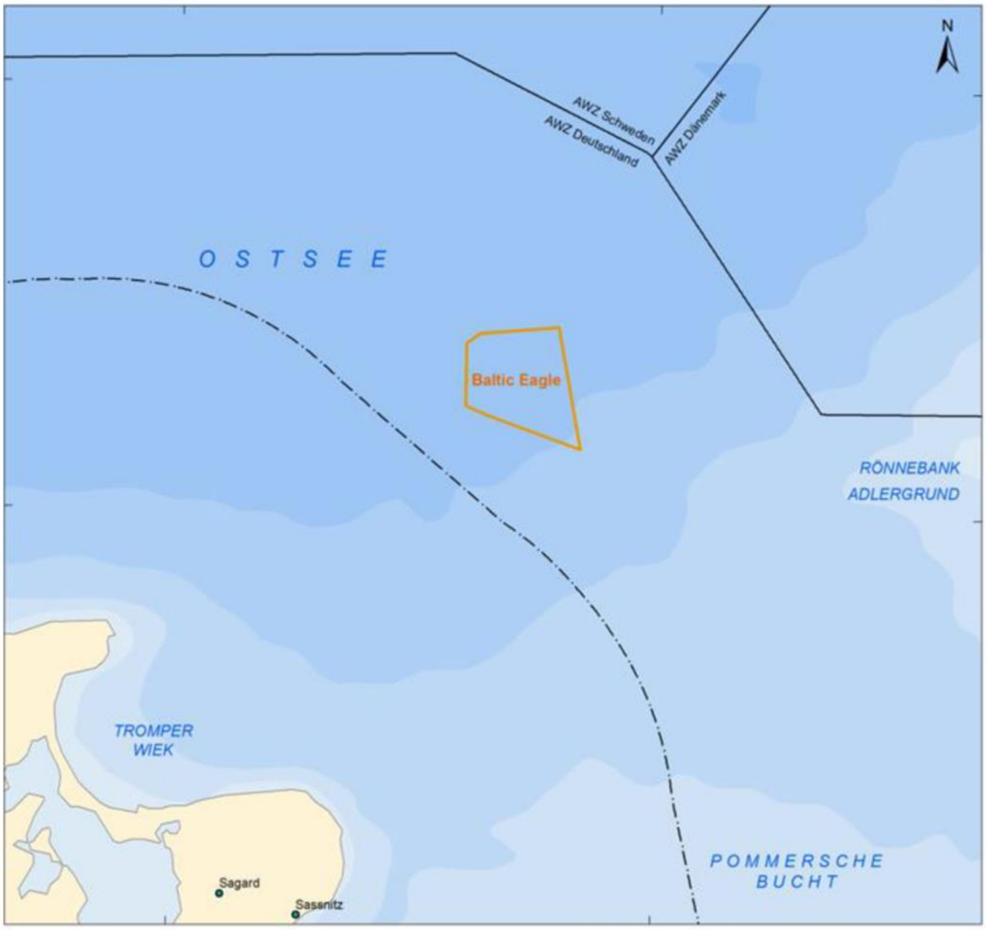
Cross-Border Effects of the Offshore Wind Farm Project

"Baltic Eagle"



IBERDROLA

06/11/2020

IfAÖ

IfAÖ [Institute for Applied Ecosystem Research] GmbH
Carl-Hopp-Str. 4a, 18069 Rostock
Phone: +49 381 252312-00
Fax: +49 381 252312-29

Particulars of order processing

Client: Baltic Eagle GmbH
Charlottenstrasse 63
10117 Berlin-Mitte

Contact: Sergej Drechsel
Telephone: +49 30 7676732-50
E-mail: s.drechsel@iberdrola.de

Cross-Border Effects of the Offshore Wind Farm Project "Baltic Eagle"

Project number: P188081

Contractor: IfAÖ [Institute for Applied Ecosystem Research] GmbH

Postal address: IfAÖ GmbH
Rostock Branch
Carl-Hopp-Strasse 4a
18069 Rostock

Head of Department Environmental Planning (EP): Dipl.-Biol. Frank Wolf
Telephone: 0381 252312-32
E-mail: wolf@ifaoe.de

In charge of processing: Dipl. LaÖk. Henning Rohde
Telephone: 0381 252312-14
E-mail: H.Rohde@ifaoe.de

Completion date: 06/11/2020

Version	Date	Document description	Created	Reviewed	Approved
01	06/11/2020	Distribution version	HRO	FWO	FWO
02	06/11/2020	Final version	HRO	FWO	FWO

Table of Contents

List of Tables

List of Figures

1 Introduction

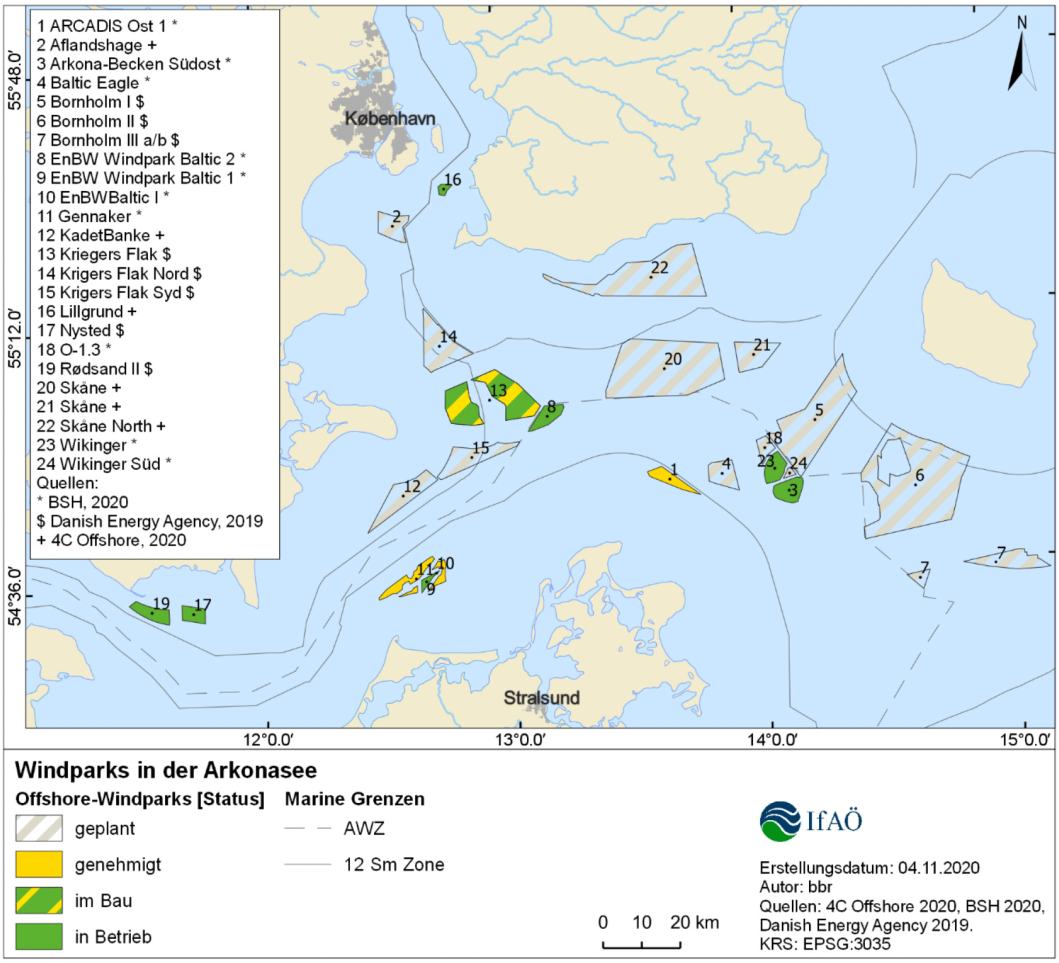
Baltic Eagle GmbH plans to install the offshore wind farm (OWF) “Baltic Eagle” with 50 (originally 83) offshore wind energy converters (OWECs), an offshore substation (OSS), including internal cable-laying within the wind farm, in the exclusive economic zone (EEZ) of the Baltic Sea. The area of the OWF project “Baltic Eagle” is situated 7.5 km west of the “Westlich Adlergrund”, a suitable area for wind farms and approximately 28 km to the north-east of the island of Rügen.

For the offshore wind farm, 50 OWECs in the 9.5 MW output class are planned. In order to take into account a possible further development in the size of the installation, a maximum rotor diameter of the OWEC of 174 m and a hub height of approx. 109 m above MSL is assumed. More technical information on OWECs can be found in the EIA report (IfAÖ 2020).

This document discusses possible cross-border impacts of the "Baltic Eagle" OWF. The focus here is on the biotic, mobile protected natural resources.

2 Project Area and Surrounding Planning

Fig. 1 shows the location of the "Baltic Eagle" project area in the southwestern Baltic Sea, together with other plans. With regard to the wind farms presented as "in planning", it should be noted that various actual planning statuses are summarised under this category according to the information available on the Internet site 4C Offshore and the areas presented may differ considerably from the dimensions of any areas that may be approved at a later date. The "Baltic Eagle" project area is located in the EEZ approx. 28 km north-east of the island of Rügen and covers an area of approx. 42.9 km^2 (excluding the safety distance). On a large scale, the site is located in the south-eastern Arkona Basin and borders on the Bay of Pomerania. The Adlergrund and Rönne Bank shallow grounds are located in the immediate vicinity.



Windparks in der Arkonasee	Wind farms in the Arkona Sea
Offshore-Windparks [Status]	Offshore wind farms [status]
Marine Grenzen	Marine borders
geplant	Planned
genehmigt	Approved
im Bau	Under construction
in Betrieb	In operation
AWZ	EEZ

12 Sm Zone	12 nm zone
Erstellungsdatum: 04.11.2020	Created on: 04/11/2020
Autor: bbr	Author: bbr
Quellen: 4C Offshore 2020, BSH 2020.	Sources 4C Offshore 2020, BSH 2020.
Denish Energy Agency 2019.	Danish Energy Agency 2019.
KRS: EPSG: 3035	KRS: EPSG: 3035

Fig. 1: Location of the "Baltic Eagle" (No. 4) OWF in the southwestern Baltic Sea, together with other offshore wind farms at different planning stages

The shortest distances to cross-border OWF projects are Bornholm I (approx. 11.4 km), Skane (approx. 19 km), Bornholm II (approx. 31.6 km) and Skane North (approx. 42.9 km). The shortest distance from the Danish EEZ is about 11.4 km and to the Swedish EEZ about 12.9 km.

3 Cross-Border Effects

As described in Chapter 11 of the EIA report (IfAÖ 2020), significant adverse effects due to cumulative effects, in the form of noise emissions, barrier effects or collisions, on the mobile protected natural resources have already been excluded. The interaction of the OWFs "ARCADIS Ost 1", "WIKINGER", "ARKONA" and "Wikinger Süd" was considered. The distance of these OWFs from "Baltic Eagle" ranges from 4.7 km ("ARCADIS Ost 1") to 12.3 km ("Wikinger Süd"). Possible cross-border impacts for the main species groups are discussed below.

3.1 Migratory Birds

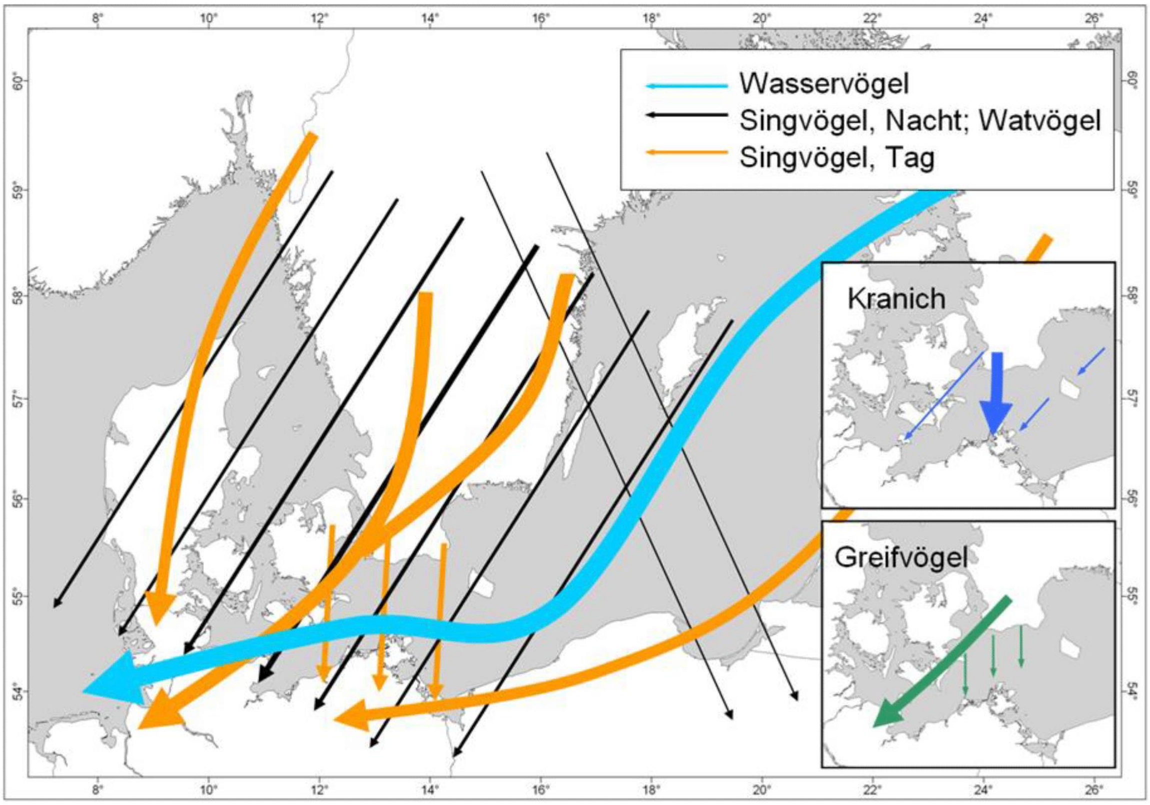
Main migration routes

At present, around 500 million birds migrate through the western Baltic Sea every autumn(Tab. 1). In the spring, lower numbers are to be expected due to mortality in winter.

Table 1: Population estimates for migratory birds of different flight types in the southern Baltic Sea region (data only applies to the autumn season; calculated according to Heath et al. 2000 and Skov et al. 1998) (IfAÖ 2010)

Migration type	Species groups	Autumn stock
Waterbirds	Loons, grebes, pelecaniformes, ducks, geese, mergansers, shorebirds, gulls, terns, guillemots	10–20 million
Land birds: thermal gliders	Birds of prey Cranes	< 0.5 million 60,000
Land birds: flapping flyers	Nocturnal migrators	200–250 million
	Diurnal/nocturnal migrators, pure diurnal migrators	150–200 million

Depending on the species, these birds migrate partly on long-term migration routes or as a broad-fronted migration across the area of the southwestern Baltic Sea (Fig. 2).



Wasservögel	Waterbirds
Singvögel, Nacht; Watvögel	Songbirds, nocturnal; shorebirds
Singvögel, Tag	Songbirds, diurnal
Kranich	Crane
Greifvögel	Birds of Prey

Fig. 2: Schematic diagram of important migration routes in the western Baltic Sea in autumn (Bellebaum et al. 2010)

Most birds migrate in broad-fronted movements. Birds in individual subpopulations fly, in accordance with a (primarily endogenously) established direction of migration, in parallel neighbouring sectors, giving rise to extensive migration patterns (e.g. Berthold 2000). Preference for broad-fronted migration applies mainly to nocturnal migrants which are less influenced by geographical structures. However, in the case of diurnal migrants, in particular, ecological barriers such as large expanses of water or guides, can influence migration routes.

In addition to the broad-fronted migration preferred by nocturnal migrants, the following three main flyways have been identified in the western Baltic Sea (summary diagram in Fig. 2):

- Southern Sweden – Danish islands (Seeland, Mon, Falster, Lolland) – Fehmarn ("bird migration path" in autumn towards the **southwest**; examples: wood pigeon, common buzzard). This route is preferred mainly by songbirds that migrate in the day and thermal gliders such as birds of prey. Such only includes short stretches over water.

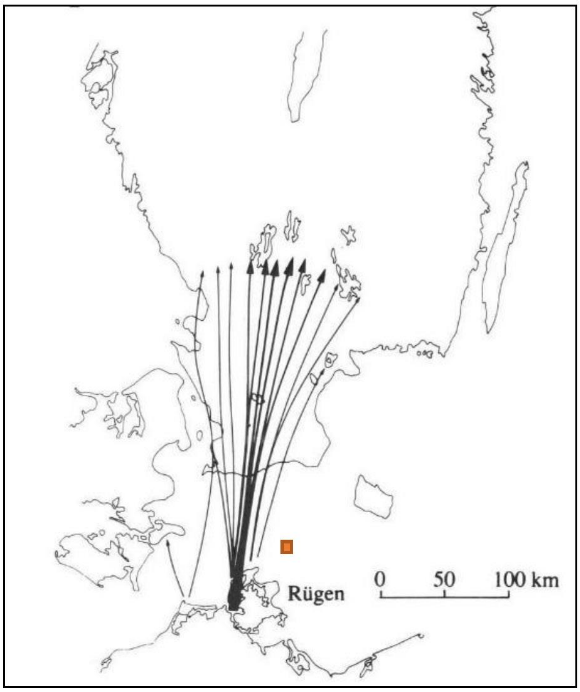
- Southern Sweden – Rügen (in autumn towards the **south**; for example, the crane or rough-legged buzzard). In addition to cranes and birds of prey, this route is presumably also used primarily in spring by songbirds crossing the Baltic Sea in a northerly direction from Darss and Rügen.

- Coming from the Baltic States/Finland/Siberia, following the narrowing "funnel" of the Baltic Sea towards the **southwest/west** (especially waterfowl and shorebirds; waders: Migratory route along the "East Atlantic Flyways"; arctic geese: for example, migratory routes of the barnacle goose/brent goose). There are two different coastal routes here: 1) along the Mecklenburg coast and 2) along the south coast of Sweden and the Danish islands as far as Fehmarn. Due to a lack of systematic observations on the high seas, the extent of the migration in the area far from the coast is insufficiently known.

In addition to the primarily southwesterly and southern autumn flyways, part of the Scandinavian population also migrates in a south-easterly direction. This applies mainly to the eastern population. The extent, for example, to which Finnish populations migrate SW over the Baltic Sea or follow the SE flyway cannot be assessed at the present time.

Cranes

Most of the cranes crossing the southwestern Baltic Sea pass between Hiddensee and the northern tip of Rügen and Skåne in both autumn and spring. Relatively small proportions migrate further west across the open Baltic Sea or follow the bird flight path and pass over Denmark and Fehmarn or, in the case of individuals migrating east, over Bornholm (ALERSTAM 1990, BfN 2006, BELLEBAUM et al. 2010, BSH 2019). The project area of the "Baltic Eagle" OWF lies east of the aforementioned main migration corridor between Rügen and Skåne (see Fig. 3).



Orange square = approximate location of "Baltic Eagle"

Rügen	Rügen

Fig. 3: Spring migration of the crane from resting grounds in the Rügen-Bock region towards Sweden (according to radar studies; from Alerstam 1990)

Barrier effects affecting crane populations in other countries/regions are not expected, as the "Baltic Eagle" OWF is located outside the main migration route. The nearest cross-border OWF project "Bornholm I" (in planning) is located 11.4 km east of "Baltic Eagle" and thus also outside the main migratory route. A barrier effect in combination with "Baltic Eagle" is therefore excluded. North (approx. 19 km) of "Baltic Eagle" is the "Skane" OWF (in planning). This has a much larger west-east extension than the "Baltic Eagle" (see Fig. 1). A possible barrier effect (north-south direction) of "Baltic Eagle" would, in interaction with "Skane", be overlaid by its barrier effect in the north-south direction, so that no cumulative effects can be assumed here. In addition, a single extension of the flight path, for example, during migration does not have a significant impact on the investigated species, even over distances of several kilometres (Masden et al. 2009, 2010).

Cranes mostly migrate in favourable weather conditions (very good visibility, weak or tailwind) and then at least two-thirds of the time to heights of over 200 m and thus above the rotors (BSH 2019). Moreover, since they, like waterfowl, show clear avoidance behaviour at OWFs (see also Skov et al. 2015), the risk of collisions at OWFs is low from the outset. Cross-border cumulative effects of passing several OWFs on the migration route are therefore not expected. Due to the low probability of collision and the location outside the main migration route, effects on crane populations in other countries/regions are not expected.

Birds of Prey

Most gliding birds of prey of Swedish populations follow the "bird flight route" (coming from

Falsterbo via Fehmarn; see Fig. 2). As the numbers observed in the project area, which is located in the O-2 area, were very low throughout (see IfAÖ 2020), a low occurrence of this bird group on the open sea can be expected. Area O-2 is also of minor importance for the migration of birds of prey (BSH 2019).

Barrier effects on bird of prey populations of other countries/regions are not expected, as the "Baltic Eagle" OWF is located outside the main migration route. As with the cranes, there are also no barrier effects in conjunction with cross-border OWF projects.

Blew et al (2008) found for the "Nysted" OWF that most birds of prey (except hawks) migrated mainly at higher altitudes and in good weather conditions. In the area around the "Nysted" OWF, migrating birds of prey up to 500 m in altitude were recorded. Birds of prey fly mainly in good visibility and in tailwinds mainly above the rotor plane (SKOV et al. 2012). The collision frequencies of birds of prey estimated by SKOV et al (2012) were low. Due to the generally low probability of collision and the minor importance of the project area for birds of prey, effects on populations of birds of prey in other countries/regions are not to be expected.

Land Birds

The main migration routes of land birds (e.g. migrating songbirds) lie outside the project area (see Figure 2). However, the actual course of a migration route also depends to a large extent on weather conditions. North-westerly winds regularly cause strong migratory movements towards the SE, leading the birds directly across the Baltic Sea (e.g. redwing and fieldfare). The daily migration directions and the spatial distribution of migrating songbirds are strongly influenced by the current weather conditions. Since these vary greatly over time, the migration over the entire season or longer periods is best described as a broad-front migration towards the SSW (autumn) or NNW (spring).

At the "Nysted" OWF, land birds flew in a S direction through the farm or over it and away. Ringdove flew over the "Horns Rev" OWF and away. One flock was observed climbing on its approach to the farm, which it then flew over at an altitude of approximately 300 m. A large flock of thrushes divided into two separate troops about 300 m before the farm; one flew into the farm, while the other visibly increased flight altitude and flew over the farm and away. Investigations showed that 56.6% (2016) and 54.4% (2017) of the songbirds recorded flew through the construction site area of the "WIKINGER" wind farm in the sectors concerned (cluster data Iberdrola 2016, 2017). A significant barrier effect (long-range bypassing), which has an impact on bird populations in other countries, is therefore not to be expected.

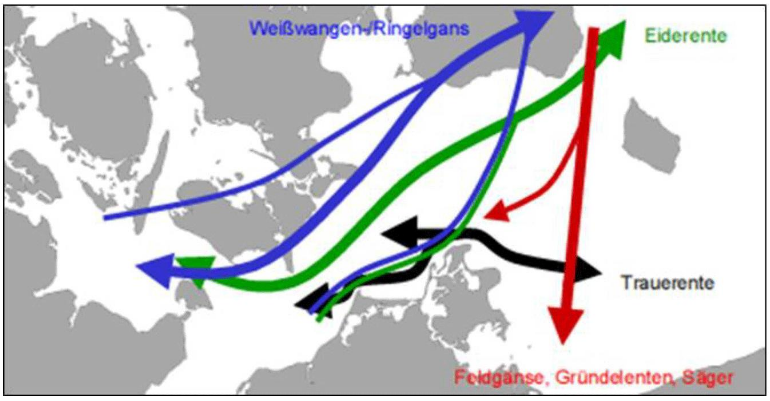
The "Horns Rev" OWF was largely overflown by diurnal migrating land birds (wood pigeons, thrushes in part), although some diurnal migrators are certainly to be found in OWFs (Blew et al. 2008). In the "alpha ventus" OWF, only 1.4–2.6 collisions per year were recorded at an OWEC during the bright hours of the day, which corresponds to 17–31 collisions per year in the entire OWF (Schulz et al. 2014). The small risk of collision assumed for land birds that migrate during the daytime is confirmed by analyses of lighthouse collisions (Hansen 1954).

Due to the high number of songbirds migrating at night over the southern Baltic Sea and the proven lure effects of illuminated structures, including offshore wind turbines, the risk of collision for this bird group is estimated to be higher than for day migrating bird groups. For the planned "Baltic Eagle" OWF an individual collision risk of nocturnally migrating birds was therefore calculated. This is significantly less than 0.1 % (IfAÖ 2020).

In principle, the "Baltic Eagle" OWF poses a low risk of collision for both diurnal and nocturnal migrators. Cross-border effects on the stocks of other countries/regions due to an increased collision rate with OWECs are therefore excluded.

Waterbirds

The southern and western Baltic Sea is an intersection of important migratory routes for waterbirds, whereby the project area lies outside the most important migratory corridors (Fig. 4).



Weißwangen-/Ringelgans	Barnacle/brent goose
Eiderente	Eider duck
Trauerente	Black Scooter
Feldganse, Gründelenten, Säger	Greylag goose, dabbling duck, merganser

Fig. 4: Schematic diagram of selected migratory routes of waterfowl in the western Baltic Sea

The black scooters thus prefer to migrate some distance from the coast (within visibility), rather than over the open sea. Eider ducks also migrate in a very concentrated manner along the coastline in a north-easterly direction (during the migration home). For red-throated divers, a coastal parallel migration corridor was observed off the north coast of Rügen (IfAÖ 2020).

Waterfowl such as sea ducks and loons also show a pronounced avoidance behaviour towards OWFs during migration. In view of the high natural variations of migration paths (e.g. the eider duck, DESHOLM et al. 2002) and in the context of the total migration distance to be covered, the additional burden caused by the avoidance is rather insignificant; also not by cumulative effects when passing several wind farms located on the migration route. In contrast, other species of seabirds such as cormorants or gulls and terns are regularly observed in wind farms (IfAÖ 2020). Due to the high variation in migratory routes of waterbirds, there are no significant barrier effects even in combination with cross-border OWF projects (see cranes).

The construction and operational collision risk for waterfowl is estimated to be low. In particular, sea ducks and loons show a pronounced avoidance behaviour towards OWFs. For the brent goose, an average flight altitude of 341 m (spring) and 215 m (autumn) was observed during the migration (IfAÖ 2020). Other species of geese probably migrate across the Baltic Sea at higher altitudes or preferably follow the coast (BSH 2019). Cross-border effects on the stocks of other countries/regions due to an increased collision rate with OWECs belonging to "Baltic Eagle" are therefore excluded.

3.2 Resting Birds

The "Baltic Eagle" OWF is located in the "O-2" area. According to the environmental report of the FEP (BSH 2019), this is of little importance for seabirds. The area has a low population of endangered species and species requiring special protection. It does not belong to the main resting, feeding and wintering habitats for species in Appendix I of the Bird Conservation Directive or species requiring protection in the "Bay of Pomerania – Rönnebank" nature conservation area (BSH 2019). The investigations of the cluster monitoring confirm this (IfAÖ 2020).

During the resting period, sea ducks, loons and guillemots, in particular, show avoidance of OWFs. For the sea ducks, the project area of "Baltic Eagle" lies outside the important winter and moulting resting areas due to the prevailing water depths of 21–40 m. The shortest distance from the Danish EEZ is approximately 11.4 km and from the Swedish EEZ 12.9 km. Assuming a disturbance radius of 5.5 km for loons (Garthe et al. 2018), the disturbance effects do not extend into the EEZs of Denmark and Sweden. The protected areas "Bay of Pomerania" (DE 1552-401) and "Adlergrund" (DE 1251-301) have an important function for resting bird populations, also of other countries/regions. These are located 14.2 km (Bay of Pomerania) and 15.2 km (Adlergrund) away from the planned "Baltic Eagle" OWF and are thus far outside the estimated reporting radius of 2 km (or 5.5 km). Any impairment of the resting bird populations there by the "Baltic Eagle" OWF is therefore ruled out. No cross-border effects on resting populations or reproductive communities in other countries are therefore to be expected. The risk of collision for resting birds has already been discussed in the section on waterfowl. There is a low risk of collision, so cross-border effects on resting populations or reproductive communities in other countries are not expected.

3.3 Bats

Up to now, bat migration in the area of the Baltic Sea has not been sufficiently investigated. It is assumed that a broad-frontal migration takes place along prominent landscape elements such as coastlines. Probably, there is increased migration where the distances between coasts are shortest. This would certainly apply to the maritime sector of project planning (IFAÖ 2020).

Bats are basically affected by the same factors (barrier effect, risk of collision) as migratory birds. According to Ahlen et al. (2007), the majority of bats fly over the sea mainly in mild wind conditions. The most intensive hunting flights took place at 0 m/s and smooth sea. However, at these low wind speeds, the OWEC's rotors are stationary, so there is less risk of collision on the nights most suitable for the migration. For this reason, and due to the fact that the migrations are scattered over the project area, the risk of collision with bats is assumed to be low. Cross-border impacts on bat populations of other regions/countries are therefore not assumed.

According to preliminary results of the BATMOVE research project, no increased contact rates of migrating bats were found at measurement sites north-east of Rügen, the lowest rates were measured at the Arkona Basin platform (A. Seebens-Hoyer, lecture 26/1/2019). Based on the current state of knowledge, it cannot be assumed that the "Baltic Eagle" OWF will cut important migration routes for bats. A barrier effect, which has an impact on the population of migrating bats from other regions/countries, is therefore not assumed.

3.4 Marine Mammals

In the context of various studies since 2002 to the present, almost no harbour porpoise calves were found in the area of the planned “Baltic Eagle” OWF. Harbour porpoise calves have been detected. Calf sightings were mainly concentrated around Fehmarn(GILLES & SIEBERT 2009, GILLES et al. 2006, 2007, 2011, 2014, Scheidat et al. 2008, Fais et al. 2016, ICES 2018, 2019). Therefore, the area does not appear to have any special relevance for breeding. However, it can be assumed that the area around the planned "Baltic Eagle" OWF will be used as a feeding and transit area. The project area also does not play a major role for seals (grey seals and harbour seals) (IfAÖ 2020).

The most far-reaching impacts on marine mammals are expected to occur during pile driving. The shortest distance of the "Baltic Eagle" OWF from the border of the EEZ is approximately 11.4 km (Denmark) and 12.4 km (Sweden). If the limit values are complied with (single event level of 160 dB re 1 pPa or peak sound pressure level of 190 dB re 1 $\mu Pa^2 s$ at 750 m), the interference radius for harbour porpoises is 8 km (BMU 2013). Provided that the limit values are complied with, in addition to significant impacts (750 m), disturbances (8 km) in total can be excluded for harbour porpoises in Danish and Swedish waters.

Effects of continuous noise (noise input from construction ships and OWECs) also do not extend beyond the border of the German EEZ. It is assumed for the harbour porpoise that already at a distance of approx. 125 m almost the entire spectrum of operating noises is below the hearing threshold and the sounds are therefore not audible. Operating noises from OWECs are audible to seals up to a range of about 2 km. Noise from ships can lead to avoidance effects for harbour porpoises at distances of up to 1 km and more.

Considerable impairments due to the interaction of several OWF projects in the German EEZ could already be excluded in IfAÖ (2020). This presupposes that in the unlikely event of parallel pile driving by different OWFs, a higher-level pile driving time control system can be ordered. Significant impairments in the interaction of "Baltic Eagle" with cross-border OWF projects (pile driving with the most far-reaching effects) can be excluded due to the long distance (at least 11.4 km, see Chapter 2), provided that the limits (see above) are observed. In contrast, the range of operation-related effects of OWFs must be rated much lower.

Due to the non-overriding importance of the area and the maximum distances covered by construction and operation-related impairments, no significant cross-border effects are assumed to result from the "Baltic Eagle" project. In principle, however, it is advisable to have an overriding construction period regulation to avoid the effects of the simultaneous construction of several wind farms in the German EEZ and beyond.

3.5 Fish

During the surveys in the project area "Baltic Eagle", a demersal fish community for sandy seabeds typical for the southern Baltic Sea was found (IfAÖ 2020). The “Baltic Eagle” project area is located at the southern edge of a main spawning ground for cod in the south-west Baltic Sea (BLEIL et al. 2009). Spawning grounds for flounder and plaice are also known in the vicinity of the project area (ICES 2011). The regional or supra-regional importance was therefore assessed as medium in IfAÖ (2020).

As more far-reaching effects on fish, turbidity plumes (worst-case assumptions here are a range of 1,000 m for silty sediments and approx. 500 m for fine sandy sediments) and corresponding sedimentation, as well as construction-related noise emissions, are to be mentioned.

Due to the assumed range, turbidity plumes reaching into Scandinavian waters (11.4 km and 12.9 km distance) can be excluded. Neither is it to be assumed that this will result in sedimentation, which may lead to the covering of spawning or food resources outside German territorial waters. If the limit values are complied with at a distance of 750 m during pile driving (see marine mammals), no cross-border impacts on fish are expected.

There is a possibility that fish (e.g. salmon or eel) may experience disorientation due to changes in the natural magnetic field, for example, as a result of wind farm operation (MEIßNER ET AL. 2006; SHIELDS & PAYNE 2014). However, this has not yet been scientifically proven (see IfAÖ 2020). Cross-border effects for migratory fish species are therefore not assumed.

The construction of OWFs in the Baltic Sea results in a land use that is low for the respective OWF ("Baltic Eagle": 0.18%). However, the simultaneous closure of the wind farm area (including the safety zones) to fishing may reduce fishing mortality of both commercially exploited target species and unused fish species (unrecovered by-catches). In addition, the reef effect (see IfAÖ 2020) can have a positive impact on the fish community, so that there may also be positive effects in the cross-border interaction of OWFs.

The interaction of the Baltic Eagle with cross-border OWF projects is not expected to have a significant impact. Due to the long distance (at least 11.4 km, see Chapter 2) to cross-border OWF projects, no cumulative effects (e.g. if OWFs are constructed simultaneously) are assumed. Overlapping of construction-related turbidity effects (max. range 1,000 m range) is excluded. If the limit values for pile driving (see marine mammals) are not exceeded, there will be no cumulative, significant impacts. In contrast, the range of operation-related effects of OWFs must be rated much lower.

Overall, the Baltic Eagle project is not expected to have a significant cross-border impact on the fishing communities of other regions/countries.

In principle, however, it is advisable to have an overriding construction time regulation with regard to noise emissions in the event of the (unlikely) simultaneous construction of several OWFs.

4 Conclusion

In Chapter 3, possible cross-border impacts of the OWF project "Baltic Eagle" on the mobile protected natural resources of migratory birds, resting birds, bats, marine mammals and fish were examined. As a result of the study, it can be stated that significant disturbance to mobile protected natural resources in other countries or regions can be ruled out. In general, it is advisable to prevent the simultaneous (cross-border) construction of several wind farms by means of a superordinate construction time regulation in order to keep possible impacts on the mobile protected natural resources as low as possible.

5 Bibliography

AHLEN, I.; BACH, L.; BAAGOE, H.J. & J. PETTERSSON (2007):
Bats and offshore wind turbines studied in southern Scandinavia. Swedish Environmental Protection Agency Report 5571. July 2007.

ALERSTAM, T. (1990):
Bird migration. Cambridge University Press. 420 pp.

**BELLEBAUM, J., GRIEGER, C., KLEIN, R., KÖPPEN, U., KUBE, J., NEUMANN, R., SCHULZ, A., SORDYL, H. &
H. WENDELN (2010):**
Ermittlung artbezogener Erheblichkeitsschwellen von Zugvögeln für das Seegebiet der südwestlichen Ostsee bezüglich der Gefährdung des Vogelzuges im Zusammenhang mit dem Kollisionsrisiko an Windenergieanlagen. Final Report. Forschungsvorhaben des Bundesministeriums für Umwelt, Naturschutz und Reaktorsicherheit (FKZ 0329948). Neu Broderstorf.

BERTHOLD, P. (2000):
Vogelzug. Eine aktuelle Gesamtübersicht. Wissenschaftliche Buchhandlung, Darmstadt, 280 pages.

FEDERAL OFFICE FOR NATURE CONSERVATION (BFN) (2006):
Naturschutzfachlicher Planungsbeitrag des Bundesamtes für Naturschutz zur Aufstellung von Zielen und Grundsätzen der Raumordnung für die Ausschließliche Wirtschaftszone der Nord- und Ostsee. German Federal Agency for Nature Conservation.

BLEIL, M.; OEBERST, R. & P. URRUTIA (2009):
Seasonal maturity development of Baltic cod in different spawning areas: importance of the Arkona Sea for the summer spawning stock. Journal of Applied Ichthyology, 25: 10–17.

BLEW, J., HOFFMANN, M., NEHLS, G. & V. HENNIG (2008):
Investigations of the bird collision risk and the responses of harbour porpoises in the offshore wind farms Horns Rev, North Sea, and Nysted, Baltic Sea, in Denmark. Part I: Birds. – Final Report 2008. Funded by the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (FKZ 0329963 + FKZ 0329963A): 133 pp.

FEDERAL MINISTRY FOR THE ENVIRONMENT, NATURE CONSERVATION AND NUCLEAR SAFETY (BMU) (2013):
Konzept für den Schutz der Schweinswale vor Schallbelastungen bei der Errichtung von Offshore- Windparks in der deutschen Nordsee (Schallschutzkonzept), Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit, Final version 1 December 2013: 33 pp.

FEDERAL MARITIME AND HYDROGRAPHIC AGENCY (BSH) (2019):
Umweltbericht zum Flächenentwicklungsplan 2019 für die deutsche ausschließliche Wirtschaftszone der Ostsee. Federal Maritime and Hydrographic Agency Hamburg, 28 June 2019.

DESHOLM, M., T. K. CHRISTENSEN, G. SCHEIFFARTH, M. HARIO, A. ANDERSSON, B. ENS, C. J. CAMPHUYSEN, L. NILSSON, C. M. WALTHO, S.-H. LORENTSEN, A. KURESOO, R. K. H. KATS, D. M. FLEET & A. D. FOX (2002):
Status of the Baltic/Wadden Sea population of the Common Eider Somateria m. mollissima. Wildfowl 53:167–203.

FAIS, A., S. VIQUERAT, B. UNGER, H. HERR & U. SIEBERT (2016):
Monitoring von marinen Säugetieren 2015 in der deutschen Nord - und Ostsee. P. 18. Unpublished monitoring data, Stiftung Tierärztliche Hochschule Hannover Institute for

Terrestrial and Aquatic Wildlife Research (ITAW), client: German Federal Agency for Nature Conservation.

GARTHE, S., SCHWEMMER, H., MÜLLER, S., PESCHKO, V., MARKONES, N., MERCKER, M. (2018):
Seetaucher in der Deutschen Bucht: Verbreitung, Bestände und Effekte von Windparks. Report for the Federal Maritime and Hydrographic Agency and the Federal Agency for Nature Conservation.

GILLES, A., SCHEIDAT, M. & SIEBERT, U. (2009):
Seasonal distribution of harbour porpoises and possible interference of offshore wind farms in the German North Sea. Marine Ecology Progress Series: 383: 295–307.

GILLES, A., H. HERR, D. RISCH, M. SCHEIDAT & U. SIEBERT (2006):
Erfassung von Meeressäugetieren und Seevögeln in der deutschen AWZ von Nord-und Ostsee (EMSON). Subprojects: Collection of data on marine mammals. Final report for the R+D project FKZ 802 85 260. Federal Office for Nature Conservation (BfN), Bonn, Germany

GILLES, A.; HERR, H.; LEHNERT, K.; SCHEIDAT, M.; KASCHNER, K.; SUNDERMEYER, J.; WESTERBERG, U. & U. SIEBERT (2007):
Forschungsverbund MINOS Plus - Weiterführende Arbeiten an Seevögeln und Meeressäugern zur Bewertung von Offshore - Windkraftanlagen. Subproject 2 – 'Erfassung der Dichte und Verteilungsmuster von Schweinswalen (Phocoena phocoena) in der deutschen Nord- und Ostsee'. Final Report, Research and Technology Centre West Coast, Büsum (DEU): 94–160.

GILLES, A., V. PESCHKO & U. SIEBERT (2011):
Monitoring report 2010–2011. Marine Säugetiere und Seevögel in der deutschen AWZ von Nord- und Ostsee. Teilbericht marine Säugetiere - Visuelle Erfassung von Schweinswalen. Federal Office for Nature Conservation, Bonn, Germany.

GILLES, A.; VIQUERAT, S. & U. SIEBERT (2014):
Monitoring von marinen Säugetieren 2013 in der deutschen Nord- und Ostsee. A. Visuelle Erfassung von Schweinswalen, As at: 17. January 2014, on behalf of the Federal Office for Nature Conservation.

ICES OCEANOGRAPHY COMMITTEE (2011):
Report of the Advisory Committee, 2011, Book 8. Baltic Sea. http://www.ices.dk/products/icesadvice/2011/ICES%20AD-VICE%202011%20BOOK%208.pdf.

ICES (2018):
Report of the Working Group on Marine Mammal Ecology (WGMME), 19–22 February 2018. ICES CM 2018/ACOM 28:120.

ICES (2019):
Working Group on Marine Mammals Ecology (WGMME). ICES Scientific Reports 1:131.

INSTITUTE FOR APPLIED ECOSYSTEM RESEARCH GMBH (IFAÖ) (2020):
UVP-Bericht für den Offshore-Windpark „Baltic Eagle“. IfAÖ [Institute for Applied Ecosystem Research] GmbH, Rostock

MASDEN, E.A.; HAYDON, D.T.; FOX, A.D.; FURNESS, R.W.; BULLMAN, R. & M. DESHOLM (2009):
Barriers to movement: impacts of wind farms on migrating birds. ICES Journal of marine Science; 66, 746–753.

MASDEN, E.A.; HAYDON, D.T.; FOX, A.D. & R.W. FURNESS (2010):
Barriers to movement: Modelling energetic costs of avoiding marine wind farms amongst

breeding seabirds. Marine Pollution Bulletin; 60: 1085–1091.

MEIßNER, K. & SORDYL, H. (2006):
Literature review of offshore wind farms with regard to benthic communities and habitats. Ecological Research on Offshore Wind Farms: International Exchange of Experiences: 1

SCHEIDAT, M., A. GILLES, K.H. KOCK & U. SIEBERT (2008):
Harbour porpoise (Phocoena phocoena) abundance in the southwestern Baltic Sea. Endangered species research 5: 215–223.

SCHULZ, A.; DITTMANN, T. & T. COPPACK (2014):
Erfassung von Ausweichbewegungen von Zugvögeln mittels Pencil Beam Radar und Erfassung von Vogelkollisionen mit Hilfe des Systems VARS. Final report of the project "Ökologische Begleitforschung am Offshore-Testfeldvorhaben alpha ventus zur Evaluierung des Standarduntersuchungskonzeptes des BSH (StUKplus)" (BMU; FKZ 0327689A). Neu Broderstorf, 2014.

SKOV, H., K. D. CHRISTENSEN, E. M. JACOBSEN, J. MEISSNER & J. DURINCK (1998):
Fehmarn Belt Fehmarn Belt Feasibility Study, Investigation of Environmental Impact. Birds and Marine Mammals, Baseline Investigation. COWI-Lahmeyer.

SKOV, H.; HEINÄNEN, S.; JENSEN, N.; DURINCK, J. & T. JOHANSEN (2012):
Rodsand 2 Offshore Wind Farm post construction. Post construction studies on migrating red kite/landbirds. DHI. Report commissioned by E.ON Sweden.

SKOV, H., DESHOLM, M., HEINÄNEN, S., JOHANSEN, T.W. & O.R. THERKILDSEN (2015):
Kriegers Flak Offshore Wind Farm Environmental Impact Assessment. Technical background report Birds and bats. Danish Centre for Environment and Energy (DCE) and DHI, https://ens.dk/sites/ens.dk/files/Vindenergi/kriegers_flak_offshore_wind_farm_eia_birds_and_bats_technical_report.pdf.