

Out and about

Sole moves to the farm

Belgian and Dutch scientists have fine-tuned a technique for sole farming. This fish is especially popular along the North Sea coast, but wild stocks are diminishing. Fishing and Aquaculture in Europe takes a look at the first steps of this promising experiment in commercial aquaculture.

Sited at the heart of the IJmuiden port on the Dutch coast, the building – an immense fortified naval base from the Second World War – is not what one might expect. *'With three-metre-thick concrete walls, temperature variations don't bother me,'* Andries Kamstra, manager of Solea, observes with a wink. This fish farm has occupied several rooms in this huge bunker which it uses for farming sole – more precisely, the local species of sole (*Solea solea*), which is highly prized in the culinary culture of the countries along the North Sea.

A promising market

'After several attempts beginning in the 1960s, a new opportunity to develop sole farming emerged in the 1990s,' explains Andries Kamstra. *'Sole require water temperatures of between 18 and 20°C, and this used to create technical problems. But then, a technique allowing cost-effective control of water temperature (recirculation) was developed for eel farming. So we thought, why not use it for sole as well? The species is ideal from the marketing perspective. It has high value and a big market, unlike turbot, which has high value but remains a niche product. The potential demand for sole is high.'*

As wild stocks continued to decline, not all of this demand was being met.

The European Commission therefore decided to cofinance two successive research programmes enabling a consortium of European scientists, including researchers from the Netherlands and Belgium, to develop commercial sole farming techniques.

At IMARES⁽¹⁾ in the Netherlands, a small-scale experimental farm was successfully launched, which enabled the whole reproductive cycle to be captured, i.e., eggs and viable young fish were obtained from individuals born in captivity. Researchers at Belgium's Agriculture and Fisheries Research Institute (ILVO⁽²⁾) also developed an experimental fish farm in Ostend for North Sea restocking, so as to sustain this resource that is so essential for Flemish fishermen.

In 2001, the Dutch decided to take things further, moving from the experimental phase to the reality of large-scale production. IMARES researcher Andries Kamstra became manager of Solea, a spin-off whose goal was to develop sole farming on a commercial scale. Other private partners from the fisheries sector signed up, making it possible to finance the project.

The start-up phase was mostly spent working out solutions to various problems. With the recirculation system, tank water properties must be determined by establishing an ideal balance of purity, salinity and temperature, which is always a delicate issue for marine species.

Feeding was another issue that had to be resolved. Sole is a difficult fish, in that it doesn't seek food out, but waits for it to appear, recognising it by its sense of smell. A method for distributing feed in the tanks using a centralised forced air system also had to be developed, to adapt to the fact that in the natural world sole feed only at night.

'If the feed stays in the water too long before being eaten, it will lose its appeal and the sole will not detect it,' explains Andries Kamstra. *'As well as paying attention to food quality, we also have to focus on feeding management, which is extremely complex.'*

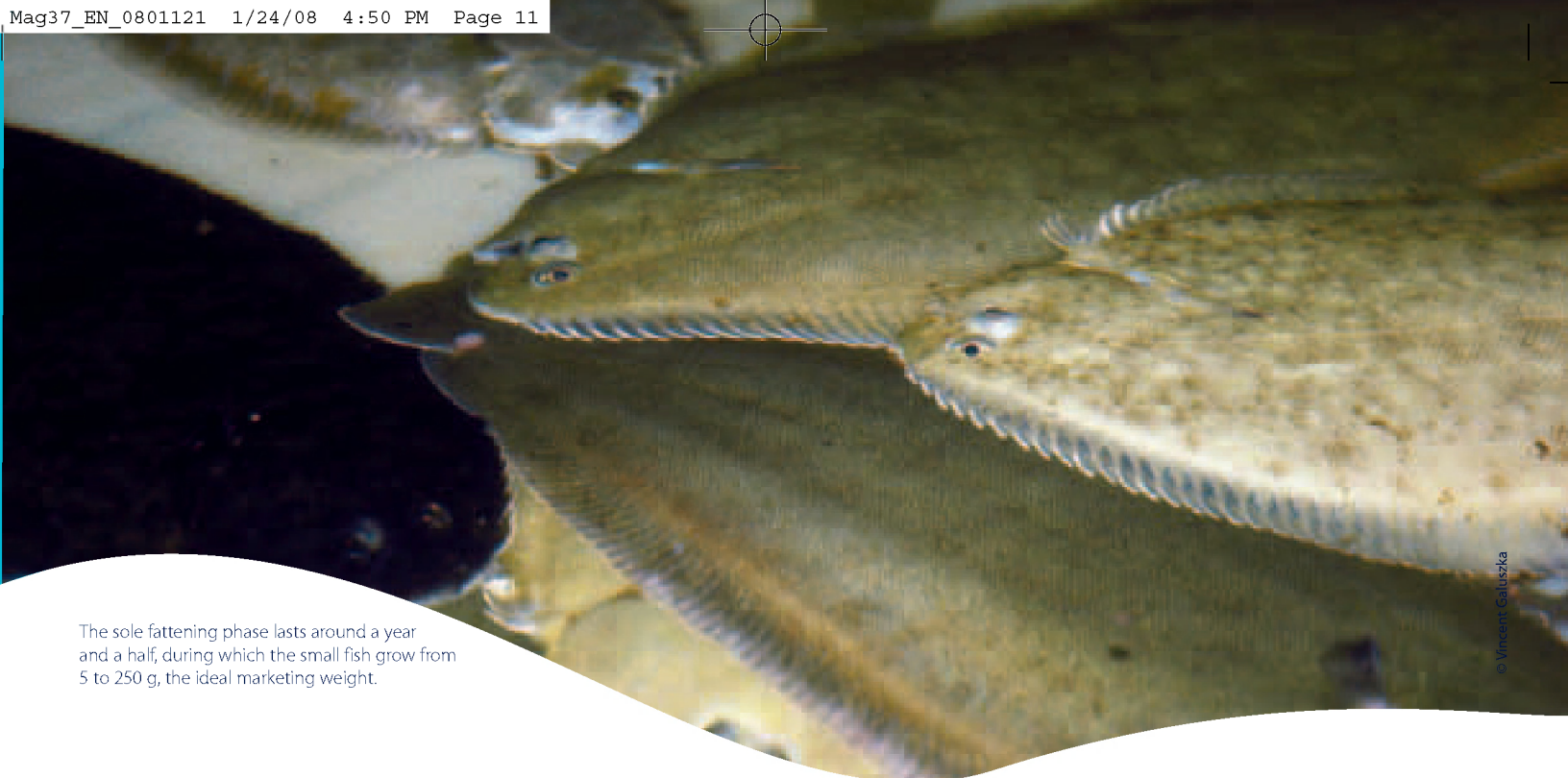
Multi-layer farming

In 2006, the Solea project ended its pilot phase and launched its commercial operations. The different stages of production had been mastered. The installations developed in the bunker in the port of IJmuiden began to produce 20 tonnes of sole a year, selling its production to restaurants and supermarkets. All stages of production, from egg to plate, took place within the company.

The product created a lot of interest among the public. *'You can't tell the difference between farmed sole and wild sole,'* states Andries Kamstra. *'The flesh is even firmer. This is due to the slaughtering method, which is quick in our case.'* Solea's next objective is to produce 100 tonnes by 2009. New tanks are being built.

(1) Institute for Marine Resources and Ecosystem Studies.

(2) Instituut voor Landbouw- en Visserijonderzoek – Institute for Agricultural and Fisheries Research.



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The sole fattening phase lasts around a year and a half, during which the small fish grow from 5 to 250 g, the ideal marketing weight.

Visitors to the Solea installations discover that farmed sole are apartment dwellers: breeding tanks are arranged in several levels – up to seven in the fattening unit.

The reason for this is simple. The problem with sole is that they grow slowly. It takes two and a half years from incubation for a sole to reach a market weight of 250 grams. This is as long as it takes for a turbot to mature, but sole are four or five times smaller. *'The cost of the farm's surface area has to be optimised,'* explains Andries Kamstra, *'especially along the coast where industrial land is very expensive.'* The most profitable solution is therefore to take advantage of the sole's morphology and to breed it in flat tanks (about twenty centimetres deep) in layers.

This multi-layer system is also the future approach being pursued by the ILVO researchers in Belgium.

The Belgian researchers have recently suspended their experimental farming activities, but only temporarily. *'Our restocking operations were a success, achieving an excellent survival rate and a recapture rate of 30%, which is very high,'* explains Daan Delbare, head of research at ILVO. *'The problem is that the dispersal area of sole in the North Sea is so vast that our releases mostly benefited Dutch and English fishermen, which is not really an ideal outcome for a national programme...'*

The scientific success of this experiment nevertheless caught the attention of a Flemish investor, who wishes to remain anonymous. His project aims to serve the consumer market, with estimated production of 75 tonnes in 2010 but with an infrastructure capable in time of producing 600 tonnes a year. ILVO will provide scientific follow-up for this new company, which is not likely to go unnoticed in a country where *sole meunière* is a national dish and where marine aquaculture is not well developed due to the lack of available land along the coast.

The Solea experiment in the Netherlands will not remain one of a kind for long. The potential demand for farmed sole is such that the Dutch government has decided to earmark 7.5 million euros, cofinanced by the European Commission's European Fisheries Fund, for the development of sole farming in the province of Zeeland (southwest Netherlands). That should whet many an appetite.

Five stages over two and a half years

Sole farming takes place entirely on land, often in covered infrastructures, to avoid temperature variations and to increase the periods of darkness during which the sole feed.

- **Reproduction** is to the responsibility of a few vigorous individuals brought from the sea. They live in tanks in a darkroom. Light and water temperature are controlled, thus sidestepping the cyclical nature of reproduction in order to obtain eggs throughout the year.
- Once harvested, the eggs are placed in **incubators** for five days while the embryos develop.
- The eggs are then transferred to small **rearing tanks** where they hatch. The larvae – which at first are invisible to the naked eye – spend three weeks in these tanks, where they acquire all the characteristics of flatfish.
- The alevins are transferred to **larger tanks** where they grow until they reach a weight of five grams.
- At this point, the small sole are **fattened** for about a year and a half until they have reached the standard portion size of 250 grams.