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DRAFT BACKGROUND DOCUMENT
JOINT RECOMMENDATION SEA BED PROTECTION
FRISIAN FRONT AND CENTRAL OYSTER GROUNDS
January 5th 2017
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1. Introduction

1.1 Aim of the background document
This document provides the background information to the draft Joint Recommendation for offshore fisheries management on the Frisian Front and the Central Oyster Grounds as provided for in art. 11 of Regulation 1380/2013 (EU, 2013). The draft Joint Recommendation contains a request to the European Commission to regulate fisheries in parts of these areas to protect the sea bed ecosystem habitat.
This joint recommendation is initiated by the government of the Netherlands and agreed by Member States [PM].

[PM] This document was submitted to the Scheveningen Group by the initiating Member State the Netherlands. Final approval of the Joint Recommendation was agreed by those Member States with a direct fisheries management interests in the "High Level Group" and submitted to the commission by its Chair.

1.2 Background and problem setting
The proposed fisheries measures are part of the implementation of the Netherlands’ Marine Strategy according to the European Marine Strategy Framework Directive (MSFD; EU, 2008). They contribute to the policy’s aim to reverse the trend of degradation due to damage to sea bed habitat and to biodiversity to recovery by 2020. Article 13.4 of this Directive obliges Member States to include into their programmes of measures spatial protection measures contributing to coherent and representative networks of marine protected areas.

In Part 1 of the Netherlands Marine Strategy (2012; IenM, 2012) the Frisian Front and Central Oyster Grounds were considered as search areas for sea bed protection measures in addition to protection measures in designated Natura 2000 areas. Sea bed protection measures in these areas contribute to the overall aim of the Dutch government for the Dutch part of the North Sea to protect 10-15% of the Dutch Continental Shelf against appreciably disrupting by human activities, with a minimal impact for the fishermen.
In Part 3 of the Netherlands Marine Strategy (2015, Programme of measures; IenM, 2015) the principles for developing measures at Frisian Front and Central Oyster Grounds have been defined [See paragraph 5.1].

Frisian Front and Central Oyster Grounds are located outside the 12 NM zone. Taking fisheries measures is the explicit authority of the European Commission according to Article 46 of the Regulation 1380/2013 on the Common Fisheries Policy (EU, 2013).

Although Frisian Front and Central Oyster Grounds do not qualify for the Habitats Directive by preparing this Joint Documentation use has been made of the guidance document by the European Commission: Fisheries measures for marine Natura 2000 sites (EC, 2008).
1.3 General principles
The cooperative process was based on the following principles in accordance with article 11 of Regulation 1380/2013 (EU, 2013):
- **Sound scientific basis**
The process is centred around a scientific approach and the best scientific information available.
- **Stakeholder involvement**
Key stakeholders are involved in the process. From the start of the process fishing industry and nature organizations were invited to participate in an open and transparent manner on a national as well as European level (through the North Sea Advisory Council). [PM]
- **Transparency**
The process is transparent on the data being used, on the steps being taken and on the methodology being used.
- **Proportionality**
The proposal is delivering a key contribution to the achievement of the conservation objectives while minimizing the economic impact on the fishing industry.
- **Non discrimination**
The proposal will need to ensure that measures are not applied in a discriminatory manner. Presenting a proposal to the European Commission for regulation in the framework of the CFP, will ensure a level playing field for the fishing sector affected.

2. Legal Framework

2.1 Common Fisheries Policy (CFP)
The European Common Fisheries Policy (CFP) is a key policy framework for the current proposal. Any regulation of fisheries in European marine waters must follow the principles, rules and procedures of the CFP. The basic rules are laid down in Basic Regulation EC 1380/2013 (EU, 2013). Recital 11 of the CFP states that ‘The CFP should contribute to the protection of the marine environment, to the sustainable management of all commercially exploited species, and in particular to the achievement of good environmental status by 2020, as set out in Article 1(1) of Directive 2008/56/EC [Marine Strategy Framework Directive; see next paragraph] of the European Parliament and of the Council’.

The procedure to obtain appropriate fisheries measures is explained in article 11 of the Basic Regulation. In this article it is stated that ‘where a Member State ("the initiating Member State") considers that conservation measures need to be adopted and other Member States have a direct management interest in the fisheries to be affected by such measures, the Commission shall be empowered to adopt such measures, upon request, by means of delegated acts’. To this end, the initiating Member State and the other Member States having a direct management interest may submit a joint recommendation to the Commission.
2.2 Marine Strategy Framework Directive

The EU Marine Strategy Framework Directive (MSFD; EU, 2008) requires member states according to article 1 and 5 of the MSFD to draw up a strategy for their marine waters to achieve a good environmental status by 2020 and to take the necessary measures to actually achieve or maintain that good status. The directive covers the full environmental and ecosystem policy and the sustainable use. It comprises the themes (descriptors) of biodiversity (D1), non indigenous species (D2), habitats (D6), hydrography (D7), pollutants (D8, D9) and eutrophication (D5), litter (D10) and introduction of energy (D11, including underwater noise). The starting points are the ecosystem approach and the precautionary principle. The MSFD according to article 13 requires to draw up a programme of measures by 2015, aimed at achieving or maintaining a good environmental status (GES). Under Article 13.4 of the Marine Strategy Framework Directive, it is stated that programmes of measures shall include spatial protection measures, contributing to coherent and representative networks of marine protected areas. These are areas that fall under the Birds and Habitats Directive, but other areas can also contribute to the desired diversity of the constituent ecosystems.

2.3 Habitats Directive

The Habitats Directive (EU, 1992) was adopted in 1992 and is aimed at conserving (the natural habitats of) European wild flora and fauna. The main objective of the Habitats Directive is to bring habitats and species listed on Annex I and II of this directive into "favourable conservation status". An important element of the Habitats directive is the designation and protection of special areas of conservation (SACs). These areas are part of the European Natura 2000 Network.

Management plans for the Netherlands’ part of the North Sea have been developed for three onshore Natura 2000 areas (North Sea Coastal Zone, Voordelta, Raan Flats). May 27th 2016 the secretary of state of Economic Affairs designated two offshore special areas of conservation: Dogger Bank and Cleaver Bank. For both areas management measures are in preparation.

2.4 Birds Directive

The Birds Directive was adopted in 2009 (EU, 2009). It relates to the conservation of all species of naturally occurring birds in the wild state in the European territory of the Member States. It covers the protection, management and control of birds and lays down rules for their exploitation. In order to do so Member States shall classify special protection areas (SPAs) for the conservation of these species. The special protection areas are also part of the Natura 2000 Network. May 27th 2016 the secretary of state of Economic Affairs designated the Frisian Front as an offshore special protection area. Management measures for the Frisian Front are in preparation.

2.5 Application to sea bed protection on Frisian Front and Central Oyster Grounds.

The Frisian Front and Central Oyster Grounds do not qualify for the Habitats Directive, because their habitats are not included in the list of natural habitat types in Annex I of the Directive. Because of a unique combination of ecosystem elements it was decided in the Netherlands’ Marine Strategy to offer additional protection to the sea bed ecosystem in the areas of the Frisian Front and Central Oyster Grounds on the basis of article 13.4 of the MSFD. The proposed conservation
measures areas are an addition to Natura 2000 areas on the Netherlands’ part of the North Sea in order to contribute to a coherent and representative network of marine protected areas. For a complete overview of the protected areas in the Netherlands’ part of the North Sea, see Annex I. The Commission is empowered to adopt fisheries measures in order to protect the sea bed.

3. Process

3.1 National stakeholder process

In 2012 the Netherlands published the Marine Strategy for the Netherlands part of the North Sea, part 1. In this document the Central Oyster Grounds and Frisian Front were assigned as search areas for benthic protecting measures, in addition to the N2000 sites in the Dutch EEZ. From mid 2013 a stakeholder process was established, including the stakeholders most affected by the upcoming measures, namely the fisheries organisations VisNed and the Nederlandse Vissersbond (NVB) and the NGO’s the North Sea Foundation and WWF. In October 2014 also Greenpeace joined the table. The lead for this process was taken by the Ministry of Infrastructure and the Environment because this Ministry is primarily responsible for the implementation of the Marine Strategy Framework Directive. All work was carried out in close cooperation with the Ministry of Economic Affairs which includes the Fisheries and Nature Department. Several meetings with directors and board members of the different organisations were held from June 2014 until 2016.

In 2014 the main principles for the process were established with the stakeholders. These were, amongst others, maximum ecological gain, minimal costs for the fisheries, and robust larger areas instead of several smaller areas. Also, which proved crucial for the process, it was established beforehand that the group would strive for consensus, however, if no consensus could be reached, the government would decide on the final outcome.

There were several knowledge gaps identified by the stakeholders and project group, and these were discussed in different workshops. The first knowledge workshop was held 2014, another one was held in 2015, followed by a design workshop (mapping tables), where fisheries organisation and NGO’s attempted to design variants for closures. After this process, six variants were established, two by the fisheries sector, one by the NGO’s (namely the entire Central Oyster Grounds and Frisian Front areas) and three by the government.

A Societal Cost Benefit Analysis was performed on all of those six variants, combining all the ecological and economic information available to get a sense of the ecological and economic values of the variants. All parties were involved in the drafting of the SCBA, by different workshops and possibilities for input along the process. The SCBA was finalised in December 2015 (LEI, 2015). On the basis of this document and the Marine Strategy goals in mind the government decided to strive towards a medium protection level of 2400 km². The arrangement of the protected areas can vary within the selected goal and therefore the minister of Infrastructure and the secretary of state of Economic Affairs proposed two alternative variants to Parliament (letter to the Dutch House of Representatives, 2015-2016 session, 33450, no. 49) and a definite variant (letter to the Dutch House of Representatives, 2016-2017 session, 33450, no. 50). The stakeholders were formally
consulted on this choice. All variants were analysed on their economical costs to fishing industries (Oostenbrugge, 2016a and 2016b).

[PM Text to be completed; definitive layout of the management zones might be subject to discussion in Parliament]

### 3.2 Research and analysis

Part of the stakeholder process was the identification of knowledge gaps and the development of sound scientific information in order to provide for a solid base to decision making. The scientific institutes IMARES, NIOZ and LEI were asked to write reports on the knowledge gaps. Reports that have been used are:

- Biodiversity hot spots on the Dutch Continental Shelf, by Wageningen Marine Research (formerly: IMARES; Bos et al, 2012). In this report Frisian Front and Central Oyster Grounds were identified as important and vulnerable benthic habitats;
- overview of available knowledge and data on Frisian Front and Central Oyster Grounds at the start of the process (Slijkerman et al, 2013; in Dutch);
- preliminary zoning measures with Marxan (Slijkerman et al, 2014; in Dutch);
- trends and developments in the fisheries sector (Kuhlman et al, 2014; in Dutch);
- expert workshop on the possible developments on Frisian Front and Central Oyster Grounds in case of absence of sea bed disturbing fisheries (Jongbloed et al, 2013);
- comment on the issue how to interpret ecological information reported by fishermen (Kraan, 2015);
- the possible impact of flyshoot fisheries on Frisian Front and Central Oyster Grounds (Rijnsdorp, 2015);
- the ecological importance of the Frisian Front (Lindeboom et al, 2015);
- analysis of environmental conditions and trawling on species richness and benthic ecosystem structure in the Frisian Front and Central Oyster Grounds (Van Kooten et al, 2015);
- literature review of fisheries displacement effects of closed areas (Slijkerman et al, 2015);
- case study of Fisheries displacement effects in the Voordelta (De Vries; 2015);
- cost benefit analysis of the effects of sea bed protection on the Frisian Front and Central Oyster Grounds (Van Oostenbrugge, 2015). This study integrates a lot of knowledge generated in the above mentioned reports and advises;
- Addenda to the cost benefit analysis on the costs to fisheries as a consequence of proposed measures on sea bed protection by government (Van Oostenbrugge, 2016a and 2016b).

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1 All reports in this paragraph can be found on https://www.noordzeeloket.nl/Beleid/europese-kaderrichtlijn-mariene-strategie/stand_van_zaken/nationaal/econom_analyses_2010/Rapporten_Bodembescherming_Friese_Front_en_Centrale_Oestergronden.aspx
4. Description of the Frisian Front and Central Oyster Grounds

4.1 General characteristics and ecological significance

The Frisian Front and the Central Oyster Grounds mark the transition from sandy sea bed into the deeper, silt-rich part of the Dutch continental shelf (DCS), going from south to north. The area, especially the depth gradient, accommodates a variety of sea bed habitats, resulting in a high benthos biodiversity (see Fig. 1).

Figure 1 Habitat distribution on the DCS based on combinations of grain size and depth classes (Source: Bos, 2011).
Together with the Central Oyster Grounds the Frisian Front the megabenthos shows the highest biodiversity values on the DCS (see Fig. 2).

**Figure 2** Total macro and mega benthos on the DCS (Source: Bos, 2011).

The sea floor and the related benthos communities (for some examples see Fig. 3) are an essential link in the marine ecosystem and food webs. Species that live in the sea floor are important for the exchange of nutrients and oxygen. Species living in and on the sea floor form bottom structures. Burrowing animals locally rummage the soil (bioturbation). Natural sediment deposition processes and bioturbation determine structure and solidity of the bottom.

For example: parchment worms create fibrous channels protruding a couple of centimeters above the bottom. The channels dug by the burrowing mud shrimp result in deposition of manganese and iron, reinforcing the channels and thus stabilizing the open sea floor structure. (Jongbloed, 2013)

### 4.2 Frisian Front

The Frisian Front\(^2\) is situated above the West Frisian Islands, 75 km from the city of Den Helder. It is a transition area between the shallow sandy grounds of the Southern North Sea and the deeper muddy sea bed of the Central Oyster Grounds. Over a relatively short distance the sea floor drops 10 to 15 m, from approximately 25 until 40 metres.

The following physical phenomena concur in the Frisian Front area:

- Two main seawater currents, one from the British coast and the second, nutrient-rich flow from The Channel and the southern North Sea, meet and mix, forming a hydrographic front.
- Increasing sea water depth causes a decreasing water flow rate, thereby causing silt and organic material to settle on the sea floor. In fact the flow rates are the lowest on the Dutch Continental Shelf (DCS).
- Transport of nutrient-rich bottom water to the surface induces a high primary production (algae growth). Benthic fauna profits from dead algae sinking to the bottom.

These phenomena result in a large variety of sediment types, each with a specific fauna, parallel to the depth contour lines. The sediments range from sand in the south, via the hydrographic front to the silt-rich northern part. In the core area of the Frisian Front (100 x 15 km) the bottom consists of 15-20% silt.

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\(^{2}\) The content of this paragraph is taken from Lindeboom, 2015, unless otherwise mentioned.
Due to the concurrence of the physical phenomena the Frisian Front is unique in the North Sea. Even globally there are only a couple of sites that are slightly similar: close to Newfoundland and in the Sea of Japan.

The wide variety of sediment types each with their specific fauna on a relatively limited surface with a steep gradient in environmental circumstances make the area special, even on a global scale. The area is characterized by high biodiversity and biomass and a high production of sea bed fauna. The relatively short distance between the different fauna communities allows interaction between them. The front with its gradients forms a palette of valuable circumstances in which many species can find their potential niche.

On the Frisian Front there are many large growing macrobenthic species. Together with the Central Oyster Grounds the Frisian Front the megabenthos shows the highest biodiversity values on the DCS. Also a richness of megabenthic species is high and the area contains high densities and biomasses of megabenthos, and many rare megabenthic species. The area contains relative rare habitat types.

Due to the high primary production and production of plankton caused by the hydrographic front, the area attracts fish and birds. Appearance of sprat (Sprattus sprattus) and herring (Clupea harengus) attracts guillemots (Uria aalge), mainly in August-September. In this respect the Frisian Front has been assigned as a Natura 2000 SPA to protect the guillemot. Moreover the Frisian Front meets three of the seven scientific criteria for a special ecologic area as mentioned in the Convention on Biological Diversity (CBD): it is unique and has a high biologic production as well as diversity.

**4.3 Central Oyster Grounds**

Going north from the Frisian Front one enters the relatively low-dynamic sedimentation area of the Central Oyster Grounds and stratification in summer (Jongbloed, 2014). Water depth is 40-50m. The silty deep water habitat is rare.

The name originates from the fact that in the past a large part consisted of oyster banks, for example shown on a map by Olsen (1883). It is highly probable that these oyster banks with the attached fauna formed a habitat type of its own (Lindeboom, 2008). Between 1880 and 1926 the oyster banks have disappeared, probably due to fisheries, climate change and illnesses. Between May and October the phenomenon of stratification occurs: a layer of warm sea water (up to 20°C) floats on a colder one (12°C) without mixing. Only in autumn strong winds cause the layers to mix again.

The most biodiverse element of this area is the benthos. The microbenthic community in the Northern part of the DCS, north of the Frisian front, is characterized by a high species richness with a relative high number of rare species (low frequency of occurrence), a relative high number of old growing (>10 years) and larger growing species (>1 g AFDW, ash-free dry weight). Together with the Frisian Front the megabenthos shows the highest biodiversity values on the DCS.
North of the -30 m bathymetric contour the ocean quahog (*Arctica islandica*) is found on the Frisian Front and Central Oyster Grounds. Density is low: about 0.1 specimen per m$^2$. The oldest specimen of the long-lived quahog ever found in the North Sea was 167 years old (Lindeboom, 2008)

**5. Rationale for conservation measures**

**5.1 Recovery objective**

There is no sea bed protection of Frisian Front and Central Oyster Grounds under the Habitats Directive. On the DCS only two natural habitat types of community interest whose conservation requires the designation of special areas of conservation (Annex 1 of the Habitats Directive) can be found. These are H1110 Sandbanks which are slightly covered by sea water all the time and H1170 Reefs (of open sea). Thus, the ecologically valuable silty sea beds of the Frisian Front and Central Oyster Grounds do not qualify for protection under the Habitats Directive. As mentioned in 4.3 the Frisian Front has been designated as a Natura 2000 area under the Birds Directive.

However, article 13.4 of the MSFD stipulates that programmes of measures shall include spatial protection measures, contributing to coherent and representative networks of marine protected areas, adequately covering the diversity of the constituent ecosystems.

In order to determine the potential for such spatial measures a study has been carried out to analyze and present hotspots of biodiversity for several taxonomical groups and habitats on the Dutch Continental Shelf, based on the spatial application of the good environmental status (GES; see par. 2.2) descriptor 1 (Biodiversity): ‘Biological diversity is maintained. The quality and occurrence of habitats and the distribution and abundance of species are in line with prevailing physiographic, geographic and climatic conditions’. (Bos, 2011). In this study data series and literature on benthos (macrobenthos and megabenthos), fish, seabirds, marine mammals and habitats have been assessed, thus providing biodiversity information on the three different levels (species, habitat and ecosystem) described in the 2010 Commission Decision on the criteria and methodological standards for GES-descriptor 1.

All in all, a set of 13 metrics of biodiversity covering the width of the Commission Decision criteria has been defined and maps per biodiversity metric and per taxonomical group have been constructed.

Conclusions from the maps:

- spatial patterns of benthic biodiversity were more consistent than for other taxonomic groups. Notably the Frisian Front and the Central Oyster Grounds score high for different biodiversity metrics;
- for fish and marine mammals spatial biodiversity patterns are less clear;
- for birds, the coastal area and the Frisian Front stand out. Not by coincidence these areas already have been designated under the Birds Directive.

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3 Distribution, density, biomass, resilience, dependence on the marine environment, breeding in the Netherlands, importance of the Dutch Continental Shelf for the species, trends, rarity, large specimens within populations, (potentially) large species, species richness, species evenness.
• a map of frequency of occurrence of different habitat types shows the level of uniqueness/rareness of the various habitats in the Dutch North Sea. Unique habitats on the DCS, e.g. Cleaver Bank, already have been designated under de Habitats Directive. As stipulated before, this is not the case for the Frisian Front and the Central Oyster Grounds.

<table>
<thead>
<tr>
<th>Area</th>
<th>Macrobenthos</th>
<th>Megabenthos</th>
<th>Habitat</th>
</tr>
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<tbody>
<tr>
<td>Frisian Front</td>
<td>Many big growing species</td>
<td>High density</td>
<td>Rare habitat</td>
</tr>
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<td></td>
<td>High species richness</td>
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<tr>
<td></td>
<td></td>
<td>High species richness</td>
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</tr>
<tr>
<td>Central Oyster Grounds</td>
<td>Many old growing species</td>
<td>High density</td>
<td>Rare Habitat</td>
</tr>
<tr>
<td></td>
<td>Many big growing species</td>
<td>High biomass</td>
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</table>

Based on the findings above regarding descriptor 1 (biodiversity) in 2012, the Frisian Front and Central Oyster Grounds have been considered as search areas for spatial measures aiming at the protection of benthos in addition to sea bed protection in Natura 2000 areas on the Dutch part of the North Sea. The conservation objective for Frisian Front and Central Oyster Grounds is the recovery of substantial parts of the sea bed ecosystem of from a disrupted state towards a natural condition.

The measures will not only contribute to GES for biodiversity (descriptor 1), but also to:
- descriptor 6: sea-floor integrity;
- descriptor 4: food webs; and
- to a limited extent descriptor 3: populations of commercially exploited fish and shellfish (although fish are highly mobile and displacement of fisheries may occur, obviously fish mortality due to fisheries will decrease in the protected areas).

The Dutch Marine Strategy combined descriptors 1, 3, 4 and 6 into one integrated descriptor: ‘marine ecosystem’.

5.2 Human activities on Frisian Front and Central Oyster Grounds

This paragraph provides an overview of predominant human activities on the Frisian Front and Central Oyster Grounds. Information on the Frisian Front is based on Van der Burg (2012). Information on the Central Oyster Grounds is taken from RWS-data.

1. Shipping

Several deep water shipping routes cut through the Frisian Front. The density of all ships using these routes is about 3 to 9 ships per 1000 km². In addition, shipping not bound to these routes occurs on both the Frisian Front and the Central Oyster Grounds, mainly recreational and fishing vessels. Disregarding eventual polluting incidents, shipping has no effect on the sea floor. In the past the use of TBT (tributyltin) as biocide in anti-fouling paint on ship hulls had serious negative effects on marine organisms, including benthos (e.g. imposex in dog whelk populations). From the
1980s regulations developed towards a complete ban of TBT. However, TBT may remain present in the ecosystem for 30 years or so, but is not linked to present shipping.

2. Cables and pipelines

Figure 4 Human activities on Frisian Front and Central Oystergrounds Shipping lanes, cables and pipelines, oil and gas platforms, sand and shell extraction and military use [Source PM].

On the DCS cables stretch over about 4000 km (including 2100 km no longer in use). The length of pipelines is an estimated 2500 km. In the Frisian Front area several telecom cables are found, but only one is still in use. Three long distance gas pipelines cut through the area. Plans exist for the construction of a new telecom cable between England and Denmark probably partly through the Central Oyster Grounds. Construction, inspection and maintenance of cables and pipelines obviously affect the sea floor, but the scale is very limited in terms of surface and duration.

3. Oil and gas extraction

Above sea level the lighting on oil and gas installations during nighttime may disturb birds within a radius of 5 km. To a lesser extent optical disturbance by the silhouette of the installations may occur. For the Frisian Front (BD area) the effects have been investigated. Conclusion: there are no
significant negative effects on the conservation objectives occur, mainly because the impacted surface is very limited (Tamis, 2011).

Regarding the impact on the sea floor and benthos: again the surface impacted by piles and drilling is very limited, in fact even much smaller than in the case of light disturbance mentioned above. Moreover, once an installation has been constructed the piles provide substrate for various organisms. In addition all shipping is prohibited within a distance of 500m from the installation, thus providing an area in which bottom disturbance is absent during the lifetime of the installation (Lindeboom et al, 2008).

4. Fisheries

Figure 5  Fishing on the Dutch Continental Shelf [Source PM]
Beam trawling on the DCS is intensive. Target species are plaice and sole. In addition, trawling for pelagic species such as herring and mackerel occurs. The Frisian front is within reach of smaller fishing vessels.

The principle bottom contacting fisheries on the DCS are:
- Beam trawl with tickler chains. The chains dig through the sea bed to chase demersal fish (sole and plaice) into the net. Bycatch of benthos is imminent. Discards in the past amounted to 50-60% (Overzee and Quirijns, 2007);
- Otter trawl;
- Pulse trawl: beam trawl using electric pulses instead of tickler chains.

5. Impact on the sea bed
The direct effects of trawl fishing are: fish death (sensitivity depending on species), change in food availability and changes in habitat conditions on the benthos which ultimately results in effects on abundance and diversity of the benthic community (Deerenberg et al, 2010, referred to in Slijkerman, 2013). Also, significant negative effects on total biomass, secondary production and species richness have been identified (Reiss et al 2009 and Hinz 2009, both referred to in Slijkerman, 2013).

Fisheries have a more severe impact on bigger species than on smaller species (Hiddink, 2006, referred to in Slijkerman, 2013).
Towed nets may affect the sea floor in various ways. The cables and ground rope that are dragged over the sea bed may homogenize the texture of the sea bottom, destroy hard structures and move stones or shells. Heavy gear components such as the otter boards or tickler chains will penetrate into the sea bed and disturb the vertical structure of the sediment. Sediment may be brought into suspension by the turbulence generated in the wake of the gear. The physical impact can therefore be broadly classified into (Rijnsdorp, 2015a and 2015b):

- penetration into the sea bed, thus damaging or taking away benthos;
- collision with (hard) structures; and
- re-suspension of sediments.

As a result the sea floor is homogenized, having a negative impact on deep digging species such as shrimps. Those species are important for the structure, chemical conditions, mineralization of the sea floor, enhancing the distribution of other species (Slijkerman, 2013).

Bottom structure is more important on the depth gradient to the deeper, silt-rich sea bed than for shallower sandy parts (Jak et al, 2009, referred to in Slijkerman 2013).

Bottom fishing causes mortality and results in a reduction of biomass and biodiversity. Long-lived species are more vulnerable because they need a longer time to recover. Robustly built animals are less susceptible than fragile species. Usually the share of long-lived species in fished areas is lower than in unfished areas (Rijnsdorp, 2015a and 2015b).

The density of ocean quahogs diminished since 1980. A probable cause is the increase of bottom trawling on the Frisian Front (Lindeboom, 2008b, referred to in Slijkerman, 2013).

The sensitivity of the sea bed to disturbance of towed fishing gears depends primarily upon the natural disturbance (shear stress) and the structure of the sea bed. The degree of natural disturbance decreases with water depth. The grain size of the sediment is usually a good indicator of the natural disturbance. High dynamic areas are characterized by coarse sediments, low
dynamic areas by fine sediments. The Frisian Front and the Central Oyster Grounds are low dynamic areas with fine sediment and are characterized by a benthic community with a higher proportion of long-lived species (Rijnsdorp, 2015a and 2015b).

The relative impact of towed bottom contacting fisheries on benthos is much more substantial than any other human activity at sea, even compared with extraction of surface minerals, e.g. sand (Lindeboom, 2005, mentioned in Slijkerman, 2013). Besides, sand extraction has not been mentioned above under predominant human activities on the Frisian Front and Central Oyster Grounds, because it is non-existent in these areas.

6. Designing sea bed protecting measures on Frisian Front and Central Oyster Grounds

6.1 Accordance with policy
The conservation objective for Frisian Front and Central Oyster Grounds is the recovery of substantial parts of the sea bed ecosystem of from a disrupted state towards a natural condition. Since the main pressure on benthos in the areas is fisheries with bottom contacting gear the projected measures focus on reducing bottom trawling in the area.

In the Marine Strategy for the Netherlands part of the North Sea 2012-2020, Part 1 (2012) therefore states: In addition to the existing Natura 2000 areas, the Friese Front (Frisian Front) and Centrale Oestergronden (Central Oyster Grounds) are considered search areas for protective measures aimed at reducing bottom trawling to be taken within the CFP framework.

This is in accordance with the position of the Dutch Cabinet regarding the 2013 revision of the CFP: focus on the sustainable use and preservation of natural marine resources and ecosystems (First Chamber of Parliament, 2011-2012, 32 848, A). The Frisian Front and the Central Oyster Grounds are considered search areas for protective measures aimed at reducing bottom trawling (see map Annex 1).

This ambition is in accordance with Sustainable Development Goal 14, part 5: By 2020, conserve at least 10 per cent of coastal and marine areas, consistent with national and international law and based on the best available scientific information (UNGA, 2015).

Moreover, the aforementioned ambitions support the objective as expressed by the contracting parties in the Convention on Biological Diversity (CBD), namely that 10% of coastal and marine areas, especially areas that are important for biodiversity and ecosystem services, are to be protected by 2020. This ambition was confirmed by the General Assembly of the United Nations in Rio de Janeiro in 2012. [CBD Strategic Plan 2011-2020, Aichi Biodiversity Targets, Goal C Target 11].
6.2 Principles for protected areas on Frisian Front and Central Oyster Grounds

In the designing process towards sea bed protection the following prerequisites were applied (Marine Strategy for the Netherlands part of the North Sea 2012-2020, Part 3; IenM, 2015):

- the ambition to protect 10 to 15% of the Dutch part of the North Sea against significant sea bed disruption (including parts of the Dogger Bank, Cleaver Bank, North Sea Coastal Zone, Voordelta and the Raan Flats that already fall under the Habitats Directive) and
- minimization of economic impact on the fisheries sector.

On the basis of these preconditions and after consultation with fisheries organizations and nature organizations (prior to the draft programme of measures and while the draft was published for public consultation), the central government formulated the following principles for developing measures:

a) The areas in the Frisian Front and the Central Oyster Grounds where sea bed protection measures will apply comprise a minimum of 1200 km\(^2\) (at least 2% of the Dutch part of the North Sea) and a maximum of 4200 km\(^2\) (7%)\(^4\). In this area or in these areas, fishing that significantly disturbs the sea bed will no longer be permissible.

b) The measures are geared towards protecting the ecologically most valuable areas and, wherever possible, ensuring the recovery of the sea bed ecosystem.

c) Areas should be established within the search area and be large enough to be ecologically valuable and able to contain (as many) different habitats and gradients (as possible), such as in depth or silt richness; they must be effective and cost-effective in terms of monitoring; they must be effective and cost-effective in terms of maintenance.

d) Within the area or areas where sea bed protection measures apply, areas can be designated in which another management regime applies, enabling comparison of two protection procedures.

e) The spatial implementation of the measures allows for the principle of minimal burdening of fisheries.

f) When ascertaining the economic impact of measures, consideration will be given to various fishing technologies and the interests of Dutch and foreign fishermen. Current fishing data will be used in this process. Current and future interests of local fishermen and the development towards more sustainable fishing will also be taken into account.

g) A societal cost-benefit analysis will be prepared for the potential measure(s). Any effects (socio-economic, ecological) ensuing from the possible relocation of fishing activities will be also included, as will the local effects on fishing communities.

7. Economic interest of Frisian Front and Central Oyster Grounds for fisheries\(^5\)

Dutch and foreign fisheries on the Frisian Front and Central Oyster Grounds have been analysed using a methodology described in. a societal cost benefit analysis of fisheries measures in these areas (Oostenbrugge, 2015). The analysis of fisheries on the Frisian Front is

\(^4\) Sea bed protection measures in Natura2000 areas on shore and off shore add up to about 8% of the Dutch part of the North Sea. In order to fulfill the Government ambition to protect 10-15% an additional 2 – 7% of the Dutch North Sea bed has to be protected.

\(^5\) The information in this chapter is mainly taken from Oostenbrugge et.al. (2015), unless otherwise indicated.
applied on the area that matches with the area assigned for as Natura 2000 on grounds of the Birds Directive. The analysed area on the Central Oyster Grounds is not formally assigned but is often referred to in scientific reports (e.g. IMARES 2013); actually the habitat extends over a larger area than used in scientific reports.

7.1 Dutch fleet

Main target species of Dutch demersal fisheries are plaice, shrimp and sole and to a lesser extend turbot, brill, codfish, whiting and langoustine (Kuhlman, 2014). Average annual landing values of the Dutch demersal fleet amount around €250 million. The number of trawlers has been reduced from about 370 in 2003 to 270 in 2012.

Landing values of the Dutch fishing sector on Frisian Front and Central Oyster Grounds amount to about € 4,9 million on annual average in the period 2008-2014; this 2% of the total value of the Dutch demersal fleet. Average annual gross value added (GVA) is about € 1,7 million in this period. Fishing efforts (fishing days) decreased substantially over this period by 50-60%, landing values decreased by about 30% due to increasing fishing opportunities and decreasing prices.

From 2013 beam trawls including traditional beam trawl, puls trawl, puls-wing and sum-wing, are no longer the dominant gear used in the areas, other bottom trawls such as otter trawl and twin trawl and seines, became more important. Within the beam trawls a partial shift has taken place from the traditional beam trawl to the pulse wing gear. Nets, dredges or shrimp trawl are hardly used in the areas.

Oyster Grounds

Landing values of fisheries on the Frisian and on the Central Oyster Grounds on average are on 3 to 1, although this proportion might differ considerably from year to year. Quarterly about 45 vessels are fishing in the areas. Three quarters of them take 10% or less of their revenues from these areas.

7.2 Foreign fleet

Information on the foreign fleet is based on data sets provided by institutes in Denmark, Germany, Belgium and the UK (Oostenbrugge, 2015).

Landing values of the foreign fleet on Frisian Front and Central Oyster Grounds are on average 1,5 larger than landing values of the Dutch fleet. Average gross value added by the foreign fleet amounts on average 2 times gross value added by the Dutch fleet (Table 1).

The majority of the fishing activities is carried out by the UK fleet which contributes to more than 50% of the effort. The landings volume (tones) of the Danish fleet is more or less comparable with the UK, but these are predominantly low price species, caught in large quantities. As a result the contribution of the Danish fleet to the total landings value and GVA is relatively low. The effort levels of the German fleet and Belgian fleet are generally comparable to the Danish ones, but
differences exist for specific years. The time series of the foreign fleets do not show a clear trend. Fishing activities seem to be stable over time.

**Table 1** Gross value added (GVA) by the Netherlands and foreign fleets on Frisian Front and Central Oyster Grounds. Average of foreign fleet over period 2010-2014; average of Dutch fleet over period 2008-2014.

<table>
<thead>
<tr>
<th></th>
<th>GVA range</th>
<th>Average GVA</th>
<th>Percentage of foreign fleet</th>
<th>Percentage of NL and foreign fleet</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>€ million</td>
<td>€ million</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>UK</td>
<td>1,5-2</td>
<td>1,8</td>
<td>55</td>
<td>36</td>
</tr>
<tr>
<td>Denmark</td>
<td>0,5-1</td>
<td>0,8</td>
<td>25</td>
<td>16</td>
</tr>
<tr>
<td>Germany</td>
<td>0,3-0,5</td>
<td>0,4</td>
<td>13</td>
<td>8</td>
</tr>
<tr>
<td>Belgium</td>
<td>0-0,3</td>
<td>0,2</td>
<td>7</td>
<td>5</td>
</tr>
<tr>
<td>Total foreign</td>
<td>3-3,5</td>
<td>3,3</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>Netherlands</td>
<td>1,2-2,3</td>
<td>1,7</td>
<td></td>
<td>35</td>
</tr>
<tr>
<td>Total</td>
<td>4,2-5,8</td>
<td>5,0</td>
<td></td>
<td>100</td>
</tr>
</tbody>
</table>

### 7.3 Flag vessels

Part of the foreign fishing fleet on the Frisian Front and the Central Oyster Grounds consists of flag vessels, Dutch owned vessels under foreign flag. 80% of the effort from German vessels and 60% of the effort of Belgian vessels is made by flag vessels. Flag vessels under Belgian and German flag operating contribute minimal 20% to the total effort and 4% to the GVA of foreign fleets over the period 2010-2014. Based on the current data, the German flag fleet in the area is more important than the Belgian flag fleet. Fishing activities of Belgian and German flag vessels have been increasing over the period 2010-2014. Efforts nearly doubled in the areas and value of landings and GVA more than doubled. This might be due to the fact that in the last years it has become easier for owners of flag vessels to use their Dutch quota on foreign vessels.

Data for UK flag vessels is missing due to the fact that for the UK the information on fishing activity could be matched only partly with the vessel information from the Dutch sector. The significant number of UK flag vessels (33) suggests that the proportion of the UK fishing activities carried out by Dutch owned vessels is substantial.

No Danish flag vessel (Dutch owned Danish vessel) is operating in the areas.

### 7.4 Social aspects

In the demersal fisheries sector in the Netherlands about 3000 people are employed. In auctions, trade, supply and use about 20,000 people were working in 2012. Most vessels fishing on Frisian Front and Central Oyster Grounds are from two fishing communities: Urk and Wieringen.
7.5 Future developments
In the societal cost benefit analysis developments in the fisheries sector are described and incorporated in four policy, economy and innovation scenarios. The most important developments are price changes of fish and fuel; changes in fish abundance (MSY targets of management); implementation of the landing obligation; technical innovations; and restriction of the fishing area by nature conservation, wind parks etc.

8. Description of the proposed conservation measure to be implemented

8.1 Geographical description, management zones
In order to allow the sea bed ecosystem of Frisian Front and Central Oyster Grounds to recover from the present disturbed state, measures aim at reducing the adverse effects of fisheries with bottom contacting fishing gear in designated areas (See Fig. 8).

Figuur 8 Proposed management zones
The designated areas amount up to 2400 km². On the Central Oystergrounds protection will be given to the sea bed of 1200 km² in one area with a size of 30 by 40 km. On the Frisian Front protection will be given to the sea bed in three areas with a size of 20 by 20 km each (1200 km² in total). The full details/coordinates of the closed zones are attached in Annex III.

The areas on the Frisian Front and the Central Oyster Grounds to be closed can with respect to their ecological merits be compared with areas in the variants that have been analyzed in the societal cost benefit analysis (Oostenbrugge, 2015). Information on the ecological quality of the subareas in these variants is presented in Table A4.2 of Appendix 4 of Oostenbrugge (2015).

a. The area on the northern part of the Central Oyster Grounds (1200 km²) on fine sand contains relatively high numbers of long lived macrobenthos species and species richness.

b. The area on the Frisian Front covers the central part of the gradient including the core area with the highest amount of silt, over 20%, and contains relatively high macro- and megabenthos biomass, species richness and species density.

c. The area south-east of the Frisian Front of coarse and medium fine sand runs into the Frisian Front itself and contains relatively high amounts of megabenthos biomass, species richness and species density.

d. The area south-west of the Frisian Front of medium coarse sand runs into the Frisian Front itself as well; it contains relatively high amounts of macrobenthos biomass.

### 8.2 Fisheries measures

All management zones will be closed to fisheries using existing, new and/or modified bottom contacting gears and travelling under six knots. Therefore the use of the following towed bottom contacting gear types is prohibited:

- Beam Trawl.
- Bottom Trawl/Otter trawl.
- Dredges.
- Semi-pelagic trawls.
- Demersal seines

#### Table 2 Gear codes for the banned towed bottom contacting gear types.

<table>
<thead>
<tr>
<th>Gear groups that are banned in all closed zones</th>
<th>Gear Code Annex XI in EU Regulation 404/2011</th>
<th>International Standard Classification of Fishing Gears (ISSCFG)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beam trawl</td>
<td>TBB</td>
<td>03.1.1</td>
</tr>
<tr>
<td>Bottom Otter Board Trawl</td>
<td>OTB, OTT, PTB, TBN, TBS, TB</td>
<td>03.1.2, 03.3.0, OTP (?), 03.1.3, 03.1.9</td>
</tr>
<tr>
<td>Dredges</td>
<td>DRB, HMD</td>
<td>04.1.0, 04.2.0, DRM (?), DRX (?)</td>
</tr>
<tr>
<td>Semi-pelagic trawls</td>
<td>Classified as ‘Bottom Otter Board Trawls’</td>
<td>TSP (?)</td>
</tr>
<tr>
<td>Demersal seines</td>
<td>SDN, SSC, SPR, SX, SV</td>
<td>SPR, SDN, SSC, SPR, SX, SV</td>
</tr>
</tbody>
</table>
8.3 Alert zones
Around each management zone an alert zone will be established. The zone will measure 4 nautical miles from the outer limit of each management zone. In the alert zone there are no restrictions to fishing activities, with exception of the restrictions on the Frisian Front posed by the Birds Directive (seasonal closure of the wider Frisian Front for gill nets).
Its aim is to alert enforcement authorities that a vessel is in the alert zone thus enabling these authorities to warn the vessel that it is near a management zone.

9. Methodology to assess the ecological and economical impacts
The conservation objective for Frisian Front and Central Oyster Grounds is the recovery of substantial parts of the sea bed ecosystem of from a disrupted state towards a natural condition.
In order to assess the possible impacts of the conservation measure a societal cost benefit analysis was performed in 2015 (Oostenbrugge, 2015). In this analysis ecological benefits and economic costs to industry were assessed to facilitate decision making. Initially the analysis was performed on six variant of closures of areas to sea bed disturbing fisheries. Three variants have been proposed by Government (1200, 1600, 4200 km$^2$), two variants were proposed by fishing industry (1265 and 1685 km$^2$) and one by nature organizations (6340 km$^2$).

9.1 Ecological effects
In the societal cost-benefit analysis the ecological benefits were assessed using the ecopoint method, focusing on the current status of the benthic ecosystem and possible focus areas in the management. The ecopoint method makes it possible to compare options with different ecological qualities on the basis of a numerical score attributed to an area or subarea. The final ecopoint score is the product of the size of each specific area (i.e. in km$^2$), the numerical value of that area on the basis of biodiversity characteristics (preferably the future biodiversity recovery potential) and a weighing factor. The Ecopoint method does not provide for an absolute value of the biodiversity situation of an area, but is always relative to other areas.

Because of lack of adequate information on the recovery potential of the protected areas the future situation of the areas could not be taken into account in terms of ecopoints. Therefore in the societal cost-benefit analysis the ecopoints attributed to the six variants are based on the current status of the benthic ecosystem. In a qualitative way the the development of habitat and species characteristics as a result of closing Frisian Front and Central Oyster Grounds for sea bed disrupting fishering techniques have been assessed by expert judgement (Jongbloed, 2013). In general it is expected that sea bed structure will change towards natural intrinsic conditions and an increase in natural bioturbation. A benthic community in which epifauna has a larger role can develop. It is assumed that benthos biodiversity increases, biogenic structures develop, scavengers and worms decrease, crustaceans and bivalves increase, as well as sensitive fish species, predatory fish and large specimens of certain species.
On the basis of various studies, it is expected that the period over which a benthic community recovers may be in the order of 5 to 25 years.

Furthermore it is assumed that the Frisian Front ecosystem will show a faster recovery of benthic fauna than Central Oyster Grounds because of an initial situation which is a result of a greater impact of fisheries and dynamism, heterogeneity and dynamics of the landscape on the Frisian Front than is the case for the Central Oyster Grounds. Frisian Front is also assumed to have a higher potential for growth of long-lived benthic (individuals and species), higher potential for growth of biomass, higher potential for increasing biodiversity, higher potential for several types of big fish.

The experts do not expect the return of the historical ecosystem of the Central Oyster Grounds (where oyster beds were key elements) in the foreseeable future due to the absence of hard structures. Natural oyster beds may develop again, provided there is hard substrate present on which oyster larvae can settle. Also, the quahog can spread in the northern part of the Central Oyster Grounds, potentially making a major contribution to the status of local biomass and long lived species.

In order to assess the ecological development of closed areas and to evaluate the measure monitoring of the areas is of utmost importance. Monitoring of Frisian Front and Central Oyster Grounds is part of the Monitoring Programme (Netherlands’ Marine Strategy, part 2; IenM, 2014 (see also paragraph 10)).

9.2 Economic effects
A prerequisite to sea bed protecting measures is the minimization of economic impact on the fisheries sector. The economic effects of closures on both the Dutch fishing sector have been estimated assessed by an analysis of the historic fishing activities in the areas combined with scenario analysis. The scenarios used are four Policy, Economy and Innovation scenarios (PEI scenarios) and three displacement scenarios. The PEI scenarios include effects of external developments such as fish prices, stock developments and other area closures. The displacement scenarios are based on scientific insights into displacement effects, the fishing sectors’ point of view, and the assumption that because of alternative fishing opportunities the long-term costs of displacement will be negligible. The scenarios result in a wide range of costs with substantial overlap between the various variants. The results have been presented as net present values (future discounted costs over a 30-year period). The displacement scenario based on the fishing sectors view results in significantly higher costs than the two other displacement scenarios. The closures will have an effect on social aspects in fisheries and their communities. These social effects have been assessed through interviews with fishermen. Most of these aspects cannot be attributed to one of the variants but have been described in Oostenbrugge (2015). Costs for monitoring and control have been estimated but are non-distinctive for most of the variants as the uncertainty in the costs is high.

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6 The information in this paragraph is taken from Van Oostenbrugge (2015) unless otherwise indicated.
In order to assess the economic effects of the final proposal an addendum to the societal cost benefit analysis has been produced applying the PEI scenarios and displacement scenarios (Van Oostenbrugge, 2016b). Key findings are that costs in term of gross value added of the proposed variant for the Dutch fisheries range between € 0 and € 6 million (net product value GVA over a 30-year period).

The relative contribution of the fishing activities of the Dutch fleet in each of the variants amounts to less than 1% of the fishing activities of the Dutch demersal fishing sector. On average over the period 2008-2014 the total number of vessels in the areas to be closed in a quarter of the year range from 20 to 40. More than 80% of these vessels are dependent for less than 10% of their revenues from these areas of that quarter. About 5 vessels are (quarterly) dependent for more than 10%. The data show that beam trawling decreased considerably over the period 2008-2014 and pulswing increased.

[PM to be completed] The total importance of the areas for foreign fleets is comparable and larger than for the Dutch fleet. Landings values of the foreign fleet are higher then those for the Dutch fleet on average by a factor 1,5. Gross value added (GVA) of the foreign fleet is on average about 2 times higher. Because part of the foreign vessels is owned by Dutch enterprises the effects on foreign fleets will also affect the Dutch economy.

10. Monitoring and assessment
Part 2 of the Marine Strategy, the MSFD monitoring programme, describes the monitoring of the Frisian Front and the Central Oyster Grounds (IenM, 2014). The objectives of this monitoring are definition of the status of the areas, and definition of the impacts of the measures. In order to bring about these objectives the areas will be monitored every three years. Every six years the measure will be evaluated. Fisheries industries and nature conservation organizations will be involved in the monitoring and assessment process.

To assess the state of the areas sampling with boxcorer as well as ground plane is envisaged. The monitoring plan incorporates 42 boxcorer and 12 ground planing for the central Oyster Grounds and 9 boxcorer and 15 ground planing for the Frisian Front. The sample locations are randomly scattered over the area. An assessment will be made of ‘smart’ species (see Table 3). With this sampling method, there is a chance detecting a 50-percent change in spatial distribution between two monitoring sequences, with a confidence level of 95 percent.

Once the measures to prevent sea bed disruption are determined the monitoring programma will be modified to also monitor the effects of these measures. With regard to slow recovery of benthic habitats it might take 12 years (two MSFD cycles) or longer to assess the impacts of the measures.
**Table 3** Species to be used to assess the measures in the protected areas at Frisian Front and Central Oystergrounds (source IenM, 2014).

<table>
<thead>
<tr>
<th>Central Oyster Grounds</th>
<th>Dutch name</th>
<th>English name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Callianassa subterranea</td>
<td>Moddergarnaal</td>
<td>Burrowing mud shrimp</td>
</tr>
<tr>
<td>Upogebia stellata</td>
<td>n.a.</td>
<td>n.a.</td>
</tr>
<tr>
<td>Brissopsis lyrifera</td>
<td>n.a.</td>
<td>Spiny mudlark</td>
</tr>
<tr>
<td>Corbula gibba</td>
<td>Korfschelp</td>
<td>Basket shell</td>
</tr>
<tr>
<td>Acanthocardia echinata</td>
<td>Gedoornde hartschelp</td>
<td>Prickly cockle</td>
</tr>
<tr>
<td>Turritella communis</td>
<td>Penhoren</td>
<td>Common tower shell / Auger shell</td>
</tr>
<tr>
<td>Amphiura filiformis</td>
<td>Draadarmige slangster</td>
<td>Brittle star</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Frisian Front</th>
<th>Dutch name</th>
<th>English name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amphiura filiformis</td>
<td>Draadarmige slangster</td>
<td>Brittle star</td>
</tr>
<tr>
<td>Callianassa subterranea</td>
<td>Moddergarnaal</td>
<td>Burrowing mud shrimp</td>
</tr>
<tr>
<td>Upogebia deltaura</td>
<td>Harige molkreeft</td>
<td>n.a.</td>
</tr>
<tr>
<td>Thracia convexa</td>
<td>Bolle papierschelp</td>
<td>Convex thracia</td>
</tr>
<tr>
<td>Goneplax rhomboides</td>
<td>Trapezium krab</td>
<td>Angular crab</td>
</tr>
<tr>
<td>Corystus cassivelaunus</td>
<td>Helmkrab</td>
<td>Masked crab / Helmet crab</td>
</tr>
<tr>
<td>Nephtys incisa</td>
<td>n.a.</td>
<td>n.a.</td>
</tr>
</tbody>
</table>

11. Control and enforcement of the proposed fisheries management measures

The proposed control, enforcement and compliance regime for the Frisian Front and the Central Oyster Grounds consist of a combination of surface and aerial surveillance, establishment of an alert zone outside of the CO/FF management areas, and remote monitoring of vessel position.

Key provisions, in accordance with Council Regulation (EC, 2009) of 20 November 2009 establishing a Community control system for ensuring compliance with the rules of common fisheries policy to be included in the delegated act to facilitate control enforcement and compliance are:

- Fishing activities of all fishing vessels in the management zones and a 4 NM wide alert zone around the management zones shall be controlled by the fisheries monitoring authorities of the coastal Member State by using their system to detect and to record the vessels’ entry into, transit through and exit from the fishing restricted areas.

- Fishing vessels carrying on board any prohibited gear types and travelling under six knots within the alert zone and management zone must use their vessel monitoring system for reporting fishing vessel identification, geographical position, date, time, course and speed. These data shall be transmitted every 10 minutes.

- The relevant fisheries monitoring authority shall be informed about entry and exit of alert and management zone.
• Fishing vessels may transit alert zone and management zone with prohibited gears on board provided that
  o any prohibited gear on board be lashed and stowed during the transit; and
  o the speed during transit is not less than six knots except in case of force majeure or adverse conditions. In such cases, the master shall without delay inform the fisheries monitoring centre of the flag Member State which shall then inform the competent authorities of the coastal Member State.

• The high frequency data can also be transmitted via GPRS/GSM. When GPRS/GSM signal is not available data shall be safely stored and forwarded as soon as the signal is available.

• A fishing vessel travelling at six knots or less that carries a prohibited gear entering an alert zone area without such a system or not transmitting or storing the data is in breach of the regulations, except in the case of force majeure or adverse conditions.

12. Implementation

In case of EC Regulation there is no need for implementation in national law. In order to enforce the regulation a provision will be made in the Uitvoeringsregeling Zeevisserij (implementing regulation for marine fisheries) under the Visserijwet 1963 (Fisheries Act 1963).

After a period of 6 years after the publication of the Regulation the initiating Member State will assess the impact of the measure on the benthic ecosystem.

Fisheries industry and nature conservation organizations are invited to jointly give guidance to the implementation process, the communication on it, the monitoring of the ecological effects and evaluation of the measure and to the improvement of compliance and enforcement.
### Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AFDW</td>
<td>Ash-free dry weight</td>
</tr>
<tr>
<td>BD</td>
<td>Birds Directive</td>
</tr>
<tr>
<td>CBD</td>
<td>Convention on Biological Diversity</td>
</tr>
<tr>
<td>CFP</td>
<td>Common Fisheries Policy</td>
</tr>
<tr>
<td>CO</td>
<td>Central Oyster Grounds</td>
</tr>
<tr>
<td>DCS</td>
<td>Dutch Continental Shelf</td>
</tr>
<tr>
<td>EC</td>
<td>European Commission</td>
</tr>
<tr>
<td>EEZ</td>
<td>Exclusive Economic Zone</td>
</tr>
<tr>
<td>EU</td>
<td>European Union</td>
</tr>
<tr>
<td>EZ</td>
<td>Ministry of Economic Affairs</td>
</tr>
<tr>
<td>FF</td>
<td>Frisian Front</td>
</tr>
<tr>
<td>GES</td>
<td>Good Environmental Status</td>
</tr>
<tr>
<td>GVA</td>
<td>Gross Value Added</td>
</tr>
<tr>
<td>GPRS/GSM</td>
<td>General Packet Radio Service/Global System for Mobile Communications</td>
</tr>
<tr>
<td>HD</td>
<td>Habitats Directive</td>
</tr>
<tr>
<td>IenM</td>
<td>Ministry of Infrastructure and the Environment</td>
</tr>
<tr>
<td>IMARES</td>
<td>Institute for Marine Resources &amp; Ecosystem Studies, as per September 1&lt;sup&gt;st&lt;/sup&gt; 2016: Wageningen Marine Research</td>
</tr>
<tr>
<td>LEI</td>
<td>Landbouw Economisch Instituut (Agriculture Economic Institute), as per September 1&lt;sup&gt;st&lt;/sup&gt; 2016: Wageningen Economic Research</td>
</tr>
<tr>
<td>MSY</td>
<td>Maximum Sustainable Yield</td>
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<td>NIOZ</td>
<td>Koninklijk Nederlands Instituut voor Onderzoek der Zee (Royal Netherlands Institute for Sea Research)</td>
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<td>NM or Nmi</td>
<td>Nautical mile (1852 m)</td>
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<td>NSAC</td>
<td>North Sea Advisory Council</td>
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<td>Policy, Economy and Innovation</td>
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<td>Rijkswaterstaat (managing agency of the Ministry of Infrastructure and the Environment)</td>
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<td>SAC</td>
<td>Special Area of Conservation (Habitats Directive)</td>
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<td>SCBA</td>
<td>Societal Cost-Benefit Analysis</td>
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<td>Special Protection Area (Birds Directive)</td>
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<td>WER</td>
<td>Wageningen Economic Research (formerly: LEI)</td>
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References


EC, 1992, Directive on the conservation of natural habitats and of wild flora and fauna (the Habitats Directive; 92/43/EEC)


EC, 2008, Fisheries measures for marine Natura 2000 sites - A consistent approach to request for fisheries management measures under the Common Fisheries Policy


UNGA, 2015, UN Resolution A/RES/70/1, Transforming our world: the 2030 Agenda for Sustainable Development (2015)
Annex I Marine protected areas in the Netherlands’ part of the North Sea (IenM, 2015)
### Annex II Coordinates of the protected areas / Management Zones (based on WG84)

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### Annex III Coordinates of the alert zones (based on WG84)

[PM to be added]