Species Fact Sheets for the Wadden Sea Fish Strategy

Overview of 19 species in the Wadden Sea sampled in the Demersal Fish Survey
Factsheets for Wadden Sea Fish Strategy

Fish in the Wadden Sea

The current status of fish in the Wadden Sea has been analysed by the research institutes IMARES and NIOZ in cooperation with the Programme towards a Rich Wadden Sea (PRW). The results are published in the report “Wadden Sea Fish Haven – development agenda for fish in the Wadden Sea and overview of species” which can be found online at: www.rijkewaddenzee.nl/fish

The report makes clear that fish populations have declined in the Wadden Sea since the 1980’s. The drivers are unclear, but increased water temperature, damage of coastal habitats (through sand nourishment, dredging and fisheries) and heightened predation by top predators probably play a role.

The largest decrease can be seen in the marine juvenile species, such as plaice and cod, that are present in the Wadden Sea during early life stages. Estuarine resident species such as gobies, show an increase or stable trend. For juvenile plaice and eel pout there is a clear relationship between rising water temperatures and decrease in density, but it is not possible to draw conclusions for other species. The size structure of the fish community changed in all areas, with generally the strongest declines in the largest size classes. Most size classes show higher densities in the mid 1980s and a decline afterwards.

This study shows that there is a lack of data on the fish community in the Wadden Sea. Not only on the drivers affecting the trends, but also on the species themselves. This is especially the case for the pelagic species such as anchovy and sandeel, as the current monitoring techniques are not suitable for these species. Insight into the entire community, and the associated food web relationships, is important.

Restoration of fish migrations routes and brackish water areas will not only benefit the diadrome (migrating) species, but also species such as herring and flounder which need brackish water areas as spawning and nursery areas.

It is important to develop insight into the role the Wadden Sea plays in the life-cycle of the various species in order to develop successful management measures. A life-cycle analysis per fish species in which the importance of the Wadden Sea to the status of the population can be quantified is recommended. This ‘swimway’ approach will support the development of management measures.

This is especially relevant because it is likely that factors outside the Wadden Sea (North Sea, estuaries, rivers) determine the distribution and abundance of the species in the Wadden Sea itself.

Important habitats for fish have disappeared in the past decennia. The Wadden Sea is sandier and shallower than it used to be due to human activities such as sand nourishments and management of channels. An historical analysis of the development of habitats, combined with case studies of non-commercial fish species such as dab, could provide information on measures for habitat restoration.

Fishermen and women have a wealth of information and expertise on fish and how to catch them, but also insights in the ecosystem and how it has changed in the past years. Enabling an exchange of ideas and information between fishermen, scientists and managers would enhance the management process for both fisheries and fish.

In the report suggestions have been made for possible management measures and a research agenda which will be addressed at a later stage. www.rijkewaddenzee.nl/fish

In this document 19 of the 34 fish species caught are examined in detail. The choice of species is based on those covered in current policy documents (Natura 2000 and Water Framework Directive) and which the last Quality Status Report identified as priority species for further study (Jager et al., 2009). Per species information on life-history, distribution, trends, information on drivers and knowledge gaps are given. This information is necessary for the future development of management measures. Species are presented in alphabetical order according to their English common name.

Introduction

The Demersal Fish Survey (DFS) is a beam trawl survey covering the subtidal and deeper channels of the Wadden Sea and the coastal zone Tulp et al. (2008, 2015). It has been carried out in September-October since 1970 and is concurrently carried out in the coastal waters (up to 25m depth) from the southern border of the Netherlands to Esbjerg, including the Wadden Sea, the outer part of the Ems-Dollard estuary, and the Westerschelde and the Oosterschelde in the south-east. IMARES is responsible for the survey in Dutch waters.
**Engraulis encrasicolus**

**MS - Marine Seasonal migrant**

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**Occurrence in the Wadden Sea**

Rarely found in DFS survey. Is less rare in German stow net survey\(^1\) and found May-Oct in pelagic sampling net in Mandelbeek\(^2\). Used to spawn in brackish water in Zuiderzee, Western Wadden Sea and German Bight. Fish in spawning condition were observed again in Wadden Sea in 1994\(^4\). Anchovy also spawns again in the German Bight, after absence of 50 years\(^5\). Anchovy has also been observed in the WFD monitoring in the Ems estuary since 2006.

**Commercial value**

None in Wadden Sea - used to be important fisheries in Zuiderzee before closure and in the Dollard even before those times (Stratingh & Venema, 1855).

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**Policy objectives**

Anchovy is a typical species for H1110A. N2000 states that there should be an improvement in this habitat type. Species is classified as endangered or vulnerable in Dutch, German or trilateral Red List. No management measures are in place but when distribution is widespread minor targeted fisheries take place\(^6\).

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**Trend**

Recent increase in the North Sea.

**Available information on drivers**

**Climate variability:** periods of increase often coincide with warm phases of the Atlantic Multi-decadal Oscillation during the last century\(^1\).

**Knowledge gaps**

No good pelagic monitoring in Dutch Wadden Sea. Importance of Wadden Sea as spawning area and requirements for spawning spatial and diurnal dynamics in distribution and in by-catch in shrimp fisheries, diet, role Wadden Sea in life cycle, habitat preferences.

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Myoxocephalus scorpius
(ER - Estuarine Resident)

**Occurrence in the Wadden Sea**

Bull routes are found in marine and brackish waters from 0 to 450 m depth with a southern limit around the bay of Biscay and a northern limit above the Arctic Circle. Vast majority occurs at depths of <40 m. Regularly found in Wadden Sea in DFS. Typically associated with inshore and coastal areas, often on rocky substrates, reefs and grounds with macroalgal cover, which allow these ambush predators to make optimal use of their camouflage. Spawning Dec-Mar. Bullrout presumably spawn in coastal waters throughout their range, wherever suitable habitats are available1,2.

**Commercial value in North Sea fisheries**

None. Caught (but not landed) as by-catch in shrimp fisheries (survival estimated at 90%).

**Policy objectives**

Bull rout is a typical species for H1110A; N2000 states that there should be an improvement in this habitat type.

**Trend**

Stable in Ems-Dollard and declining in Wadden Sea.

**Available information on drivers**

Habitat degradation (prefer rocky bottoms with sand or mud, can be found among seaweeds); local pressures e.g. fisheries – by-catch in shrimp fisheries.

**Knowledge gaps**

Spatial and diurnal dynamics in distribution and in by-catch in shrimp fisheries, diet, role Wadden Sea in life cycle, habitat use.

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**Pholis gunnellus**
(ER - Estuarine Resident)

Rock gunnel
Botervis
Butterfisch
Tangspræl

Occurrence in the Wadden Sea
Butterfish typically occur on rocky habitats in coastal waters, including intertidal zones, also commonly found in the Wadden Sea. Most commonly encountered in waters <50 m deep, as they often inhabit intertidal and shallow sublittoral zones.

Commercial value in North Sea fisheries
None.

Demersal fish, the diet comprises amphipods, shrimps and other small crustaceans, polychaetes and molluscs. Within the intertidal zone, they are prey for a variety of seabirds.

Policy objectives
Butterfish is a typical species for H110A. N2000 states that there should an improvement in this habitat type.

Trend
The species appears stable in the Ems and western Wadden Sea Fisheries: bycatch in shrimp fisheries.

Available information on drivers
Habitat degradation and local pressure.

Knowledge gaps
Spatial and diurnal dynamics in distribution and in by-catch in shrimp fisheries, diet, role Wadden Sea in life cycle, habitat preferences.

**Cod (Gadus morhua)**

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**Occurrence in the Wadden Sea**
Highest catch rates restricted to the Baltic Sea, the Kattegat/Skagerrak, and the German Bight. In the North Sea and south of the Dover Strait catches are lower, south of 49°N catches drop. Newly-settled demersal juveniles can be found close inshore even in depths <5 m. In the southern North Sea, immature cod aggregate in shallow water during winter and move to deeper water during summer. The distribution pattern in the North Sea has changed markedly during the last 30 years. In the 1980s, the highest concentrations were found in the southeast, along the continental coast, off northeast England and in the Skagerrak and Kattegat. Since then, the continental coast has almost completely lost its function as an important nursery area. Cod is a winter guest in the Wadden Sea.

**Commercial value in North Sea fisheries**
High. Cod has been exploited on both sides of the Atlantic for centuries as an important target as well as a bycatch species in almost all gears used in demersal and pelagic fisheries throughout the area. Total catches (including discards) in the North Sea peaked at about 350 thousand t in the 1970s and early 1980s, during the time of the ‘gadoid outburst’. Thereafter, catches gradually declined to a level of 50–70 thousand t during the 2000s.

**Policy objectives**
In an attempt to reverse the decline in spawning stock biomass in northern European seas an international Cod Recovery Plan was initiated in 2004. Measures introduced under the Common Fisheries Policy included increases in mesh size, seasonal area closures and a considerable reduction in fishing effort. Cod falls under the EU TAC and quota regulations. Cod is a typical species for H1110A. N2000 states that there should an improvement in this habitat type.

**Trend**
Declining in all Wadden Sea subareas.

**Available information on drivers**

**Habitat requirements:** no clear preferences for specific sediments but may be attracted to underwater structures (including wrecks). Occupy a wide range of salinities, from near-freshwater conditions in the Baltic Sea to about 35 psu.

**Climate:** There is no evidence that cod have a particular preferred temperature range, although larger ones seem to avoid shallow waters during summer. The thermal niche ranges from −1.5 to 19°C, but small 0-group cod in the Wadden Sea can tolerate temperatures up to 23°C.

**Fisheries:** bycatch in shrimp fisheries, demersal fisheries North Sea.

**Knowledge gaps**
The preference of 0- and 1-group for shallow water or for rough and/or weedy ground makes it difficult to obtain reliable indices of abundance from bottom-trawl surveys. Spatial and diurnal dynamics in distribution and in by-catch in shrimp fisheries, diet, role Wadden Sea in life cycle, habitat preferences.
**Dab**

_Most abundant flatfish species in the North Sea, found on sandy and soft substrates at depths of 2–150 m. Settlement of dab occurs in coastal areas, not in the Wadden Sea_.

_Juvenile dab can occur over a wide depth range_. In autumn, the 0-group migrate inshore and enter the Wadden Sea. Juvenile dab stay in the tidal gullies and are hardly ever found on the tidal flats of the Wadden Sea.

**Commercial value**

_Limited; dab is a common bycatch but is not very valuable and a large proportion of the catch is discarded._

**Policy objectives**

_Dab is a typical species for Habitat 1110A. Natura 2000 states that there should be an improvement in this habitat type._

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**Limanda limanda**

_(MJ - Marine Juvenile)_

_Demerald flatfish, eats polychaetes, small crustaceans, molluscs, brittle-stars, small sea urchins and fish._

**Occurrence in the Wadden Sea**

_Most abundant flatfish species in the North Sea, found on sandy and soft substrates at depths of 2–150 m. Settlement of dab occurs in coastal areas, not in the Wadden Sea_.

_Juvenile dab can occur over a wide depth range_. In autumn, the 0-group migrate inshore and enter the Wadden Sea. Juvenile dab stay in the tidal gullies and are hardly ever found on the tidal flats of the Wadden Sea.

**Commercial value**

_Limited; dab is a common bycatch but is not very valuable and a large proportion of the catch is discarded._

**Policy objectives**

_Dab is a typical species for Habitat 1110A. Natura 2000 states that there should be an improvement in this habitat type._

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**Trend**

_Dab has strongly decreased in all Wadden Sea areas_.

**Available information on drivers**

**Climate:**

likely similar to plaice: increasing water temperatures in recent decades make the Wadden Sea less suitable as nursery area and young fish move to deeper waters in the coastal area.

**Fisheries:**

bycatch in shrimp fisheries. Possibly water visibility and nutrient levels.

**Knowledge gaps**

Spatial and diurnal dynamics in distribution and in by-catch in shrimp fisheries, diet, role Wadden Sea in life cycle, habitat preferences.
Eelpout
Puitaal
Aalmutter
Ålekvabbe

Zoarces viviparus
(ER - Estuarine Resident)

Occurrence in the Wadden Sea
Eelpout is a northern species and during summer, the eelpout is at its southernmost distribution area in the German Wadden Sea\(^1\). Eelpout is a resident species in the Wadden Sea, with year-round presence.

Commercial value in North Sea fisheries
None. Caught as bycatch by shrimp fisheries.

Policy objectives
Eelpout is a resident species which is considered typical for H1110A. Natura 2000 states that there should be an improvement in this habitat type. This species falls under the Water Framework Directive (River Ems.) for the metric species composition.

Trend
Declining in Wadden Sea and fluctuating in Em-Dollard.

Available information on drivers
Climate: The relative abundance of the non-migratory eelpout decreases upon warming, reflecting a higher mortality in hot summers\(^1\). Growth also declines due to physiological constraints (Ref. Polte).
Habitat: preference for muddy bottoms and mussel beds.
Fisheries: bycatch in shrimp fishery.

Knowledge gaps
Spatial and diurnal dynamics in distribution and in by-catch in shrimp fisheries, diet, role Wadden Sea in life cycle, habitat preferences.

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Commercial value in North Sea fisheries
None. Caught as bycatch by shrimp fisheries.

Policy objectives
Eelpout is a resident species which is considered typical for H1110A. Natura 2000 states that there should be an improvement in this habitat type. This species falls under the Water Framework Directive (River Ems.) for the metric species composition.

Trend
Declining in Wadden Sea and fluctuating in Em-Dollard.

Available information on drivers
Climate: The relative abundance of the non-migratory eelpout decreases upon warming, reflecting a higher mortality in hot summers\(^1\). Growth also declines due to physiological constraints (Ref. Polte).
Habitat: preference for muddy bottoms and mussel beds.
Fisheries: bycatch in shrimp fishery.

Knowledge gaps
Spatial and diurnal dynamics in distribution and in by-catch in shrimp fisheries, diet, role Wadden Sea in life cycle, habitat preferences.

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**Platichthys flesus**  
(ER - Estuarine Resident / CA - Catadrome)

### Occurrence in the Wadden Sea
Flounder is a common flatfish in coastal, brackish and estuarine waters and is most abundant in the Baltic Sea. Species found from coast up to 50 m depth but preference for shallow seas outside spawning time (Feb – May); migrates to brackish and freshwater. Flounder occur at great depths but are most abundant in the 0–5 m depth zone. The nursery areas are located in the shallow coastal zones and estuaries, including the Wadden Sea, where the larvae arrive from early April to early May to settle on the tidal flats. Year-class strength appears to have been largely determined before that time, when the larvae are still in the open sea. After settlement, a period of density-dependent mortality follows, the main predators being crustaceans. Immature flounder spend most of their first 2 to 3 years of life in freshwater or brackish littoral and coastal areas before joining the mature stock. Adults perform an annual spawning migration in late autumn or early winter to the offshore spawning grounds, and a feeding migration from May to November towards the coastal areas.

### Commercial value
Limited; small scale passive gear fisheries in Wadden Sea and coastal waters.

### Policy objectives
Flounder is a typical species for H1110A; this is one of the species for which the Wadden Sea is considered a nursery area. N2000 states that there should be an improvement in both H1110A and nursery area. Flounder falls under the EU TAC and quota regulations. The abundance of flounder is assessed as part of the WFD-fish index for transitional waters (River Ems).

### Trend
Unclear.

### Available information on drivers
Habitat degradation, in Wadden Sea and Eems, including opportunities for migration in Eems; Fisheries: bycatch in shrimp fisheries.

### Knowledge gaps
Spatial and diurnal dynamics in distribution and in by-catch in shrimp fisheries.

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### Gobiidae
**(ER - Estuarine Resident)**

#### Occurrence in the Wadden Sea
Several species occur in the Wadden Sea. Various species prefer different habitats, some favour sandy bottoms in estuarine and inshore waters, such as the sand goby (*Pomatoschistus minutus*). Taxonomic species discrimination in monitoring is difficult.

#### Commercial value
None.

#### Policy objectives
Gobies are considered typical species for H1110A. N2000 states that there should be an improvement in this habitat type.

#### Trend
Stable or increasing.

#### Available information on drivers
**Fisheries:** bycatch in shrimp fisheries.

#### Knowledge gaps
- Spatial and diurnal dynamics in distribution and in by-catch in shrimp fisheries, diet, role Wadden Sea in life cycle, habitat preferences.
- Species specific occurrence/stock size/habitat preferences/trends
- Species specific trends
**Clupea harengus**

(MJ - Marine Juvenile)

**Herring**

- Found across estuarine, euryhaline, coastal, and continental shelf areas. Herring is not sampled well by the DFS. Juvenile herring occur in the Wadden Sea in considerable numbers and use gullies and intertidal for growth. They originate from different autumn (and winter) spawning herring stocks (e.g. Channel). Abundance reflects the processes that act during the larval phase on the North Sea, is thus mainly determined outside the Wadden Sea. In 2001-2007, there was poor herring recruitment for 6 years in a row. Increase in herring abundance in 1970s reflects a period of recovery of collapsed North Sea herring populations after closure of fishery 1977-1983. Occurs in Wadden Sea April-Oct. Together with sprat most abundant pelagic species. In former times there was a spring-spawning herring population (Zuiderzeeharing) which has disappeared after closure of Lake IJssel. Spring-spawning populations may be present in other estuaries (Elbe).

**Commercial value**

Commercially one of the most important pelagic species in several North Atlantic ecosystems and intensive exploitation goes back several centuries. No commercial fishing in Wadden Sea.

**Policy objectives**

Herring is a typical species for H1110A. N2000 states that there should an improvement in H1110A. Herring falls under the EU TAC and quota regulations. The abundance of juvenile herring is assessed as part of the Water Framework Directive fish index for transitional waters (Ems).

**Trend**

Stable or decreasing.

**Available information on drivers**

Probable causes: changes in the North Sea hydrography, and shift in the dominant food items. Abundance of herring varies as a result of natural variability in recruitment and human exploitation. Most stocks in the Northeast Atlantic have been overexploited, resulting in low abundance during the 1970s. By 2010, recovery to numbers close to the pre-collapse state.

**Knowledge gaps**

No good pelagic monitoring in Dutch Wadden Sea. Spatial and diurnal dynamics in distribution and in by-catch in shrimp fisheries, diet, role Wadden Sea and estuaries in life cycle, habitat preferences. Seasonal availability as food for birds (also condition, important for breeding success terms).
Syngnathus spp.  
(S. acus, S. rostellatus and S. typhle)  
(ER - Estuarine Resident)

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Occurrence in the Wadden Sea
Pipefish are widely distributed, with relatively high densities along the continental North Sea coast and Wadden Sea. Pipefish are thought to be associated with seagrass and other seaweeds, they are certainly not restricted to this type of habitat, but include open water barren sandy and muddy grounds in shallow areas. They occur within the coastal zone down to 20 m. The channels in the Wadden Sea are used for growing by lesser pipefish. In the Wadden Sea, Nilsson’s pipefish is the most abundant pipefish with a year-round occurrence. Deep-snouted pipefish became extinct with the disappearance of the submerged seagrass vegetation. In the DFS, only S. rostellatus and S. marinus are caught.

Commercial value
None.

Policy objectives
All species are estuarine residents and as such typical species for H110A. N2000 states that there should an improvement in H110A. Greater pipefish is endangered or vulnerable according to Red List (NL, D, DK).

Trend
Variable.

Available information on drivers
Climate: Increase in the Atlantic has been related to warming seawater. Fisheries: Bycatch in shrimp fisheries.

Knowledge gaps
Spatial and diurnal dynamics in distribution and in by-catch in shrimp fisheries and cooling water intake, diet, role Wadden Sea in life cycle, habitat preferences. Index of individual species of pipefishes.

**Pleuronectus platessa**  
(MJ - Marine Juvenile)

### Occurrence in the Wadden Sea

Only juvenile plaice (0- and 1-group) occur in the Wadden Sea, mainly during spring and summer. Highest densities of adult plaice are recorded in the south-eastern North Sea and in the waters around Denmark and the British Isles. The distribution is size-dependent with the smaller plaice found in coastal areas. The Wadden Sea is described as a major nursery ground of plaice with the abundance in the Wadden Sea reflecting the size of the North Sea population. In recent years however, juvenile plaice are found increasingly further offshore with numbers in the Wadden Sea declining despite a large North Sea population.

### Commercial value in North Sea fisheries

Landings culminated at about 170 thousand t in the 1980s, but subsequently fell to about 100 thousand t. Since the late 1990s the stock has recovered because fishing effort has been effectively reduced, even though discarding has continued. Plaice are caught in beam trawl (coast) as bycatch in sole fishery and shrimp trawl; net adaptation (use of inner net - 'zeeflap') in shrimp fisheries should exclude bycatch of >10cm fish.

### Policy objectives

Plaice is a typical species for H1110A; this is one of the species for which the Wadden Sea is considered a nursery area. N2000 states that there should an improvement in both H1110A and nursery area. Place falls under the EU TAC and quota regulations.

### Trend

Increasing in Eems-Dollard after decline, Wadden Sea stable following decline.

### Available information on drivers

**Habitat requirements:** Settlers and juveniles favour coastal and estuarine waters (20–32 psu). Juvenile stages show a clear preference for fine sandy sediments, which allows them to bury themselves and hide from predators. They undertake tidal migrations on the tidal flats.

**Climate:** Increasing water temperatures in recent decades make the Wadden Sea less suitable as nursery area and young fish move to deeper waters in the coastal area.

**North Sea fisheries:** Could be detrimental to parent stocks; Wadden Sea fisheries-bycatch in shrimp fisheries.

**Habitat degradation:** Smaller area for spawning (North Sea) and nursery (Wadden Sea).

**Larval transport of North Sea to coastal areas:** May not be affected.

### Knowledge gaps

Causal explanation of the changed distribution and reduced use of the Wadden Sea; spatial and diurnal dynamics in distribution and in by-catch in shrimp fisheries, diet, role Wadden Sea in life cycle, habitat preferences.

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Lampetra fluviatilis
(CA - Anadromous)

Occurrence in the Wadden Sea
River lamprey larvae spend the first three years buried in the soil in fresh water. At 12-14 cm they migrate to sea, they stay ca 2 years at sea after which they return to the fresh water at lengths of 30-45 cm to spawn. In the Wadden Sea they are regularly caught in DFS survey and pelagic sampling1 and as bycatch in shrimp fisheries2. Wadden Sea probably used as growing habitat for juveniles and as passage to fresh water.

Commercial value
None.

Policy objectives
River lamprey is a Habitat Directive species for H1110A. N2000 states that the abundance of the species should improve and that there should be an improvement H1110A. It is classified as endangered or vulnerable in Dutch, German or trilateral Red Lists.

Trend
Not clear because of insufficient monitoring.

Available information on drivers
Hampered connectivity, loss of spawning habitat.

Knowledge gaps
Relationship Wadden Sea with spawning sites. No good pelagic monitoring. Spatial and diurnal dynamics in distribution and in by-catch in shrimp fisheries, diet, role Wadden Sea in life cycle, habitat preferences.

1 Couperus, B. et al. Abundance and tidal behaviour of pelagic fish in the gateway to the Wadden sea. (MS subm.).
**Ammodytes sp**  
*(ER - Estuarine Resident)*  
Because of identification difficulties all species treated as one group

**Occurrence in the Wadden Sea**  
Distribution is closely linked to that of their preferred habitat: medium to coarse sand (0.25–2.0 mm grain size) in well-oxygenated waters2-4. Spawn during winter, and spend most of that season underground in a state of hibernation5. Schools of sandeel may extend from very close to the bottom, to 20–30 m into the pelagic domain, but also schools may be seen that are in the water column, completely off the ground (Hassel et al., 2003). Occurs in Wadden Sea April-Oct6,7. After sprat and herring most abundant pelagic species7.

**Commercial value**  
None in the Netherlands.

**Policy objectives**  
Sandeel sp. is a typical species for H1110A. N2000 states that there should an improvement in H1110A. Sandeel falls under the EU TAC and quota regulations.

**Trend**  
Increasing in all areas.

**Available information on drivers**  
Possibly habitat degradation (dredging, sand suppletions?), in Wadden Sea and Eems, over exploitation in the North Sea.

**Knowledge gaps**  
Current monitoring DFS is not adequate to determine occurrence and abundance, spatial and diurnal dynamics in distribution and in by-catch in shrimp fisheries, diet, role Wadden Sea in life cycle, habitat preferences.
**Petromyzon marinus**
(CA - Anadromous)

**Occurrence in the Wadden Sea**
Roam outside Wadden Sea further offshore into the open sea. Upon reaching maturity enters rivers to spawn in June/July, they are between 70–120 cm and between 8 and 11 years old. Die after reproduction. Larva spend several years buried in the sediment, upstream in rivers. In the Wadden Sea rarely caught in DFS survey and fyke sampling.

**Commercial value**
None.

**Policy objectives**
Sea lamprey is a typical species for H1110A, as well as one for which there is a specific objective to improve stocks in the Wadden Sea. N2000 states that there should be an improvement H1110A. Is classified as endangered or vulnerable in Dutch, German or trilateral Red Lists.

**Trend**
Unclear.

**Available information on drivers**
Hampered connectivity, accessibility and quality of spawning habitat, quality of larval habitat.

**Knowledge gaps**
No good pelagic monitoring. Spatial and diurnal dynamics in distribution, diet (species is parasitic), role Wadden Sea in life cycle, habitat preferences, location of spawning areas.

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**Osmerus eperlanus**  
*(CA - Catadrome)*

**Occurrence in the Wadden Sea**  
Smelt form dense spawning aggregations in the estuaries late winter and early spring, and migrate upstream depositing their eggs usually on hard substrates along the shores of rivers and lakes. In the Wadden Sea they are concentrated in areas with low salinities close to the mainland coast and in the Ems estuary. Probably no contribution of Wadden Sea smelt to landlocked IJsselmeer population.

**Commercial value**  
Limited small-scale active gear on landlocked population in IJsselmeer/Markermeer. Small scale fisheries at sluices near Afsluitdijk, landed and marketed as whitebait.

**Policy objectives**  
Smelt is a typical species for H1110A. N2000 states that there should an improvement in both H1110A. The abundance of juvenile herring is assessed as part of the Water Framework Directive fish-index for transitional waters (River Ems).

**Primary drivers**  
Climate/nutrients: potentially in IJsselmeer, connectivity, water quality (estuary), habitat loss (spawning).

**Knowledge gaps**  
Actual abundance is not well established in current (DFS) monitoring. Spatial and diurnal dynamics in distribution and in by-catch in shrimp fisheries, diet, role Wadden Sea in lifecycle, habitat preferences.

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**Solea solea**
(MJ - Marine Juvenile)

**Occurrence in the Wadden Sea**
Juvenile sole occur in the Wadden Sea during the summer months. Highest catch rates are observed in the southern North Sea, Irish Sea, Bristol Channel and English Channel. Although sole may occasionally be recorded at depths down to 250 m, they are largely restricted to inner shelf waters <50 m deep and the depth distribution is related to size (smaller sole remain in shallower waters). Settlement of larval sole in the Wadden sea occurs from May onwards, whereby the timing of settlement is inversely related to water temperature in spring. Maximum densities are found around the end of June. Sole leave the Wadden Sea in autumn when water temperatures drop below 10 °C.

**Commercial value in North Sea fisheries**
Sole has always been a valuable commercial species that, up to the 1960s, was exploited by otter trawls and gill nets. Owing to quota restrictions, landings since 2000 have decreased to around 15 thousand t in the North Sea, 5000 t in the Bay of Biscay, 2000 t in the English Channel and less than 1000 t in the Irish Sea. Since the end of the 1990s, the fishing mortality on North Sea sole has also declined through a reduction of the fleet. Year-class strength in the subtidal part of the western Wadden Sea has been shown to have a significant positive relationship with recruitment.

**Policy objectives**
Sole is a typical species for H1110A; N2000 states that there should an improvement in both H1110A. Sole falls under the EU TAC and quota regulations.

**Trend**
Variable

**Available information on drivers**
**Habitat requirements:** sole prefer sandy or sandy/muddy bottoms within which they can bury. Climate: sole are a southern species at their northern boundary in the North Sea. During winter they migrate offshore to warmer waters. Temperatures below 3°C are fatal for sole.

**Fisheries:** the development of the pulse trawl has made catching sole more efficient for the fleet. Bycatch in shrimp fisheries.

**Knowledge gaps**
Spatial and diurnal dynamics in distribution and in by-catch in shrimp fisheries, location of spawning grounds.

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Demersal flatfish, eats polychaete worms, small soft-shelled bivalves, small fishes and crustaceans.
**Sprattus sprattus**  
*(MS - Marine Seasonal migrant)*

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### Occurrence in the Wadden Sea
Most abundant in relatively shallow (20-40m) coastal waters and a wide tolerance of salinity, strongly affected by hydrographic conditions, resulting in large variations in distribution (and abundance) among years. Sprat spawn at temperatures of 8–15°C in coastal waters from spring until late summer, with a peak between May and August. Known spawning areas closest to the Wadden Sea: inner German Bight, off Jutland, along English coast. Migrates inshore for migrations for overwintering, though older fish remain offshore. Present in Wadden Sea April-Oct. Most abundant pelagic fish in Wadden Sea.

### Commercial value in North Sea fisheries
Landed commercially from the North Sea, mainly used for fish meal. No commercial landings from Wadden Sea.

### Policy objectives
Sprat is a typical species for H1110A; N2000 states that there should an improvement in both H1110A. Sprat falls under the EU TAC and quota regulations (plus by-catch regulation for herring affects sprat).

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### Trend
Declining.

### Available information on drivers
Little known on drivers.

### Knowledge gaps
Not well established in DFS. No pelagic monitoring in Dutch Wadden Sea. Spatial and diurnal dynamics in distribution and in by-catch in shrimp fisheries, diet, role Wadden Sea in life cycle, habitat preferences. Seasonal availability as food for birds.

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4. Couperus, B. et al. Abundance and diet behaviour of pelagic fish in the gateway to the Wadden Sea (MS subm.).
Allosa fallax
(CA - Catadrome)

Twaite shad

Fint

Finte

Brisling

Occurrence in the Wadden Sea
Juveniles migrate downstream to join the older fish in estuaries and coastal areas, and are occurring in the Wadden Sea from late summer to autumn and winter. Spawning in April/May in estuaries such as Ems-Dollard, Weser Elbe, Loire and Gironde. Generally only juveniles are found that presumably originate from spawning areas in Germany since the Ems estuary is assessed to be unsuitable for reproduction in its present state. Preferred depth 10-20m. Use area as a feeding area for juveniles and as passage to spawning areas.

Commercial value in North Sea fisheries
None.

Policy objectives
Twaite shad is a Habitat Directives species has an objective to improve stocks under H1110A. WFD objective in Ems (abundance per age-group) and on Dutch, German and Trilateral Red Lists.

Available information on drivers
Connectivity with fresh water and lack of feeding habitat for juveniles; estuarine water quality and the presence of suitable spawning habitat.

Knowledge gaps
Abundance is not well determined in DFS; pelagic monitoring is lacking, spatial and diurnal dynamics in distribution and in by-catch in shrimp fisheries, diet, role Wadden Sea in life cycle, habitat preferences.

Trend
Declining.

**Merlangius merlangus**  
(MJ - Marine Juvenile)

**Occurrence in the Wadden Sea**
Whiting enter the Wadden Sea in autumn, in pursuit of the shrimp as their main food item. It is found in high numbers throughout the North Sea, to the east in the Skagerrak/Kattegat and in the western part of the Baltic Sea, but also all along the shelf to the west of the British Isles. The depth distribution ranges from extremely shallow inshore waters (<10 m) to a maximum of 550 m, greatest numbers occur in the range 30–100 m. The Kattegat and the German Bight are hotspots for the juveniles. Older juveniles (0- and 1-group) are often abundant in coastal waters, including estuaries and Wadden Sea. Adults occur in deeper water, mainly over sandy and muddy substrates. Demersal juveniles (0-group) are found mainly in water <50 m deep, including estuaries. The locations where 0-group are concentrated vary on an annual basis and nursery areas do not seem to be fixed geographically. Whiting populations can fluctuate very much between years.

**Commercial value in North Sea fisheries**
Whiting are caught in mixed demersal roundfish or flatfish fisheries, Nephrops fisheries and as a bycatch in the industrial fisheries for sandeel and Norway pout. Most of the landed catch is for human consumption although under-valued, but substantial quantities, often larger than the landed catch1, may be discarded at sea as whiting flesh is undervalued by most nations. Total catches (including discards) in the North Sea and eastern English Channel have decreased markedly during the last two decades – from about 50 thousand t per annum in the early 1990s to <20 thousand t since 2003.

**Policy objectives**
Whiting is a typical species for H110A. Natura 2000 states an improvement in this habitat type. Whiting falls under the EU TAC and quota regulations. Whiting (abundance) is suggested as WFD-indicator for transitional waters, but it is not fully implemented yet.

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References


