Productschap Vis

Plaice and sole - an overview of activities and measures in the flatfish sector (April 2008)

Contents

0. Current situation of plaice and sole

In October 2007, ICES (International Council for the Exploration of the Sea) published an overview of the status of the fish stocks. On the basis of this situation, ICES' advisory committee ACFM issued advice to the European Commission (EC) on the catch amounts for 2008. In December, the Fisheries Ministers have taken a decision on the Total Allowable Catches (TACs) in the European Council and on the number of days fishermen are allowed to go to sea.

In this paper the Dutch Fish Product Board has prepared an overview of the measures to safeguard responsible fishing for flatfish that have been taken by virtue of regulations and by the fishermen themselves.
After a brief overview of the current situation, this document presents a brief representation of the species of flatfish, plaice and sole that are most important to the Dutch sector, fishery for both species, and their importance to the Dutch fish trade and fish processing. Subsequently, we deal with control measures imposed by Brussels and the measures taken by the flatfish fishermen in the Netherlands.

This is an in-depth memo and the use of jargon cannot be avoided. Therefore we have added a number of Appendices that clarify the various terms.

0.1 Situation of sole and plaice stocks in the North Sea

ICES estimates the current stocks of adult (Dover) sole (this is the spawning stock) at approximately 23,600 tonnes. The fishing effort or fishing mortality (F) of sole doubled during the 1960s and subsequently fluctuated at around 0.5 per year. During this period, the spawning stock gradually reduced. During the 1990s the spawning stock increased temporarily, because large numbers of juvenile sole were born during 1987 and 1991 in particular. As the result of such a large growth, catches were realised of more than 30,000 tonnes per year. Such a large growth of sole has not occurred during the last few years. According to ICES, the sole stock suffers from reduced reproductive capacity, as there are insufficient adult soles to ensure sufficient offspring. According to ICES, the fishing mortality has now dropped to F0.38, which means that the stock is harvested sustainably.

The current stocks of adult plaice remained stable in relation to last year, and are estimated at approximately 193,000 tonnes. The fishing effort on plaice increased more gradually, and the fishing mortality (F) hovers around 0.6 per year. Here too, we notice that the decrease in the spawning stock was interrupted by a period of above-average growth of juvenile plaice during the 1980s. Due to this large amount of juvenile plaice and the better body growth during that period, the spawning stock increased again towards the end of the 1980s. As the growth of plaice fell again after the 1980s, the fishing industry was able to realise reduced catches. According to ICES, the reproductive capacity of plaice is at risk, as there are insufficient adult plaice to ensure enough offspring. However, according to ICES the fishing mortality is now at F0.55, which means that the stock is harvested sustainably.

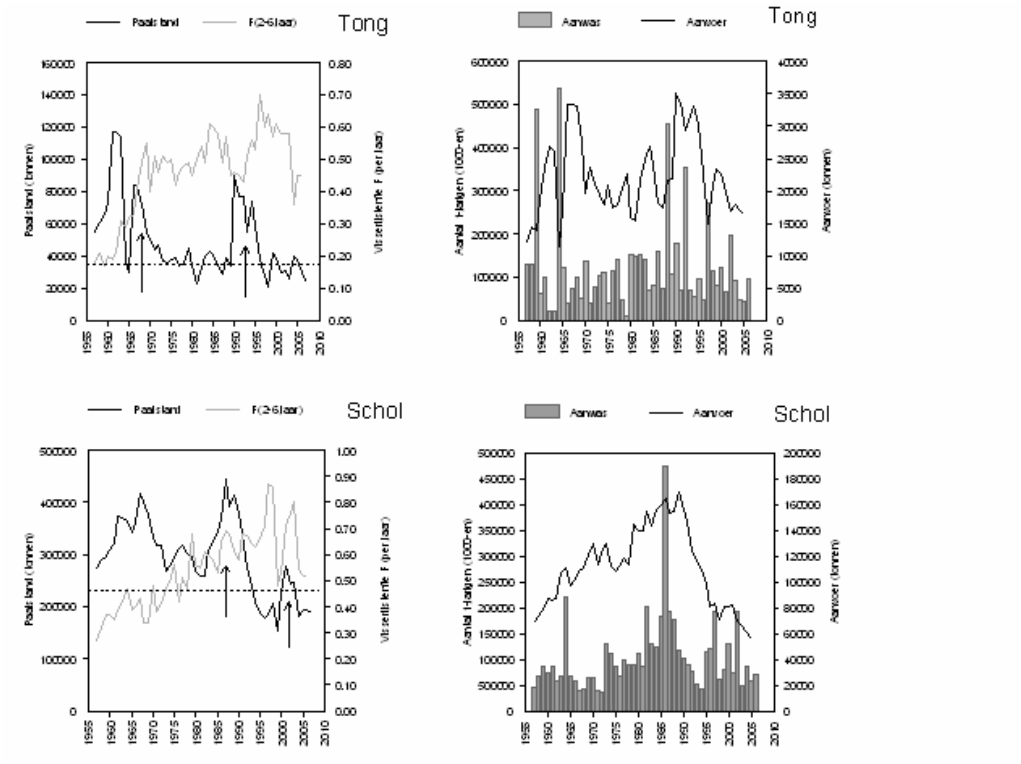


Figure 0.1: Developments in the fish stocks and fishery for sole (top) and plaice (below). Left the spawning stock (black line) with the precautionary level for that spawning stock (dotted line) and the fishing mortality F (grey line). Right the young growth as the number 1-year old fish or recruits (bars) and the registered landings (black line). The vertical arrows indicate when a higher growth provides a greater spawning stock.
Tong=sole, Schol = plaice, Paaistand = spawning stocks, Aanwas = growth, Aanvoer (tonnen) = landings (tonnes), Aantal 1-jarigen = number of 1-year olds, Visserijsterfte F (per jaar) = fishing mortality F (per year)

0.2 ACFM catch advice

As the spawning stock of sole is below the precautionary level of risk-averse fisheries management, ACFM advises to limit the catch to 13,900 tonnes in 2008. In 2006, fishermen were allowed to catch 17,670 tonnes of sole. With this catch advice, ACFM anticipates the sole stocks to be above the precautionary level of 35,000 tonnes by the end of 2007.

In anticipation of a long-term management plan for plaice, ACFM recommends a catch amount based on the principles of risk-averse fisheries management. For 2008, ACFM recommends a catch of 26,000 tonnes. ACFM anticipates that this will enlarge the spawning stocks, which are currently below the precautionary level, to the precautionary level of 230,000 tonnes within one year.

0.3 Decision Council of Fisheries Ministers, December 2007

On 19 December 2007, the Fisheries Ministers of the European Council have decided upon the catch possibilities (TACs) for 2008. For plaice and sole, the most important species for the Dutch flat fish fishermen, the TACs were reduced again. The TACs for North Sea plaice and sole have been set in accordance with the harvest rules stipulated in the long term management plan for North Sea plaice and sole, which agreed by the Fisheries Council in April 2007. The sole TAC has been reduced with 15% to 12,800 tonnes (2007: 14,970 tonnes). The plaice TAC has been reduced with 2.5% to 49,000 tonnes (2007: 50,300 tonnes); a historical low. For smaller, but not less important, flat fish species, like turbot, brill and lemon sole, the TAC was kept at the same level as in 2007. The number of days at sea, the days a fishermen are allowed to go to sea, has been reduced with 10% for sole and plaice fishermen. This means effectively a day per month less to go to sea.

The ministers also extended the permission to around 8 vessels (5% of the beam-trawl fleet) to start fishing with the pulse trawl. The pulse trawl uses less gas oil than the beam-trawl, has considerably fewer by-catches of seabed animals and the fish that is caught, is of improved quality.

0.4 Response from the Dutch demersal industry

The December Council has been very important to the demersal industry. The long term management plan for plaice and sole offers a certain amount of clarity and peace in the flat fish industry. Fishermen can now – following the ACFM advice - make a prediction of their catch possibilities and the number of days at sea they get before the final decision in the Fisheries Council. This is an improvement compared to the uncertainty of the decision making process up to now whereby the TACs for the following year only became clear a couple of days before Christmas.

The industry was, however, disappointed that ICES did not give its advice on the basis of the European Union's long term management plan, but in accordance with the traditional system. In that system, the TAC advice is the maximum catch allowed to bring the stock above the precautionary level within one year. ACFM decided to stick to the traditional system because the management plan had not yet been evaluated internally. The Fisheries Council did, however, set the TACs in accordance with the management plan.

The industry was pleased with the provision in the days-at-sea regulation that for the flatfish fleet additional days can be granted if the effort allocation is insufficient to fish the quota. The Dutch fleet operates within an system of Individual Transferable Quotas (ITQs) and over the years has put significant investments in these quota. Economically it would be perverse if the quota could not be fully exploited. This is even more important since the flatfish fleet was placed under the days-at-sea regime for cod recovery, while the by-catch of cod is less than 5% - the threshold used for determining whether or not a fleet segment should be part of the cod recovery plan.

The Dutch fishing industry is making a transition towards an economically sound and responsible fish chain. Therefore the fishing industry has prepared a plan for the future, the multi-annual responsible fishing plan. The cutter sector also brings this into effect. The long term management plan for sole and plaice now agreed upon, aims for a reduction of the fishing mortality.

The flatfish industry agrees that a reduction of the fishing pressure is necessary for a responsible fisheries. To facilitate the transition towards a more sustainable cutter sector, it is a precondition that the size of the fleet is balanced with the catch possibilities. Early 2008, a decommissioning scheme was started. A further 23 beam-trawlers have now been decommissioned; the fleet of traditional large beamers has now been reduced to 81.

1. Description of the species

1.1 Pleuronectiformes

Plaice and (Dover) sole are both *Pleuronectiformes*. Plaice (figure 1) belongs to the *Pleuronectidae* (plaice family); a large flatfish family that encompasses many well-known species, such as halibut, flounder, dab and lemon sole. Sole (figure 2) belongs to the *Solidae* (sole family), which also includes French sole and the little sole.

Figure 1: plaice

Figure 2: Dover sole

1.2 Description

Plaice is a diamond-shaped flatfish, easily recognised by its bright orange-red dots on the top. On its head, the fish has 4-7 bony lumps, the underside is white. Plaice can grow to a maximum of 90cm.

Sole is an elongated, oval fish with a round head. The right side, the 'top', is brown with marks and dots, the underside is white. Sole grows to a maximum of 70cm.

1.3 Distribution area

Plaice occurs in the northeast Atlantic Ocean, from the south of Greenland and Norway to Morocco. Plaice also occurs in the Mediterranean and the Baltic Sea. In the North Sea, plaice is generally widespread.

The distribution area of sole ranges from the northwest coast of Africa and the Mediterranean in the south to the Irish Sea, southern North Sea, Skagerrak and Kattegat in the North.

The catch success of the fishermen (figure 3) allows you to deduce where the fish are most common. The catch success is usually represented as the number of kilos a fisherman catches per day.

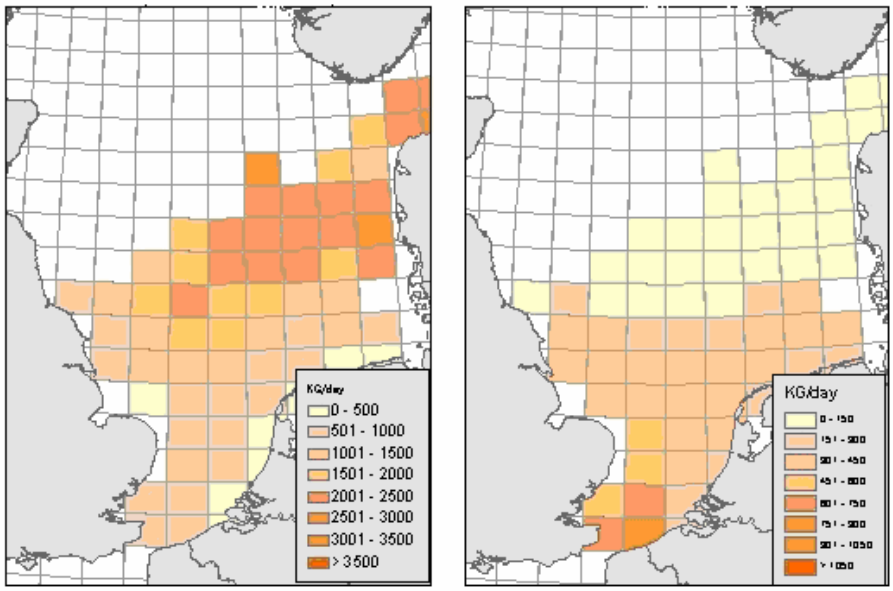


Figure 3: Catch success for plaice (left) and sole (right) in kilos per day for 2005

In contrast to plaice, adult sole only occur in the southern North Sea. The border is formed by colder and warmer seabed water in summer. North of the 56 degrees northern parallel, the water remains cold at 7 degrees Celsius. In the south, the water is warmer at approximately 17 degrees Celsius.

Due to climate change the water in the North Sea is becoming warmer. The fishermen notice this, because the distribution areas of the species are shifting. Warm-water fish swim into the North Sea from the south, whilst the animals that prefer cold water are moving further northwards. Due to the temperature changes, but also due to other causes such as the availability of food, the distribution areas of plaice and sole may change.

The changes in the distribution area of plaice since 1990 are demonstrated aptly by figure 4 – the juvenile plaice that used to grow up in the Wadden Sea and the coastal areas move to the North Sea much earlier.

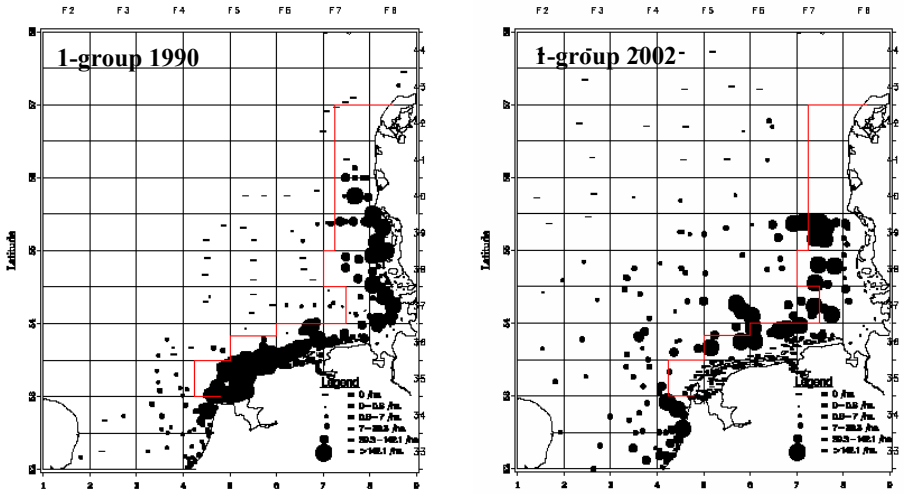


Figure 4: distribution of juvenile plaice in 1990 (left) and 2002 (right)

1.4 Food

During the day, sole and plaice dig themselves into the seabed and at night they start looking for food. Sole mainly eat worms, whilst plaice eat all types of seabed animals: lugs, bivalve shellfish and sometimes also fish that swim just above the seabed. That is why plaice have strong teeth in the pharynx.

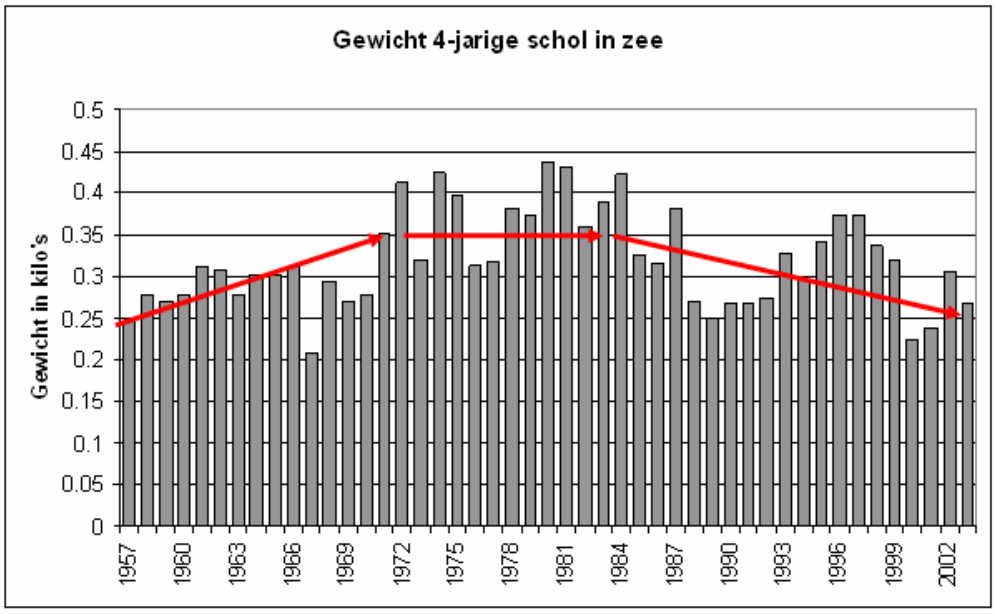


Figure 5: development in the weight of adult plaice since the 1950s

Gewicht 4-jarige school in zee = weight of 4-year old plaice in the sea, Gewicht in kilo's = weight in kilos

There are increasing scientific indications that the reduced eutrophication has consequences for the development of the plaice stocks. The water that flows from rivers to the sea is becoming cleaner, for example because of the prohibition on phosphates in detergents and the fertilizer policy for agriculture. However, this 'dirty' water used to bring nutrients (food) into the system on which plaice thrived. According to the scientists, this has a direct link with the reduction in the development rate of plaice (figure 5). So cleaner water also has some disadvantages.

1.5 Reproduction

On average, male plaice are 4 years old when they are sexually mature, whilst the females are 5 years on average. They mate in winter – between January and March. The main spawning grounds for plaice are off the Belgian-Dutch coast, in the German Bight, and in parts of the central North Sea. They spawn at temperatures of 6 degrees Celsius at a depth of 20-40 metres. The females lay half a million eggs.

On average, female soles are sexually mature at the age of 4. Soles spawn in shallow water (0-40 metres). The spawning time is determined by the water temperature. In the North Sea, they spawn during the March-May period. The main spawning grounds in the North Sea are the German Bight, the area north of Texel, the Belgian coast, the Thames and the Norfolk Banks.

1.6 Metamorphosis

During their lives, plaice and sole metamorphosise (figure 6). The eggs float in the water column, where they enter the world as roundfish, swimming upright. After some time, the young fish acquire a slightly sideways flattened form and start to incline towards one side; they swim at an angle. The left eye shifts to the other side of the body, and the skull bones also undergo a complicated change, but the beak is almost unchanged.

When the metamorphosis has been completed, the juvenile fish swim horizontally and they go down to the seabed. The side that rests on the seabed turns white and the other becomes darker, depending on the colour pattern of the seabed.

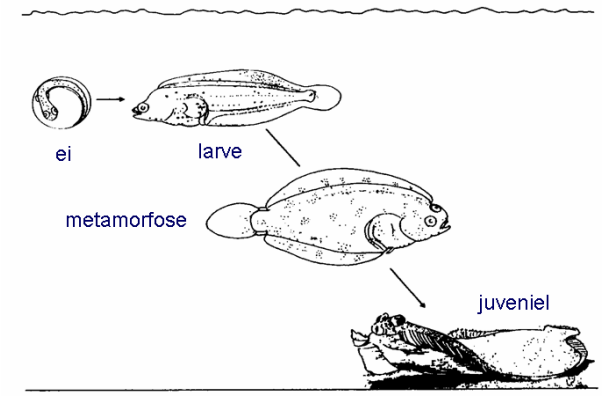


Figure 6: development of plaice, by R.N. Gibson
Ei = eggs, Larve = larvae, Metamorphose = metamorphosis, Juvenile = juvenile

The small flatfish look for areas to grow into large fish. These nurseries offer food and favourable biotic and abiotic circumstances, i.e. with the right soil condition and temperature and with few predators or the option of escaping predators.

The nurseries for sole are in the Belgian and Dutch coastal areas and in the German Bight. In winter, when the water temperature falls, the juvenile soles leave the nurseries and move to deeper and warmer water. The following spring they return to the nurseries to remain there for another year or two.

Plaice mature in the shallow coastal waters of the Wadden Sea in the North of Holland and of Zeeland in the South. After three years, when the plaice has reached a length of 20 centimetres, they leave the nursery to spend the rest of their lives in the North Sea. In harsh winters, plaice too move to places where the seawater remains warm. This migration is less distinct than the warm-water migration of sole, but plaice too occurs in the deeper parts of the southern North Sea.

Figure 4 demonstrates clearly that juvenile plaice leave the nurseries earlier and earlier. Scientists cite the reduced food production in the North Sea and/or the changes in water temperature as the main explanations.

2. Description of plaice and sole fishery

In 2008, the Dutch demersal fleet consists of 320 Dutch vessels, of which 90 large beam-trawlers and 14 euro cutters (smaller than 24 metres) are almost completely dependent upon plaice and sole. The other cutters are also focused on other target species, such as Norwegian lobster, turbot, brill, red mullet, gurnard, squid and shrimps. For these types of fishery, the Dutch fleet has 12 full-time twin-rig cutters, 5 full-time seiners, 4 fulltime static-nets fishermen and 60 cutters who exclusively fish for shrimps. The other eurocutters adjust seasonally to beam-trawling, twin-rigging and shrimping.

2.1 Fishing methods

In beam-trawl fishery, there is a net on both the port side and the starboard side of the cutter that hang in the water from booms (figure 7). So they fish with two nets at the same time. During fishing, the two booms are horizontally above the water.

Each fishing net is attached to the boom with a fishing line and is held open by a beam. At the bottom of the net, there are chains that drag over the seabed. These chains are also known as tickler chains. Flatfish dig themselves into the sand, and as the net drags over the seabed, the flatfish is startled, comes up, and swims into the net.

The mesh of a net are larger at the beginning than at the end, which means the small (undersized) fish can escape, and the ‘minimum-sized’ fish remains in the net. Rules have been established at European level in relation to the size of the mesh and the minimum landing size of the flatfish.

Figure 7: cutter with beam-trawl nets

At the end of a haul, the nets are pulled up and the cod end of the net is pulled on board. The fish is gathered in a hold. Onboard the vessel, the fish is sorted by size, gutted (having its innards removed). Then the fish is laid on ice in plastic crates and stored in a cooled fish hold.

Sole is currently still best fished with the beam-trawl. In the summer, static nets (free-standing nets that are at sea on poles or attached to buoys) are also used to fish for sole in the North Sea coastal area.

Besides the beam-trawl, other nets are also used to fish for plaice. For example the twin-rig and the Danish seine or fly-shooting method. In twin-rig fishing, two seabed trawl nets are linked together. They have hatch boards at the ends that keep the nets open. In the middle, the nets are coupled by a clump block that serves as a weight at the same time.

The fly-shooting method is comparable to the so-called anchor seines. The only difference is that fly-shooters do not use an anchor but use their vessel as the anchor. The anchor seine is gear that consists of one funnel-shaped net and two long heavy ropes. It is used to catch flatfish. The Danish fishermen call this method 'snurrevaad'. The principle is that the fisherman sets out an anchor to which one of the ropes is attached. Then the vessel sails in a circle and sets out the net and the other rope. When back at the anchor, the seiner takes in the ropes. The flatfish is driven into the net by the ropes rolling over the seabed. As the vessel does not need to drag the net through the water, this method is suitable for small cutters with a low engine power. However, this method only works well in daylight and when the water is clear, because the flatfish need to see the seine ropes coming. Therefore, seining only takes place during the May to October period.

2.2 Fishing grounds

Dutch flatfish fishermen are mainly active in the southern and south-eastern parts of the North Sea. In the entire North Sea of 170,000 square nautical miles, the beam-trawl activity is limited to an area of approximately 50,000 nautical miles. The larger part of fishery (80 percent), takes place in 30 percent of this fished area.

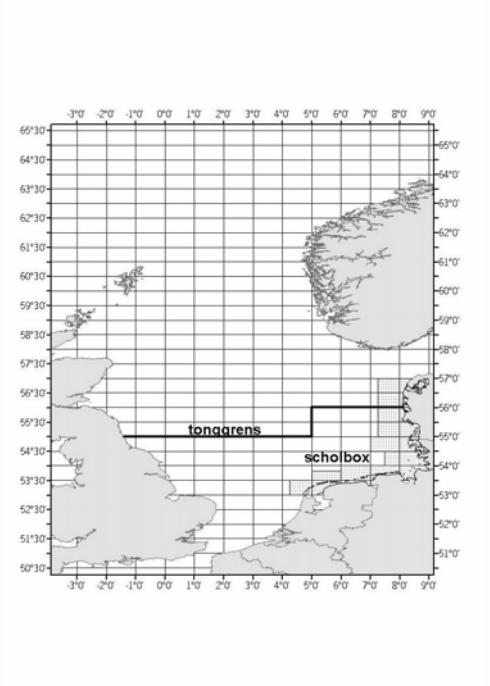


Figure 8: sole border

Tonggrens = sole border, Scholbox = plaice box

Above the 56 degrees northern parallel, beam-trawl fishermen may only fish with nets with mesh sizes of 120mm. In the area between 55 and 56 degrees northern parallel and west of the 5 degrees eastern longitude, the beam-trawl may fish with 100mm. Below this line, it is permitted to fish with a mesh size

of 80mm. This smaller size is permitted, because this is predominantly the living environment of sole. In contrast to plaice, sole are sleeker and more flexible which means they find it easier to slip through the mesh of a net. To catch sole, you need finer mesh than to catch plaice. The line that runs over 55 and 56 degrees northern parallel with a bend at 5 degrees eastern longitude is called the sole border (figure 8).

3. The production process – from catch to consumption

More than half of all fish that is brought to the eleven Dutch sea fish auctions consists of plaice. In terms of income, sole is more important, but in terms of quantity plaice has the upper hand. In auctions such as Urk, Harlingen, Den Helder, IJmuiden, Stellendam and Vlissingen considerable amounts of flatfish are brought in every week.

Onboard the ultramodern cutters, the plaice and sole are gutted immediately. After they have been gutted, the fish are rinsed in specially designed rinsing drums, which remove innards and any dirt that is still in the fish. Sometimes, the fish is landed 'whole', i.e. not gutted. After rinsing, the fish disappears through a big hole into crates that already contained a layer of crushed ice. The fish are mixed in the crates with more crushed ice. The fish remains in the crate in the cooled fish hold until the vessel is unloaded. Fishing journeys are short, usually four to five days, so that a fresh product is delivered to the auctions.

Figure 9: the auction

At the fish auctions (figure 9), traders and processors purchase flatfish for their customers or their processing companies, respectively. In the Netherlands, there is a small market for fresh plaice. Sole is a type of fish that features on the menus of many restaurants.

Fish that is destined for frozen produce is filleted, breaded, frozen and stored by the processor. Many convenience products are also increasingly made from plaice. The major processing companies are in Urk, IJmuiden, Spakenburg and Lemmer. Over the years, they have acquired an enormous expertise and within Europe they are at the forefront in terms of plaice production and distribution.

Figure 10: fish in the shop

In relation to other European countries, fish consumption is relatively low in the Netherlands. Although fish consumption has increased considerably over the last few years, flatfish is mostly exported. The market for plaice is largely an export market, as 80 percent of plaice is exported. The plaice caught and processed by the Dutch is in demand in Italy, Germany and Great Britain. The Netherlands is one of the largest exporters of flatfish in Europe.

For the Dutch fish-processing plaice industry, exports to Italy have a major economic importance. The Dutch share of the Italian market for plaice products amounts to 90 percent. You can find frozen plaice fillets from the Netherlands in many supermarkets in Italy. Germany is the second most important customer for this sector, and in Germany the 'Maischolle' is a real concept.

4. Management of the species

Like agricultural policy, managing the fish stocks in the North Sea is a European affair. Maintaining and safeguarding fish stocks is controlled carefully by 'Brussels'. The European Union has a number of measures to this effect. For example, it uses TACs (Total Allowable Catch, the maximum amount that may be fished), quota, technical measures (how you can fish) and measures that determine how many vessels there are and how often they may fish.

4.1 TAC and quota

In order to determine how much may be fished, the European Union has prepared rules and objectives. Currently, policy is focused on preventing the risk of the fish stocks collapsing. Early 2006, the European Commission made proposals to move to a policy that is focused on a maximum sustainable catch or the MSY ('maximum sustainable yield'). This allows it to switch from a risk-averse to an objective-led fishing policy for plaice and sole.

4.1.1 Risk-averse fisheries policy

The European Commission wishes to avoid overfishing of the fish stocks, and therefore it strives towards a sufficiently large amount of adult fish (= spawning stock) in the sea. A minimum has been established for every fish species. Below this limit level, the recruitment (= juvenile fish growing into adult fish or growth), and consequently the stocks are endangered. In such a case there are not enough adult animals to produce enough little ones. To prevent risks and to take account of all types of uncertainties, the EU has built in a precautionary margin on this minimum level. The objective is to maintain the spawning stock above this so-called precautionary level.

Depending on the number of fish in the sea, you can fish more or less. The ratio of the amount of fish that dies as a result of fishing in relation to the total amount of fish in the sea during the year cannot become too large. Scientists can determine how much you can fish, or how large the TAC may be on the basis of this fishing mortality (abbreviated by scientists with the letter "F" of 'fishing mortality'). Sometimes, they use fishing effort instead of fishing mortality. The scientists also advise the European Commission on fishing opportunities. On the basis of this advice, the Council of Fisheries Ministers establishes the catch option for the following year. They do this in December of every year, and they use a type of inverted traffic-light system (figure 11).

GREEN = The spawning stock is above the precautionary level and is healthy. The TAC is established in such a manner that the spawning stock remains in the green.
AMBER = The stocks are below the precautionary level, but above the lower limit at which reproduction is endangered. The TAC is set at such a level that the stocks return to the green in the short term.
RED = The stock is in the danger zone, because reproduction is endangered, and a recovery plan is needed. The TAC is set at such a level that the stocks at least grow back to the amber level. Furthermore, additional measures are taken to give the stocks an impulse in the right direction.

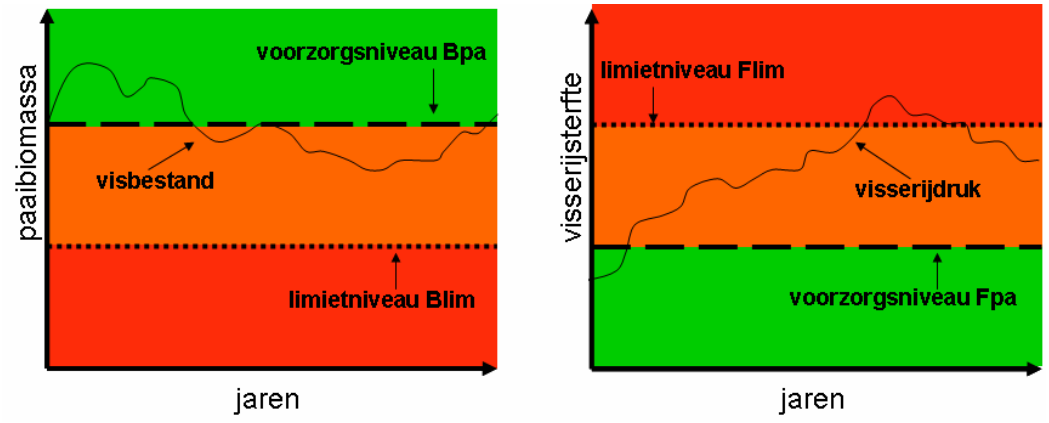


Figure 11: Schematic representation of the precautionary and limit levels for the spawning biomass (left) and fishing mortality (right)
Paaibiomassa = spawning biomass, Voorzorgsniveau Bpa = precautionary level Bpa, Visbestand = fish stocks, Limietniveau Blim = limit level Blim, Jaren = Years, Visserijsterfte= Fishing mortality, Limietniveau Flim = Limit level Flim, Visserijdruk = Fishing effort, Voorzorgsniveau = precautionary level

For the fishing mortality there are also limit levels and precautionary levels. The traffic light for fishing mortality is the inverse of that of the spawning biomass. The higher the fishing mortality, the more chance of overfishing (red). If fishing mortality is low, the fish stocks are fished sustainably (green).

The disadvantage of this traffic-light system is that many other factors besides fishing affect the size of the spawning stock. For example, if there is not enough food, or the temperature of the water is not good for small fish to grow, this has a direct effect on the stocks and therefore on fishery. This means that even if the TAC is set in such a way that the stocks could grow towards the green levels or should remain within the green levels, at the end of the year this may still not have been achieved. For example, this has been the case for plaice for many years.

4.1.2 Objective-led fisheries policy for plaice and sole
In the spring of 2006, the European Commission (EC) proposed to change its policy. Instead of striving towards a precautionary level of the spawning stock, the EC proposed to work towards a specific goal. This goal is a lower fishing mortality, in other words, less fishing effort.

In the April 2007 Council, the ministers of Fisheries have decided upon a long term management plan for North Sea plaice and sole. The plan has come into force on 1 January 2008 and aims for an increase in the plaice stock in such a way that sufficient catches can be made and a profitable fishery is possible.

The management plan consists of two phases. The first is a risk-averse fisheries policy, the second a objective-led fisheries policy.

In the first phase sole and plaice have to be brought above the safe biological minimum. This means that both the stock size and the fishing mortality should be in the green zone (figure 11). This should be reached by lowering the fishing mortality (F) by 10% every year. This reduction is translated in a corresponding TAC. The TACs for plaice and sole are, however, not allowed to differ more than 15% to the TAC of the previous year. At the same time the number of days at sea is adapted to these TACs in such a way fishermen are still able to catch the full TAC, but no more than that. The number of days at sea is limited to the awarded number in 2006 at maximum.

A reduction of the fishing mortality by 10% does not always have to result in a lower TAC. The fishing mortality is that part of the adult stock that dies through fisheries. When the stock increases, the TAC can remain constant of increase, while fishing mortality decreases. For example, fishing mortality of F=0.52 at a stock size of plaice of 100,000 tonnes results in a TAC of 52,000 tonnes. A fishing mortality of F=0.47 at a stock size of plaice of 150,000 tonnes results in a TAC of 50,500 tonnes.

In the second phase of the management plan a specific goal for the fishing mortality is set on the basis of a biological and socio-economical impact assessment. No realisation of this second phase was made by the ministers during the Council in December 2006. The North Sea Regional Advisory Council will have an important role in filling in the details of this phase. As will be the Dutch demersal fishers because plaice and sole are very important to them.

The ministers agreed that the scientists of ICES will give a different type of advice in the future. Their advice will be in line with the 10% reduction of F and no longer will it be an advice based on an increase of the stock to the green zone within one year.

Although the management plan provides a certain amount of clarity and peace in the flat fish industry, it will have major consequences. It will get a very rough time in getting plaice and sole above the safe biological minimum. In the upcoming years, the TACs will decrease and a structural reduction of the fishing pressure on young fish is required. Already it is possible to say a number of fishermen will have to stop fishing due to the lower fishing possibilities. A new decommissioning scheme will therefore be inevitable and will have consequences for the whole fishing chain and specific local regions.

4.1.3 TAC

Every year, scientific advice is used to consider how much may be fished in the coming year, i.e. how high the TAC will be. This biological advice from the International Council for the Exploration of the Sea (ICES) is produced on the instructions of the European Commission. The questions from the EC determine the advice from the scientists. The last few years the advice was always focused on risk-averse management, which means that the scientists provide advice that should lead to the spawning stock remaining above the precautionary level, i.e. for it to remain in the green area. If the stocks are below this level, risk-averse management means a catch advice is given whereby the stocks will be above the precautionary level within one year.

After ICES has issued a biological advice, the EC will obtain more advice, for example from scientists who deal with socio-economic aspects, such as STECF, and from other stakeholders. This also includes the fishermen of course. On the basis of all this advice, the EC prepares a proposal for the TACs for the Council of Fisheries Ministers. Eventually, the Council decides on the level of the TAC. Forming the TAC is therefore partially a scientific issue, but ultimately it is influenced by politics.

4.1.4 Quotas

After the total allowable catch (TAC) has been established, this TAC is divided over the relevant European countries by means of a complicated formula. The TAC can be compared with a pie that is cut into slices for each of the Member States. The slices of pie are called the quota and they are based on historic rights (figures 12, 13 and 14). The Member States themselves may then decide how they divide the national quota amongst their fishermen. In the Netherlands, the national flatfish quotas are subdivided into so-called individual transferable quotas or ITQs. These can be compared with shares.

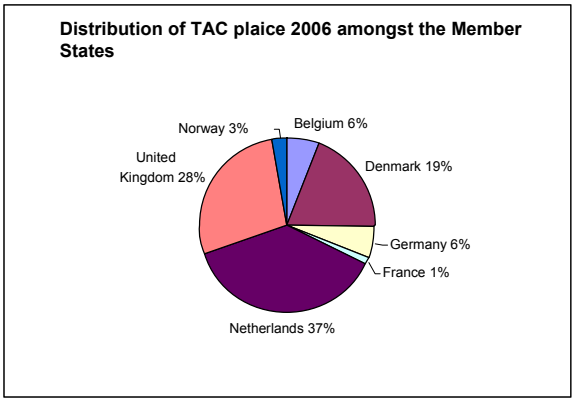


Figure 12: distribution of TAC for plaice amongst the Member States

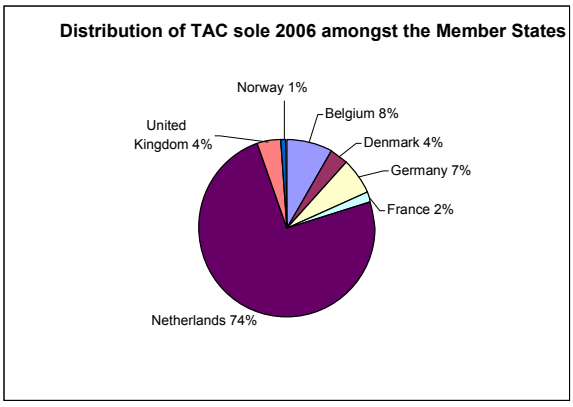


Figure 13: distribution of TAC for sole amongst the Member States

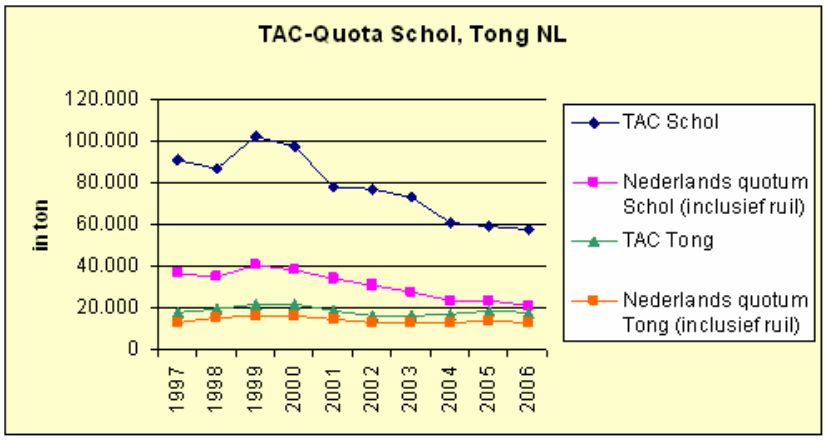


Figure 14: Trend of the TAC and the quota for plaice and sole
TAC-Quota Schol, Tong NL – TAC-Quotas Plaice NL, In ton = in tonnes, TAC school = TAC plaice, Nederlands quotum Schol (inclusief ruil) = Dutch quota for plaice (including exchange), TAC Tong – TAC sole, Nederlands quotum Tong (inclusief ruil) = Dutch quota for sole (including exchange)

4.1.4.1. Dutch quota management in the Biesheuvel (management) groups
In the Netherlands, the fishermen themselves are responsible for managing fish stocks in the Biesheuvel (management) groups. These groups of fishermen ensure that the national quotas for plaice and sole, but also for roundfish (cod and whiting) and pelagics (herring and mackerel), are not exceeded. This is a unique approach within Europe.

The quota management groups were formed in the 1990s following advice from the Biesheuvel Committee. This committee advised the then Minister for Agriculture, Nature and Food Quality Bukman on how to avoid exceeding the catch quota in future, for which the committee proposed closer co-operation between the fishermen themselves. At the time, the fishermen were extremely dependent upon their colleagues. If they exceeded their quota or landed fish illegally, the fishermen were confronted with an early closure of the fishery. In practice this meant that fishermen caught their quota as quickly as possible. In the 1980s this led to a veritable race for fish, which was exacerbated by fishermen buying larger and larger vessels. The fishermen were caught in a so-called 'prisoner's dilemma' – fearing early closure of fishing, they also started to land more fish or land fish illegally, because their colleagues were exceeding their quota. All of this pushed the price down, but in the long term it also affected the development of the fish stocks.

The members of the quota management groups, more than 90 percent of the fleet, committed themselves to a fish plan. Furthermore, they were also obliged to land all their fish via the auctions. If a fisherman exceeds his quota or breaches other rules, the management group imposes stiff fines. If the quota is exceeded by a group member, this is deducted from the quota of the other members, which ensures mutual checks and balances. Since the Biesheuvel system came into force in 1993, national

quotas are no longer exceeded and there is a properly operating monitoring and control system.
Landings are now spread over the entire year and in turn this leads to better prices.

4.1.5 The process of establishing TACs and quotas

August/September: Gather data
The national fisheries institutes gather data on the various fish stocks in the North Sea. In the Netherlands this is done by IMARES. These data are processed and collected in the international forum of fisheries biologists, ICES (International Council for Exploration of the Sea). ACFM is the name of the committee that forms part of ICES and that issues advice on the fishing opportunities.

↓

October: TAC advice ACFM
In October, ACFM issues advice on the maximum allowable catch for the next year, the TAC (Total Allowable Catch), on the basis of the biological data from the fisheries research institutes in the various countries. The advice is addressed to the European Commission.

↓

November: Deliberations European Commission
The STECF (Scientific Technical and Economic Committee on Fisheries) working group of the European Commission checks the ACFM advice, considers and weighs up the socio-economic feasibility and regional interests and advises the European Commission. In November, the European Commission issues its own proposal for the maximum catch, the TACs. This advice is addressed to the Council of Ministers.

↓

November/December: Possible negotiations with Norway
There are negotiations between the European Commission and Norway for fish stocks that are fished by Norway and European-Union countries. The outcomes of these negotiations are also incorporated in the proposal and are submitted for approval to the Fisheries Council.

↓

December: Establishing TAC and quota
At the December meeting of the Fisheries Council, where all Fisheries Ministers of the EU countries meet, the TACs are established.
The national quotas are a fixed percentage of the TAC. For the Netherlands, plaice and sole, whiting, mackerel and horse mackerel are the most important types of fish.

4.1.6 Problems with the TAC and quota system

The TAC and quota system is intended to keep the stocks at a healthy level, but it is not the be all and end all. For some species it works particularly well, for example for pelagic fish (fish that swim freely in the water column), such as herring and mackerel. They swim virtually by type in shoals. A TAC and quota system is particularly suitable for this, as you can fish in a targeted way. However, many of the North Sea fish are demersal fish, which means they swim mixed, on or near the seabed, which makes it much more difficult to manage the quota system. For example, it could occur that it is permitted to fish more of one stock, for example haddock, than of another stock that is caught by the same type of fishery, for example cod. Or the mesh of the net for the smallest size of an important type for fishermen, for example small sole, does not agree with the smallest size of another fish that is caught with the same fishery, for example plaice. Furthermore, other factors besides fishery influence the way in which stocks develop, such as water temperature, the amount of food in the sea or an increase in predators.

Plaice stocks are an excellent example. For a few years in a row, the TAC for plaice has been reduced substantially. Every time the fishermen are promised that the stocks will be healthy the following year (in the green zone), but every time the fishermen are disappointed. This confirms that it is extremely complicated for biologists to make predictions and that managing stocks is not simply a case of increasing or decreasing the fishing mortality.

4.2 Additional measures to the TAC and the quota

Fisheries can be regulated by establishing how much you can fish, i.e. the TACs. However, over the last few years it has become increasingly clear that simply determining the maximum allowable catch does not ensure healthy stocks of some types. Besides the TACs, the European Union does have some other options to reduce the fishing effort.

4.2.1 Number of vessels

In the 1970s, the European Commission and the Member States encouraged the construction of newer and better vessels with subsidies and favourable investment schemes. Very quickly the realisation set in that using ever bigger and more efficient vessels within the European Union placed too great a pressure on the communal fish stocks. Since the 1980s there have been restrictions on the capacity of the fishing fleet. A large-scale European programme is to bring the fishing fleet in balance with the fishing opportunity, often by taking vessels out of commission with subsidies. For every Member State, there is a maximum fleet capacity in terms of engine power and content. If a fisherman wishes to launch a new vessel, he must ensure that somewhere else a number of kilo Watts (engine power) and registered tonnes (content of the vessel) disappear. The capacity of the fleet may not increase. Figure 15 charts the development of the Dutch beam-trawler fleet since 1970. A fisherman requires a European fishing licence to be allowed to fish.

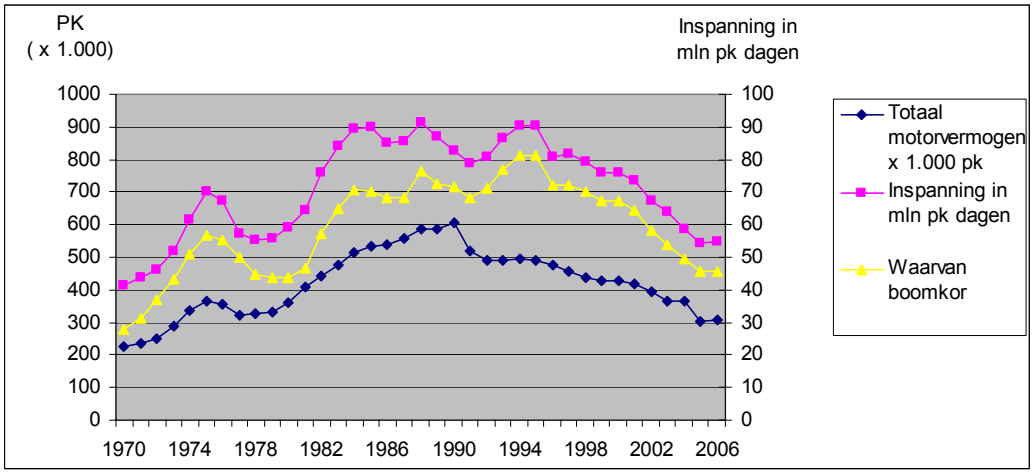


Figure 15: Historical development of the capacity and fishing effort of the Dutch demersal fleet (C. Taal, LEI 2007)
Totaal motorvermogen (1000 PK) = total engine capacity (1,000hp), Inspanning in mln pk dagen = effort in mln HP-days; waarvan bomkor = beam-trawl effort in mln HP-days

4.2.2 Number of days at sea
Since the end of the 1980s, the Netherlands has imposed some restrictions on the number of days fishermen are allowed to fish at sea. The Netherlands strove to reduce the fishing effort in this way. On the basis of a complicated formula, the fishermen were awarded sufficient, but no more, days to fish their own quota. This made the Dutch fleet unique in Europe. In 2001, this national system was abolished.

In 2001, the European Fisheries Council decided that limiting the physical size of the fleet was not enough to reduce the fishing effort further. For most fisheries in the North Sea there are a maximum number of days per year. These days at sea are set as additional measures to protect the TACs on cod in the North Sea, the so-called cod recovery plan. Each year, at the same time as setting the TACs, the Fisheries Ministers also establish the number of days at sea for all fleets that fish cod. The starting point is that the ministers strive to align the number of days at sea with the catch amounts. The days at sea scheme also applies to fleets that do not target cod, such as the beam-trawler fleet that catches less than 5 percent cod. Over the last few years, the number of days at sea has been adjusted downward every time.

In the framework of the flatfish management plan for plaice and sole in the North Sea, the days at sea are adjusted to the catch possibilities of plaice and sole. These TACs will be set according to a 10% annual reduction of the fishing mortality.

Practice demonstrates that a continued restriction upon the number of days at sea has a harmful effect. For example, the measures from the cod recovery plan contribute to a shift in flatfish fishery. In the framework of this plan, the flatfish fishermen are allocated a maximum number of days at sea. As this

is limited, the fishermen choose nearer fishing grounds rather than the further ones, and the juvenile flatfish is mainly in these nearer grounds. For a number of types of fishing gear, there is a rule that the fishermen obtain more fishing days if they fish with smaller mesh sizes instead of the other way around. The result is an increase in the by-catch of juvenile flatfish.

4.2.3 Technical measures

The technical measures prescribe the requirements the fishing gear must meet. An example of such a technical measure is a maximum beam length of 12 metres on the North Sea and of 4 metres in the coastal zone. The minimum size, the shape of the mesh and possible special escape panels for non-target species are also established. There are also requirements for the composition of the catch. For example, regulations require the catch to consist of 70 percent of the target species (figure 16).

For a large number of fish species, there are European level agreements on the minimum size of the fish that may be landed. For sole the minimum size is 24cm and for plaice it is 27cm. All flatfish that are smaller than these sizes may not be landed and must be thrown overboard.

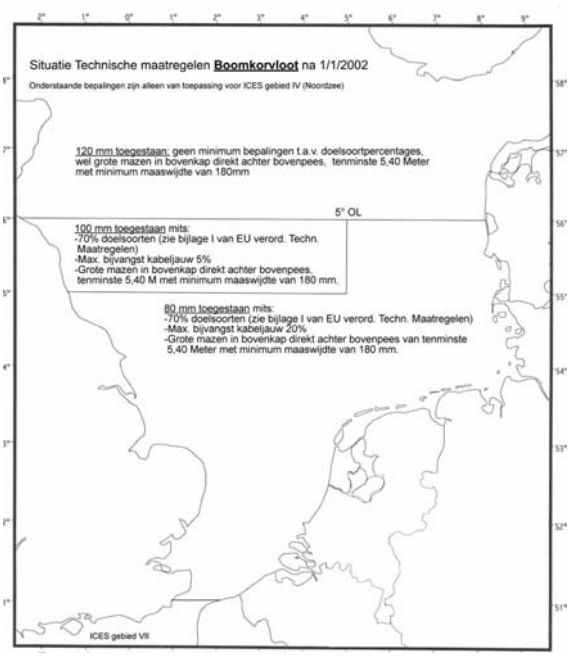


Figure 16: situation technical measures beam-trawler

Situatie technische maatregelen boomkorvloot na 1/1/2002 = situation of technical measures beam-trawl fleet post 1/1/2002,

Onderstaande bepalingen zijn alleen van toepassing voor ICES gebied IV (Noordzee) = these stipulations only apply to ICES area IV (North Sea), 120 mm toegestaan: geen minimum bepalingen t.a.v. doelsoortpercentages, wel grote mazen in de bovenkap direct achter bovenpees, tenminste 5,40 meter met minimum maaswijdte van 180mm = 120mm permitted: no minimum stipulations in respect of target type percentages, but requirement for large mesh in the top directly behind the headrope, at least 5.4m with minimum mesh size of 180mm, 100 mm toegestaan mits = 100mm permitted, provided

Met opmaak: Lettertype: 11 pt, Nederlands (standaard)

Met opmaak: Lettertype: 11 pt, Nederlands (standaard)

70% doelsoorten (zie Bijlage I van EU verord. Techn. Maatregelen) = 70 percent of target species (see Appendix I of EU Regulation Technical Measures), Max. bijvangst kabeljauw 5% = maximum by-catch cod 5 percent, grote mazen in de bovenkap direct achter bovenpees, tenminste 5,40 meter met minimum maaswijdte van 180mm=large mesh in the top directly behind the headrope, at least 5.4m with minimum mesh size of 180mm, 80 mm toegestaan mits = 80mm permitted, provided
70% doelsoorten (zie Bijlage I van EU verord. Techn. Maatregelen) = 70 percent of target species (see Appendix I of EU Regulation Technical Measures), Max. bijvangst kabeljauw 20% = maximum by-catch cod 20 percent, grote mazen in de bovenkap direct achter bovenpees, tenminste 5,40 meter met minimum maaswijdte van 180mm=large mesh in the top directly behind the headrope, at least 5.4m with minimum mesh size of 180mm, ICES gebied VII = ICES area VII

4.2.4 Plaice Box

In order to have good plaice stocks in the future, it is important that the juvenile growing plaice are protected properly. In 1989, following advice from scientists, the fishermen agreed to establish the so-called Plaice Box. The Plaice Box is an imaginary plane in the North Sea that stretches roughly from Texel to the northern point of Denmark (figure 17). In this area, fishery with beam-trawlers of more than 300hp (221kW) is forbidden. This measure is laid down in European regulations and forms part of the technical measures.

Evaluations of the Plaice Box demonstrate that the effects are not clearly visible. The predicted 25 percent increase in the spawning biomass of plaice has not been achieved. According to the scientists, the Plaice Box has had an effect on the recruitment of plaice, but much less than anticipated. Furthermore, this effect has decreased since the establishment of the Plaice Box, because there have been changes in the growth and spatial distribution of plaice. The juvenile plaice have moved away from the Plaice Box towards the fishing grounds of the adult animals, which means they are no longer protected and the fishermen catch more small plaice; consequently the discards increase.

Fishermen believe that the juvenile plaice have moved away, because there is no food left in the Plaice Box. According to the fishermen, turning over of the seabed with the tickler chains of the beam-trawler means that worms and other seabed animals that serve as food for plaice can grow well. If there is little or no turning, there is less food. This is enhanced by the fact that there are fewer nutrients (phosphate and nitrate) in the water, because of European reductions in agriculture and the removal of phosphates from detergents. Nutrients are the basic food for all animals in the North Sea.

A number of scientists support the hypothesis of the fishermen. At the same time, the scientists point out that a rising temperature can be the reason for juvenile plaice moving away. It is unclear what is going on. An evaluation of the Plaice Box with the currently available limited data cannot provide clarity.

The fishermen and social lobby groups argue for a practical study that will provide clarity on the causes of the disappointing effects of the Plaice Box. The North Sea Regional Advisory council (NSRAC) has developed a study set-up with a number of scientists. Although the European Commission and the European Parliament agree with NSRAC that there must be clarity on the question of why the Plaice Box does not do what it should do, there are no financial means to carry out the study.

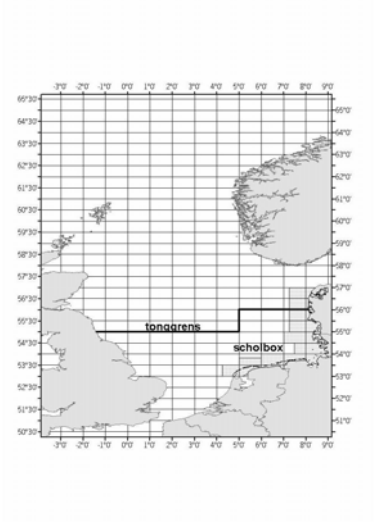


Figure 17: Plaice Box
Tonggrens = sole border, Scholbox = Plaice Box

5. Fishermen's own measures to improve the management of fish stocks
The manner in which fish stocks develop depends on a range of factors. Humans can only influence some of these, for example the fishing effort. However, natural factors cannot be controlled, and therefore managing flatfish stocks is a very complex issue. A telling example is that the extremely strong reduction in the fishing effort on plaice – by increasingly restricting the quota and the days at sea and the introduction of technical measures – did lead to stable levels of the plaice stock for many years, but not to an increase to the 'green zone' of the agreed precautionary level. Why this is, is not completely clear as yet, but more and more pieces of the jigsaw are starting to fit together.

Fishery biologists have discovered that the development rate of plaice has reduced strongly over the last years, and therefore there is an increased chance of a juvenile plaice ending up in the catch as an undersized fish. This may be connected with the water temperature or the amount of food in the sea - whatever the reason, juvenile plaice has a greater chance of ending up in the catch as an undersized fish.

Furthermore, biologists have also discovered that juvenile plaice stay less long in the nurseries along the coast and moves to the open sea at an earlier age. Fishermen have also observed this changing distribution pattern for some time. Again, the reasons for this have not been proven conclusively. Either way, it means that juvenile plaice not only take longer to reach the minimum size, they appear in the fishing grounds earlier and therefore in the catch. Despite the statutory measures, the fishing effort on the undersized part of the plaice stock remains fairly high, and some of these measures even appear to have an inverse effect.

For example, continued reductions in the number of days at sea mean that beam-trawl fishery is ever closer to the ports, and those are precisely the areas populated by undersized plaice. Another example is that the plaice fishermen who fish with a twin-rig or a Danish seine receive twice as many European days at sea when they fish with smaller mesh.

Therefore the Dutch cutter fishermen are taking additional measures, over and above the statutory obligations, to better manage the fish stocks in the North Sea. These concern measures that are focused on reducing the fishing effort on juvenile plaice and the ecosystem and to support research in relation to good management.

5.1 Adjusting the engine power of the cutter sector

At the end of March 2004, the Ministry of Agriculture, Nature and Food Quality and the cutter sector issued a statement of intent, stating that they value a sustainable, thriving and socially responsible fishing industry and that they are committed to the transition process required to achieve this objective. The first structural problem that was tackled in this transition to sustainable fishery was the engine power of the cutter fleet. The engine power of a fishing vessel influences the catch capacity, as those with more power, have more dragging power and greater speed. The engine power (the licensed capacity) of the cutter fleet is subject to a maximum. Outside the 12-mile zone, there is a nationally established statutory maximum engine power of 1,471 kW (2,000hp) and within the 12-mile zone there is European statutory maximum of 221 kW (300hp).

An engine power working group was formed under the leadership of an independent external chairman. In May 2004, the engine power working group started by preparing an inventory of all makes and types of vessels' engines onboard the Dutch cutter fleet. This was essential in order to establish the nominal power of every vessel engine and to consult with manufacturers on the options in relation to settings and sealing. On the basis of calculations and estimates, the conclusion was reached that a reduction of at least 15 percent in engine capacity was achievable if the project were to be carried out. At the same time, there were discussions with the cutter sector to consult the members within management groups on a private policy on engine power. Rules of procedure for engine power were prepared, which set out the conditions for engine-power measurements, seals, audits, and sanctions. The engine power working group indicated that the plans could be carried out if a wide majority of the members said they were in favour of the private policy. By signing an engine-power declaration, more than 95 percent of the members of the management groups - which represented the owners of more than 300 fishing vessels in total - indicated to be in favour of a private policy on engine power. In members' meetings, the members of the nine management groups unanimously adopted the rules of procedure for engine power, as prepared by the engine power working group.

In June 2005, engine-power measurements were started onboard the fishing vessels and the engines were sealed after the measurements. An engine-power measurement, including sealing, takes approximately four hours per fishing vessel. In September 2006, the last of the total of 311 fishing vessels was measured and sealed. The engine power was established by means of an engine-power measurement that was carried out by an independent specialised company. The engine was sealed immediately after the measurement, and a report was issued of the measurement (figure 18). This sealing, which would be by means of numbered seals purchased for this purpose, were recorded in a sealing schedule.

The vessel owners who did not sign the engine-capacity declaration also needed to have the engines of their fishing vessels measured and sealed. This was implemented under the auspices of the government, and concerned some 90 fishing vessels.

During the last quarter of 2006, the audits were started under the control of the management groups. The audits consist of checking the seals against the sealing schedule, and of actual measurements of engine power by means of an engine-power measurement. The audits are implemented and any sanctions imposed under the supervision of the management groups. The General Inspectorate of the Dutch Ministry of Agriculture, Nature and Food Quality also continues to exercise its statutory tasks. In the framework of supervising the audits, there will be audits of engine power for those who did and those who did not sign the engine-power declaration.

Figure 18: engine with seal

A level playing field is an important issue for the sector. As the North Sea comprises common fishing grounds, fished by several fishing vessels from surrounding Member States, the cutter sector appealed to the Dutch Secretary of State to campaign for a level playing field in terms of engine power. This was important to retain sufficient commitment for a system where the sector itself assumed responsibility for the engine power.

With the records of the engine-power measurements and the seals, a major step was taken towards controlling the engine power of the Dutch cutter fleet, and this constituted the first step towards the premise of the statement of intent, i.e. “both parties expressed they believe in and value a sustainable, thriving and socially responsible North Sea fishing industry, and … express that they are committed to the transition process required to achieve this objective.”

5.2 Reducing plaice discards

The minimum European size for sole that may be landed is 24cm, and this sole is caught with nets of 80mm. This form of fishery means that fishermen automatically catch undersized plaice. Brussels does not allow fishermen to land plaice of less than 27cm, and therefore undersized plaice must be discarded if the fishermen are to comply with the rules. There is much effort to reduce the by-catch, but this is difficult. In contrast to herring, which lives in shoals, seabed fish are individuals that live mixed. So the way in which flatfish live together makes it difficult to avoid their by-catch.

A fisherman can determine what he gets in his nets up to a point. Sole is largely in the southern North Sea and large plaice occur further north. Fishermen with a large sole quota must therefore fish in the southern North Sea with nets of 80mm. This small size is required because sole, in contrast to plaice, is sleek and flexible, which makes it easier for them to slip through the nets. However, the southern North Sea is also the area with more juvenile plaice. A fishermen with a large plaice quota will go to the northern North Sea, where he can fish with larger mesh sizes of 100mm or even 120mm, because there is hardly any sole, and he will catch the larger plaice with this size.

Simply prohibiting 80mm nets would lead to fewer undersized plaice, but it is not a good solution. The fishermen lose marketable sole, which they can no longer catch and land. An example, the small sole accounts for some 40 percent of turnover in beam-trawl fishery with 80mm. Encouraging fishing in fishing grounds that are further away is an option, for example by not counting the number of sailing days as days at sea.

Fishermen would rather do without the discards. Sorting through the catch takes time, and it is a waste to discard fish. Fishermen are very well aware that juvenile flatfish are their capital for the future.

The Dutch fishermen are taking a number of measures to prevent discards as much as possible. They work together in management groups, and together they prepare fishing plans, in which they plan their fishery for the year. In areas where fishermen come across many juvenile plaice, they may impose real time closures. For a number of years, they also fished less during the spawning season. The fishermen also worked on adjustments to nets and fishing rig, and developed different fishing gear. The pulse trawl is such an alternative gear for the beam-trawl.

5.3 Real time closures

Preventing the by-catch of juvenile fish is essential to achieving healthier plaice stocks. In certain fishing grounds, fishermen may unexpectedly come across many juvenile fish. Fishermen who notice this report the co-ordinates to their fisheries organisation. After a number of reports from the same area, this is passed on to the central co-ordination point of the European Producers Organisation. This organisation may decide to close the area to fishery for two weeks. This measure, which was introduced voluntarily by the fishermen, ensures a tailored area is closed in real time.

5.4 Sparing fish during the spawning season

Plaice reproduce during the first few months of the year. In that period, there is much milt (seed - males) and roe (eggs - females) in the body. This is the so-called spawning season. It requires a lot of energy to produce milt and roe, and therefore the fish is skinny. To ensure the fish can reproduce before they are fished, the Dutch fishermen agreed voluntary to fish less during this period for a number of years. For the first quarter of 2008, this meant that the fishing effort was reduced to 25%.

The Dutch fishermen who fish for flatfish fished alternately during the spawning seasons to ensure that landings did not stop completely, as consumers want to eat plaice all year round. There are also delivery obligations between traders and supermarkets. Some shops do not sell flatfish at all during this period. Other fish retailers freeze plaice that was caught during the fourth quarter of the year, so they do not have to disappoint the consumer during the first quarter.

5.5 Development of the pulse trawl fishery

Plaice and sole are seabed fish that dig into the sand. Fishery requires these fish to be startled. In the existing beam-trawl fishery this is done with tickler chains. There is a lot of work carried out on the development of an alternative to these chains. In 2005, a pilot test was started with a fishing cutter that was equipped with a pulse trawl. The pulse trawl startles the plaice with small electric stimuli (figure 19).

The pilot test demonstrated that this fishing gear did not fish equally well in all fishing grounds, because of the local soil conditions and does not always fish well during the winter season. The catches of sole however are no less than those with beam-trawl gear, and the fish is of good quality. The main benefit of the pulse trawl is that the gear uses less gas oil than the beam-trawl, because the pulse gear is lighter. There are also considerably fewer by-catches of seabed animals and fewer discards of plaice. The Dutch Agricultural Economics Research Institute (LEI) will shortly produce a final report on the economic analysis of fishing with the pulse trawl in this pilot test. A number of fishermen is interested in this new gear. The gear offers perspective for sole fishery in particular and may operate as an (seasonal) alternative alongside the existing beam-trawl.

As this concerns new gear, Brussels does not yet allow the use of this gear. Therefore the European Commission has requested a scientific opinion on the pulse trawl from ICES (International Council for the Exploration of the Sea). This research has not yet been completed. The fishing industry is positive about the decision of the Council of Fisheries Ministers to give permission to a number of vessels to fish with the pulse trawl.

Figure 19: the pulse trawl

5.6 Long-term flatfish management plan

In April 2007, the Council of Fisheries Ministers decided to alter the flatfish management in the North Sea. Currently, TACs are set annually on the basis of “risk-averse fisheries management”. This operates on the basis of the “traffic-light system”, which strives to keep the spawning stock above the precautionary level. The first phase of the new management plan is bases on risk-averse fisheries management, the second phase on objective-led management.
This latter implies a fundamental change in fisheries management. The flatfish fishermen in the

Netherlands would like to be involved, because of the importance of plaice and sole for them. At international level, the Dutch fishermen are co-operating with their colleague flatfish fishermen in the North Sea Regional Advisory Council (NSRAC). NSRAC not only comprises the fish sector, but also other stakeholders such as nature and environmental organisations.

NSRAC has considered the question of which type of long-term management both benefits the stocks and the profitability of the fisheries sector. In this it received support from a group of international fisheries scientists. NSRAC has formulated a number of principles, and the next step is to develop a number of control measures for the various species of stock in the North Sea. This is done in small working groups and flatfish is one of the species of fish. The working group is now preparing an inventory of all the types of fishery that are used to catch flatfish in the North Sea. This inventory forms the basis for a technical and socio-economic description of this fishery. Then they will consider the undesirable effects these types of fisheries have on the development of the flatfish stocks and they will consult the relevant fishermen from the Member States on what the fisheries can do to reduce these effects. The starting point is that the fishing effort (F) is the decision of the Fisheries Council that a downward trend to a level where ecologically and economically sustainable harvests are possible, is necessary.

The Scientific, Technical and Economic Committee on Fisheries (STECF) of the European Commission will start working on an impact assessment of various scenarios for the second phase of the management plan in October 2008. NSRAC will be closely involved.

5.7 F project

The stock assessment of the size of the spawning stock forms the basis for the scientific TAC advice to the European Commission. Scientists can only carry out this “population census” of fish species for years that have been fully completed. The further back, the more certain they are of the quantities of fish. For the current year they have data on the catches up to the time of calculations. But for the months following that they need to estimate the figures. Then they make predictions for the coming years. So, it is a combination of certainty and uncertainty.

As the fishing opportunities (TACs) are based on the amount of fish in the sea, the fishermen would like these assessments to be as accurate as possible, and sometimes there are differences of opinion between the fishermen and the scientists. The fishermen spend the larger part of their week at sea. In order to ensure that there are adequate stock assessments, the Dutch flatfish industry has started the F project.

The F project is a co-operation between scientists (IMARES), the managers (Fisheries Directorate of the Ministry of Agriculture, Nature and Food Quality) and fishermen. In this project they work on:

- Scientific improvements to the stock assessments for plaice and sole.
- Improved use of information gathered by the fishermen during stock assessments.
- Improved communication between the three parties.

These elements should lead to further improvements in the management of plaice and sole in the North Sea. In 2007, the F project concluded after five years. During these five years, scientific research of the stock assessments has produced many insights into its uncertainties. A group of fishermen collected

many data on their catch success, which is the amount of fish caught per fishing hour. The catch success forms a measure for the amount of fish and can be used to compare with the data from the stock assessment. With this project, the communication between the managers, the fishermen and the scientists has improved considerably in a number of ways. The steering group of the F project has decided it is important to continue the achieved results even when the project has finished. A management consultation will be set up with the flatfish industry, scientists and the managers. In this consultation flat fish management and research that fishermen conduct with scientists will be discussed on a regularly basis. This jointly conducted research is very important and therefore the cooperation will be intensified. In the future too, communication between all parties will have the full attention.

5.8 Discards study

Every year, the international fisheries biologists (ICES) assess the size of the fish stocks in the North Sea. For a good assessment it is important to know which part of the fish stocks were put overboard during the catch, the discards. In the Netherlands, this part of the biologists' study consists of a total of 10 fishing trips of one week each. The Dutch details for plaice are then extrapolated to all plaice fishery in the North Sea. In its most recent stocks estimate, ICES assumed that an average of 45 percent of plaice (in volume) was discarded in 2004 and 2005. According to the North Sea fishermen, these discard estimates do not match reality, as 10 fishing trips offer a limited view of a total cutter fleet. Furthermore, a large part of the stock is fished by specific plaice fishermen, who use larger mesh sizes and therefore hardly have any discards. The Dutch scientists agree that the statistical power of the data is poor as their trip represent less than 0.15% of the total Dutch beam-trawl effort.

The high discards percentages operated by the biologists constitute an important reason for the European Commission wishing to restrict flatfish fishery in the North Sea even further. Therefore, as part of its own plan to tackle responsible flatfish management, the Dutch fishery started its own study in 2004.

Since 2004, some 29 vessels have made more than 1,500 observations in relation to plaice discards. When all data are taken together, the total average discards percentages (in volume), as gathered by the industry are 29% for 2004, 28% for 2005, and 39% for 2006. The journeys made by IMARES onboard commercial fishery ships produced figures of 35% (2004), 44% (2005), and 55% (2006), respectively.

The plaice data were analysed in a statistical model, which was used to study the effect of various factors on the discards percentage. The three most influential factors were the fishing area, the fishing period, and the number of tickler chains used for fishing. Mesh size cannot be considered separately from the area – with narrower mesh sizes in the south than in the north. The model could not make this distinction, but that does not mean to say that these other factors are not important.
The model demonstrated that the discards percentage in the catch become smaller when fishing takes place further away from the coast (figure 21). It is also noticeable that the percentages are lower southwest of the province of Zeeland. There is also a clear seasonal pattern of higher discards percentages during September and low percentages during December (figure 22). The results from the model were confirmed by the fishermen's observations.

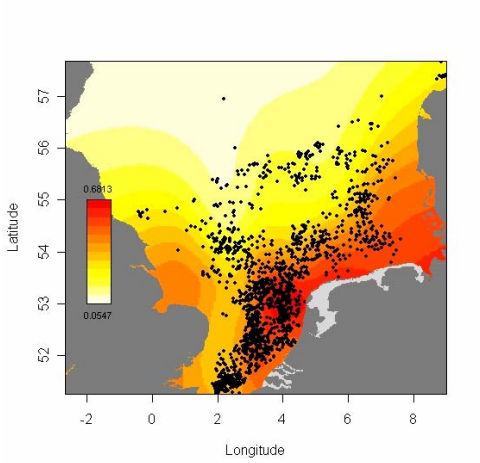
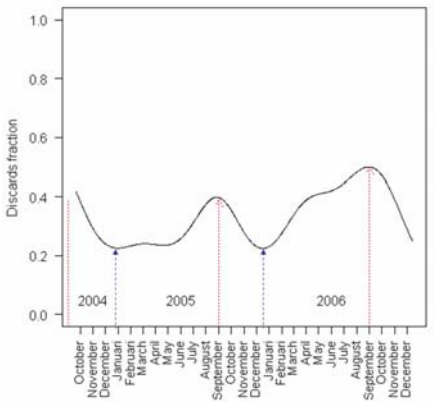


Figure 21: Model predictions of plaice discards and their spatial distribution based on industry discards data. This model prediction assumes a standard beam trawler with 8 tickler chains in June. The figure represents the results of model predictions. It does not show the actual discards percentages at that time, at that place, but provide an impression of the quantity of discards you may expect on the basis of the various factors (area, time, and fishing gear).



If the above-mentioned total average percentages for plaice from the industry data and from the IMARES data are corrected for these spatial and seasonal patterns and the fishing gear used, they still differ substantially from each other. The IMARES results remain higher than the industry ones. The IMARES scientists have tried various ways to discover what causes this difference. The impression is that the difference is in the onboard working methods of IMARES and the industry. Length data demonstrate that the industry misses many of the 0 and 1-year old plaice in the sampling, compared with the IMARES data, which could lead to lower total average percentages. First onboard investigations and discussions between scientists and fishermen indicated that the differences are caused by the way the sample is taken. Fishermen tend to take the sample at the beginning of the

processing of the haul. The top layer of the haul always has a relatively higher abundance of large (minimum-sized) fish. The sampling protocol now has been changed so that the sample is taken from various parts of the haul.

Only a limited number of data were collected and returned for cod. Catches with few or little undersized cod are probably not recorded. As there were few data, IMARES tried to calculate the discards percentage in different ways. The data based on weight produced a discards percentage of 7.4%, those based on measurements in litres (volume) produced 6.5%, whilst data based on length measurements suggested that 18.3% of cod was sent overboard. These figures represent major differences and, partly due to the limited data, they are only a first indication of the cod discards. More data will need to be collected if we want more certainty on cod. This is extremely important, as the cod recovery plan with the days-at-sea scheme is still in force.

The report concludes that the industry data provide an important insight into the discards percentages for plaice and, to a lesser extent, for cod, and into the factors that influence the percentages. The differences between the industry and the IMARES sampling programmes are reason for a critical evaluation of both study programmes. The industry data are a reference point against which the regular IMARES discards data can be calibrated and tested. With the changes in the sampling protocol, these differences should have been remedied, in which case the industry data can also be used in stock assessments and in other fisheries research. The improved understanding of the factors contributing to plaice discards, enables the industry – in collaboration with scientists and manager – to develop more directed management measures and strategies to further reduce discards.

5.9 Mesh-size study

On behalf of the beam-trawl industry, the Dutch Fish Product Board has instructed IMARES to carry out a study of the effect of mesh size on the catch composition for plaice and sole. The reason for this mesh-size project is the discussion between the European Commission and the North Sea Regional Advisory Council (NSRAC) on the effects of mesh-size adjustments to ensure improved plaice management. The European Commission and some NGOs believe there are benefits in increasing the minimum mesh size from 80 to 90mm. The fisheries sector anticipates that increasing the minimum mesh size means that many small sole will be lost, whilst it does not really reduce the plaice discards. What really happens to the catch composition on increasing the minimum mesh size should be demonstrated by the mesh-size project.

The objective of the project is to measure the effects of the mesh size on the catch of plaice and sole. The measurements ought to demonstrate what happens with the plaice discards and the sole landings with mesh sizes of 70, 80 and 90mm. A second part of the study is to obtain an idea of the usefulness of the selectivity parameters – parameters per mesh size that are used for the discard estimates for example. These parameters were calculated during the 1980s, so they would benefit from another critical examination.

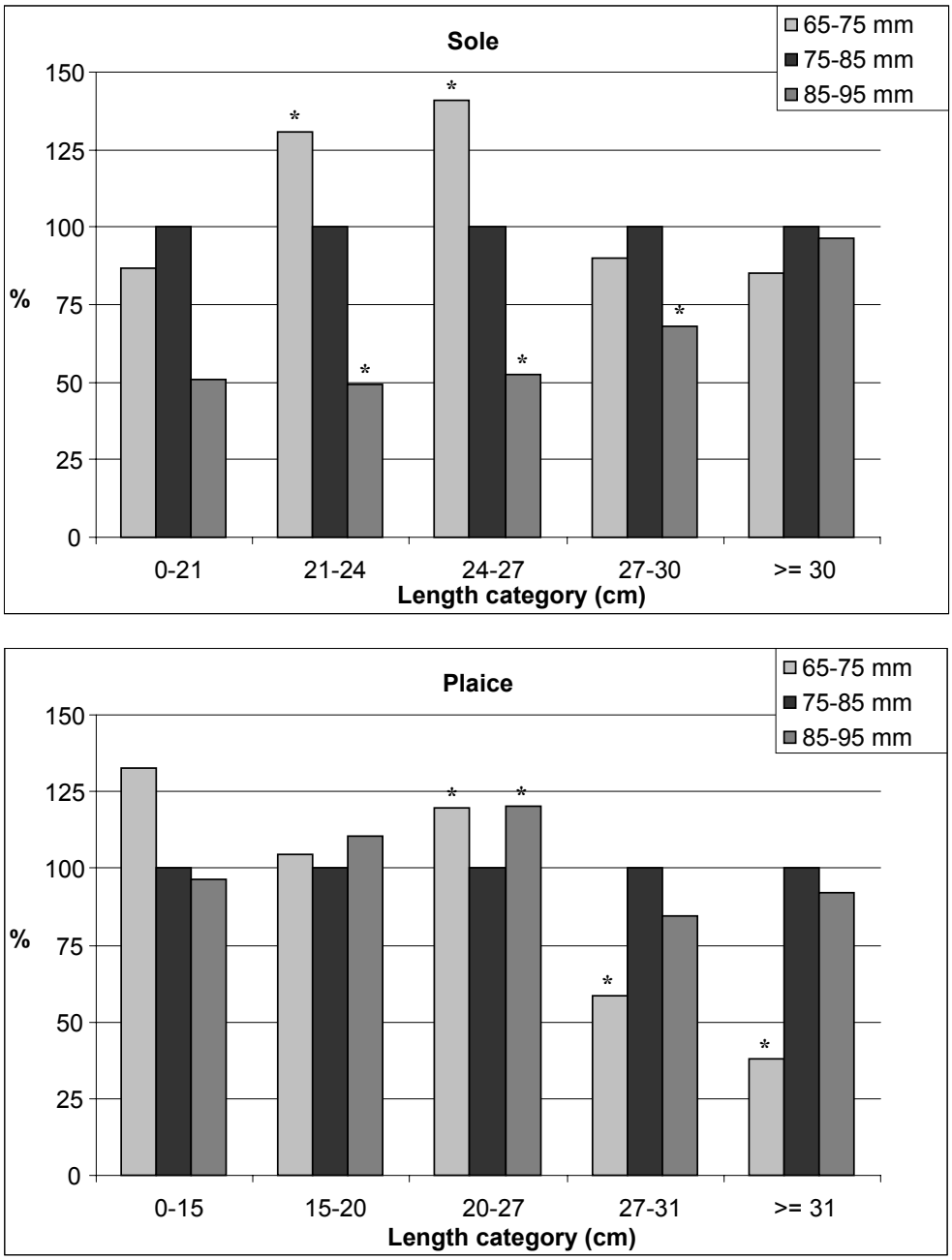


Figure 23: Relative number per hectare, expressed in percentages, for sole (top) and plaice (bottom). The numbers per hectare caught with 80mm were set at 100%, the numbers per hectare for 70 and 90mm are expressed as a percentage in relation to the value at 80mm. The difference in relation to the value at 80 mm is significant when it has an asterisk ().

In 2006 and 2007, six beam trawlers carried out measurements for the mesh-size project in five areas during four quarters. The difference in the numbers of sole and plaice per size category were measured for mesh sizes of 70, 80 and 90mm. June was the final measuring month, and the final report was presented at the end of 2007 by Wageningen IMARES to the client, the Dutch Fish Product Board (Productschap Vis).

The analyses demonstrated that fewer small soles I and II (24-30cm) were caught with 90mm than with 80mm, see figure 1, whilst fewer sole discards (21-24 cm) were caught with 90mm. Both the plaice discards and the plaice landings remained the same with an increase in mesh size from 80 to 90mm, see figure 23.

Besides comparing the catch composition, analyses were carried out to test the selectivity parameters for sole and plaice. Selectivity parameters are parameters that provide information about the length of the fish that remains caught in a net with a certain mesh size. These parameters differ from species to species. They are used in theoretical studies, where the effects of mesh-size changes are extrapolated, or in reconstructing historical discard data. Different net materials and different fishing methods may lead to different selectivity parameters. Unfortunately, the collected data did not enable a test of the selectivity factors as they are used now, as the numbers of small fish in the different mesh sizes were too close together.

Sector representatives will use the outcomes of this study in further international discussions about securing the sole fishery in relation to plaice discards. The practical details that were gathered in the mesh-size test will ensure that these discussions will be based on a more solid foundation.

Now that the use of 90mm mesh in the beam-trawl fishery for sole is ruled out as a feasible measure for reducing plaice discards, the industry works actively on the development of escape panels. Following promising first-trial results, further experiments will be carried out in May this year.

5.10 Development of discards release panels

In August 2007, a group of beam-trawl fishermen paid a working visit to their colleagues in the south-west of the United Kingdom to see for them selves the progress on the development of a benthic release panel in the beam-trawl fishery. Although both the fishing grounds and the beam-trawl fishery of their English colleagues are very different, the Dutch skippers saw potential in the escape panel.

In December 2007, a group of fishermen together with technical scientists from IMARES started experiments with this panel on the research vessel Tridens. The research is paid for by the industry; the Ministry of Agriculture, Fisheries and Food Quality provide the research vessel. The first results look promising, although the losses of the valuable Dover sole are still considerable. Follow-up trials will start again in May 2008. Two beam-trawl fishermen already use the panel in their fishery on a voluntary basis.

An adapted version of the benthic release panel was introduced on a voluntary basis on a twin-rig vessel targeting plaice. The skipper is very enthusiastic about the losses of discards in relation to the

losses of marketable fish. In June 2008, on board research will be carried out to measure the effects of the use of the panels in the twin-rig fishery. The research will be jointly funded by the ministry and the industry.

5.11 Multi-annual plan responsible fishing

We cannot and will not avoid the issue – the fishing industry must operate in a sustainable manner. Even more sustainable? As you have read, the cutter sector, in fact the entire fishing industry, is already doing a lot! Indeed, we are on the right track, but society is calling for an even greater effort and targeted action.

Sustainable means ‘being able to continue in the long term'. So in general scientific terms, using natural resources in a manner that ensures it can be continued. For the fishing industry this means that we need to deal with aquatic life in such a way that we will be able to continue fishing until eternity. This way we contribute to the global guideline 'profit, planet, people' - economically sound, environmentally aware and good for mankind. And if we manage that, then we fulfil our social responsibility.

The entire fishing industry – from fishery, fish farms, imports and processing to the retailers – contributes to solutions. We are open to critical questions from society and wish to contribute to solving issues. What we cannot solve as a sector on our own, we tackle together with others. We have collective discussions with consumers, scientists, governments, and social lobby groups. We will also be transparent in relation to our activities. The fishing industry has prepared a plan for the future – the multi-annual plan responsible fishing. With this approach, the fishing industry retains its 'licence to operate' in a continuously changing society.

Now and in the future, the fishing industry wishes to have consumers enjoy top-quality fish, crustaceans and shellfish. Social responsibility, chain management, innovation, optimum working climate, ability to adjust, and respect for the living environment play an important role in this healthy sector. Therefore, we make good agreements in the interests of the businessmen, the employees, and the purchasers of our products.

The multi-annual responsible fishing plan sets out 9 agreements for the entire fish sector.

1. We strive towards an economically sound sector as a foundation for the future.
2. We comply with laws and regulations.
3. We work on transparency and co-operation within the chain.
4. We help to preserve natural resources and the ecosystem.
5. We continue to improve the technology of fishery, farming, processing and distribution.
6. We treat employees and other stakeholders responsibly.
7. We take the interests of society into account.
8. We place food safety at the forefront of the chain and guarantee the consumer good quality fish.
9. We work jointly on appropriate solutions for overfishing, undesirable by-catch and optimum management of the deep blue seas.

The Responsible Fishing Committee, which includes representatives from the cutter sector, works on concrete actions to implement the multi-annual plan responsible fishing. Activities that being carried out in the framework of this project for the cutter sector are a specific code of behaviour for cutter fishermen, a study of the possibility of MSC certification for flatfish fishery and actions focused on reducing the by-catch. The activities undertaken by the fishing industry as a result of the Task Force report are fully in line with the multi-annual plan.

5.11 Task Force

The fishery sector faces a number of challenging tasks in a continuously changing environment. The main challenge for the sector is to achieve a considerable improvement in the returns of companies, whilst simultaneously working towards sustainable fishery. Therefore, the Task Force Sustainable North Sea Fishery was set up at the end of 2005. The Task Force comprises representatives from the fishery sector, social lobby groups and the government. The Task Force was asked to develop an economically and ecologically sustainable perspective for the North Sea cutter fleet. The main themes that were published in April 2006 in the report Fishing in heavy weather (figure 21) are reducing the costs of the sector, reducing the effects of fishery on nature, and improving the returns by focusing on quality. Recommendations were made for each of these themes, and they will be the focus of work in the coming period by means of a “Fishery Innovation Platform”. The flatfish industry supports the report and its implementation unanimously.

6. Bibliography

- Aarts, G. M. & A.T.M. van Helmond (2007). Discard sampling of plaice (Pleuronectes platessa) and cod (Gadus morhua) by the Dutch demersal fleet from 2004 to 2006. Report C120/07. IJmuiden: IMARES.
- Grift, R.E. et al (2004) Assessment of the ecological effects of the Plaice Box, 2004. Report of the European Commission Expert Working Group to evaluate the Shetland and Plaice boxes. Brussels.
- Heessen, H.J.L., P.M. de Vries en H.C. Welleman (1999). Ecosysteemdoelen Noordzee: vissen. Beschrijving van enkele aspecten van de visfauna van de Noordzee met betrekking tot het Ecosysteemdoel "Behoud van diversiteit". RIVO rapport C060/99. IJmuiden.
  [*Ecosystem targets North Sea: fish. Description of some aspects of the fish fauna in the North Sea in relation to the Ecosystem objective 'Retaining diversity'. RIVO report C060/99. IJmuiden*]
- Den Heijer, W.M. (2006). Status Nederlandse kottervloot. Scheveningen.
  [*Status Dutch cutter fleet. Scheveningen*]
- ICES. 2005. Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak (WGNSSK), 6 - 15 September 2005, ICES Headquarters Copenhagen. ICES CM2006/ACFM:09 . 971 pp.
- ICES (2006). ICES advice 200, vol. 6. Copenhagen.
- Van Keeken, O.A., S.B.M. Kraak, A.D. Rijnsdorp (2004). Growth and maturity of North Sea plaice and sole. RIVO report C088/04.
- Lindeboom, H.J. en A.D. Rijnsdorp (2006). Effecten van fosfaat addities in het verleden en mogelijkheden voor onderzoek: een bureau studie naar de mogelijke effecten van fosfatering van de zee op de visproductie. IMARES C029/06.
  [*Effects of phosphate additions in the past and research options: a literature study of possible effects of adding phosphates to the sea on fish production. IMARES C029/06*.]
- Nederlands Visbureau (2002). Persmap schol. Rijswijk.
  [*Press folder plaice. Rijswijk*]
- Website Nederlandse Vissersbond: http://www.vissersbond.nl/index.php.
- Productschap Vis (2003). Vissen met Toekomst. Rijswijk.
  [*Fishing with a Future. Rijswijk*]
- Quirijns, F.J., A.D. Rijnsdorp, R.E. Grift, (2006). Analysis of changes in spatial distribution of the beam-trawl fleet and its effects on the plaice and sole stock, 1990-2005. IMARES report C075/06. IJmuiden.
- Quirijns, F. & N. Hintzen (2007). Effect van de maaswijdte op de vangstsamenstelling in de boomkorvisserij. Rapport C122/07. IJmuiden. IMARES.
  [Effects of mesh size changes on the catch composition in the beam-trawl fishery. IMARES report C122/07 Ijmuiden]
- Rijnsdorp, A.D, G.J. Piet, F. Storbeck en E. Visser (2000). De microverspreiding van de Nederlandse boomkorvloot in de periode 1993-1999 en de effecten van de boomkorvisserij op het bodemecosysteem., RIVO rapport C017/00. IJmuiden.
  [*The microdistribution of the Dutch beam-trawl fleet in the period 1993-1999 and the effects of beam-trawl fishery on the seabed ecosystem, RIVO report C017/00. IJmuiden*.]
- Steins, N.A. & D. Langstraat (2003). The Dutch ITQ system: a basis for an integrated and flexible

Met opmaak: Nederlands (standaard)

Met opmaak: Nederlands (standaard)

management approach. In: Pesca Internacional, 2003, nr.14.

- Taal C., A. Klok , J.A.E. van Oostenbrugge en M.H. Smit (2005). Visserij in cijfers 2004. LEI Rapport PR.05.10, Den Haag.
  [*Fishery in figures 2004. LEI Report PR.05.10, The Hague.*]
- Taal C., H. Bartelings, A. Klok , J.A.E. van Oostenbrugge, B. de Vos (2006). Visserij in cijfers 2006. LEI Rapport PR.06.04, Den Haag.
  [*Fishery in figures 2006. LEI Report PR.06.04, The Hague.*]
- Task Force Duurzame Noordzeevisserij (2006). Vissen met tegenwind, advies Task Force Duurzame Noordzeevisserij. Den Haag.
  [*Task Force Sustainable North Sea Fishery (2006). Fishing with Headwind, Advice Task Force Sustainable North Sea Fishery. The Hague*]
- Tulp, I., R. van Hal en A. Rijnsdorp (2006). Effects of climate change on North Sea fish and benthos. IMARES rapport C057/06. IJmuiden.
- Verver, S.W, I.J. de Boois, J.J. Poos en A.D. Rijnsdorp (2001). Verandering van de noordgrens in de verspreiding van tong in de Noordzee. RIVO rapport C044/01. IJmuiden.
  [*Changes to the northern border of sole distribution in the North Sea. RIVO report C044/01. IJmuiden*]

Met opmaak: Nederlands (standaard)

Appendix A. Who is who when the TAC and quota are set?

A number of parties are involved with setting the TAC and the quotas. The following is an overview:

- IMARES: (formerly RIVO) Is the Dutch institute for fishery research. Other countries around the North Sea also have their own fishery research institutes.
- ICES: International Council for the Exploration of the Sea. Scientists from the national fishery institutes are represented in ICES. The Working Group on the assessment of demersal stocks in the North Sea and Skagerrak (WGNSSK) makes the stock assessments. ACFM, the Advisory Committee on Fishery Management issues advice on the fishing opportunities on the basis of the stock assessments.
- European Commission (EC): Client of the research and advice carried out and issued by ICES.
- STECF: The Scientific Technical and Economic Committee on Fisheries is an EC advisory committee. It considers and weighs up socio-economic viability and regional interests of the fishery advice issued by ICES.
- Norway: As Norway does not form part of the EU, there needs to be co-ordination of the fishing opportunities for shared fish stocks, including sole and plaice.
- Fisheries Council: The Fisheries Ministers of all EU countries decide on the fishing opportunities.
- NSRAC: In the "North Sea Regional Advisory Council", all the stakeholders in fishery management of the North Sea are represented. They advise the EC on their proposals. There are also RACs for other fishing grounds.
- Fishery organisations: In the Netherlands, the fishermen are represented by the Dutch Fishermen Union, the Federation of Fishing Associations and the Dutch Fish Product Board.
- Dutch Ministry for Agriculture, Nature and Food Quality (LNV): Is the client of IMARES in terms of fishery research and it participates in the Fisheries Council.

Appendix B: List with abbreviations used in fisheries management

- SSB: Spawning Stock Biomass, the spawning stock. This is the total of all adult animals that can reproduce.
- TAC: Total Allowable Catch, the maximum permitted catch amount. This is established per type, per area, for example the North Sea. The TAC applies to all fisheries for one type. The TAC is divided into quota for the Member States.
- F: Fishing Mortality: The fishing effort or fishing mortality (F) is the ratio between the annual catch and the stock of minimum-sized fish over the year. This ratio can vary from 0 to more than 1 per year. What is meant by the stock over the year? This means the average stock during the year, taking every day of the year into account. The stock of certain fish species is not the same every day. For example, in the North Sea the stock reduces in spring, increases during the summer, and decreases during the autumn. These changes are explained by the fact that fish do not grow in winter, but do grow in summer. At the beginning of the year they die due to natural causes and fishery. In the summer they eat lots and grow lots, therefore the size of the stock grows despite fishery. Furthermore, in summer many juvenile fish grow above the minimum size and they add to the stock of minimum-sized fish. When the fish stop growing in the autumn, the stocks start to reduce again. So, it is a question of decrease (spring), increase (summer) and another decrease (autumn). If the fishing effort is very high, it may happen that the weight of fish caught is greater than the average for the year. In such a case, the fishing mortality F is greater than 1. This happens when there is little minimum-sized fish in the spring, a lot of fish is added during the summer because they grow to above the minimum size, and in the same year a great part of that fish is caught again. On average over the year, there is not so much fish, but the catch is big. The stocks are shorn off as it were.
- B_{pa}: Abbreviation for the precautionary level of the spawning stock. B means biomass and pa means “precautionary approach”. This level takes account of the uncertainties in the stock assessments of a stock and is used to remain within a large margin of the limit level Blim.
- B_{lim}: Abbreviation for the limit level of the spawning stock. B means biomass and lim means limit. When the spawning stock falls below this level, the fish stock runs the risk of overfishing, because there are not enough adult animals to ensure sufficient offspring.
- F_{pa}: Abbreviation of the precautionary level of the fishing mortality. F means fishing mortality and pa means precautionary approach. This level takes account of the uncertainties in establishing the fishing mortality and is used to remain within a large margin of the limit level Flim.
- Flim: Abbreviation for the limit level of the fishing mortality. F means fishing mortality and lim means limit. When the fishing mortality or fishing effort exceeds this level, the stock is not fished sustainably and there is a chance of overfishing.

Appendix C: How is the scientific advice arrived at?

The fish stock is calculated on the basis of the number of adult, i.e. sexually mature, fish in the sea - the so-called spawning stock biomass (abbreviated by scientists to SSB). It is allowed to fish from this stock, but the stock must be sufficiently large to continue producing sufficient offspring.

Scientists are unable to count all fish one by one, so they need to make an estimate. These estimates are based on different types of information. They use data that are fishery dependent and data that cannot be influenced by fishery.

The data that are independent of fishery come from research trips the scientists make at sea, where they gather data on the amount of fish they catch and the size of the fish caught. The scientists also gather data on the numbers, weight and ages of the fish that are caught and landed by the fishermen.

The stock assessment, establishing the amount of fish in the sea, is in essence a simple addition and deduction on the basis of the population census of a fish type. How many fish are added each year. How many die due to natural causes and how many due to fishery. This forms the basis for an estimate of the number of fish left over after a certain year.

The scientists combine this amount with their expectation of the number of juvenile animals that mature during the following year. By calculating the various scenarios of more or less fishery in the following year, they can estimate the size of the stock in the following year.

This stock assessment, or the population census, of fish can only be carried out by scientists for the years that have fully passed. The further in the past, the more certainty on the fish stocks. For the current year, until the time of calculating, they have data on the catch, but for subsequent months they need to estimate these data. For the coming years, they make predictions. A combination of certainty and uncertainty.

As the fishing opportunity is based on the amount of fish in the sea, the fishermen wish these assessments to be as accurate as possible, and sometimes there is a difference of opinion between the fishermen and the scientists. The fishermen work at sea the larger part of their week. In order to ensure good stock assessments, the Dutch cutter sector started the F-project.

The F-project is a co-operation between scientists (IMARES), managers (Fisheries Directorate of the Ministry of Agriculture, Nature and Food Quality) and fishermen. In this project they work on:

- Scientific improvements to the stock assessments of plaice and sole.
- Better use of information gathered by the fishermen during the stock assessments.
- Improving communication between the three parties.

These three elements must lead to further improvements to the management of plaice and sole in the North Sea.

Appendix D: Fishery methods in the Netherlands

Dutch fishermen operate on a number of different fishery methods. The beam-trawl is one of the best know methods.

Beam-trawl fishery
A large part of the Dutch fishery fleet uses the beam-trawl to fish for flatfish. In beam-trawl fishing, there are booms with a net hanging in the water on the port side and the starboard side of the cutter. So they fish with two nets at the same time. During fishing, the two beams are horizontal above the water.

Each fishing net is attached to the beam with a fishing line and kept open with a boom. Under the net there is a chain that drags over the seabed, which is known at the tickler chain. Flatfish dig themselves into the sand, and as the net drags over the seabed, the flatfish is startled, comes up and swims into the net.

The mesh of the net is larger at the beginning than at the end. So the small, undersized fish can escape and the minimum-sized fish stay in the net. There are agreements at European level on the size of the mesh and the minimum landing size of the flatfish. At the end of a haul, the nets are pulled up and the cod end of the net is pulled on board. The fish is gathered in a hold. The fish is sorted onboard the cutter by size, gutted and cleaned. Then the fish is laid in ice in plastic crates and stowed in the cooled fish hold.

Static-net fishery
Static-net fishery is the umbrella term for all fishing methods where the net is static in the water. Fisherman use gillnetting and tangle netting to fish for cod, salmon and large flatfish (turbot, large sole). These nets are set up ‘standing’ in the water with floats and a weighted rope on the underside of the net (ground rope). The standing nets are put out around a wreck or in open sea as a curtain, and after a period of time the catch is collected. Fishing with fyke nets also comes under this type of fishery.

Danish seine
The anchor seine is gear that consists of one funnel-shaped net and two long heavy ropes. It is used to catch flatfish. The Danish fishermen call this method 'snurrevaad', Dutch fishermen also call it 'snorders'. The principle is that the fisherman sets out an anchor to which one of the ropes is attached. Then the vessel sails in a circle and sets out the net and the other rope. When back at the anchor, the seiner takes in the ropes. The flatfish is driven into the net by the ropes rolling over the seabed. The seining method is a typical type of coastal fishery. Recently this technique was further developed for deeper waters. This modification is known as 'Icelandic seining' or 'fly shooting'. In this method, the ropes can be as long as eight kilometres.

Modern seining is quoted as one of the alternatives to using the beam-trawl with heavy tickler chains. The influence of the anchor seining gear on the seabed is less great than that of the tickler chains, as they do not need to drag heavy fishing gear over the seabed. The quality of the fish is usually better than for beam-trawl fishery. Fly shooting, seining or snorren has its limitations in terms of time of day, type of fish and soil condition, but in essence it is an efficient and energy-saving fishery that catches good quality fish.

Pair trawling
Dragging a large trawl net with 2 vessels. These are connected to each other with a large rope, so that their position remains even during fishing. The horizontal opening is obtained by both vessels sailing at the same distance from each other. At the moment there are almost no Dutch vessels that use pair trawling.

Single-trawl fishery (hatch-board fishery)
In this case, a trawl net is dragged by one vessel. By means of hatch boards, the trawler net obtains a horizontal opening. The so-called ground rope of the net rolls over the seabed, because cod and whiting often swim just above the seabed.

Twin-rig fishery
During twin rigging one vessel drags two trawl nets alongside each other. The hatch boards are on the outside ends and in between the nets are beam heads; these are heavy weights that can slide over the seabed. A small cutter can fish a large seabed area with relatively little power. Twin-rig fishery is becoming popular as an alternative to beam-trawl fishery. Initially, twin-rig fishery was intended to catch cod, whiting and haddock, but in summer it is used to fish for plaice, dab and red mullet.