

tussen Duin & Dijk

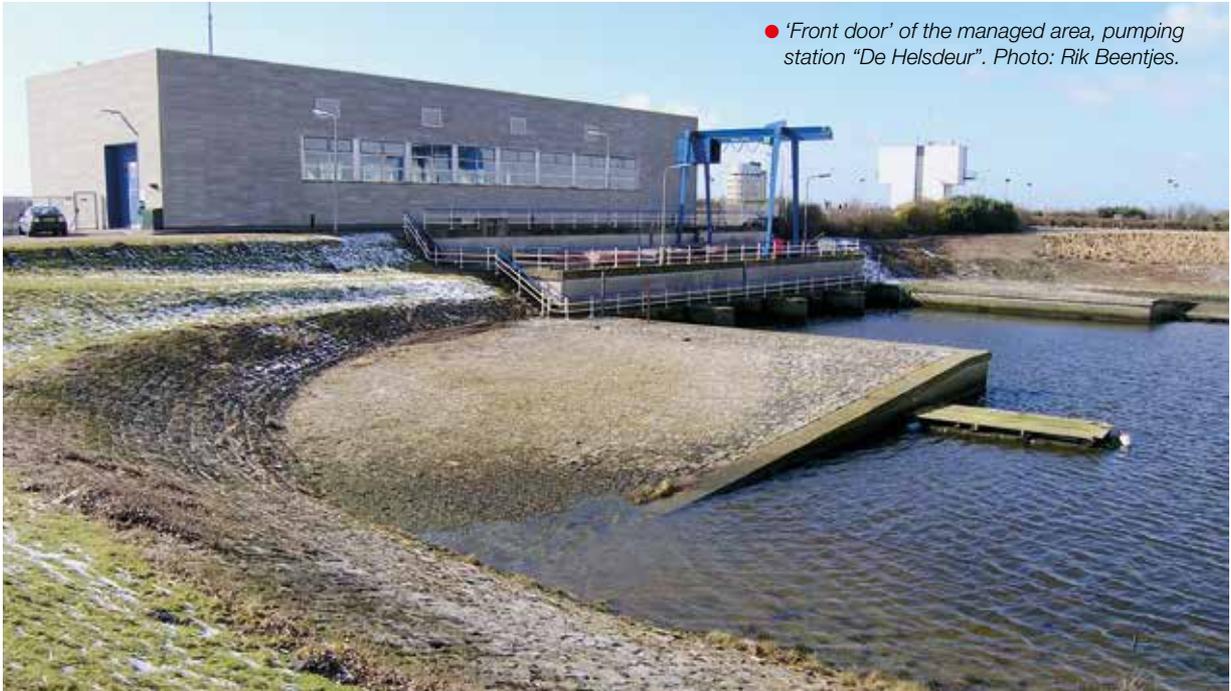


Connection and defragmentation

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Fish migration

at Hoogheemraadschap Hollands Noorderkwartier



● 'Front door' of the managed area, pumping station "De Helsdeur". Photo: Rik Beentjes.

*As early as the end of the last century, the term **vissenwater** ('fish water') was coined. The key element here is that when it comes to fish water, fish are the protagonist: fish should be able to complete their whole life cycle in a given water system, but should also be able to migrate.*

Fish water

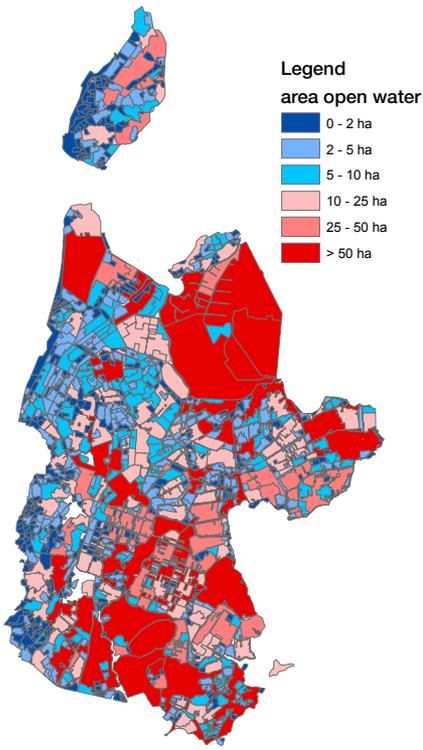
Clean and healthy water is important, no matter what the purpose of that water is. Whether it has been designated as swimming water, natural water, or agricultural water, each of these purposes of water comes with its own set of standards to assess whether it meets the predetermined quality requirements. For users of the water, this range of divergent standards is often confusing and hard to understand. At the end of the last century, the then Hoogheemraadschap Uitwaterende Sluizen in Edam came up with the term 'fish water' based on the

idea that if the necessary conditions to sustain a certain composition of fish stocks exist, other requirements to water systems for humans will also have been met sufficiently.

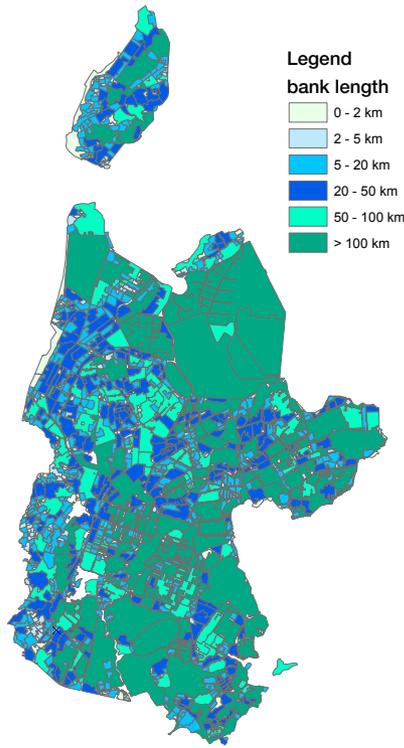
Fish are found almost anywhere, the number of freshwater species is limited, and they are easy to find. Moreover, fish have a clear role in the food chain. The presence or absence of certain species can be a meaningful indicator of the functioning of the ecosystem. As was mentioned above, in fish water the needs of the fish (and not of the anglers!) take centre stage. The

starting point is that fish should be able to fulfil their whole life cycle (foraging, breeding, and wintering) in a given water system. In large water systems such as the Schermerboezem (2000 hectares) that is easy to achieve, as it harbours a veritable multitude of habitats. Fragmentation of the polders with its various dams and pumping stations, however, poses fish with rather more of a challenge. And things get really challenging if those polders are home to species whose reproductive success depends on an interface between fresh and salt water. In Noord-Hollands polder waters, the best-known examples of the latter would be the eel (*Anguilla anguilla*) and the three-spined stickleback (*Gasterosteus aculeatus*). Consequently, these two species have become important target species in the Hoogheemraadschap's fish migration policy.

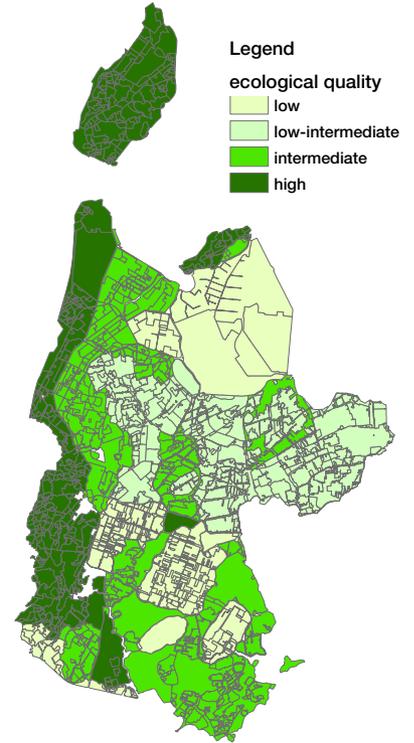
To further shape this fish water



● Surface of open water.



● Bank length.



● Ecological potential.

role, target situations have been drawn up, first of all with regard to the storage basins. The target situation ‘Vrij verkeer voor Vissen’ (‘Free movement for fish’) (Jaarsma & Witjes, 2003), in particular, has been an important reference point with respect to improving opportunities for fish migration. In the first exploratory stage, the Hoogheemraadschap entered into consultation with both recreational and professional anglers to identify the bottlenecks. The next step was beginning to actually tackle these bottlenecks, first of all by creating the area’s most important fresh water-salt water interface in the shape of pumping station and sluice De Helsdeur.

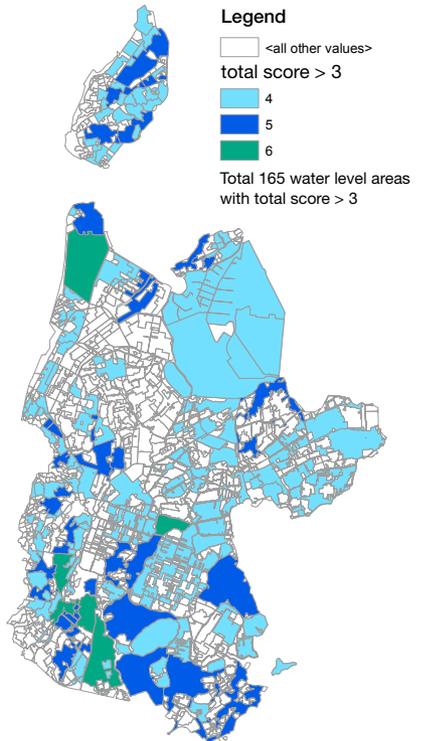
Fish migration plan

Subsequently, the fish migration plan ‘Vismigratie Vice Versa’ (‘Fish Migration Vice Versa’) (VisAdvies & HHNK, 2008) was published. It pinpoints and prioritises the migration bottlenecks in the area, as in an area encompassing 225 polders, 360 pumping stations, almost 2000 water level areas, and 4450 weirs it can be no surprise that it is difficult to know where to begin! The study involved a comprehensive geographic (GIS) analysis. On the basis of the water level areas within the

polder systems, maps were made, indicating for each water level area:

- The surface area of contiguous open water
- The amount of riparian habitat in kilometres and
- The ecological potential, combined with information on water quality and the location of nature reserves

The GIS analysis has resulted in an overview of the water level areas that would be the most interesting to connect with open water or the storage basins. Due to the fact that the facilities (pumping stations, locks, weirs) in these large, high-quality water systems generate a sizeable flow of water that attracts fish and also gives the water an ‘odour’ that is attractive to our upcoming (im)migrants, a lot of species frequent these waters. By pinpointing the facilities at these transitions as bottlenecks, it becomes clear what needs to be done. That said, the approach has to be sensible. The analysis identified no fewer than 180 bottlenecks, which is an impossible number to cover in a single year. The decision was made to implement the plan in different stages and to have it completed fully by 2021. For the purpose of the implementation, the following



● Overview of most important stream gauges.

principles were formulated:

- Prioritisation of sea water towards storage basins and polders
- Effective use of links with other ongoing projects
- From simple to complex
- Preliminary study into the presence of migratory species



● Non-return valve with vertical slots. Photo: Rik Beentjes.

A vertical-slot passage in De Helsdeur

The 'front door' through which migratory species can access the area under the management of Hoogheemraadschap Hollands Noorderkwartier (HHNK) is located at pumping station De Helsdeur in Den Helder. When this bottleneck was 'put to market' in 2006, the safety features had pushed up the estimated costs of the fish passage to such an extent (in excess of €500,000) that a meeting was called, which had professional fishermen, machinists, ecologists, and water level managers come together to find out if there really wasn't any other way. What resurfaced during that meeting was that in the past, the pumping station used to be left open slightly, allowing a certain amount of 'leakage'. A subsequent modification of the non-return valve that cost a few thousand euros altogether and a little programming then resulted in the creation of a fish passage. The so-called 'letterbox' system of vertical slots makes up the passage that fish can use to enter at high tide. We are once again allowing the pumping station to 'leak' a little, as it were. The salt water, which is heavier than fresh water, ends up in the salt water reservoir, which is a deep pit (16 m deep) in front of the pumping station. If the level of salt water at the bottom rises, the pumping station pumps the salt water back into the flow to attract the fish. An elegant solution that is both ecologically sound and fully automated. It brings in the fish without the salt water and costs next to nothing. The three-spined stickleback has since found its way to the passage. A population has emerged that spawn in the fresh waters of the city of Den Helder and then travel back up to the Wadden to enjoy lugworm pâtés and shrimp cocktails.

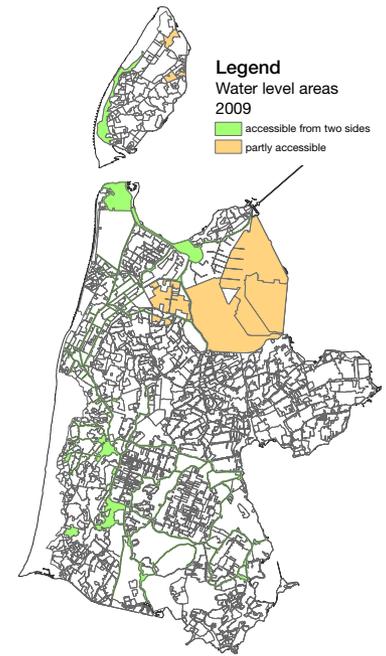
- Preliminary study into the harmfulness of existing pumping stations

Fish sluice at Kadoelen

One of the first migration bottlenecks that was dealt with under the Water Framework Directive (WFD) fish migration programme for 2009-2015 was the Kadoelen pumping station on the Lansmeerderdijk in Amsterdam. Along with pumping station De Poel in Monnickendam, Kadoelen drains the Waterlandse Boezem, which is an excellent habitat for eel (*Anguilla anguilla*). A 2010 survey already showed that the pumping station's two large augers were quite safe for fish: 92% of eels and 97% of scaled fish species

passed through the pumping station unscathed.

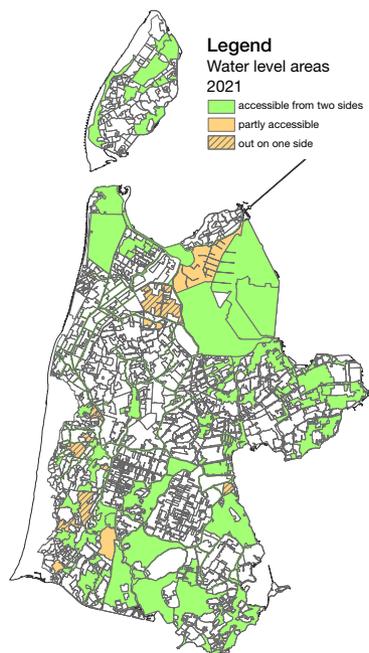
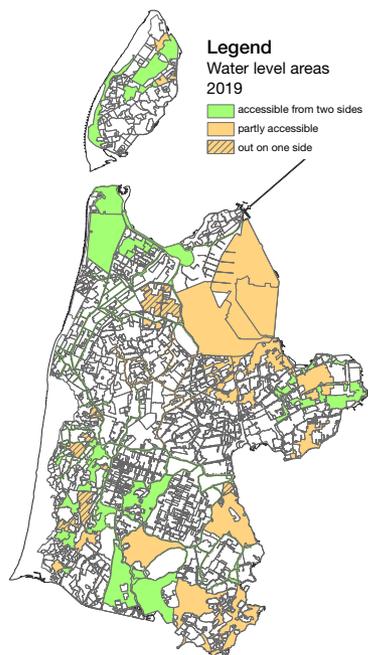
Consequently, emigration was not that much of a problem, but successful migration into the area still posed an issue. How on earth would young eel, three-spined stickleback, or smelt (*Osmerus eperlanus*) make it past a pumping station unharmed? The decision was made to create a so-called sluice-type fish passage that would also be able to generate a flow to attract fish. This design involves an amount of polder water being pumped into a tube-like structure featuring two large receptor pits by means of a small pump. On the North Sea Canal side, this water flows out into the canal



and thus attracts young eels, but also common bream (*Abramis brama*), silver bream (*Blicca bjoerkna*), and zander (*Sander lucioperca*) into the passage. After a short wait, the door on the canal side closes and the polder side opens, allowing the fish to continue their journey to the polder. Over the next few years, this fish passage and many others in the region will be the subject of extensive research.

Fish passages between the polders and dunes

When the weir in the Neksloot in Heemskerk needed renovation in 2003, the planning engineer immediately suggested including some kind of provision for fish passage. An excellent idea, of course, but what would work at a weir? After a short search we stumbled upon the so-called De Wit fish passage. This design by W.G.J. De Wit of Hoogheemraadschap De Stichtse Rijnlanden features a rectangular gutter-like structure split into separate compartments by means of dividers. These dividers have openings at the bottom, alternately positioned on the left and then the right, through which fish can pass. The structure limits the difference in water levels between the compartments to no more than 5 to 10 cm. As a result, the flow rate through the openings is reduced to allow our



● Overview of connected stream gauges, in which the green colour indicates that the area is accessible from two sides (fish can enter and exit). Orange stands for work in progress. Situation in 2009, 2015, 2021.



● Pike in fish passage Nekslot. Photo: HHNK.

polder fish to make it to the higher water levels in small increments. Seeing as the water level difference at the Nekslot weir amounts to approximately 15 cm, a structure with three compartments should be sufficient. The container could even be prefabricated in stainless steel and a few weeks later the success of this first weir passable by fish could be put to the test by the local angling club. With perch (*Perca fluviatilis*), roach (*Rutilus rutilus*), bream, eel, and even a pike (*Esox lucius*) having made it through, the project proved a definite success! Meanwhile, fish from the Binnenmeer in Uitgeest that would like to take a trip to the dunes still faced an obstacle in the shape of the Piet Verduin weir in the Tolvaart. As part of the WFD programme aimed at fish migration, this weir, too, has since been made ‘fish-passable’ and fish from the Uitgeesterbroek and Heemskerkerbroek can make it all the way to the waters of the Marquette estate! By adapting the inlet in the Korendijk, a fish sluice was created that allows fish to swim to the Castricumerpolder as well. In the spring of 2017, the effectiveness of the route along these three fish passages was put to the test in cooperation with local professional fishermen. In addition to roach and perch, the likes of eel, pike, tench (*Tinca tinca*), and bitterling

(*Rhodeus amarus*) were found in the traps.

Where are we now?

In the period 2008-2016, more than 45 bottlenecks have been eliminated and areas made accessible from two sides. This means that fish can come and go whenever they please and that there is also safe exit route for them. We aim to have connected approximately 75 areas with either the storage basin or the open water by 2021.

The job of a Water Board is never done; there are always challenges, for example in the form of climate change. It is not just the rising sea level that is important from the point of view of safety, but the water in ditches and drainage channels is warming up as well. Drainage channels already tend to warm up faster and higher and stay warm for longer and that negatively affects the ecosystem. These warmer conditions will lengthen the growing season for aquatic plants, an effect which is most prominently visible in the water in urban areas (heat stress). With regard to fish there is a noticeable trend towards changing fish stocks, in which the water’s increasing clarity plays a major role. Clear water, with the ensuing longer growing season for aquatic plants and bank vegetation, comes with different kinds of fish.

Turbid-water fish such as bream, zander and common carp are declining in numbers, while clear-water species like common rudd (*Scardinius erythrophthalmus*), pike and tench are seeing a slow increase. The presence of fish passages supports this process. The Hoogheemraadschap, in its water quality initiatives in the coming years, will have to maintain a strong focus on establishing water systems, creating fish passages and monitoring the effects on fish stocks.

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Reference literature

- VISADVIES & HHNK, 2008. Vismigratie Vice Versa. Strategisch plan voor het oplossen van vismigratieknelpunten in het beheersgebied van Hollands Noorderkwartier.
- JAARSMA, N.G. & T.G.J. WITJES, 2003. Functie vissenwater in de boezemsystemen van Hollands Noorderkwartier: integrale systeemanalyse en inschatting van de haalbaarheid van de voorlopige streefbeeld. Witteveen+Bos, Deventer.