Chapter 8. Monitoring the effects of offshore wind farms: evaluating changes in fishing effort using Vessel Monitoring System data: targeted monitoring results

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Trawling vessel in the Belgian part of the North Sea Photo RBINS / MUMM

Abstract

This chapter reports on changes in fishing effort in the vicinity of the existing windmill parks at the BPNS based on Vessel Monitoring System (VMS) data. During the analysis, displacement of activities by Belgian trawlers of different size and engine power was evaluated. Additionally, we looked at possible changes in fisheries methods, and more precisely a shift towards passive fishing methods.

The results showed that the permanent closure of the existing windmill park concession areas for fisheries has not resulted in a major disruption of Belgian fisheries activities. For large segment trawlers, the observed evolution in fishing distribution and intensity was limited and could not be attributed to the establishment of the C-Power and Belwind windmill parks. For eurocutters, however, there was a shift in distribution from 2006 to 2009, with the abandonment of the western part of the Thorntonbank after 2006 and an increase of fisheries activities between the Thorntonbank and the Bank Zonder Naam in 2009. This might indicate a local increase in the availability of commercially interesting fish species. A change in fisheries methods from active (trawling) to passive (trammel netting) gears could not be observed with the currently available data.

In the current analysis, realistic maps of fishing effort and distribution could not be drafted due to the lack of VMS data on foreign vessels fishing in the windmill park area and on vessels smaller than 15m. This was partly mediated by analysing data gathered during visual surveys. However, the integration of VMS data of all vessels fishing within the study area is indispensable for future monitoring of fisheries activities of windmill parks and other closed areas.

Samenvatting

Dit hoofdstuk geeft de resultaten weer van een analyse betreffende veranderende visserijdruk in de buurt van de bestaand Belgische windmolenparken. Deze analyse is gebaseerd op “Vessel Monitoring System” (VMS) gegevens van Belgische vaartuigen van verschillende categorieën in grootte en motorvermogen. Er werd tevens nagegaan of er een verschuiving kon waargenomen worden in het gebruik van actief en passief vistuig. De resultaten toonden aan dat de sluiting van de windmolenparken voor de visserij geen grote verstoring heeft teweeg gebracht in de Belgische visserij-activiteiten. De evolutie van de verspreiding van het groot segment was beperkt en kon niet in verband worden gebracht met de bouw van de windmolenparken. Bij eurokotters was er wel een verschuiving in de verspreiding in de periode 2006-2009, waarbij het westelijke gedeelte van de Thorntonbank grotendeels werd verlaten na 2006, maar waarbij een toenemende activiteit werd waargenomen in het gebied tussen de Thorntonbank en de Bank Zonder Naam in 2009. Dit zou een indicatie kunnen zijn van een toename in densiteiten van commercieel interessante vissoorten. Een verschuiving van actief naar passief vistuig kon niet worden waargenomen op basis van de beschikbare gegevens.

De beschreven analyse betreft enkel de Belgische vloot (schepen > 15m) en geeft dus geen realistisch beeld van de werkelijke visserij-inspanning in het gebied. Het ontbreken van gegevens betreffende kleine vaartuigen en vaartuigen varend onder een vreemde vlag werd deels opgevangen door de analyse van gegevens afkomstig van visuele waarnemingen. Het is echter van het grootste belang om alle VMS gegevens afkomstig uit het studiegebied te integreren voor de toekomstige monitoring van windmolenparken en andere gesloten gebieden.

8.1. Introduction

In the Belgian part of the North Sea (BPNS), the construction of offshore windmill parks gave rise to the establishment of areas closed for fisheries. After such a closure, different effects on both the ecosystem as on fishing activities have been observed (e.g. Murawski *et al.*, 2000; Grizzle *et al.*, 2009) and can be thus also be expected to manifest themselves in the BPNS. These effects comprise (1) the establishment or recovery of spawning and nursing grounds, (2) the recovery of benthic communities and diversity within the area, and (3) edge effects along the borders resulting from

displacement of fisheries activities and changes in fishing intensity (MUMM, 2004). The latter effect can be evaluated using VMS data originating from the Belgian part of the North Sea.

VMS data originate from a fishing vessel monitoring system (VMS), which is a program of fisheries surveillance, in which satellite transmission equipment that is installed on fishing vessels, provides information about the vessels' position and activity. This is different from traditional monitoring methods, such as using surface and aerial patrols, on-board observers, logbooks or dockside interviews. VMS data constitute a cost-effective tool for the successful monitoring, control and surveillance of fisheries activities. In this respect, they are an excellent tool for monitoring compliance with closed-area regulations and for investigating changes in fisheries distribution and effort in the vicinity of such closed areas.

Recently, Vessel Monitoring System (VMS) data have been made available by the Belgian Sea Fisheries Service[1] for scientific research related to fisheries management. Unfortunately, only VMS data of Belgian vessels were provided. The lack of data concerning foreign vessels on the BPNS hampers the drafting of realistic maps on fishing effort in the vicinity of Belgian offshore windmill parks. Nevertheless, an analysis of the available Belgian data can already give an indication of the extent of the changes in fisheries activities following the construction of offshore windmill parks and the subsequent closure of the concession zones for bottom disturbing fisheries.

The aim of the described analysis was to investigate changes in fishing effort in the vicinity of the existing windmill parks at the BPNS based on Vessel Monitoring System (VMS) data. During the analysis, displacement of activities by Belgian trawlers of different size and engine power was evaluated. Additionally, we looked at possible changes in fisheries methods, and more precisely a shift towards passive fishing methods.

8.2. Material and Methods

VMS data were available for the years 2006 to 2009, for vessels > 15m (EG 2244/2003). These data encompass specifications concerning the identity of the vessel, and the position, time of registration, speed and heading at 2 hour intervals.

All VMS registrations originating from the BPNS were assigned to vessel groups defined by engine power and gear, as derived from the yearly published "Official List of Belgian Fishing Vessels" (Anonymous, 2006 to 2009). Ten combinations of engine power class (eurocutters EC, large segment vessels LS) and gear (beam trawl B, otter trawl OT, trammel net W, shrimp trawl KO, Twin Rig T) were encountered in the database, of which EC B and LS B were most abundant and constituted over 95% of the data.

The activity of a vessel at the time of the VMS registration was derived from the recorded speed, by applying a speed filter. According to Fock (2008), speed filters for data with long interval length (2 hours at the BPNS) are best developed by calculating mean fishing speed (MFS) values. For the BPNS data, these values were calculated per ship category, based on engine power and registered gear. Average speed was calculated based on all "at sea" values smaller than 8 knots (all trawlers) or 5 knots (trammel netters). Fishing activity was then defined as all activity at speeds lower than MFS + 2 knots (Fock, 2008).

Ten combinations of engine power and gear were encountered in the database. Since data on some power and gear combinations (e.g. EC B/KO) were too limited to calculate a representative mean fishing speed, only 4 groups were retained: EC trawlers / EC W/ LS trawlers/ LS W. During a quality check of the vessel list per group, it appeared that the vessel group "EC W" did not exist in real life. This vessel group was in fact subject to administrative actions related to quotum transfer and did not actually fish with trammel nets. The registrations of these vessels were removed from the geodatabase.

Based on the calculated mean fishing speed per vessel category, a selection was made of all VMS registrations representing presumed fishing activity. These data were plotted on BPNS maps representing the number of VMS registrations (fishing) per 3km² grid cell, since this proved to be an

[1] All primary data were supplied by the Department of Agriculture and Fisheries – Sea Fisheries Service / Departement Landbouw en Visserij – Dienst Zeevisserij.

adequate resolution for VMS data with a 2 hour interval (Mills *et al.*, 2007). Maps were generated per vessel group and per year.

The data were processed, filtered and visualized using Microsoft Access and ArcView 10.0 (ESRI Inc, 2010).

8.3. Results

Maps were generated for the three vessel groups per year, by plotting the VMS registrations representing presumed fishing activity as the number of registrations per 3km² grid cell. Since the vessel group "LS W" consisted of only one vessel, the generated maps cannot be published in the light of confidentiality regulations concerning VMS data (BS, 8/12.1992). Consequently, only maps on trawling activity are shown, while trammel net activity is only vaguely described in terms of intensity and geographic distribution.

- **EC trawl**

Eurocutters mainly fishing for flatfish (there were only a few registrations for shrimp fisheries, and only in 2006) concentrated their activities in the Vlaamse Banken and south of the Gootebank, with a maximum of 438 VMS registrations per grid cell per year. Within the windmill park area, the Thorntonbank area was less intensively, but regularly trawled in 2006 (up to 13 VMS registrations per grid cell), but the western section was abandoned during 2007 and 2008. In 2009, a lot of trawling activity appeared in the zone between the Thorntonbank and the Bank Zonder Naam (up to 22 registrations per grid cell). This is the zone where Rentel has been given a domain concession for another future wind farm. The borders of the windmill park concessions were well respected by Belgian eurocutters: not a single VMS registration was observed within their limits after 2006.

- **LS trawl**

Large beam trawlers in the BPNS fished more widely distributed but with lower intensity than eurocutters. In 2006, registrations were observed throughout the Belgian windmill zone, but fisheries effort was mostly limited to single events per grid cell per year. Throughout the offshore area of the BPNS, the dispersion of registrations decreased in 2007 and 2008, which was also the case in the windmill zone. In these years, the highest numbers of VMS registrations were observed in the vicinity of the Gootebank, while the rest of the zone remained virtually untrawled by Belgian vessels. In 2009, the number of fished grid cells again increased, but still with low intensity (maximally 6 registrations per grid cell at the Gootebank and single events in the rest of the windmill zone). The borders of the windmill park concessions were well respected by Belgian large segment trawlers: only a single VMS registration was observed within the Belwind concession area in 2009. None were seen in the Thorntonbank concession areas.

- **LS W**

The single large trammel net vessel operating on the BPNS did not fish within the Belgian windmill zone. Only a single registration was observed within the zone in 2009, but outside the existing windmill concessions.

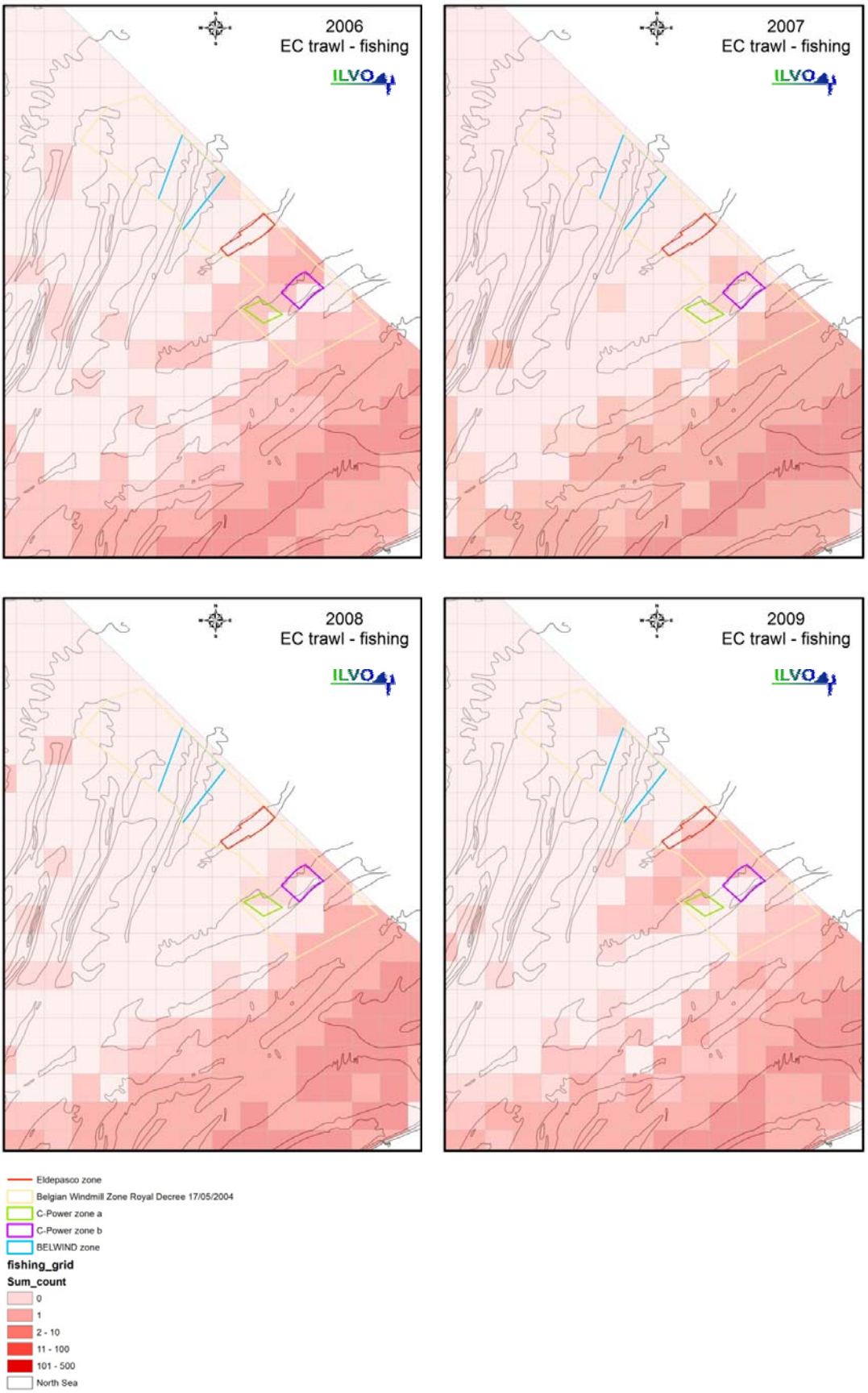

Figure 1. BPNS maps of fisheries effort per 3km² grid cell for the years 2006-2009 per vessel type (EC trawl : trawlers ≤ 221kW, LS trawl: trawlers > 221kW). Colors represent a gradient in numbers of VMS registrations per grid cell representing fishing activity.

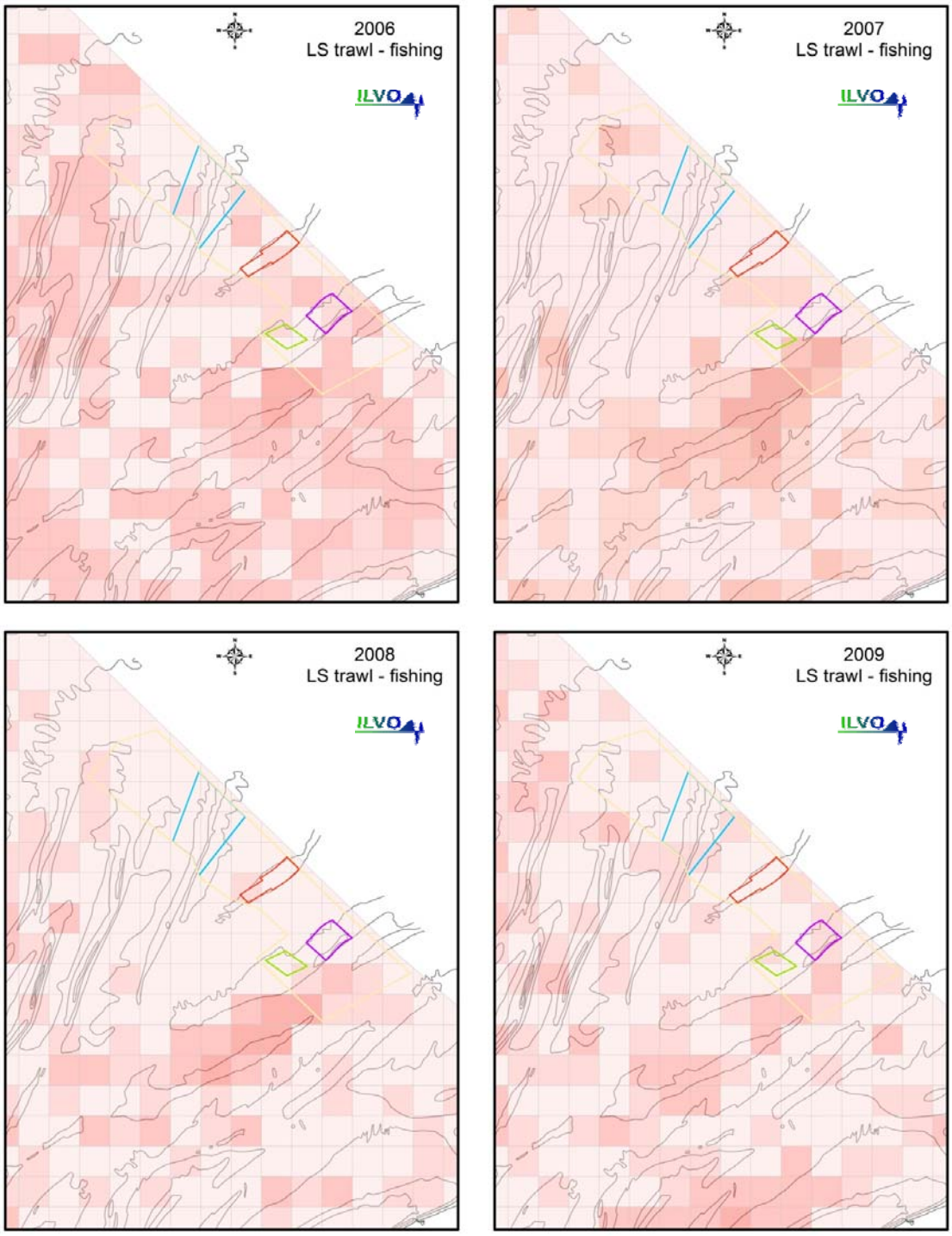

Figure 1. continued.

8.4. Discussion

8.4.1. Windmill parks and fisheries

As far as can be derived from the available VMS data, it seems that the permanent closure of the existing windmill park concession areas for fisheries has not resulted in a major disruption of Belgian fisheries activities. For large segment trawlers, the observed evolution in fishing distribution and

intensity was limited and could not be attributed to the establishment of the C-Power and Belwind windmill parks. For eurocutters, however, there was a shift in distribution from 2006 to 2009, with the abandonment of the western part of the Thorntonbank after 2006 and an increase of fisheries activities between the Thorntonbank and the Bank Zonder Naam in 2009. This might indicate a local increase in the availability of commercially interesting fish species. This hypothesis could be tested by an integrated analysis of VMS data and logbook data on landings. Linking these datasets is however still in progress for Belgian fisheries data. The increased trawling activity may also result in effects with regard to soft-bottom macrobenthos, epibenthos and demersal fish. Although sampling stations have been assigned to study edge effects resulting from a shift in fisheries activity, these are generally situated very close to the concession (see WT6 and WT8 for epibenthos and demersal fish in Chapter 7, and see WTC4, WTC6, WTB16, WTB18 for macrobenthos in Chapter 6). The increased fisheries activities are, however, situated closer to the gully between the Thorntonbank and the Bank Zonder Naam, so it might be useful to move these "fringe stations" to this area, or to assign new monitoring stations.

A change in fisheries methods from active (trawling) to passive (trammel netting) gears could not be observed with the currently available data.

8.4.2. Usability of VMS data for monitoring the distribution and intensity of fisheries activities near windmill parks

The maps generated using the available VMS data only represented fishing activities of vessels fishing under a Belgian flag. If VMS data of Dutch, French , Danish and British vessels fishing in the Belgian windmill park area would be overlaid, the trends observed in Figure 1 would change drastically. Although all VMS data of vessels fishing in the Belgian EEZ are present at the administrative level, sharing VMS data for non-CFP[2] purposes is constrained by a combination of human rights law; data protection law; the law of confidence, and EU law - in particular the EU confidentiality obligation under Article 113 of EC Regulation 1224/2009 (the "Control Regulation"). When sharing VMS data outwith the sphere of the CFP, compliance with the EU confidentiality obligation cannot be guaranteed. However, it is arguable that sharing anonymized and aggregated VMS data for marine planning and management purposes is not contrary to human rights law, data protection law or the EU confidentiality obligation if certain safeguards are put in place to protect the commercial value of VMS data and preserve confidentiality (ICES, 2010). Consequently, the need for integration of data from all flag states operating in a single EEZ can and should be tackled as soon as possible. Such an integration was already possible for the Irish, German and Dutch EEZ's (Fock, 2008; Anonymous, 2009; Deerenberg *et al.*, 2010; Oostenbrugge *et al.*, 2010; ICES, 2011), including data of the Belgian fleet, and proved to significantly increase the utility of VMS data in providing a spatially and temporally explicit understanding of fishing activities.

Other than the lack of data on foreign vessels, the current analysis suffers from an underestimation of actual fishing effort due to the lack of data on vessels under 15 m of length. Since small-scale commercial fisheries and all recreational fisheries have been estimated to represent a meaningful proportion of total fishing effort in the BPNS (Depestele *et al.*, 2008), VMS data do not suffice to get a correct and detailed view of the total effort. Ideally, all commercial fishing vessels regardless of their size should be equipped with a VMS transmitter or a similar device. Installing VMS devices for recreational fisheries is however not realistic, so other ways of estimating fishing effort by these small vessels have to be considered. In that perspective, visual surveys are complementary to VMS data, since they can provide an estimate of the spatial distribution and the presence of hot spots of small scale fishing activities (Maes *et al.*, 2005; Goffin *et al.,* 2007; Depestele *et al.*, 2008). In the Belgian windmill park area, intensive ship-based seabird surveys are performed by the Research institute for Nature and Forest (INBO) (see chapter on seabird monitoring), during which observations of vessels of any size are being recorded in a standardized way. These data clearly showed a concentration of recreational fisheries (mostly anglers) north of the existing C-Power turbines in 2008-2009 (fig 2), in the area where VMS data also showed a concentration of eurocutter

[2] CFP: Common Fisheries Policy

activity in 2009. Such a cluster was not observed in 2006-2007, but this may partly be due differences in sampling intensity between the periods. Still, the co-occurrence with higher eurocutter activity (as derived from VMS data, which are not subject to differences in sampling intensity) is striking, so increased angler activity likely is a reality. This angler activity usually targets pelagic and bentho-pelagic species, of which high densities have already been observed in the vicinity of the turbines (Reubens *et al.*, 2010; Reubens *et al.*, 2011). Hence, it is likely that the increased activity is a direct result of the presence of pelagic and bentho-pelagic fish species near the turbines.

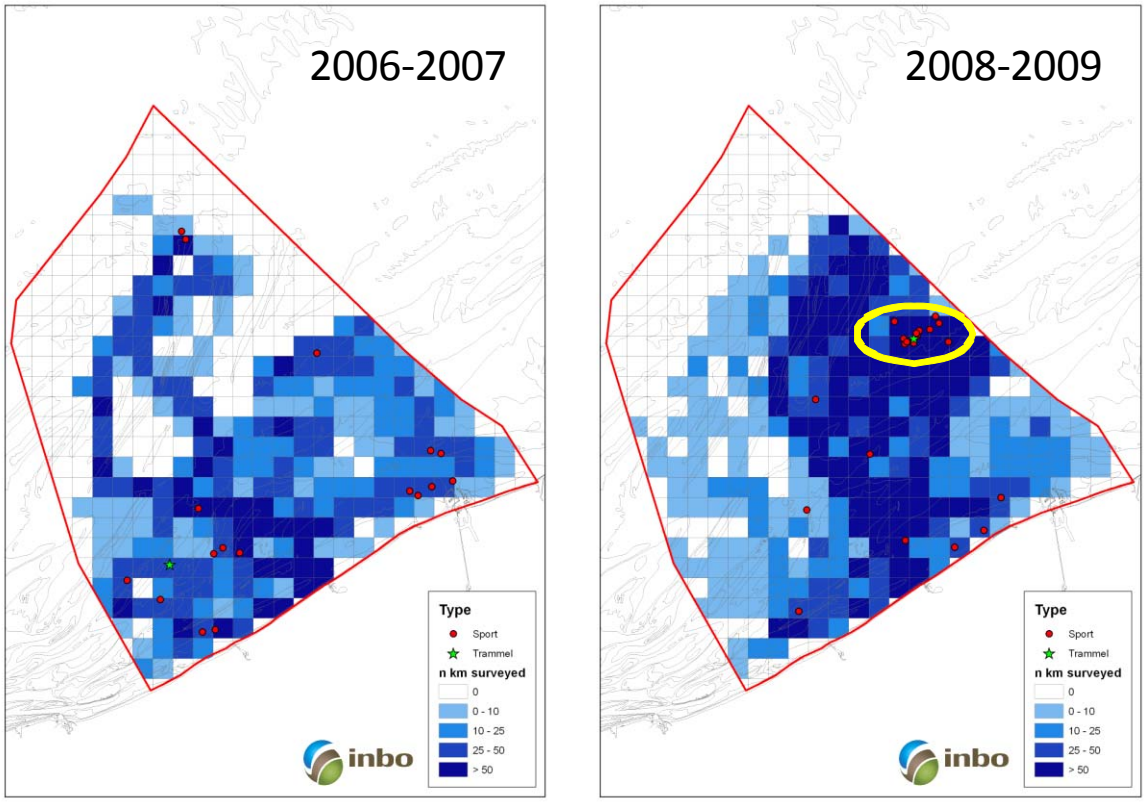

Figure 2. Point observations of trammel net activity (green stars) and recreational fisheries (red dots) for the years 2006-2007 and 2008-2009, based on vessel observations during seabird surveys. The underlying blue grid (3 km²) represents the survey intensity as the number of kilometers effectively sailed in each grid cell.

8.5. Conclusion

The permanent closure of the existing windmill park concession areas for fisheries has not resulted in a major disruption of Belgian fisheries activities. VMS data analyses showed that for eurocutters, there was a shift in distribution from 2006 to 2009, with the abandonment of the western part of the Thorntonbank after 2006 and an increase of fisheries activities between the Thorntonbank and the Bank Zonder Naam in 2009. For recreational fisheries, mapping observations from visual surveys by INBO revealed a concentration of activity in the same region north of the Thorntonbank. These observations might indicate a local increase in the availability of commercially interesting fish species, and the existence of fringe effects with regard to the state of soft-bottom fauna in the area north of the existing C-Power turbines. The state of commercial fish, and of non-commercial fish and invertebrates can be investigated by means of the analysis of logbook data and of (re-)assigned sampling stations for macrobenthos, epibenthos and demersal fish.

The observed increase in fisheries activities by Belgian eurocutters and by recreational fisheries may be altered in the near future following the construction of new wind mill parks in the area, more precisely the park planned between the C-Power and the Eldepasco concessions. Additionally, windmill park construction is also planned in the area south of the C-Power concession, which is an area that is traditionally intensively fished.

VMS data show to be very useful in providing a spatial and temporal understanding of fisheries activities. In the current analysis however, overall fishing activities in the area could not accurately be mapped due to the lack of VMS data on foreign vessels fishing in the windmill park area and on vessels smaller than 15m. This was partly mediated by analysing data gathered during visual surveys. However, the integration of VMS data of all vessels fishing within the study area is indispensable for future monitoring of fisheries activities of windmill parks and other closed areas. Hence, scientists and administrators should strive for an integration of all data, taking into account confidentiality regulations and national and European laws.

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