Project part-financed by the European Union (European Regional Development Fund)

The Interreg IVB North Sea Region Programme

WP5 Measures

Basic analysis reports

Measure nr° 23. Fish spawning pond ("Vispaaiplaats")

Annelies Boerema,
Antwerp Port Authority (APA)

Disclaimer

The authors are solely responsible for the content of this report. Material included herein does not represent the opinion of the European Community, and the European Community is not responsible for any use that might be made of it.

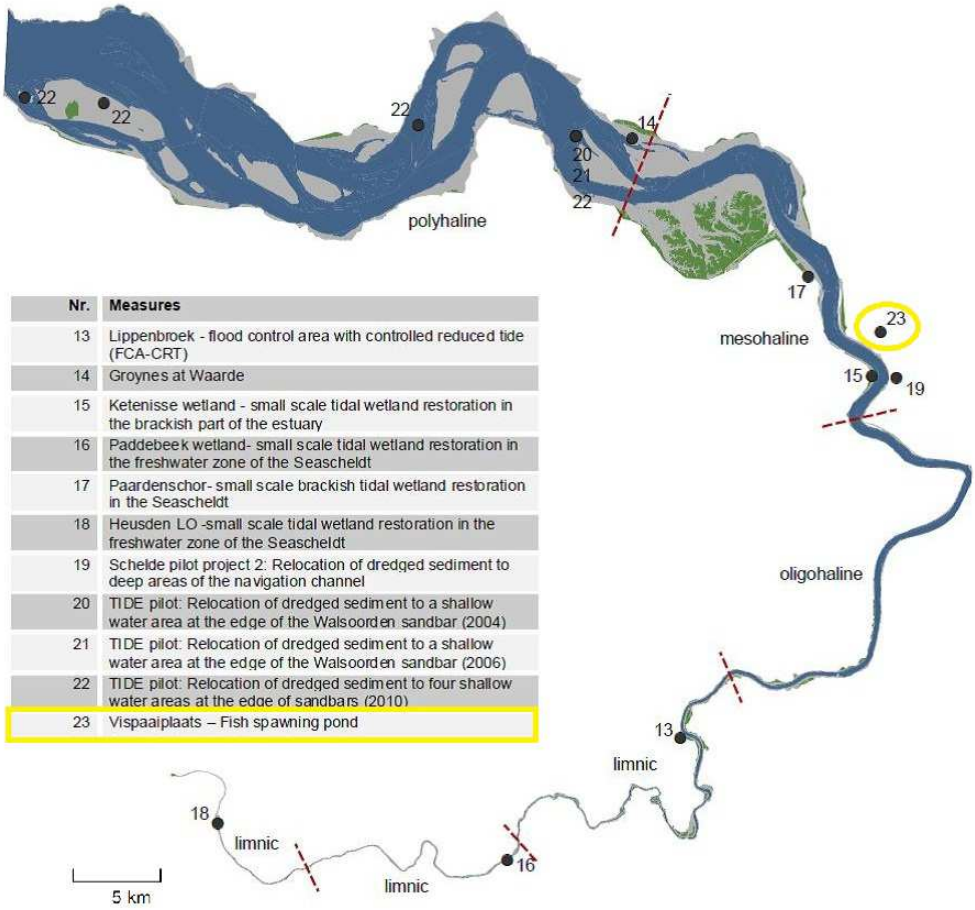
Annelies Boerema
Antwerp Port Authority

23.01.2013

TABLE OF CONTENTS

1 Description of measure

- Measure Category: Biology/Ecology
- Estuary: Scheldt
- Salinity zone: Mesohaline
- Pressure: Habitat loss and degradation
- Status: Implemented (in 2007)
- River km: TIDE-km 95
- Country: Belgium
- Specific location: Sea Scheldt, Antwerp, Port of Antwerp, near Thijsmanstunnel
- Responsible authority: Antwerp Port Authority
- Costs: /
- Cost category: 50,000 – 250,000 €



Nr.	Measures
13	Lippenbroek - flood control area with controlled reduced tide (FCA-CRT)
14	Groynes at Waarde
15	Ketenisse wetland - small scale tidal wetland restoration in the brackish part of the estuary
16	Paddebeek wetland- small scale tidal wetland restoration in the freshwater zone of the Seascheldt
17	Paardenschor- small scale brackish tidal wetland restoration in the Seascheldt
18	Heusden LO -small scale tidal wetland restoration in the freshwater zone of the Seascheldt
19	Schelde pilot project 2: Relocation of dredged sediment to deep areas of the navigation channel
20	TIDE pilot: Relocation of dredged sediment to a shallow water area at the edge of the Walsoorden sandbar (2004)
21	TIDE pilot: Relocation of dredged sediment to a shallow water area at the edge of the Walsoorden sandbar (2006)
22	TIDE pilot: Relocation of dredged sediment to four shallow water areas at the edge of sandbars (2010)
23	Vispaaiplaats – Fish spawning pond

Figure 1. Location of the fish spawning pond

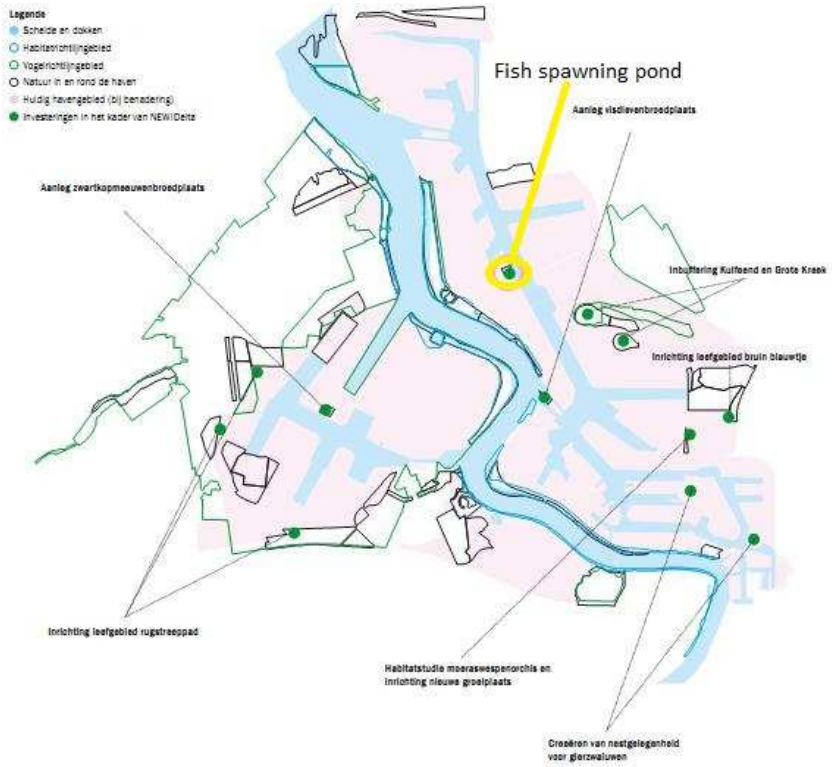


Figure 2. Location of the fish spawning pond in the Antwerp harbour docks

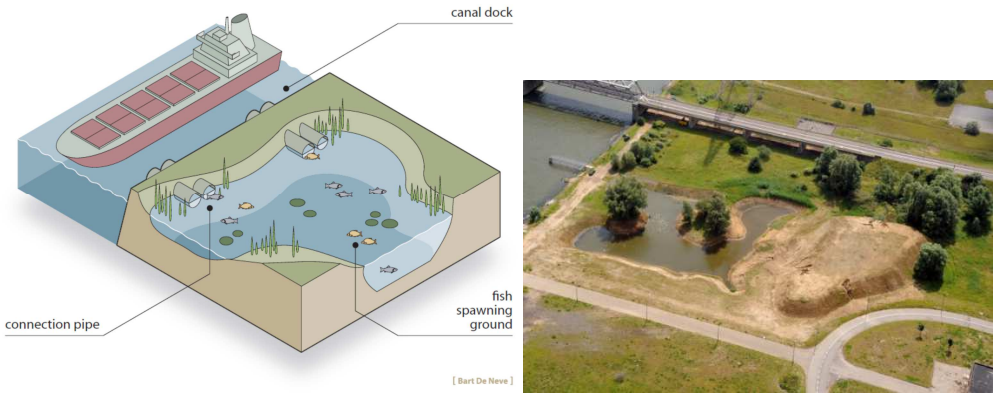


Figure 3. Left: Scheme of a fish spawning pond (Bart De Neve); Right: a picture of the Antwerp fish spawning pond

1.1 Measure description

This measure was a pilot project to create a suitable area where fish can breed, and larvae and juvenile fish can grow up safely.

Fish fauna is large in harbour docks and the freshwater-brackish water transition is important for migratory fish. However, a survey in the harbour docks revealed that few young fish were present. Fish spawn mainly in shallow, calm waters where water plants grow. Because of the depth of the docks, the steep quay walls and the intensive shipping movement, there are few good spawning places in the port area. A fish spawning pond has been excavated on the right bank in the port of Antwerp and connected to the docks (Kanaaldok B2). The connection consists of 4 cylindrical concrete pipes with a diameter of 600 mm and a length of 30 m. The water level (constant in the docks) is situated at 150 mm from the upper border of the pipes;

thus the pipes are not completely submerged. The pond is shallow water (1.5 m at deepest parts). There is some wave-induced current through the pipes, which is probably important to attract the fish into the pipes. Aimed value of pond: absence of large predators, presence of water plants, fast warming by sun, absence of large waves/currents, presence of food.

In general, the fish spawning pond has the objective of improving the natural increase of the fish diversity and density. More specific, the new pond in the harbour area aims to create habitat for diverse fish fauna, migratory fish and spawning fish. Target fish are bream, ruffe, zander, roach and eel. In addition to fish, the pond can also contribute to the growth of aquatic plants.

This investment is part of the efforts the Antwerp Port Authority is making to encourage wildlife that is compatible with port activity. It was a project under New! Delta (Interreg 3B). This project fits in with objectives for nature infrastructure in port areas defined in the Regional (Flemish) spatial plan, and in the spatial plan for the port area (in development).

1.2 Monitoring

The monitoring is organized by the “Provinciale Visserijcommissie Antwerpen” and is still in progress. In 2010, a first fish inventory has been carried out. Fish length was measured. Species were determined. In the near future a more elaborate monitoring is planned using hoop nets with small mesh size (both in the middle of the pond and covering the pipe openings) and electricity (using equipment that is suitable for brackish water).

1.3 Monitoring results

First monitoring results showed a positive evolution with a high density of juvenile fish.
The Antwerp docks are classified under the bream-pike perch, deep-water fish stock type, and indeed the commonest types of fish found in the docks are bream (*Abramis brama*), ruffe (*Gymnocephalus cernuus*), roach (*Rutilus rutilus*), perch (*Perca*), zander (*Sander*), and eel (*Anguilla*). So far 6 species were captured in the pond: roach, perch, zander (1 juvenile), eel, European flounder (*Platichthys flesus*) and three-spined stickleback (*Gasterosteus aculeatus*). Perch, pike perch, and European flounder certainly use it for spawning or growing-up. Juvenile fish has been observed in substantial quantities. Because capturing methods so far were not optimal for very small fish, some species may have left yet unobserved.

2 Execution of main effectiveness criteria

2.1 Effectiveness according to development targets of measure

Step 1: Definition of development targets
This measure was defined to be a success if the pond would be found by fish and if it would be used as spawning area and as area where juvenile fish grow up.

Step 2: Degree of target achievement
From the first results we can conclude that, based on these criteria, the measure is indeed a success.

2.2 Impact on ecosystem services

Step 1: Involved habitats
The measure Fish spawning pond in the mesohaline zone of the Scheldt estuary was about the creation of a fish spawning pond connected to a harbour dock by transforming adjacent land into subtidal shallow habitat with a high change in the habitat quality.

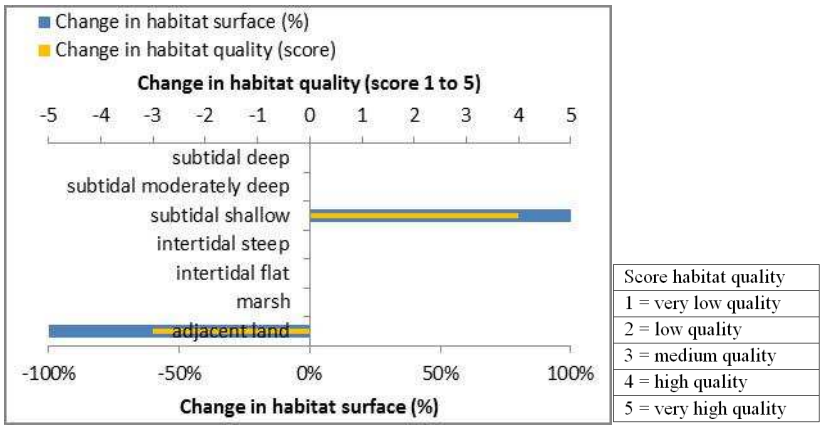


Figure 4. Ecosystem services analysis for Fish spawning pond: Indication of habitat surface and quality change, i.e. situation before versus after measure implementation. The change in habitat quality, i.e. situation after the measure is implemented corrected for the situation before the measure, is '1' in case of a very low quality shift, and '5' in case of a very high quality shift.

Step 2: Expected impact on ecosystem services, compared with targeted ecosystem services, and expected impact on beneficiaries

More information about the methodology and the correct interpretation of the results could be found in the overall measures report (Saathoff et al. 2013).

(1) Overall expected impact on ES:
From the ES assessment it is concluded that this measure generates overall a positive expected impact for many ES, with a very positive expected impact for "biodiversity", and

some regulating services: Erosion and sedimentation regulation (by water bodies); Water quantity regulation: dissipation of tidal and river energy.

However, it is important to compare the result of the ES assessment with the local context of the measure. Although the measure creates subtidal shallow habitat, it will (evidently) not impact all estuarine ES because the measure site is not directly connected to the estuary (connected by four concrete pipes to an adjacent harbour dock). Hence, most regulating and provisioning services are not relevant (between brackets in Table 1). The expected impact is overall still positive, but with only a very positive expected impact on „biodiversity“.

(2) Expected impact on targeted ES

This measure aims to improve the fish biodiversity in the harbour area (ES “biodiversity”). The expected impact on this development target is very positive.

(3) Expected impact on beneficiaries

The expected impact for the different beneficiary groups is overall positive, with a positive expected impact for indirect and future use and for local use.

Table 1. Ecosystem services analysis for Fish spawning pond: (1) expected impact on ES supply in the measure site and (2) expected impact on different beneficiaries as a consequence of the measure

Vispaaiplaats - Fish spawning pond

Cat.	Ecosystem Service	Score
S	"Biodiversity"	3
(R1)	(Erosion and sedimentation regulation by water bodies)	3
R2	Water quality regulation: reduction of excess loads coming from the catchment	1
R3	Water quality regulation: transport of polutants and excess nutriënts	2
(R4)	(Water quantity regulation: drainage of river water)	1
(R5)	(Erosion and sedimentation regulation by biological mediation)	1
(R6)	(Water quantity regulation: transportation)	0
(R7)	(Water quantity regulation: landscape maintenance)	2
R8	Climate regulation: Carbon sequestration and burial	1
(R9)	(Water quantity regulation: dissipation of tidal and river energy)	3
(R10)	(Regulation extreme events or disturbance: Wave reduction)	0
(R11)	(Regulation extreme events or disturbance: Water current reduction)	1
(R12)	(Regulation extreme events or disturbance: Flood water storage)	0
(P1)	(Water for industrial use)	0
(P2)	(Water for navigation)	0
(P3)	(Food: Animals)	1
C1	Aesthetic information	2
C2	Inspiration for culture, art and design	2
C3	Information for cognitive development	2
C4	Opportunities for recreation & tourism	2

Beneficiaries:	
Direct users	0
Indirect users	2
Future users	2
Local users	2
Regional users	1
Global users	1

X Targeted ES

Legend: expected impact*	
3	very positive
2	positive
1	slightly positive
0	neutral
-1	slightly negative
-2	negative
-3	very negative

*: Indicative screening based on ES-supply surveys and estimated impact of measures on habitat quality and quantity. Quantitative socio-economic conclusions require local supply and demand data to complement this assessment.

2.3 Degree of synergistic effects and conflicts according to uses

It was difficult to find a good location for the new fish spawning pond in the highly industrialised area. A suitable location was found by the Antwerp Port Authority nearby the Tijsmanstunnel and the Lillobrug, at the Western side of the Kanaaldok B2. At this location, no large scale harbour activities were possible so that the new pond did not disturb the economic functioning of the harbour. In addition, this location was not used before, while it now has an ecological purpose.
The construction of the pond needed to agree with present piers and underground electricity pipes. Some minor conflicts with shipping/industry had to be solved because other activities and developments nearby the pond need to agree with the presence and function of the pond. For instance a waste collection site for individual shippers is installed on the same spot. To create a win-win, the construction of the waste collection site is designed in such a way that structures of the dock-shore are more nature-friendly, by the application of a diversity of surface structures and constructions (hiding places).

3 Additional evaluation criteria in view of EU environmental law

3.1 Degree of synergistic effects and conflicts according to WFD aims

The fish spawning pond offers new spawning habitat in the estuary. This is needed to compensate for the lost spawning habitat with the lost wetlands in history.

Indicator Group	Code	Main pressures **mesohaline** zone Scheldt	Effect?					Description
			- -	-	0	+	++	
S.I.	1.1	Habitat loss and degradation during the last about 100 years: Intertidal				X		New spawning habitat
S.I.	1.5	Gross change of the hydrographic regime during the last about 100 years			X			
S.I.	3.1/3.2	Decrease of water and sediment chemical quality			X			
D.I.	1.3	Land claim during the last about 100 years				X		New spawning habitat
D.I.	1.7	Relative Sea Level Rise			X			
D.I.	2.12	Port developments			X			

S.I. = state indicator; D.I. = driver indicator

3.2 Degree of synergistic effects and conflicts according to Natura 2000 aims

This measure is not located in habitat directive or in bird directive area.

4 Crux of the matter

This pilot project shows that simple connection by pipes between pond and docks is sufficient to make the pond successful as spawning and juvenile area. Also, the pipe length of 30 m is not too long and the diameter of 600 mm is large enough. One pond is probably far from enough to contribute significantly to the fish stock in harbor docks or connected estuary. Sites without large-scale port development are preferable to create such fish spawning ponds. It is important to note that this measure was created behind the locks; it is unclear whether this kind of measure would be successful if the water level in the pipes is not being kept constant.
Maintenance was very low in this project because the soil is poor so that vegetation is not too abundant. At times floating trash has to be removed.
Remaining knowledge gaps are related to the behaviour of the juvenile fish (do they stay in the pond?) and if they don't, what is the survival success if they swim into the docks? Large predators have been observed near the pipe exits at the dock side. Extra analysis is needed to decide which adaptations are needed in the construction to increase the survival of the juvenile fish.

5 References

Saathoff, S., J. Knüppel, S. Manson, and A. Boerema. 2013. Management measures analysis and comparison. Investigation of measures planned and implemented at the estuaries of Weser, Elbe, Humber and Scheldt. Study report in the framework of the Interreg IVB project TIDE, Oldenburg, Hamburg, Hull, Antwerp.