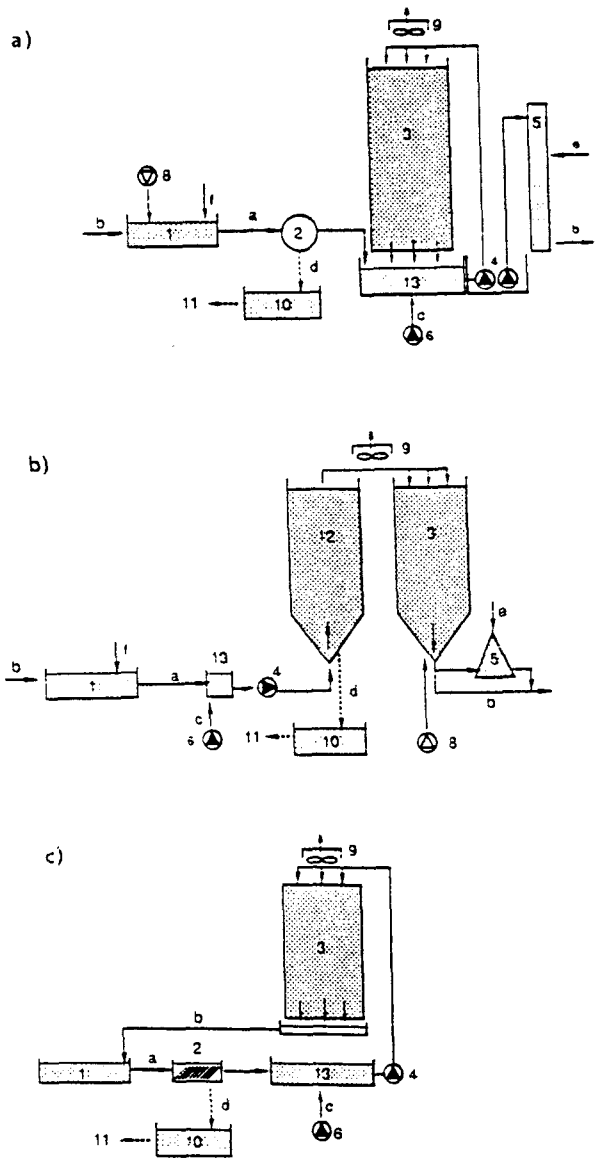


Fig. 4 Development of the number of farms and production of the African catfish in the Netherlands

Fig. 5 Design of the two most important types of recirculation systems for culture of eels (a and b) and of African catfish (c).



Legend:

1	Rearing tank	a	Outflow of rearing tank
2	Triangle filter / drum filter / lamellae separator	b	Inflow of rearing tank
3	Trickling filter	c	Water suppletion
4	Pump	d	Siudge
5	Oxygen reactor	e	Oxygen
6	Deep-well pump	f	Oxygen for emergencies
7	UV lamps		
8	Air blower (for aeration)		
9	Fan		
10	Settling tank		
11	Discharge into sewer or surface water		
12	Upflow filter		
13	Pump sink		