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Report to Inform an Appropriate Assessment: Natura 2000 sites designated for migratory Common Crane in the west-central Baltic

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Dansk resumé

Denne rapport indeholder en vurdering af potentielle påvirkninger af trækkende traner (*Grus grus*) som følge af risikoen for kollision mellem traner og Kriegers Flak Havmøllepark. Trækkende traner er på udpegningsgrundlaget for en række EU-fuglebeskyttelsesområder, og vurderingen af den potentielle påvirkning er foretaget for Kriegers Flak Havmøllepark alene og i kombination med andre relevante havmølleprojekter.

I VVM-baggrundsrapporten om fugle og flagermus (DHI & Aarhus University, 2015) er der foretaget en væsentlighedsvurdering i forhold til potentielle påvirkninger af udpegningsgrundlaget for relevante Natura 2000-områder. Væsentlighedsvurderingen DHI & Aarhus Universitykunne ikke afvise, at Kriegers Flak Havmøllepark i kumulation med andre projekter potentielt kan medføre en væsentlig påvirkning af trækkende traner på udpegningsgrundlaget for relevante Natura 2000-områder. Derfor er der udarbejdet nærværende konsekvensvurdering af påvirkningen af trækkende traner.

Konsekvensvurderingen omhandler trækkende traner på udpegningsgrundlaget for relevante Natura 2000-områder langs tranernes migrationsrute. Analysen medtager ikke Natura 2000-områder, der er udpeget alene for ynglende traner. Konsekvensvurderingen fokuserer alene på den potentielle kollisionsrisiko med havmøllerne. Vurderingerne foretages i henhold til habitatbekendtgørelsen (BEK nr. 408 af 01/05/2007) og bekendtgørelse om konsekvensvurdering vedrørende internationale naturbeskyttelsesområder samt beskyttelse af visse arter ved projekter om etablering m.v. af elproduktionsanlæg og elforsyningsnet på havet (BEK nr. 1476 af 13/12/2010).

For at identificere trækkende traner på udpegningsgrundlaget for Natura 2000-områder er der foretaget en analyse af data fra 833 Natura 2000-områder. Analysen resulterede i en liste på 26 relevante Natura 2000-områder.

Tranerne i Nord- og Vesteuropa er en del af en samlet population, der overvintrer på den iberiske halvø og den nordlige del af Marokko. Tranerne yngler i Sverige, Norge eller Finland, og en del af bestanden trækker over Arkona Basinnet, som er vandområdet vest for Bornholm, hvor projektområdet for Kriegers Flak Havmøllepark ligger placeret. Det er estimeret, at ca. 84.000 traner trækker over Arkona Basinnet (DHI & Aarhus University, 2015). I VVM-baggrundsrapporten om fugle og flagermus (DHI & Aarhus University, 2015) er det forudsat, at traner flyver i hele korridoren mellem Bornholm og Sjælland, og således forventes kun 13 % af fuglene at krydse Kriegers Flak Havmøllepark, hvilket svarer til ca. 10.920 traner. Dette skyldes, at længdetværsnittet af havmølleparken vil spænde over omkring 13 % af bredden af Arkona Bassinet.

Den eneste relevante påvirkning af trækkende traner er risikoen for kollision med havmøllerne. Kollisionsrisikoen for den andel af tranepopulationen, der forventes at trække over havmølleparken, er fortrinsvis bestemt af flyvehøjden og tranernes undvigeadfærd. Havmøllernes højde, men også antal, har derfor betydning for kollisionsrisikoen. Undvigelsesraten for traner er i VVM-baggrundsrapporten om fugle og flagermus (DHI & Aarhus University, 2015) estimeret til at være 0,69. Estimatet er baseret på data indsamlet under en undersøgelse ved Baltic II på den tyske del af Kriegers Flak i foråret 2015. For traneflokke antages der at være en dødelighed på 50 % af individerne, der kolliderer med havmøllerne. Antagelsen er foretaget i mangel på empiriske data for hvor mange traner i en flok, der dør ved kollision med havmøller (DHI & Aarhus University, 2015).

På baggrund af de udførte analyser er det i denne konsekvensvurdering vurderet, hvorvidt Kriegers Flak Havmøllepark vil skade trækkende traner på udpegningsgrundlaget for relevante fuglebeskyttelsesområder.

Vurderingen er som udgangspunkt foretaget for de 26 relevante fuglebeskyttelsesområder. Analysen er foretaget ved en trinvis model, hvor dødeligheden som følge af kollision i første omgang sammenholdes med populationsstørrelsen inden for hvert enkelt fuglebeskyttelsesområde. Hvor dødeligheden overstiger 1 % af populationen inden for det pågældende fuglebeskyttelsesområde foretages yderligere vurdering i trin 2. I konsekvensvurderingen er 25 af de undersøgte fuglebeskyttelsesområder analyseret nærmere under trin 2, som indeholder en forholdsmæssig fordeling af traner inden for hvert fuglebeskyttelsesområde i forhold til den samlede bestand, som trækker over Arkona Bassinnet.

Det er på baggrund af ovenstående vurderet, at Kriegers Flak Havmøllepark i sig selv ikke vil skade eller påvirke bevaringsmålsætningerne for trækkende traner på udpegningsgrundlaget for de relevante fuglebeskyttelsesområder.

Der er planlagt en række havmølleprojekter i området omkring Kriegers Flak Havmøllepark. Projekterne er ikke lige langt i planlægningen, hvilket der er taget højde for i forbindelse med vurderingen af påvirkninger fra Kriegers Flak Havmøllepark i kombination med andre havmølleparker. De planlagte havmølleprojekter er både danske, tyske og svenske. Af de kendte projekter har fire opnået tilladelse. Der hersker dog meget stor usikkerhed om, hvorvidt Arcadis Ost 1 og Kriegers Flak II kan realiseres, og disse er derfor kategoriseret sammen med syv øvrige havmølleprojekter, hvor der er indsendt ansøgning om tilladelse til etablering, eller ansøgningsmaterialet er under udarbejdelse. En tysk havmøllepark, Baltic I, er allerede opført, og den tyske havmøllepark Baltic II er under opførelse.

Med baggrund i viden om disse etablerede og planlagte havmølleprojekter i området omkring Kriegers Flak Havmøllepark er der foretaget en vurdering af kumulative effekter, hvor påvirkningen fra Kriegers Flak Havmøllepark er vurderet i kombination med andre relevante eksisterende og planlagte havmølleprojekter. Vurderingen af kumulative effekter er ligeledes foretaget for alle relevante fuglebeskyttelsesområder langs tranernes trækrute. Vurderingen er foretaget for 26 relevante fuglebeskyttelsesområder. I analysen er der taget højde for, at den Nord- og Vesteuropæiske tranepopulation udviser en stigende tendens.

På baggrund af de udførte analyser er det samlet vurderet, at Kriegers Flak Havmøllepark, hverken i sig selv eller i kombination med andre havmølleprojekter vil skade eller påvirke bevaringsmålsætningerne for trækkende traner på udpegningsgrundlaget for de relevante fuglebeskyttelsesområder.

Executive Summary

1.1. This report presents the details of the assessment of the potential impacts on Natura 2000 sites designated for migratory Common Crane (*Grus grus*) due to the risk of collision with Kriegers Flak Offshore Wind Farm (OWF) alone or in-combination with other plans or projects.

1.2. An EIA Technical Background Report for Kriegers Flak OWF (DHI & Aarhus UniversityDHI & Aarhus University, 2015) focused on the assessment of potential impacts on migratory species and also undertook an initial screening exercise for Habitat Regulations Assessment (HRA). The EIA Technical Report included a literature review investigating records and data of migratory species using potential Baltic flyways over the Arkona Basin and Bornholm, Denmark and also utilised radar tracking and GPS telemetry of Common Cranes in order to inform Collision risk Modelling (CRM). The Technical Report further considers a preliminary cumulative impacts assessment on Common Crane and calculates collision rates for a select number of other projects.

1.3. It is evident that therefore, further investigation is warranted to provide the Danish Energy and Nature Protection Agencies respectively, with an investigation in the form of a Report to Inform an Appropriate Assessment (RIAA) with respect to Natura 2000 sites designated for migratory Common Crane in the Baltic region.

1.4. Whenever there is a risk of a project significantly affecting an International Nature Conservation designation, an Appropriate Assessment must be carried out according to executive order no. 1476 13/12/2010 (Bekendtgørelse om konsekvensvurdering vedrørende internationale naturbeskyttelsesområder samt beskyttelse af visse arter ved projekter om etablering m.v. af elproduktionsanlæg og elforsyningsnet). The EU Habitats Directive is implemented into Danish law by the Habitat Regulation (BEK nr. 408 af 01/05/2007), with an associated guidance document (Naturstyrelsen, 2011). The conclusions made within this report are designed to enable the Danish Nature Agency to ascertain whether or not a project would adversely affect the integrity of the Natura 2000 site or the species concerned (Naturstyrelsen, 2011).

1.5. This RIAA focuses specifically on Common Crane and Natura 2000 sites that are designated for this species on their migratory flyway and does not consider SPAs designated for breeding cranes. The report is also restricted to the potential impact mechanism of collision with rotor blades.

1.6. The Natura 2000 data forms for 833 SPAs within the Baltic search area were analysed to establish which SPAs contained designated features for migratory Common Crane on passage (i.e. 'concentration' features). The results of this analysis returned a final list of 26 SPAs where such features are designated.

1.7. One of two migration routes are used by the Scandinavian population when passing the Baltic Sea, with most of the Finnish component (that forms part of the eastern population with the Baltic States) migrating along the southern Baltic coast (BSH 2009, IfAÖ 2012), and the Swedish and Norwegian birds crossing the Arkona Basin over a broad front (BSH 2009, DHI & Aarhus University, 2015). It is estimated that around 84,000 Common Cranes in autumn cross the western Baltic on a broad-front migration (DHI & Aarhus University, 2015).

1.8. DHI & Aarhus University (2015) assumed that the Common Crane during both spring and autumn migration would disperse throughout the Arkona Basin. In doing so, it was assumed Common Crane are using all parts of the corridor west of Bornholm equally and therefore only 13% are expected to cross Kriegers Flak OWF on average during autumn, which is equal to 10,920 Common Crane. The 13% corresponds to the proportional area occupied by the two wind farm lay-out areas of the Kriegers Flak

OWF. Though not explicitly stated DHI & Aarhus University. (2015), the assumption is that 10,920 Common Cranes was also used as the number for cranes passing the Kriegers Flak OWF during spring migration.

1.9. In order to estimate collision mortality using the Band Collision Risk Model (CRM) as used by DHI & Aarhus University (2015) for Kriegers Flak, a correction factor, termed an avoidance rate, has to be applied to overall collision risk values to account for the extent to which birds avoid turbines. The avoidance rate of 0.69 was used by DHI & Aarhus University (2015) for Common Crane based on the results of the dedicated behavioural study at the Baltic 2 offshore wind farm in spring 2015 where a macro avoidance rate of 0.07 and a meso avoidance rate of 0.64 were recorded. A micro avoidance rate of 0.08 was assumed. The Band CRM has been developed to estimate collisions of single flying birds, and does not take into account that for species which migrate in flocks, like Common Crane, it is unlikely that all individuals in the flock will die following collision with a rotor. In the absence of empirical data regarding the proportion of individuals likely to die in a collision event, DHI & Aarhus University (2015) applied a factor of 50 % to the collision estimates for Common Crane.

1.10. The potential collision effects of Kriegers Flak OWF have been assessed alone. Apportioning of predicted total mortality to each SPA in turn, highlighted 25 of the 26 SPAs that surpass a coarse but precautionary 1% threshold. Stage 2 of the assessment has highlighted that there is a negligible likelihood of an adverse effect on the Common Crane feature of the 25 SPA carried forward from stage 1 and are therefore screened out of the assessment. It is therefore concluded that there are no expected adverse effects on Natura 2000 sites integrity as a result of collision impacts on migratory Common Crane from Kriegers Flak OWF alone.

1.11. A tiered approach to the consideration of plans and projects within a in combination assessment has been adopted, based upon the consenting stage at which each wind farm currently sits within the planning and consenting process. For the purposes of this assessment, collision estimates for Common Crane for projects included in Tiers 1 and 2 in-combination with Kriegers Flak OWF form the basis of the analysis. This effectively encompasses a 'building block' approach where Kriegers Flak OWF contributes to mortality estimated for projects lying ahead in the consenting process. Reference however, is also made to the implications of mortality predicted for projects in Tiers 1-3 in-combination with Kriegers Flak OWF.

1.12. Kriegers Flak OWF contributes a proportion of estimated in combination estimated Common Crane mortality (64.5% of Scenario 1 or 18.1% of Scenario 2 totals). All 26 SPAs considered were carried forward to Stage 3 of the assessment with respect to Scenario 2 only (i.e. considering projects in all tiers). When considering Scenario 1 (tiers 1-2) 1% thresholds are not surpassed for any given SPA in Stage 2. Stage 3 applies an apportioning approach based on the total migratory Common Crane flyway and concludes that PBR thresholds (at a recovery factor of 0.5 deemed appropriate for the population) are not surpassed for any SPA under scenario 2.

1.13. It is concluded that no adverse effects on any Natura 2000 site integrity as a result of collision impacts on migratory Common Crane from Kriegers Flak OWF either alone or in-combination with other projects are expected.

1.14. Considering these conclusions with respect to Kriegers Flak OWF, no consideration of alternative options for the Project or application of mitigation are deemed to be necessary.

2. Introduction

Background

2.1. Like many other countries, Denmark has a significant energy policy challenge in terms of securing energy supply, while helping to reduce global warming by reducing emissions of greenhouse gasses. To meet the challenge, on March 22, 2012, a broad political majority in the Danish parliament, Folketinget, passed an Energy Policy Agreement for the period 2012-2020. The goal is that Denmark's entire energy supply (power, gas, heating) and transportation will be based on sustainable energy in 2050. The energy policy agreement will ensure that wind power will produce 50 percent of the total Danish power usage by 2020. The planned Kriegers Flak Offshore Wind Farm (OWF) is part of the implementation of the energy policy agreement. Energinet.dk, on behalf of the Ministry of Climate and Energy, is responsible for the construction of the electrical connection to the shore and for development of the wind farm site at Kriegers Flak, including the production of the Environmental Impact Assessment (EIA) and the Report to Inform and Appropriate Assessment (RIAA).

2.2. This report presents information to inform the Appropriate Assessment (AA) in relation to migratory Common Crane (*Grus grus*) due to risk of collision with Kriegers Flak OWF alone and in-combination with other plans and projects, detailing the assessment of the potential impacts on Natura 2000 sites designated for this species on their seasonal migratory flyway.

The Project

2.3. The planned Kriegers Flak OWF (600 MW) is located approx. 15 km east of the Danish coast in the southern part of the Baltic Sea and in close proximity to the exclusive offshore economic zones (EEZ) of Sweden and Germany.

2.4. The Kriegers Flak OWF pre-investigation area covers an area of approx. 250 km^2, and contains the bathymetric high "Kriegers Flak", a shallow region of sea approximately 150 km^2. Central in the pre-investigation area there is an area of circa 28 km^2 reserved for sand extraction within which it is not permitted for technical OWF components to be installed. Hence, wind turbines in the Kriegers Flak OWF will be separated into an Eastern (110 km^2) and Western (69 km^2) wind farm, allowing for 200 MW on the western part, and 400 MW on the eastern part. According to the permission given by the Danish Energy Agency (DEA), a 200 MW wind farm must use up to 44 km^2.

2.5. In areas adjacent to the Swedish and German EEZ border, a safety zone of 500 m will be established between wind turbines at Kriegers Flak OWF and the EEZ border. Baltic II OWF is currently under construction in neighbouring German waters, while pre-investigations for an OWF have been carried out in Swedish territory, however construction is currently on standby.

2.6. The location of the planned Kriegers Flat OWF, including the boundary of the pre-investigation area and the sand extraction area is shown in Figure 2.1.

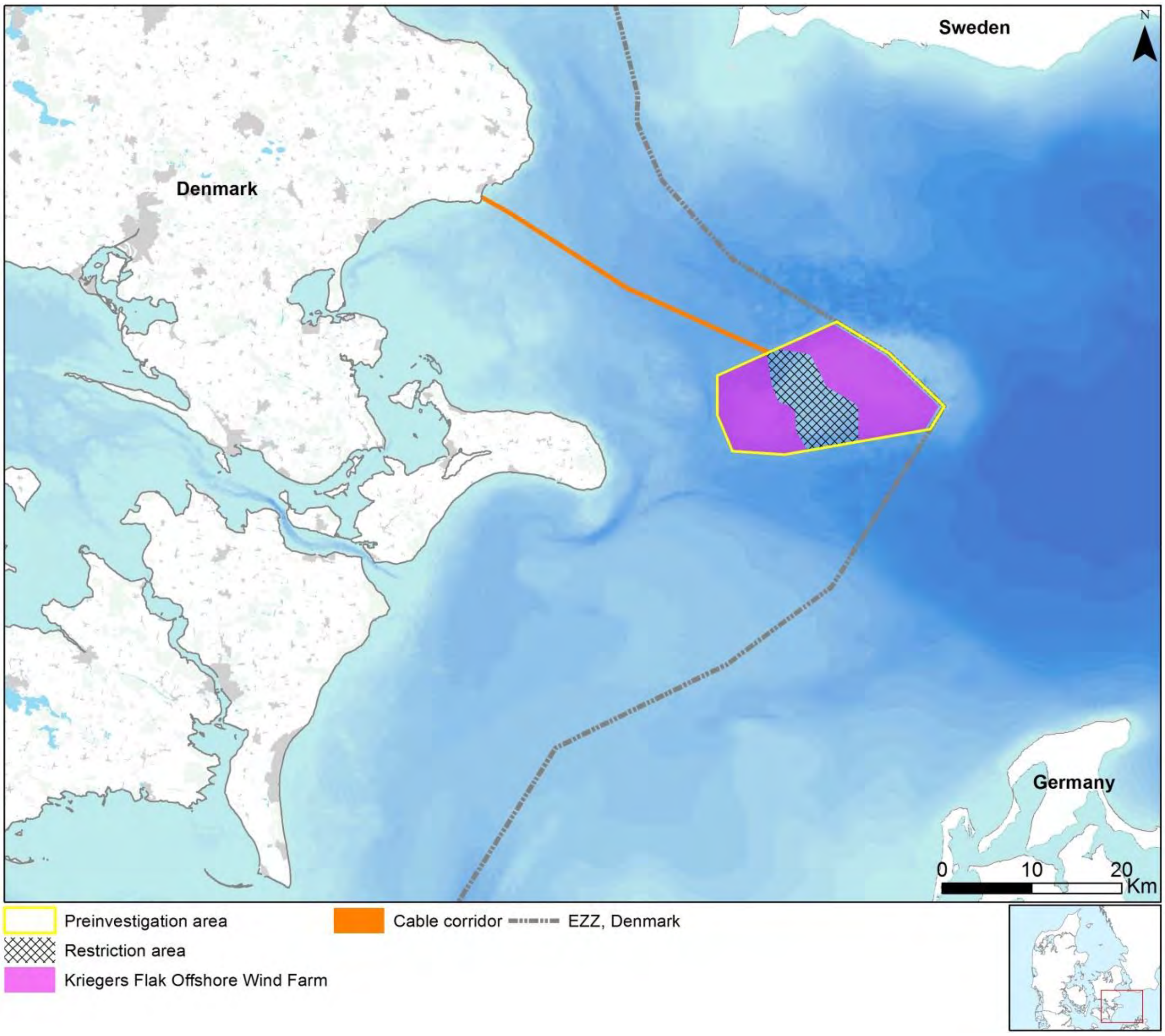

Figure 2.1 Location of the planned Kriegers Flak OWF.

2.7. Turbines under consideration for installation at Kriegers Flak OWF range from 3 MW to 10 MW. Given the maximum potential installed capacity (600 MW) the wind farm may include from 60 (+4 additional[1] turbines) to 200 (+ 3 additional turbines).

2.8. The distance between Mean Sea Level (MSL) and maximum turbine rotor tip height will require approval from the Danish Maritime Authority (Søfartsstyrelsen). However, in line with most Danish offshore wind farms, the distance is expected to be at least 20 m.

2.9. Potential layouts of the Kriegers Flak OWF considering installation of 3 MW and 10 MW turbines are shown in Figure 2.2 and Figure 2.3 respectively, including the location of turbines within the adjacent German Baltic 2 OWF, currently under construction.

[1] Extra turbines may be allowed (independent of the capacity of the turbine), in order to secure adequate production in periods when one or two turbines are out of service due to repair

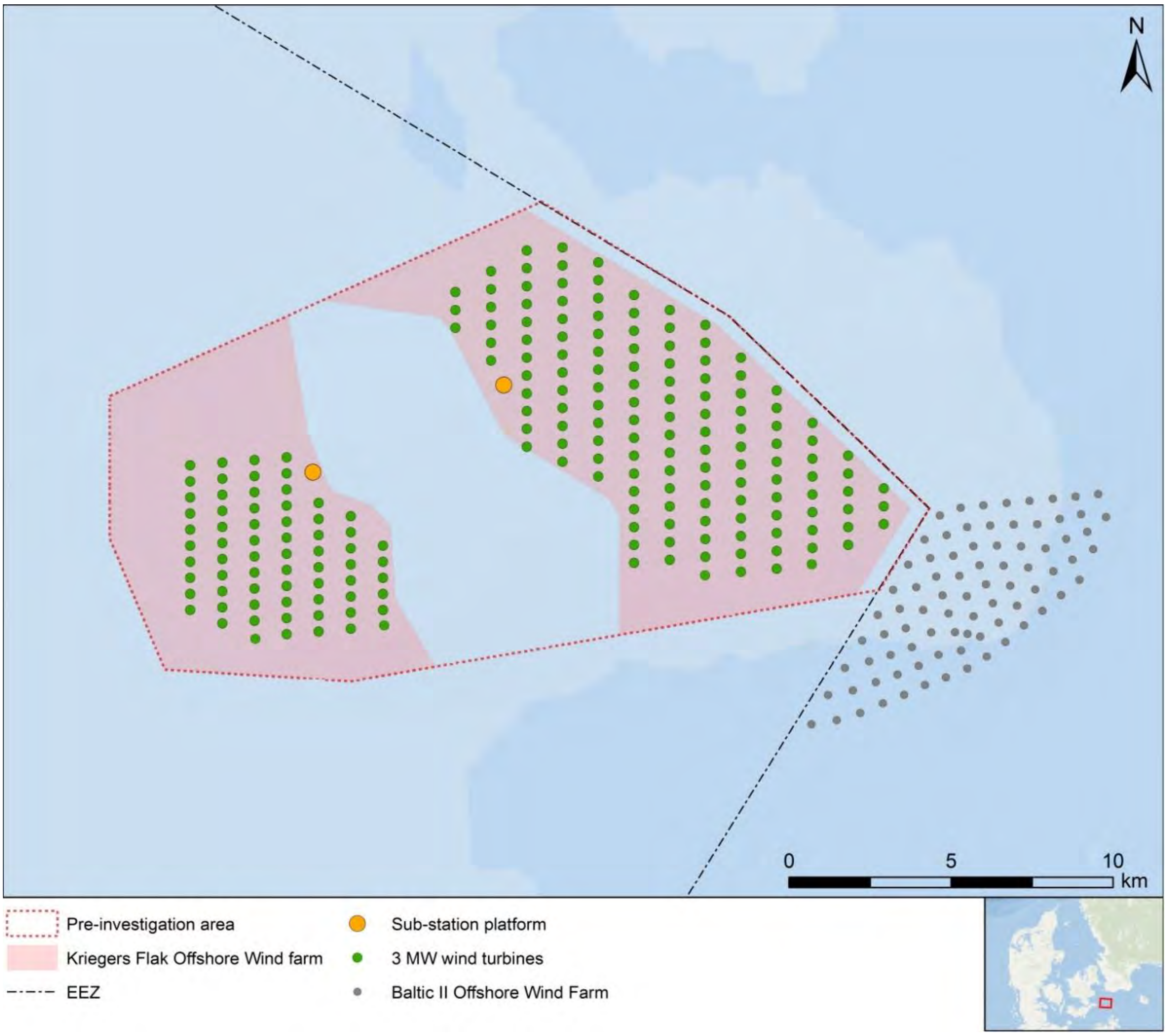

Figure 2.2Proposed layout for 3 MW turbines at the eastern and western part of the planned Kriegers Flak OWF.

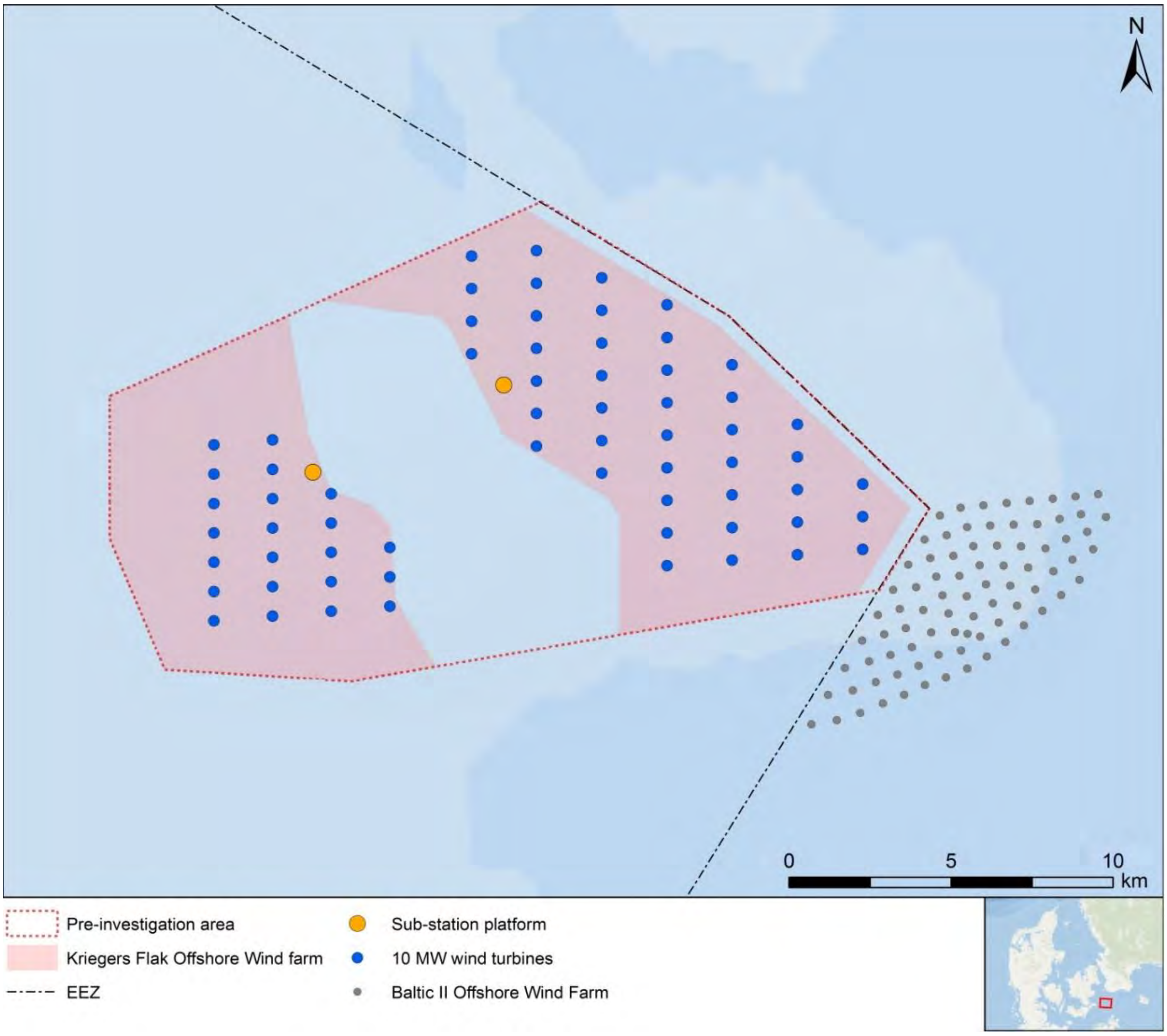

Figure 2.3 Proposed layout for 10 MW turbines at the eastern and western part of the planned Kriegers Flak OWF.

2.10. Two 220 kV export cables will be installed from the offshore transformer stations to the landfall at Rødvig (see Figure 2.1). In addition to the two export cables to shore, a 220 kV cable will be installed between the sub-station platforms. The total length of the export cables will be approx. 100 km.

2.11. The Kriegers Flak area where the cables are to be installed is partly consisting of soft (sand) and hard (clay and chalk) sediments. It is anticipated that export cables will be installed in one length on the seabed and, after trenching, protected to one meter depth.

2.12. The lifetime of the wind farm is expected to be up to 30 years. It is anticipated that two years in advance of the operational period expiration, the developer will submit a decommissioning plan. The method for decommissioning will follow best practice and the legislation at that time.

The Appropriate Assessment (AA) Process

2.13. Established under the 1992 Habitats Directive, the EU Nature 2000 network is comprised of a wide number of protected geographic areas and species. The aim of the network is to assure the long-term survival of Europe's most ecologically valuable and threatened species and habitats. It is comprised of Special Areas of Conservation (SACs) designated by Member States under the Habitats Directive, and also incorporates Special Protection Areas (SPAs), designated under the 1979 EC Birds Directive.

2.14. When a proposed project is located within or close to one or more Natura 2000 sites, or affecting Annex IV species (species which are strictly protected under Annex IV of the EU Habitats Directive), the overall process applied is called Habitat Regulation Assessment (HRA), with Appropriate Assessment (AA) being part of this process (Danish Energy Agency 2013a).

2.15. Whenever there is a risk of a project significantly affecting an International Nature Conservation designation, an Appropriate Assessment (AA) must be carried out according to executive order no. 1476 13/12/2010 (Bekendtgørelse om konsekvensvurdering vedrørende internationale naturbeskyttelsesområder samt beskyttelse af visse arter ved projekter om etablering m.v. af elproduktionsanlæg og elforsyningsnet). The EU Habitats Directive is implemented into Danish law by the Habitat Regulation (BEK nr. 408 af 01/05/2007), with an associated guidance document (Naturstyrelsen, 2011).

2.16. The HRA process is a stepwise approach, where the first stage is a screening process to assess if a likely significant effect (LSE) on a Natura 2000 site or an annex IV species may occur as a result of the project. If so, the second stage is required which includes the AA. The process of the AA is described in detail in the EU guide: Assessment of plans and projects significantly affecting Natura 2000 sites, and in the EU Wind Energy Developments and Natura 2000 guidance document from 2010 (Methodological guidance on the provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC, November 2001) (European Commission, 2001).

2.17. The principal aim of the Birds Directive is to protect birds, their eggs, nests and habitats in the European Member States. This is achieved in the same way as for the Habitats Directive through the establishment of Natura 2000 sites and identification of sensitive species. Apart from the fact that the sites designated with reference to the Birds Directive, are only established to protect birds, there are no fundamental differences in the way that LSEs are determined and AAs carried out between sites designated with reference to the Birds Directive and the Habitats Directive.

2.18. The following stages are implemented as part of an HRA:

- **Screening**: to determine whether the plan or project ‘either alone or in-combination with other plans and projects’ is likely to have a significant effect on a European site(s);
- **Appropriate Assessment (AA)**: to determine whether in view of the European site’s conservation objectives, the plan or project ‘either alone or in-combination with other plans and projects’ would have an adverse effect (or risk of adverse effect) on the integrity of the site. If not, the plan can proceed; and
- **Mitigation and Alternatives**: where the plan or project is assessed as having an adverse effect (or risk of this) on the integrity of a site, there should be an examination of the mitigation measures and alternative solutions. If adverse effects cannot be mitigated, and in the absence of alternative solutions, the plan can only proceed if imperative reasons of overriding public interest are involved.

Rationale for the Undertaking of AA at Kriegers Flak OWF

2.19. An EIA Technical Report (DHI & Aarhus University, 2015) presenting the potential impacts of the planned Kriegers Flak OWF in relation to birds and bats in EIA terms and including a Natura 2000 screening exercise, was carried out prior of this RIAA. DHI & Aarhus University (2015) present a literature review of records and data of migratory species using potential Baltic flyways over the Arkona Basin and Kriegers Flak. These data were analysed to determine those species with likely migratory flyway connectivity with Kriegers Flak OWF with the subsequent identification of migratory bird species requiring further assessment including Common Crane.

2.20. Common Crane is probably the internationally most important species in relation to assessments of collision risk with offshore wind turbines in the Arkona Basin between Sweden and Germany. Almost all Common Cranes breeding on the Scandinavian Peninsula pass the Arkona Basin twice a year. Most birds pass to and from breeding grounds via stop-over sites in southern Sweden (most notably Hornbogasjön) and northern Germany. Studies related to other wind farms between Sweden and Germany have highlighted this species as very important in relation to offshore wind farms due to the large proportion of a biogeographic population passing and the fact that little is known about how Common Cranes react to offshore wind farms. Further, Common Cranes have been highlighted as being of key concern in parallel assessments for other planned OWFs in the Baltic region (i.e. Bornholm OWF; NIRAS, 2015a,b).

2.21. DHI & Aarhus University (2015) conclude that that there is potential for minor impacts in EIA terms in relation to collision risk for migrating Common Crane to arise as a result of Kriegers Flak OWF alone, whilst cumulative effects taking account of consented and planned offshore wind farm projects in the region would result in greater, significant impacts on this species. In line with the findings of the EIA, the Natura 2000 screening included in DHI & Aarhus University (2015) indicates that although there is no indication of a significant impact from Kriegers Flak OWF alone, an adverse effect arising from in-combination collision risk, associated with the operational phase of Kriegers Flak and consented and planned offshore wind farms in the region cannot be discounted.

2.22. It is evident that therefore, further investigation is warranted to provide the Danish Energy Agency and the Nature Agency, with an investigation in the form of a RIAA with respect to Natura 2000 sites designated for migratory Common Crane in the Baltic region.

2.23. This RIAA compiles all existing information and builds upon, in particular, the Natura 2000 screening and EIA presented in DHI & Aarhus University, (2015). In addition, this report provides the following core information:

- Defines a west-central Baltic region in order to assess impacts on Natura 2000 sites within the Common Crane migratory flyway;
- Attempts to provide indicative (although quantitative) mortality estimates for proposed and consented projects in the Baltic;
- Where significant uncertainty exists regarding predicted mortality of Common Crane, defines a single scenario informed by evidence and/or expert opinion on which assessment is carried forward; and
- Details tiered approaches to apportioning and assessing estimated mortality for relevant Natura 2000 sites.

AA Considerations: Site Integrity

2.24. In determining whether the development of Kriegers Flak OWF will adversely affect the integrity of the Natura 2000 sites designated for migratory Common Crane, the Competent Authority should need to consider:

- The meaning of integrity of a Natura 2000 (SPA) site; and
- The definition of 'adverse effect' with respect to the integrity of the SPA, both in terms of the duration and detectability of effect.

Meaning of integrity of an European Site

2.25. There is currently no legal definition of the term 'integrity' in, the Danish regulations (Habitatvejledningen) or the EU Directive. Managing Natura 2000 (EC, 2000) provides a useful definition of the term 'integrity of the site': 'the coherence of the site's ecological structure and function, across its whole area, or the habitats, complex of habitats and/or populations of species for which the site is or will be classified'.

2.26. The guidance document Managing Natura 2000 (EC, 2000) emphasises the conservation objectives of a site as the basis for defining adverse effect: '*The integrity of the site involves its ecological functions. The decision as to whether it is adversely affected should focus on and be limited to the site's conservation objectives*'.

Adverse effect and detectability

2.27. The assessment of adverse effect on integrity is necessarily addressed in the light of the Natura 2000 site's conservation objectives (where they are available). An adverse effect would be one which caused a detectable reduction in the species and/or habitats for which a site was designated, at the scale of the site rather than at the scale of the location of the impact. Where a conservation objective relates directly to a habitat, loss can be readily measured in terms of area. Where a site is designated for the species that it supports, the assessment becomes more complex.

2.28. The approach taken to assess adverse effects on site integrity with respect to collision mortality of migratory Common Crane expands on the methods presented in DHI & Aarhus University, (2015) and NIRAS, (2015b) and is fully detailed in Section 5. In summary, a series of analytical stages are applied as follows:

- Stage 1: Total collision mortality is apportioned to each individual SPA population
- Stage 2: Collision mortality is apportioned to each SPA population based on the contribution each SPA population makes to the western Baltic migratory flyway population of Common Crane
- Stage 3: Collision mortality apportioned to an SPA under Stage 2 is compared to the Potential Biological Removal values calculated for individual SPAs.

Purpose of this Document and Structure of the Assessment

Purpose

2.29. An initial Natura 2000 screening process has been undertaken in DHI & Aarhus University, (2015) with regards to Kriegers Flak OWF. This report updates the screening in relation to migratory Common Crane and provides further detail to inform an AA in relation to collision risk for this species.

2.30. The purpose of this report is to assess the implications of the Kriegers Flak OWF in respect of Natura 2000 site(s) conservation objectives, individually and in-combination with other plans or projects. The conclusions should enable the Nature Agency to ascertain whether or not this project would adversely affect the integrity of the Natura 2000 site or the annex IV species concerned (Naturstyrelsen 2011).

2.31. This RIAA report focuses specifically on Common Crane and Natura 2000 sites that are designated for this species in a defined area of the species migratory flyway. The report is also restricted to the potential impact mechanism of collision with rotor blades. For assessment of other potential impact mechanisms (e.g. barrier effects) the reader is directed to DHI & Aarhus University (2015).

2.32. The following information and documentation has been used to compile this report:

- Birds and bats at Kriegers Flak: Baseline Investigations and impact assessment – EIA Technical Report (DHI & Aarhus University, 2015);
- Habitat Regulations Assessment for Bornholm OWF (NIRAS, 2015b);
- Guidance document on Environmental Impact Assessment for Danish Offshore Wind Farms (Danish Energy Agency 2013b);
- Standard data forms for Natura 2000 designated sites (http://eunis.eea.europa.eu/);
- GIS data for Natura 2000 sites (http://www.eea.europa.eu/data-and-maps/data/natura-2); and
- 4C Offshore 'Offshore Wind Farms Database': http://www.4coffshore.com/offshorewind/

Structure

2.33. In order to provide a robust and transparent assessment of the potential impacts on Common Crane arising from the Kriegers Flak OWF on relevant Natura 2000 sites, either alone or in-combination with other plans or projects, the following information is included in this report:

- Background information on the phenology and migration of Common Crane and the potential impacts of offshore wind development on this species;
- Screening of Natura 2000 sites to be included for assessment of potential impacts of Kriegers Flak OWF on Common Crane;
- Appropriate Assessment, including:
  - A description of the methodology used for apportioning predicted mortality and determining population level effects;
  - A collision risk assessment for Kriegers Flak OWF alone; and
  - A collision risk assessment for Kriegers Flak OWF in-combination with other plans or projects.
- Conclusions

3. Background Information

Phenology and migration of Common Crane

3.1. The breeding origins of Common Crane crossing the Baltic Sea are primarily Sweden and Norway with small numbers from Finland (FEBI 2013). These birds are a part of the North-west Europe/Iberia & Morocco population of Common Crane the number of which is currently estimated at 240,000 individuals (Wetlands International 2015).

3.2. The Common Crane population in northern Europe was recently estimated at approximately 150,000 individuals (G. Nowald personal communication, cited by BSH 2009). Birdlife International (2014a) estimated the populations of Sweden, Norway and Finland at up to 43,000 breeding pairs (3,000 pairs in Finland with an equal divide between Sweden and Norway), whilst Ottosson *et al*., (2012) estimated the Swedish population at 30,000 pairs. One of two migration routes are used by the Scandinavian population when passing the Baltic Sea, with most of the Finnish component (that forms part of the eastern population with the Baltic States) migrating along the southern Baltic coast (BSH 2009, IfAÖ 2012), and the Swedish and Norwegian birds crossing the Arkona Basin over a broad front (BSH 2009, DHI & Aarhus University, 2015). It is estimated that around 84,000 Common Cranes in autumn cross the western Baltic on a broad-front migration (DHI & Aarhus University, 2015), up to 10,000 of these birds heading south-west through the Baltic Sea crossing within the vicinity Bornholm (BSH 2009; Figure 3.1). IFAÖ (2012) estimate around 5,000 birds which pass over the Baltic Sea originate from the Finnish population.

3.3. The Rügen-Bock Kirr-region is the main resting area on the southern Baltic Coast for Common Cranes crossing the Baltic in autumn and spring migration. During autumn most birds stage on wetlands in Rügen, Germany, while during spring most birds stage 50 km further west in the Darss area (DHI & Aarhus University, 2015). In autumn up to 40,000 cranes may be present on any one day (NABU 2014). A schematic map of the Common Crane migration across the Baltic Sea during both migratory periods with estimated numbers of individuals, was presented by (BSH 2009) and is reproduced here in Figure 3.1. It should however be noted that the migration routes taken from BSH (2009) are subject to inter-annual variation and drift dependent on wind direction and speed. Though not shown in Figure 3.1, spring migration of Common Crane over waters between Rügen-Bock Kirr-region and Bornholm does occur, albeit likely that this involves smaller numbers (IfAÖ 2012).

3.4. Further investigation of crane migration and the potential for interaction with Kriegers Flak OWF is presented in Section 6.

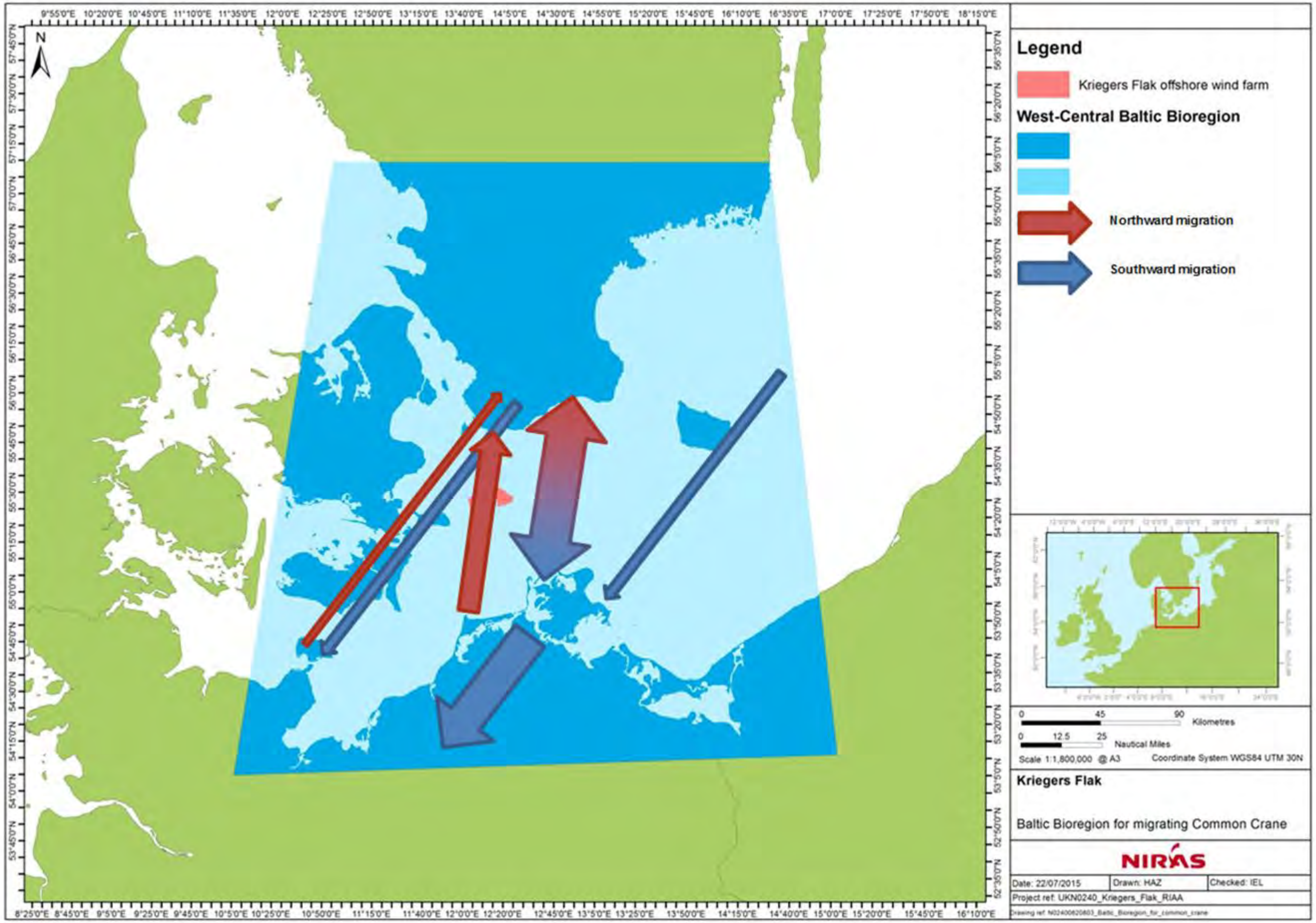

Figure 3.1: Schematic of the Common Crane migration routes in the western Baltic (based on BSH 2009).

Potential effects of offshore wind developments on Common Crane

3.5. Wind turbines have the potential to present risks to birds through collision, disturbance/displacement, barriers to movement, habitat change and the cumulative/in-combination effects across multiple schemes (Langston, 2010).

3.6. Common Crane are longer lived and a late first age of breeding of 4 years which means that consequently they have a low annual reproductive output (Robinson 2005). Such species may therefore be more susceptible to effects of increased mortality above background levels by, for example, collision with turbine rotors. The effects of disturbance and displacement are in comparison, more difficult to quantify, although both seabirds and migratory species are potentially vulnerable to such effects. Barriers to movement can affect migratory birds on their annual flyways and as disruption to functional links, such as between feeding and breeding areas. Habitat loss has the potential to affect birds at different times of their life cycle with foraging, roosting and moulting areas requiring consideration, although such effects are generally limited to seabirds rather than migrant species such as Common Crane.

3.7. This report focusses on the potential effects of collision on migratory Common Crane. Birds can collide with the turbine rotor blades, which is likely to result in direct mortality. Most studies have found evidence of low levels of bird mortality associated with operational offshore wind farms, as birds are able to take avoiding action (Drewitt and Langston, 2006). The actual risk of collision depends on a number of factors including the location of a wind farm, the bird species using the area, weather and visibility conditions, and the size and design of the wind farm, including the number and size of turbines and the use, or otherwise, of lighting (e.g., Kerlinger and Curry, 2002).

3.8. The effect of collision rates on a population is influenced by various characteristics, notably its size, density, recruitment rate (additions to the population through reproduction and immigration) and mortality rate (the natural rate of losses due to death and emigration). In general, the effect of an individual lost from the population will be greater for species that occur at low density, are relatively long-lived, reproduce at a low rate and/or are subject to a population decline.

4. Screening of Natura 2000 sites

Purpose of Screening

4.1. Screening is a relatively coarse filter to identify those Natura 2000 sites and features for which a LSE cannot be discounted. A filtering process is undertaken whereby all of the sites that can be identified as having 'connectivity' with a project, based upon geographical location and designated features can be discerned from those which do not. Where the potential for a LSE exists for a Natura 2000 site, further assessment is undertaken at the Appropriate Assessment stage (also included within this report), which tests for Adverse Effect on Site Integrity.

4.2. The purpose of screening in relation to this specific report is to identify the Natura 2000 sites with connectivity to Kriegers Flak OWF where populations of migratory common crane are listed as designated migratory features (i.e. 'Concentration' features). Natura 2000 sites that are designated for breeding features of Common Crane are not considered in this report.

4.3. The screening carried out in this report builds on the previous screening undertaken for Kriegers Flak OWF (DHI & Aarhus University, 2015) and critically, now defines a west-central Baltic region within which Natura 2000 sites are considered.

Approach to Screening

4.4. The screening undertaken for Kriegers Flak OWF has been carried out to identify those Natura 2000 sites with designated 'concentration' features of migratory common crane, that have been recognised as having potential connectivity with the Project.

4.5. The screening exercise undertaken for Kriegers Flak OWF has been carried out with reference to the following guidance:

- Methodological guidance on the provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC): Assessment of plans and projects significantly affecting Natura 2000 sites. EU Commission guidance on Nature (November 2001);
- Guidance document on Article 6(4) of the 'Habitats Directive' 92/43/EEC (2012);
- EU Guidance document on wind energy development in accordance with EU nature legislation. (2010);
- Habitat Directive guidelines: Vejledning til Habitatbekendtgørelsen (VEJ nr. 408 af 01/05/2007); and
- Danish Energy Agency Guidance document on Environmental Impact Assessment, Danish Offshore Wind Farms (Danish Energy Agency 2013b).

4.6. Screening comprises the following key steps:

I. Define the geographic scope of the project and define a biologically appropriate 'area of search';
II. Identify and scope-in all Natura 2000 sites located within the area of search; and
III. Filter the sites within the area of search to identify all Natura 2000 sites which have designated 'concentration' features of common crane and screen-out those that do not.

4.7. Following the screening process, a subsequent conclusion is drawn. Any Natura 2000 site with a designated 'concentration' feature of Common Crane and located within the area of search, will be considered to have the potential for LSE, due to the potential connectivity of the feature with Kriegers Flak OWF. Therefore the conclusion will state that either:

- No Natura 2000 sites scoped in for screening have been identified as containing designated 'concentration' features of Common Crane, and therefore no further assessment will be required; or
- One or more Natura 2000 sites scoped in for screening have been identified as containing designated 'concentration' features of Common Crane with the potential for connectivity with Kriegers Flak OWF, and therefore the potential for LSE cannot be discounted and an Appropriate Assessment will be required.

Screening

Defining the area of search: The west-central Baltic bioregion

4.8. Screening has used a specific spatial 'area of search' to determine the potential for connectivity between Common Crane features at Natura 2000 sites and Kriegers Flak OWF (See Figure 4.1). This search area is defined as a polygon representing a 'west-central Baltic bioregion' and encompasses segments of Denmark, Sweden, Germany and Poland. The spatial scale of the search area is considered to be biologically appropriate for the screening of Common Crane features, due to the way in which the area encapsulates the dominant migratory flyway for the birds which cross the Baltic, from their breeding origins which are primarily Sweden and Norway with small numbers from Finland (FEBI 2013).

4.9. It is estimated that over 84,000 Common Cranes in autumn cross the western Baltic on a broad-front migration (DHI & Aarhus University, 2015). Figure 4.1 presents this predicted main migration route as a blue shaded area. Common Crane migration over the Arkona Basin within the Baltic is thought to move from Sweden to Rügen in the fall and the other way in spring. There are thought to be slight differences in the path taken between the two seasons. In the spring they often pass in the western part near or over Falster, Møn and Zealand, especially in easterly and south-easterly winds. It is also likely that cranes use a more westerly route despite the wind direction in spring. This is supported by higher concentrations of Common Cranes staging to the west in Germany. In the spring they tend to use the area of Darss 50 km to the west of Rügen, whereas in the autumn they stage in wetlands on Rügen (DHI 2014). However, observations from the spring of 2015 at Kriegers Flak and Baltic II showed that several flocks of cranes have passed through the area during easterly winds (DHI & Aarhus University, 2015). In the autumn the westerly wind are more prevalent therefore pressing the cranes more to the east and over Bornholm. The majority of birds leaving Sweden are heading south and are then pressed east or west depending on the wind.

Identification of Natura 2000 Sites

4.10. GIS analysis enabled all Natura 2000 sites within the Baltic bioregion area of search (Figure 4.1) to be identified. The shapefile containing the location of European SPAs was sourced from the European Environment Agency website[2]. The outcome of the analysis provided a total list of 833 SPAs which were subsequently scoped in for screening. Using the European Nature Information System (EUNIS) Natura 2000 database[3], site data-form information was obtained for all sites screened in.

Sites screened in

[2] http://www.eea.europa.eu/data-and-maps/data/natura-2#tab-gis-data
[3] http://eunis.eea.europa.eu/

4.11. The Natura 2000 data forms for all 833 SPAs within the Baltic search area were analysed to establish which SPAs contained designated features for migratory Common Crane on passage (i.e. 'concentration' features). The results of this analysis returned a final list of 26 SPAs where such features are designated (Table 4.1 and Figure 4.1). This list encompasses:

- One Danish SPA;
- Fourteen German SPAs;
- Seven Swedish SPAs; and
- Four Polish SPAs.

4.12. As described in the 'approach to screening' section, due to the designation of 'concentration' features of Common Crane at these SPAs and the potential for connectivity with Kriegers Flak OWF, these sites are screened-in as the potential for LSE cannot be discounted and an AA will be required for these sites. The sites within the Baltic bioregion screened-in for AA are presented in Table 4.1 below and illustrated in Figure 4.1.

Table 4.1: SPAs screened in for Appropriate Assessment

Country	SPA Name	Minimum Distance to Kriegers Flak OWF (km)
Germany	Binnenbodden von Rügen	40.05
Germany	Vorpommersche Boddenlandschaft und nördlicher Strelasund	42.70
Denmark	Bøtø Nor	64.60
Sweden	Sövdesjön	67.66
Sweden	Klingavälsån	69.01
Germany	Greifswalder Bodden und südlicher Strelasund	74.99
Germany	Nordvorpommersche Waldlandschaft	75.76
Germany	Recknitz- und Trebeltal mit Seitentälern und Feldmark	84.07
Sweden	Fulltofta-Ringsjön	94.00
Germany	Peenetallandschaft	108.39
Germany	Warnowtal, Sternberger Seen und untere Mildenitz	109.03
Germany	Mecklenburgische Schweiz und Kummerower See	112.78
Sweden	Egeside-Pulken-Yngsjön	114.98
Sweden	Vramsåns mynningsområde	120.79
Germany	Kariner Land	121.13
Sweden	Hammarsjöområdet	123.75
Sweden	Araslövssjöområdet	127.76

Country	SPA Name	Minimum Distance to Kriegers Flak OWF (km)
Germany	Nebel und Warinsee	131.90
Germany	Großes Landgrabental, Galenbecker und Putzarer See	135.86
Germany	Kuppiges Tollensegebiet zwischen Rosenow und Penzlin	146.13
Germany	Schweriner Seen	153.72
Poland	Bagna Rozwarowskie	159.16
Poland	Jezioro Świdwie	174.45
Germany	Koblentzer See	175.23
Poland	Dolina Dolnej Odry	191.99
Poland	Ostoja Ińska	213.66

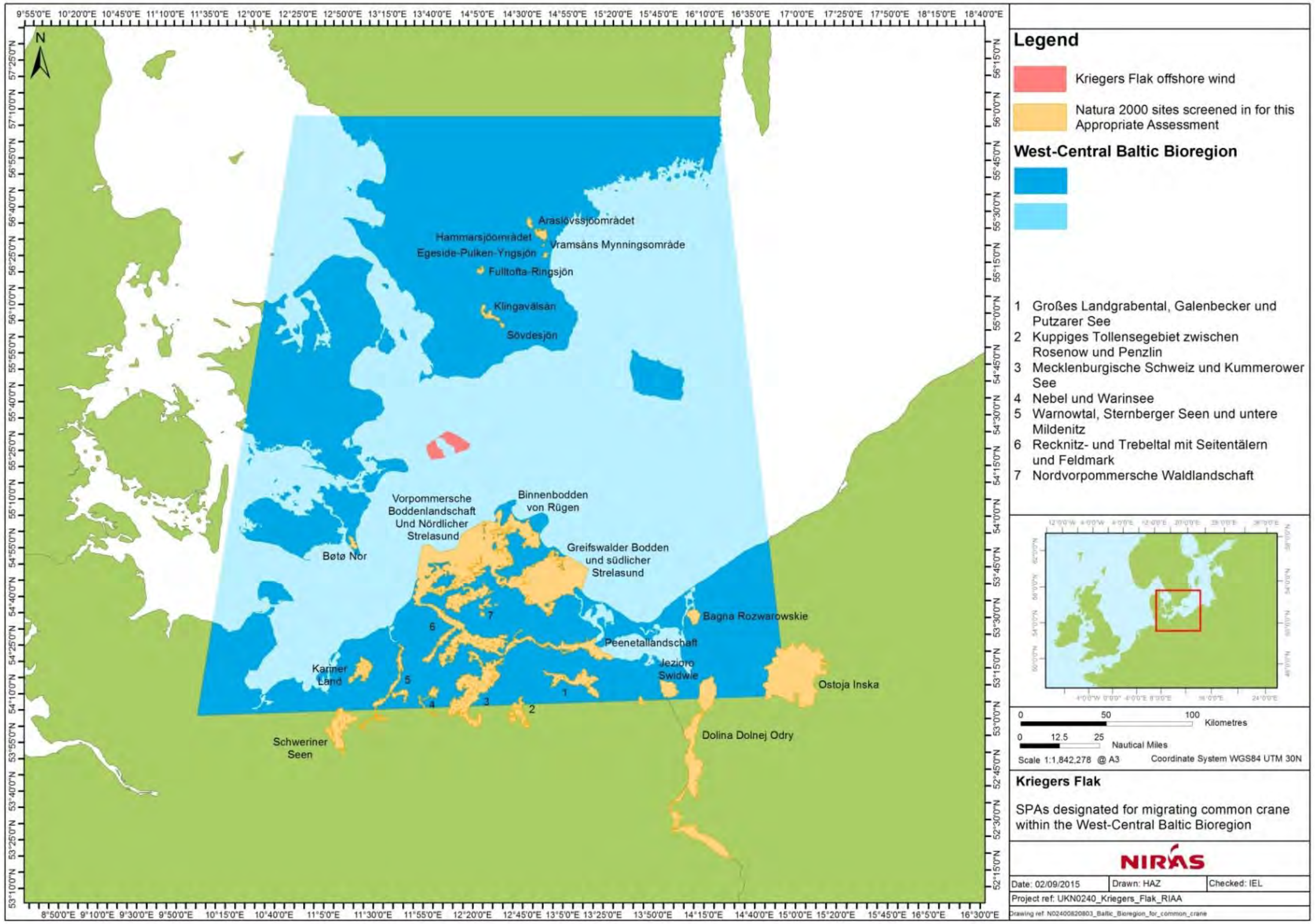

Figure 4.1: The defined west-central Baltic bioregion and Natura 2000 sites screened in to the assessment.

Natura 2000 Site Summaries

4.13. This section provides site summaries for all Natura 2000 sites screened in for Appropriate Assessment (i.e. those sites listed within Table 4.1). Summaries detail the following characteristics of the respective sites:

- Geographical location (also presented in Figure 4.1);
- Distance to Kriegers Flak OWF,
- Spatial extent;
- Designation classification;
- Number of qualifying features (species of conservation importance); and
- Population size in respect of qualifying 'concentration' (i.e. migratory) features listed for Common Crane.

4.14. Site information has been sourced from the online EUNIS database[4] where the standard data forms for each Natura 2000 site were also retrieved. Calculations of the distances between Kriegers Flak OWF and Natura 2000 sites were undertaken using GIS.

Binnenbodden von Rügen SPA

4.15. Binnenbodden von Rügen SPA is a German Natura 2000 site, located in the Rügen area of Mecklenburg-Vorpommern, north Germany, approximately 40 km from Kriegers Flak OWF. The site was designated as an SPA in 2008, and contains 87 qualifying features. The SPA encompasses an area of 207 km^2 , 70% of which is considered marine. In respect of Common Crane, a qualifying feature for a 'concentration' of Common Crane is listed. Both the minimum and maximum populations listed for this Common Crane qualifying feature are 3,000 birds.

Sövdesjön SPA

4.16. Sövdesjön SPA is a Swedish Natura 2000 site located in southern Sweden near Blentarp, around 30 km from the Ystad at the coast and approximately 68 km from Kriegers Flak OWF. The site was designated as an SPA in 2004, and contains 25 qualifying features. The SPA encompasses an area of 5 km^2. In respect of Common Crane, a qualifying feature for a 'concentration' of Common Crane is listed. The minimum and maximum populations listed for this Common Crane qualifying feature are 50 and 100 birds respectively.

Klingavälsån SPA

4.17. Klingavälsån SPA is a Swedish Natura 2000 site in southern Sweden. The site lies northwest of Sövdesjön SPA, in close proximity. Klingavälsån SPA is located approximately 69 km from Kriegers Flak OWF. The site was designated as an SPA in 1996, and contains 28 qualifying features. The SPA encompasses an area of 28 km^2. In respect of Common Crane, a qualifying feature for a 'concentration' of Common Crane is listed. The minimum and maximum populations listed for this Common Crane qualifying feature are 100 and 200 birds respectively.

Greifswalder Bodden und südlicher Strelasund SPA

4.18. Greifswalder Bodden und südlicher Strelasund SPA is a German Natura 2000 site, located in north Germany across the Strela Sound. The site lies approximately 75 km from Kriegers Flak OWF. The site was designated as an SPA in 2008, and contains 108 qualifying features. The SPA encompasses an area

[4] http://eunis.eea.europa.eu/

of 875 km^2 , 82% of which is considered marine. In respect of Common Crane, a qualifying feature for a 'concentration' of Common Crane is listed. Both the minimum and maximum populations listed for this Common Crane qualifying feature are 5,000 birds.

Vorpommersche Boddenlandschaft und nördlicher Strelasund SPA

4.19. Vorpommersche Boddenlandschaft und nördlicher Strelasund SPA is a German Natura 2000 site, located in north Germany across the Strela Sound, to the west of the nearby Greifswalder Bodden und südlicher Strelasund SPA. The site lies approximately 43 km from Kriegers Flak OWF. The site was designated as an SPA in 2008, and contains 124 qualifying features. The SPA encompasses an area of 1,223 km^2 , 65% of which is considered marine. In respect of Common Crane, a qualifying feature for a 'concentration' of Common Crane is listed. Both the minimum and maximum populations listed for this Common Crane qualifying feature are 70,000 birds.

Egeside-Pulken-Yngsjön SPA

4.20. Egeside-Pulken-Yngsjön SPA is a Swedish Natura 2000 site located in southern Sweden, to the south west of Åhus in Skåne County, slightly inland from the coast. The site lies approximately 115 km from Kriegers Flak OWF. The site was designated as an SPA in 1998, and contains 21 qualifying features. The SPA encompasses an area of 5 km^2. In respect of Common Crane, a qualifying feature for a 'concentration' of Common Crane is listed. Both the minimum and maximum populations listed for this Common Crane qualifying feature are 7,000 birds.

Vramsåns mynningsområde SPA

4.21. Vramsåns mynningsområde SPA is a Swedish Natura 2000 site located in southern Sweden, directly to the west of Åhus in Skåne County. The site lies to the north of the nearby Egeside-Pulken-Yngsjön SPA. A distance of approximately 121 km separates Vramsåns mynningsområde SPA from Kriegers Flak OWF. The site was designated as an SPA in 1996, and contains 14 qualifying features. The SPA encompasses an area of 1 km^2. In respect of Common Crane, a qualifying feature for a 'concentration' of Common Crane is listed. Both the minimum and maximum populations listed for this Common Crane qualifying feature are 250 birds.

Hammarsjöområdet SPA

4.22. Hammarsjöområdet SPA is a Swedish Natura 2000 site located in Skåne County, southern Sweden, directly south of Kristianstad and north west of Åhus. The site lies to the north of the nearby Vramsåns mynningsområde and Egeside-Pulken-Yngsjön SPAs. A distance of approximately 124 km separates Hammarsjöområdet SPA from Kriegers Flak OWF. The site was designated as an SPA in 1996, and contains 42 qualifying features. The SPA encompasses an area of 26 km^2. In respect of Common Crane, a qualifying feature for a 'concentration' of Common Crane is listed. Both the minimum and maximum populations listed for this Common Crane qualifying feature are 1,500 birds.

Fulltofta-Ringsjön SPA

4.23. Fulltofta-Ringsjön SPA is a Swedish Natura 2000 site located in southern Sweden, north west of nearby Hörby in Skåne County. The site is located inland and encompasses an eastern segment of the Östra Ringsjön lake. The site lies approximately 94 km from Kriegers Flak OWF. The site was designated as an SPA in 1996 and contains 38 qualifying features. The SPA encompasses an area of 9 km^2. In respect of Common Crane, a qualifying feature for a 'concentration' of Common Crane is listed, however population numbers are not presented. The Natura 2000 standard data form indicates that the population is category 'B', which represents 2-15% of the relevant migratory population. If the 2% value is applied to the 84,000 birds known to migrate across the Baltic, this would represent a population of 1,680 birds, whilst the 15% value would represent a population of 12,600 birds.

Araslövssjöområdet SPA

4.24. Araslövssjöområdet SPA is a Swedish Natura 2000 site located in southern Sweden, around the northwest margins of Kristianstad and encompassing Araslovssjon lake. The site lies approximately 128 km from Kriegers Flak OWF. The site was designated as an SPA in 1996 and contains 40 qualifying features. The SPA encompasses an area of 11 km^2. In respect of Common Crane, a qualifying feature for a 'concentration' of Common Crane is listed. The minimum and maximum populations listed for this Common Crane qualifying feature are 1 and 500 birds respectively.

Bagna Rozwarowskie SPA

4.25. Bagna Rozwarowskie SPA is a Polish Natura 2000 site located in the West Pomerania Province in north west Poland, directly to the east of the Dziwna channel. The site lies approximately 159 km from Kriegers Flak OWF. The site was designated as an SPA in 2004 and contains 29 qualifying features. The SPA encompasses an area of 42 km^2. In respect of Common Crane, a qualifying feature for a 'concentration' of Common Crane is listed. The minimum and maximum populations listed for this Common Crane qualifying feature are 80 and 520 birds respectively.

Nordvorpommersche Waldlandschaft SPA

4.26. Nordvorpommersche Waldlandschaft SPA is a German Natura 2000 site located in the state of Mecklenburg-Vorpommern, north Germany. The site straddles a large area between Stralsund, which lies to the east and Ribnitz-Damgarten which lies to the west. The site lies approximately 76 km from Kriegers Flak OWF. The site was designated as an SPA in 2008 and contains 58 qualifying features. The SPA encompasses an area of 155 km^2. In respect of Common Crane, a qualifying feature for a 'concentration' of Common Crane is listed. Both the minimum and maximum populations listed for this Common Crane qualifying feature are 4,500 birds.

Peenetallandschaft SPA

4.27. Peenetallandschaft SPA is a German Natura 2000 site located in the state of Mecklenburg-Vorpommern, north Germany. The SPA encompasses large reaches of the river Peene from Demmin to Anklam to the western fringes of the Szczecin Lagoon. The site lies approximately 108 km from Kriegers Flak OWF. The site was designated as an SPA in 2008 and contains 95 qualifying features. The SPA encompasses an area of 190 km^2, 2% of which is considered marine. In respect of Common Crane, a qualifying feature for a 'concentration' of Common Crane is listed. Both the minimum and maximum populations listed for this Common Crane qualifying feature are 5,500 birds.

Recknitz- und Trebeltal mit Seitentälern und Feldmark SPA

4.28. Recknitz- und Trebeltal mit Seitentälern und Feldmark is a German Natura 2000 site, located 84 km from Kriegers Flak OWF in the Mecklenburg-Vorpommern state in northern Germany. The site was designated as an SPA in 2008 and is designated for 79 qualifying features. The SPA encompasses an area of 388 km^2 with no marine component. Common Crane qualifies at this SPA with a concentration population of 5,400 individuals.

Großes Landgrabental, Galenbecker und Putzarer See SPA

4.29. Großes Landgrabental, Galenbecker und Putzarer See is a German Natura 2000 site, located 136 km from Kriegers Flak OWF in the Mecklenburg-Vorpommern state of northern Germany. The site was designated as an SPA in 2008 and is designated for 24 qualifying features. The SPA encompasses 142 km^2 with no marine component. Common Crane qualifies at this SPA with a concentration population of 4,300 individuals.

Jezioro Świdwie SPA

4.30. Jezioro Świdwie is a Polish Natura 2000 site, located 174 km from Kriegers Flak OWF in north-western Poland along the Polish-German border. The site was designated as an SPA in 2004 and is designated for 71 qualifying features. The SPA encompasses 72 km^2 with no marine component. Common Crane qualifies at this SPA with a concentration population of 1,500 individuals.

Osotja Ińska SPA

4.31. Osotja Ińska is a Polish Natura 2000 site, located 214 km from Kriegers Flak OWF in north-western Poland. The site was designated in 2004and is designated for 49 qualifying bird features. The SPA encompasses 877 km^2 with no marine component. Common Crane qualifies at this SPA with a concentration population of between 1,800 and 2,000 individuals.

Dolina Dolnej Odry SPA

4.32. Dolina Dolnej Odry is a Polish Natura 2000 site, located 192 km from Kriegers Flak OWF in north-western Poland along the Polish-German border. The site was designated in 2004 and is designated for 89 qualifying bird features. The SPA encompasses 616 km^2 with no marine component. Common Crane qualifies at this SPA with a concentration population of 17 individuals.

Mecklenburgische Schweiz und Kummerower See SPA

4.33. Mecklenburgische Schweiz und Kummerower See is a German Natura 2000 site, located 113 km from Kriegers Flak OWF in the Mecklenburg-Vorpommern state of northern Germany. The site was designated as an SPA in 2008 and is designated for 139 qualifying features. The SPA encompasses 436 km^2 with no marine component. Common Crane qualifies at this SPA with a concentration population of 2,500 individuals.

Koblentzer See SPA

4.34. Koblentzer See is a German Natura 2000 site, located 175 km from Kriegers Flak OWF in the Mecklenburg-Vorpommern state of northern Germany. The site was designated as an SPA in 2008 and is designated for 16 qualifying features. The SPA encompasses 9 km^2 with no marine component. Common Crane qualifies at this SPA with a concentration population of 2,100 individuals.

Bøtø Nor SPA

4.35. Bøtø Nor is a Danish Natura 2000 site, located 65 km from Kriegers Flak OWF on the island of Falster, southern Sjælland. The site was designated as an SPA in 1983 and is designated for 18 qualifying features. The SPA encompasses 17 km^2 with no marine component. Common Crane qualifies at this SPA with a concentration population of 13 individuals.

Kuppiges Tollensegebeit zwischen Rosenow und Penzlin SPA

4.36. Kuppiges Tollensegebeit zwischen Rosenow und Penzlin is a German Natura 2000 site, located 146 km from Kriegers Flak OWF in the Mecklenburg-Vorpommern state of northern Germany. The site was designated as an SPA in 2008 and is designated for 77 qualifying features. The SPA encompasses 77 km^2 with no marine component. Common Crane qualifies at this SPA with a concentration population of 1,100 individuals.

Warnowtal, Sternberger Seen und untere Mildenitz SPA

4.37. Warnowtal, Sternberger Seen und untere Mildenitz is a German Natura 2000 site, located 109 km from Kriegers Flak OWF in the Mecklenburg-Vorpommern state of northern Germany. The site was designated as an SPA in 2008 and is designated for 29 qualifying features. The SPA encompasses 108 km^2 with no marine component. Common Crane qualifies at this SPA with a concentration population of 50 individuals.

Nebel und Warinsee SPA

4.38. Nebel und Warinsee is a German Natura 2000 site, located 132 km from Kriegers Flak OWF in the Mecklenburg-Vorpommern state of northern Germany. The site was designated as an SPA in 2008 and is designated for 22 qualifying features. The SPA encompasses 30 km^2 with no marine component. Common Crane qualifies at this SPA with a concentration population of 200 individuals.

Kariner Land SPA

4.39. Kariner Land is a German Natura 2000 site, located 121 km from Kriegers Flak OWF in the Mecklenburg-Vorpommern state of northern Germany. The site was designated as an SPA in 2008 and is designated for 18 qualifying features. The SPA encompasses 87 km^2 with no marine component. Common Crane qualifies at this SPA with a concentration population of 1000 individuals.

Schweriner Seen SPA

4.40. Schweriner Seen is a German Natura 2000 site, located 154 km from Kriegers Flak OWF in the Mecklenburg-Vorpommern state of northern Germany. The site was designated as an SPA in 2008 and is designated for 64 qualifying features. The SPA encompasses 186 km^2 with no marine component. Common Crane qualifies at this SPA with a concentration population of 100 individuals.

5. Methodology for Apportioning Predicted Mortality and Determining Population Level Effects

5.1. In order to determine if there is an adverse effect on the site integrity of the SPAs designated for migratory Common Crane that are considered to exhibit connectivity with Kriegers Flak OWF alone and in-combination with other plans and projects, an apportioning exercise has been conducted using the 3-stage methodology outlined in Figure 5.1. The assessment incorporates both the precautionary principle and consideration of the likely behaviour of migratory Common Crane.

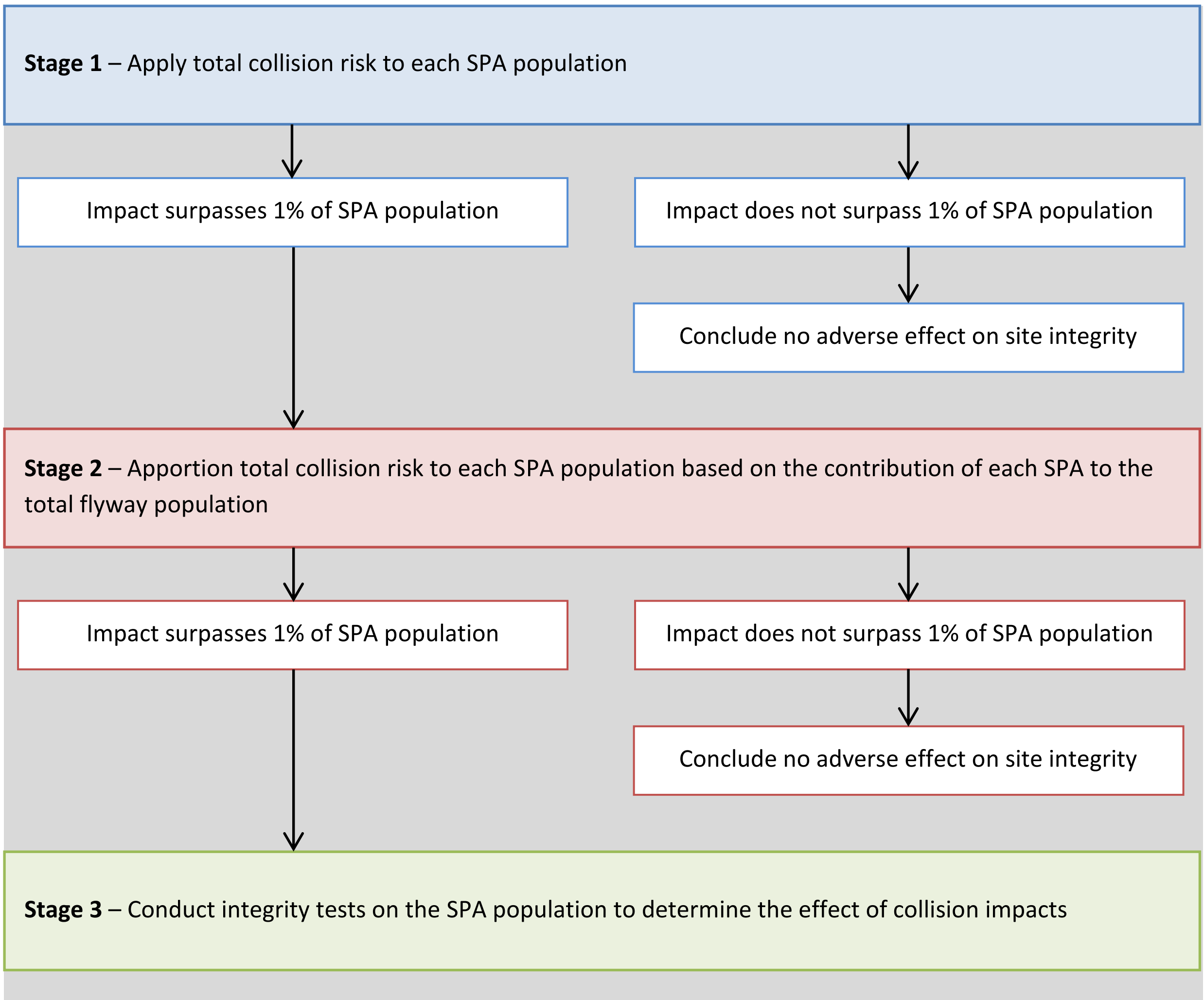

Figure 5.1 Apportioning methodology applied to the assessment of Kriegers Flak OWF alone and in-combination with other plans/projects.

Stages 1 - 2: Apportioning mortality

5.2. In the first two stages of the assessment the calculated impact is compared to 1% of the relevant SPA population in order to determine whether the SPA should be included in the next stage of analysis. The 1% criterion, whilst not necessarily of biological relevance, has been previously used as a standard for designating areas of conservation interest (Kuijken 2006) and has since been used as a convenient threshold figure to indicate potential significance of effects (be it through proportions of relevant populations affected or through changes in background mortality). When the 1% threshold of the SPA population is not surpassed by the calculated collision impact there is considered to be no adverse effect on the integrity of the SPA and the site is discounted from further assessment. For the final stage of the assessment Potential Biological Removal (PBR) is used to establish if there is an adverse effect on the integrity of the SPA.

5.3. Stage 1 of the methodology is effectively used as a further level of screening in order to identify those SPAs that are unlikely, at the current estimated level of in-combination collision mortality, to ever experience an adverse effect on integrity. This stage implements an over-precautionary worst case scenario of apportioning the total predicted collision mortality to each SPA population individually. Where the 1% threshold of an SPA population is surpassed, the SPA is taken forward to Stage 2 of the assessment. Where the 1% threshold of an SPA population is not surpassed there is considered to be no adverse effect on the integrity of the SPA and therefore the SPA is not considered for further assessment.

5.4. Stage 2 applies the total collision risk to each SPA based on the contribution of an SPA to the western Baltic flyway of Common Crane. This flyway population consists of 84,000 individuals and represents the number of birds considered to cross the western Baltic during autumn migration (DHI & Aarhus University, 2015). It is this population that is used to calculate the size of an SPA population when one is not provided on the standard data form for an SPA. In terms of this assessment, this applies to only one SPA, Fulltofta-Ringsjön located in southern Sweden. As noted above (paragraph 4.23), the Common Crane population at this SPA represents 2-15% of the biogeographic population, which represents between 1,680 and 12,600 birds. On a precautionary basis, and based on anecdotal evidence, the lower population estimate is believed to best represent the Common Crane population at this site. The use of this population in the assessment means that collision risk values are compared to a lower 1% threshold ensuring the assessment is of a precautionary nature.

5.5. Where the 1% threshold of an SPA population is surpassed, the SPA is taken forward to Stage 3 of the assessment. As in Stage 1 of the assessment, if the 1% threshold is not surpassed there is considered to be no adverse effect on the integrity of the SPA and therefore the SPA is not considered for further assessment.

5.6. Potential Biological Removal (PBR) is used in order to provide further contextual support to the determination whether here is an adverse effect on the migratory crane flyway population (within Stage 2) and subsequently on the integrity of individual SPAs (Stage 3 below). PBR provides a means of estimating the number of additional mortalities (i.e. additional to annual mortality caused by other factors) that a given population can sustain. Wade (1998) and others have defined a simple formula for PBR:

$$PBR = \frac{1}{2} r_{max} N_{min} f$$

Where:
r_{max} is the maximum annual recruitment rate
N_{min} is a conservative estimate of the population size
f is a “recovery factor” applied to depleted populations where the management goal may be to facilitate growth back to a target population size

5.7. Wade (1998) showed that PBR can be used to identify sustainable harvest rates that would maintain populations at, or above, maximum net productivity level (MNPL or maximum sustained yield). Based on a generalised logistic model of population growth and assuming that the density dependency in the population growth is linear (θ = 1.0) then MNPL is equivalent to 0.5K (where K is the notional carrying capacity) and the net recruitment rate at MNPL (RMNPL) is 0.5 r_{max}.

5.8. Wade (1998) also showed that PBR is conservative for populations with θ > 1.0 (i.e. a convex density-dependent growth curve) where RMNPL will be > 0.5 r_{max} (see Figure 1 in Wade (1998)).

5.9. The maximum annual recruitment rate (r_{max}) is equivalent to $\lambda_{max} - 1$, therefore:

$$r_{max} = \lambda_{max} - 1$$

Where:
λ_{max} is the maximum discrete rate of population growth.

5.10. Niel and Lebreton (2005) show two methods for calculating λ_{max}:

A quadratic solution (equation 15 of Niel and Lebreton 2005) also used by Watts (2010):

$$\lambda_{max} \approx \frac{(s\alpha - s + \alpha + 1) + \sqrt{(s - s\alpha - \alpha - 1)^2 - 4s\alpha^2}}{2a}$$

And a relationship based on mean optimal generation length (equation 17 of Niel & Lebreton 2005):

$$\lambda_{max} = exp\left[\left(\alpha + \frac{s}{\lambda_{max} - s}\right)^{-1}\right]$$

Where: *s* is annual adult survival; *α* is age of first breeding.

5.11. Niel and Lebreton (2005) suggest that the second method is most suitable for short-lived species. A comparison of the results of both methods indicated that the first generated slightly more precautionary PBRs for the relatively long-lived species considered in this note. Consequently λ_{max} has been estimated using the first method (appropriate for all species, including Common Crane) below.

5.12. N_{min} is a conservative estimate of the population size which was suggested by Wade (1998) to be the lowest bound of a 60% confidence interval (Dillingham and Fletcher 2008). This correction has been applied to all reference populations for which PBR has been undertaken.

5.13. The recovery factor *f* is an arbitrary value set between 0.1 and 1.0 and its purpose is to increase conservatism in the calculation of PBR or to identify a value for PBR that is intended to achieve a specific outcome for nature conservation (e.g. population recovery). The recovery factor is reflecting the population trend: in a decreasing population additional mortality has much higher effects than in increasing populations and a removal of a lower number of birds would cause adverse impacts. The recovery factor is defined as 0.1=decreasing population, 0.5=stable population, 1=increasing population.

5.14. In support of Stage 2 PBR analysis of the Common Crane migratory flyway population (i.e. 84,000) birds provides further indication on whether SPAs should be carried forward to Stage 3. A critical component of this analysis is the investigation of the proportion the PBR value represents of the migratory population. This provides clear guidance as to whether any SPA population will be able to sustain more that 1% additional mortality in a given year.

Stage 3 - PBR assessment of individual SPAs

5.15. When required, the collision risk impact from Stage 2 of the assessment (i.e. that which has been apportioned to an SPA based on the contribution of the SPA population to the western Baltic flyway of Common Crane) is compared to the PBR value for an individual SPA (rather than the entire flyway population) with the recovery factor deemed appropriate (based on the flyway population trends of Common Crane).

6. Potential effects of the proposed development

Collision risk assessment of Common Cranes potentially interacting with Kriegers Flak OWF

Wind farm parameters & determination of worst case scenario

6.1. The size of the turbines to be used at Kriegers Flak OWF is yet to be determined with turbine capacities between 3 MW and 10 MW under consideration. In order to determine the worst case scenario in terms of collision risk for migrating birds at Kriegers Flak OWF, modelling was carried out for each turbine scenario (see DHI & Aarhus University, 2015). The turbine parameters used are shown in Table 6.1.

6.2. In terms of determining a worst case scenario, it is considered that the larger the rotor swept area the more risk of collision for birds passing through a wind farm. The outputs from the preliminary collision risk model indicated that, in terms of rotor swept area, the 4 MW turbine scenario represents the worst case for migratory Common Cranes. Establishment of additional turbines to each scenario can be allowed in order to ensure a sufficient power production even in periods when turbines are out of service due to repair. Based on the span of individual turbine capacity (from 3 MW to 10 MW) the wind farm will feature from 60 (+4) to 200 (+3) turbines. The consideration of these additional turbines will not alter the outcome of the assessment.

Table 6.1: Determination of the worst case scenario for flight risk window and rotor swept area for Kriegers Flak OWF (derived from DHI & Aarhus University, 2015).

Turbine Capacity (MW)	Rotor diameter (m)	Total height (m)	Hub height above MSL (m)	No. of turbines	Total Swept area (m)[5]
3	112	137	81	200	**1,970,400**
3.6	120	141.6	81.6	166	**1,920,500**
4	130	155	90	150	**1,995,000**
6	154	179	102	100	**1,860,000**
8	164	189	107	75	**1,584,300**
10	190	220	125	60	**1,704,000**

Determining the migratory population potentially interacting with Kriegers Flak OWF

6.3. As detailed in Section 3, an estimated autumn passage of 84,000 Common Cranes cross the western Baltic on a broad-front migration (DHI & Aarhus University 2014). DHI & Aarhus University (2015) assumed that the Common Crane during both spring and autumn migration would disperse throughout the Arkona Basin. In doing so, it was assumed Common Crane are using all parts of the corridor west of Bornholm equally and therefore only 13% are expected to cross Kriegers Flak OWF on average during autumn, which is equal to 10,920 Common Crane. The 13% corresponds to the proportional area occupied by the two wind farm lay-out areas of the Kriegers Flak OWF. Though not explicitly stated by DHI & Aarhus University (2015), the assumption is that 10,920 Common Cranes was also used as the number for cranes passing the Kriegers Flak OWF during spring migration.

[5] Multiple of swept area per turbine presented by DHI & Aarhus University 2015

6.4. The above mentioned assumptions are carried forward from DHI & Aarhus University (2015) into the following assessment. Therefore to inform further analysis, 10,920 Common Cranes will be used as precautionary number for cranes passing the Kriegers Flak OWF during both autumn and spring migration. This population figure represents 4.5% of the North-west Europe/Iberia & Morocco biogeographic population.

Flight height model

6.5. No or limited existing information was available that characterised the magnitude and flight altitude of Common Crane crossing the Arkona Basin each autumn and spring (DHI & Aarhus University, 2015). GPS tracking, radar and rangefinder data was therefore collected in 2013 from the FINO 2 platform, Falsterbo Rev Lighthouse and the coasts of eastern Denmark and southern Sweden. The collected data was analysed and fed into a flight altitude model developed for Kriegers Flak (DHI & Aarhus University, 2015) which coupled flight heights to weather parameters using Generalised Additive Mixed Models (GAMMs). This flight altitude model uses geographical position and altitude of birds to assess flight height at a given distance to the coast for both leaving and approaching it. This is combined with meteorological conditions (wind speed, air pressure, relative humidity, clearness and temperature) to assess the flight height in different conditions.

6.6. These initial collision models developed following acquisition of GPS tracking, radar and rangefinder data in 2013 indicated potentially high risks for Common Crane (DHI & Aarhus University, 2015). However, due to the lack of behavioural data on the response of migrating Common Crane to an offshore wind farm assessments of the actual collision risks involved were highly uncertain. DHI & Aarhus University (2015) therefore undertook supplementary investigations in spring 2015 of Common Crane responses at the Baltic 2 offshore wind farm located close by in the German part of Kriegers Flak. The behavioural records from spring 2015 formed the basis for the assessment of collision risks for Common Crane by DHI & Aarhus University (2015).

6.7. DHI & Aarhus University (2015) found that most Cranes arrive at Denmark and Sweden in the spring at altitude between 150 and 200 m. The flight height profile during spring apparently depended on wind direction, with birds descending during tail winds and ascending during head winds. Thus, the Cranes can use thermals drifting offshore to gain altitude at distances of up to 5 km from the coast. The samples affected by thermals were therefore removed from the data set used for the altitude models.

6.8. Steep descends are seen in both tail wind and head wind at increasing distance from the Swedish coast in autumn, the descent being slightly steeper in head winds. On average birds seem to cross the Arkona Basin at lower altitude during tail winds than head winds in autumn, but in westerly crosswind they tend to fly the highest. Despite these weather-induced variations in the collision risk, the behavioural investigations at the Baltic 2 offshore wind farm clearly indicated that the vast majority of Common Crane cross Kriegers Flak at altitudes between 50 and 200 m. There are though GPS track recordings of cranes flying at 400 m altitude at large distances from the coast (DHI & Aarhus University, 2015). According to the predictions of the flight models the Common Crane fly on average at rotor height of the 10 MW turbines but slightly above the 3 MW turbines during all wind conditions.

Migration direction, wind and weather influence

6.9. Common Crane migration over the Arkona Basin is thought to involve movement from Sweden to Rügen in the autumn and the other way in spring. There are thought slight differences in the path taken between the two seasons. In the spring they often pass in the western part near or over Falster, Møn and Sjælland. This is possible often due to the coinciding timing of the migration period and the “Easter

Eastern" (Påskeøsten). The latter is a prolonged period of strong easterly winds around Easter, often in March, due to the breakdown of winter high pressures over continental Europe while the equivalent high pressures over Scandinavia and Russia remains intact longer into the spring.

6.10. It is also likely that Common Cranes use a more westerly route (Figure 3.1) despite the wind direction in spring. This is supported by higher concentrations of cranes staging to the west in Germany. In the spring they tend to use the area of Darss 50 km to the west of Rügen, whereas in the autumn they stage in wetlands on Rügen (DHI & Aarhus University, 2015). In the autumn westerly winds are more prevalent therefore pressing the cranes more to the east and over Bornholm. This is also apparent from the data in www.DOFBasen.dk and observations in Sweden (NIRAS, 2015a), as the majority of cranes only reach Bornholm in winds from west, northwest, north and northeast. In other wind directions the cranes pass either over eastern Zealand (easterly winds) or fly directly across the sea to Rügen.

Avoidance rate

6.11. In order to estimate collision mortality using the Band Collision Risk Model (CRM) as used by DHI & Aarhus University (2015) for Kriegers Flak, a correction factor, termed an avoidance rate, has to be applied to overall collision risk values to account for the extent to which birds avoid turbines. This avoidance rate should be species-specific and take into account observed avoidance behaviour (e.g. SNH 2010). The avoidance rate of 0.69 was used by DHI & Aarhus University (2015) for Common Crane based on the results of the dedicated behavioural study at the Baltic 2 offshore wind farm in spring 2015 where a macro avoidance rate of 0.07 and a meso avoidance rate of 0.64 were recorded. A micro avoidance rate of 0.08 was assumed.

6.12. The Band CRM has been developed to estimate collisions of single flying birds, and does not take into account that for species which migrate in flocks, like Common Crane, it is unlikely that all individuals in the flock will die following collision with a rotor. In the absence of empirical data regarding the proportion of individuals likely to die in a collision event, DHI & Aarhus University (2015) applied a factor of 50 % to the collision estimates for Common Crane, meaning that the number of birds dying from the collision would be half the total number in any respective flock.

Collision Risk Modelling

6.13. Table 6.2 presents collision risk estimates at Kriegers Flak OWF for Common Crane as derived by DHI & Aarhus University (2015) using the Band 2012 CRM based on the assumption of single transits of the same individual. The model was applied using bird crossings of the 10 MW, 8 MW, 6 MW, 4 MW and 3 MW layouts. The number of collisions predicted for Common Crane, at an overall 69% avoidance rate, was predicted to be 296 collisions per annum using the worst case 4 MW turbine scenario. The predicted annual number of casualties for the remaining turbine types fall within this range of 216 (8 MW) and 296 (4 MW) at an overall 69% avoidance rate.

Table 6.2: Kriegers Flak offshore wind farm collision risk modelling results for Common Crane for 4 MW scenario.

Avoidance rate (%)	Collision estimate (birds per annum)
69	**296**
95	48
98	19
99	10

Avoidance rate (%)	Collision estimate (birds per annum)
99.8	2
99.99	0.1

Apportioning of predicted mortality to individual Natura 2000 sites

6.14. Table 6.3 presents Stage 1 of the apportioning assessment for those SPAs within the Baltic bioregion that are designated for migrating populations of Common Crane (Figure 4.1). A total of 296 collisions were estimated for Kriegers Flak alone with all of these collisions apportioned to each individual SPA population in Stage 1 of the apportioning assessment. The annual level of collision predicted for Kriegers Flak OWF is such that the impact surpasses the 1% threshold of all but one of the SPA populations, Vorpommersche Boddenlandschaft und nördlicher Strelasund. With the exception of the latter site, all SPAs are therefore taken forward to Stage 2 of the assessment.

Table 6.3: Stage 1 of the apportioning assessment for SPAs with predicted connectivity to Kriegers Flak Offshore Wind Farm. Those SPAs taken forward to Stage 2 of the assessment are shaded in blue.

SPA	SPA population (individuals)	1% SPA population (individuals)	Collision estimate (birds per annum)	Include in Stage 2 assessment (Y/N)
Araslövssjöområdet	500	5	296	Y
Bagna Rozwarowskie	520	5.2	296	Y
Binnenbodden von Rügen	3,000	30	296	Y
Bøtø Nor	13	0.13	296	Y
Dolina Dolnej Odry	17	0.17	296	Y
Egeside-Pulken-Yngsjön	7,000	70	296	Y
Fulltofta-Ringsjön	1,680	17	296	Y
Greifswalder Bodden und südlicher Strelasund	5,000	50	296	Y
Großes Landgrabental, Galenbecker und Putzarer See	4,300	43	296	Y
Hammarsjöområdet	1,500	15	296	Y
Jezioro Świdwie	1,500	15	296	Y
Kariner Land	1,000	10	296	Y
Klingavälsån	200	2	296	Y
Koblentzer See	2,100	21	296	Y
Kuppiges Tollensegebiet zwischen Rosenow und Penzlin	1,100	11	296	Y
Mecklenburgische Schweiz und Kummerower See	2,500	25	296	Y
Nebel und Warinsee	200	2	296	Y
Nordvorpommersche Waldlandschaft	4,500	45	296	Y
Ostoja Ińska	2,000	20	296	Y
Peenetallandschaft	5,500	55	296	Y
Recknitz- und Trebeltal mit	5,400	54	296	Y

SPA	SPA population (individuals)	1% SPA population (individuals)	Collision estimate (birds per annum)	Include in Stage 2 assessment (Y/N)
Seitentälern und Feldmark				
Schweriner Seen	**100**	**1**	**296**	**Y**
Sövdesjön	**100**	**1**	**296**	**Y**
Vorpommersche Boddenlandschaft und nördlicher Strelasund	70,000	700	296	N
Vramsåns mynningsområde	**250**	**2.5**	**296**	**Y**
Warnowtal, Sternberger Seen und untere Mildenitz	**50**	**0.5**	**296**	**Y**

6.15. Stage 2 of the apportioning assessment is presented in Table 6.4 and includes all 25 SPAs for which the 1% threshold of the SPA population was surpassed in Stage 1. Stage 2 apportions the collision impact from Kriegers Flak alone to all SPAs based on the contribution of each individual SPA population to the total SPA population. When the collision impact from Kriegers Flak alone is apportioned to each SPA (of the remaining 25 being assessed) based on the designated size of the respective SPA population, the resulting impact does not exceed the 1% threshold of any of the SPA populations assessed. As such no SPAs are further assessed as part of Stage 3.

Table 6.4: Stage 2 of the apportioning assessment for SPAs with predicted connectivity to Kriegers Flak Offshore Wind Farm.

SPA	SPA population (individuals)	1% SPA population (individuals)	SPA population as a proportion of the flyway population (%)	Estimated collision risk	Collision estimate (birds per annum) apportioned to SPA	Include in Stage 3 assessment (Y/N)
Araslövssjöområdet	500	5	0.60	296	1.76	N
Bagna Rozwarowskie	520	5.2	0.62	296	1.83	N
Binnenbodden von Rügen	3,000	30	3.57	296	10.57	N
Bøtø Nor	**13**	**0.13**	0.02	296	0.05	N
Dolina Dolnej Odry	17	0.17	0.02	296	0.06	N
Egeside-Pulken-Yngsjön	7,000	70	8.33	296	24.67	N
Fulltofta-Ringsjön	1,680	17	2.00	296	5.92	N
Greifswalder Bodden und südlicher Strelasund	5,000	50	5.95	296	17.62	N
Großes Landgrabental, Galenbecker und Putzarer See	4,300	43	5.12	296	15.15	N
Hammarsjöområdet	1,500	15	1.79	296	5.29	N
Jezioro Świdwie	1,500	15	1.79	296	5.29	N
Kariner Land	1,000	10	1.19	296	3.52	N

SPA	SPA population (individuals)	1% SPA population (individuals)	SPA population as a proportion of the flyway population (%)	Estimated collision risk	Collision estimate (birds per annum) apportioned to SPA	Include in Stage 3 assessment (Y/N)
Klingavälsån	200	2	0.24	296	0.70	N
Koblentzer See	2,100	21	2.50	296	7.40	N
Kuppiges Tollensegebiet zwischen Rosenow und Penzlin	1,100	11	1.31	296	3.88	N
Mecklenburgische Schweiz und Kummerower See	2,500	25	2.98	296	8.81	N
Nebel und Warinsee	200	2	0.24	296	0.70	N
Nordvorpommersche Waldlandschaft	4,500	45	5.36	296	15.86	N
Ostoja Ińska	2,000	20	2.38	296	7.05	N
Peenetallandschaft	5,500	55	6.55	296	19.38	N
Recknitz- und Trebeltal mit Seitentälern und Feldmark	5,400	54	6.43	296	19.03	N
Schweriner Seen	100	1	0.12	296	0.35	N
Sövdesjön	100	1	0.12	296	0.35	N
Vramsåns mynningsområde	250	2.5	0.30	296	0.88	N
Warnowtal, Sternberger Seen und untere Mildenitz	50	0.5	0.06	296	0.18	N

Integrity test of effects from Kriegers Flak OWF alone

6.16. The potential collision effects of Kriegers Flak OWF have been assessed alone (i.e. not in combination with other plans or projects). The estimated collision rates from Kriegers Flak OWF have been derived using a worst case scenario wind farm design and a CRM avoidance rate that is considered precautionary. Apportioning of predicted total mortality to each SPA in turn highlighted 25 of the 26 SPAs that surpass the coarse but precautionary 1% threshold.

6.17. Stage 2 of the assessment has highlighted that there is a negligible likelihood of an adverse effect on the Common Crane feature of the 25 SPA carried forward from stage 1 and are therefore screened out of the assessment.

6.18. It can therefore be concluded that there are no expected adverse effects on Natura 2000 sites integrity as a result of collision impacts on migratory Common Crane from Kriegers Flak OWF alone.

7. In-combination effects

Identification of projects considered in-combination

7.1. In-combination assessment requires other major relevant developments in the area to be considered for the potential to contribute to collision impacts on migratory Common Crane. Scoping of projects for inclusion within the in-combination assessment was based upon:

- Geographical location (i.e. projects that have been identified as being situated in the central Baltic within the dominant migratory flyway of Common Crane); and
- Consenting status (i.e. projects which are ahead of Kriegers Flak OWF in the consenting process).

7.2. A tiered approach to the consideration of plans and projects has been adopted, based upon the consenting stage at which each wind farm currently sits within the planning and consenting process. Therefore, the wind farm projects have been categorised into the following tiers:

- Tier 1- Projects operational or under construction;
- Tier 2- Projects with consent authorised; and
- Tier 3- Projects with planning application submitted and/or status uncertain.

7.3. This tiered approach provides a straightforward way of presenting the assessment with particular focus on the confidence that can be drawn from various mortality estimates. Where a project is in initial stages of planning, there may be some uncertainty over whether the Project will lead to consent and subsequent construction / operation of turbines. Furthermore, where no site specific ornithological data has been published lower levels of confidence can be drawn over final in-combination mortality estimates.

7.4. For the purposes of this assessment, collision estimates for Common Crane for projects included in Tiers 1 and 2 in-combination with Kriegers Flak OWF form the basis of the analysis. This effectively encompasses a 'building block' approach where Kriegers Flak OWF contributes to mortality estimated for projects lying ahead in the consenting process. Reference however, is also made to the implications of mortality predicted for projects in Tiers 1-3 in-combination with Kriegers Flak OWF.

7.5. All information regarding the geographical location and consenting status of projects was retrieved from the online 4C Offshore 'Offshore Wind Farms Database'[6] information resource. Following analysis of the project information within the central Baltic and the consideration of the in-combination scoping criteria, the final list of projects for inclusion within the in-combination assessment was established. The list of projects that have been included for assessment are presented within Table 7.1 and also Figure 7.1. It should be noted that Strom-Nord OWF is not listed as it wholly overlapped by the more recently consent submitted Ostseeschatz and Baltic Eagle OWF. Inclusion of all three sites would amount to double counting within the coverage of Strom-Nord OWF.

[6] http://www.4coffshore.com/offshorewind/

Table 7.1: Projects to be included for in-combination assessment and associated project information.

Consenting phase	Wind farm	Country	Assessment tier	Total planned MW	Total planned WTGs
Tier 1					
Operational	Baltic I	Germany	1	48.3	21
Under construction	Baltic II	Germany	1	288	80
Tier 2					
Consent authorised	Wikinger	Germany	2	350	70
Consent authorised	Arkona-Becken Sudost	Germany	2	385	60
Tier 3					
Status uncertain	Kreigers Flak II	Sweden	2	640	128
Status uncertain	Arcadis Ost 1	Germany	2	348	58
Consent submitted	Wikinger Nord	Germany	3	40	8
Consent submitted	Baltic Power	Germany	3	500	80
Consent submitted	Adlergrund 500	Germany	3	72	20
Consent submitted	Ostseeschatz	Germany	3	225	45
Consent submitted	Baltic Eagle	Germany	3	415	83
Consent submitted	Ostseeperle	Germany	3	245	35
Consent submitted	Bornholm	Denmark	3	50	16

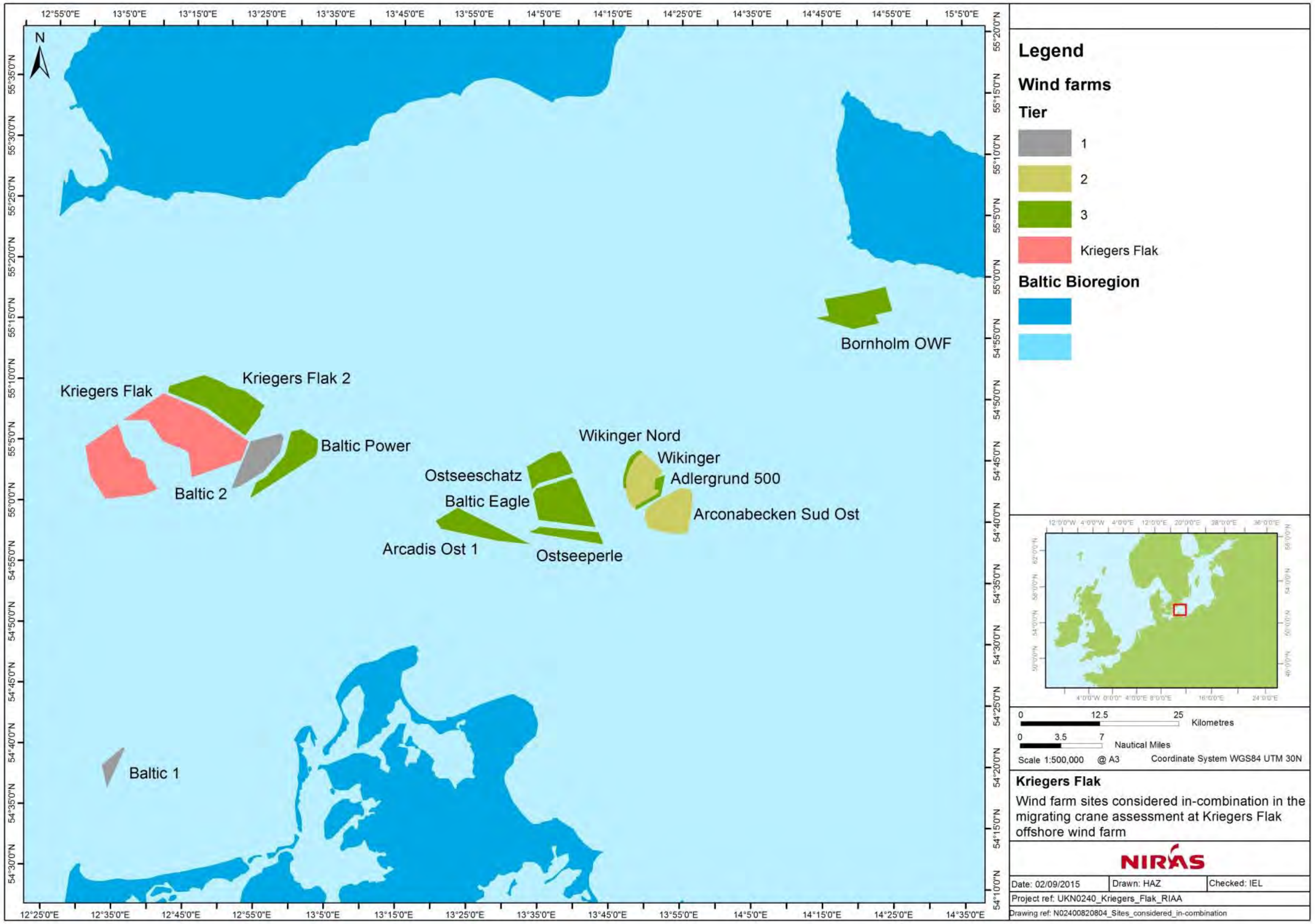

Figure 7.1: Planned and consented Baltic wind farm projects considered within the in-combination assessment.

In-combination collision risk assessment of Common Crane

7.6. It was not possible to source baseline ornithological data that infers risks to migratory Common Crane for the projects listed for inclusion within in-combination assessment (Table 7.1). As no project-alone assessments are available to inform this in-combination assessment, collision mortality for these projects has been calculated specifically for the purposes of this assessment.

7.7. Predicted collisions mortality data is available, however, for Bornholm OWF (NIRAS, 2015a) and Kriegers Flak OWF (DHI & Aarhus University, 2015) in respect of migratory Common Crane. This collision data has therefore been used as a proxy to inform the calculation of collision risk at the other projects outlined within Table 7.1, the results of which are presented in Table 7.3. The two exceptions are Baltic I and Baltic II wind farms for which the combined collision mortality estimates provided by DHI & Aarhus University (2015) is used in the current assessment.

7.8. For Kriegers Flak OWF, it was established that the 4 MW scenario (i.e. 150 x 4 MW WTGs) was the worst case layout scenario (DHI & Aarhus University, 2015) in respect of collision risk to migrating Common Cranes, resulting in a collision mortality of 296 birds per annum at 69% avoidance, and therefore this has also been used within this assessment (Table 7.2). With regard to Bornholm OWF, it was established that the 3 MW scenario (i.e. 16 x 3 MW WTGs) was the worst case layout scenario (NIRAS, 2015a) in respect of collision risk to migrating Common Cranes, resulting in a collision mortality of 0.14 birds per annum at 95% avoidance. This equates to 0.868 birds per annum when using the avoidance rate of 69%, and therefore this has been used within this assessment (Table 7.2).

7.9. The number of collisions per megawatt (MW) was calculated for both Kriegers Flak and Bornholm respectively, using the worst case scenario turbine layout and an avoidance rate of 69%. This provides a convenient metric to be applied to other projects in order to provide indicative quantitative in-combination analysis.

7.10. The estimate of collision mortality per MW applied to the projects listed within Table 7.1, was determined by whether a project was considered to be positioned within the migratory pathway extending from Rügen-Bock Kirr-region eastwards to Bornholm OWF (as indicted in Figure 3.1) or northwards to southern Sweden, the area in which Kriegers Flak OWF lies (i.e. the central Baltic projects for which Common Crane CRM outputs are available). For those four sites within the vicinity of the pathway to Bornholm, the total number of planned MWs (generating capacity) for each of the respective sites was multiplied by the number of collisions per MW for Bornholm (Table 7.2). Those four sites were Wikinger, Wikinger Nord, Arkona-Becken Sudost and Adlergrund 500. For the remaining projects listed within Table 7.1, the total number of planned MWs for each of the respective sites was multiplied by the number of collisions per MW for Kriegers Flak (Table 7.2). This differentiation in the treatment of other projects on the basis of their position in relation to Kriegers Flak and Bornholm OWFs was considered to best reflect the likely interaction between project and the numbers of migrating Common Cranes. This provides project-specific collision mortality per annum estimates for these projects, the results of which are presented in Table 7.3.

Table 7.2: Calculation of mean collisions per MW value for Kriegers Flak OWF and Bornholm OWF.

Offshore Windfarm	Generating capacity (MW)	Collision estimate (birds per annum) (per annum at 69% avoidance rate)	Mean number of collisions per MW per annum
Kriegers Flak – Project alone *	600	296	0.493
Bornholm – Project alone **	48	0.868	0.018

* Values derived from DHI & Aarhus University (2015)

**Values derived from NIRAS (2015b)

Table 7.3: In-combination collision mortality per annum: total mortality presented by Project, individual tiers and tiers cumulatively.

Assessment tier	Wind farm	Total planned MW	Collision estimate (birds per annum) *
1	Baltic I	48.3	150
1	Baltic II	288	
Tier 1 total			**150**
2	Wikinger	350	6
2	Arkona-Becken Sudost	385	7
Tier 2			**13**
Tiers 1 + 2 combined + Kriegers Flak			**459**
3	Kreigers Flak II	640	316
3	Arcadis Ost 1	348	172
3	Wikinger Nord	40	1
3	Baltic Power	500	247
3	Adlergrund 500	72	1
3	Ostseeschatz	225	111
3	Baltic Eagle	415	205
3	Ostseeperle	245	121
3	Bornholm	48	0.868
Tier 3			**1174**
Tiers 1 + 2 + 3 combined + Kriegers Flak			**1,633**

*Numbers rounded to nearest whole number

Apportioning of mortality to individual Natura 2000 sites

7.11. Two scenarios have been used to assess the in-combination collision impact on those SPAs identified in Figure 7.1. Table 7.4 presents these scenarios and includes the projects in each scenario and the total in-combination collision risk estimates used in the in-combination assessment. Scenario 1 incorporates the collision risk estimates for all projects that are currently operational and those that have consent authorised together with Kriegers Flak OWF, resulting in a total of 459 collisions per annum. Scenario 2 incorporates all projects including those that are operational, those that have consent authorised and those for which a planning application has been submitted, resulting in a total of 1,633 collisions per annum.

Table 7.4: In-combination collision risk scenarios used in the in-combination apportioning assessment

Tier	Project	Scenario 1 Collision estimate (birds per annum)	Scenario 2 Collision estimate (birds per annum)
1	Baltic I	150	150
1	Baltic II		
2	Arkona-Becken Sudost	7	7
	Wikinger	6	6
3	Arcadis Ost 1		172
	Kriegers Flak II		316
	Adlergrund 500		1
	Baltic Eagle		205
	Baltic Power		247
	Ostseeperle		121
	Ostseeschatz		111
	Wikinger Nord		1
Other projects	Kriegers Flak	296	296
	Bornholm		0.87
Totals		459	1,633

7.12. Table 7.5 presents Stage 1 of the apportioning assessment for those SPAs within the west-central Baltic bioregion that are designated for migrating populations of Common Crane (Figure 4.1). This assessment incorporates both scenarios outlined in Table 7.4. For both scenarios, the 1% threshold of all SPA populations is surpassed. Therefore all remaining 26 SPAs are taken forward to Stage 2 of the in-combination apportioning assessment.

Table 7.5: Stage 1 of the apportioning assessment for SPAs with predicted connectivity to Kriegers Flak OWF in-combination with for other plans/projects.

SPA	SPA population (individuals)	1% SPA population (individuals)	Collision estimate (birds per annum)		Include in Stage 2 assessment (Y/N)	
			Scenario 1	Scenario 2	Scenario 1	Scenario 2
Araslövssjöområdet	500	5	459	1,633	Y	Y
Bagna Rozwarowskie	520	5.2	459	1,633	Y	Y
Binnenbodden von Rügen	3,000	30	459	1,633	Y	Y
Bøtø Nor	13	0.13	459	1,633	Y	Y
Dolina Dolnej Odry	17	0.17	459	1,633	Y	Y
Egeside-Pulken-Yngsjön	7,000	70	459	1,633	Y	Y
Fulltofta-Ringsjön	1,680	17	459	1,633	Y	Y
Greifswalder Bodden und südlicher Strelasund	5,000	50	459	1,633	Y	Y
Großes Landgrabental, Galenbecker und Putzarer See	4,300	43	459	1,633	Y	Y
Hammarsjöområdet	1,500	15	459	1,633	Y	Y
Jezioro Świdwie	1,500	15	459	1,633	Y	Y
Kariner Land	1,000	10	459	1,633	Y	Y
Klingavälsån	200	2	459	1,633	Y	Y
Koblentzer See	2,100	21	459	1,633	Y	Y
Kuppiges Tollensegebiet zwischen Rosenow und Penzlin	1,100	11	459	1,633	Y	Y
Mecklenburgische Schweiz und Kummerower See	2,500	25	459	1,633	Y	Y
Nebel und Warinsee	200	2	459	1,633	Y	Y
Nordvorpommersche Waldlandschaft	4,500	45	459	1,633	Y	Y
Ostoja Ińska	2,000	20	459	1,633	Y	Y
Peenetallandschaft	5,500	55	459	1,633	Y	Y

SPA	SPA population (individuals)	1% SPA population (individuals)	Collision estimate (birds per annum)		Include in Stage 2 assessment (Y/N)	
Recknitz- und Trebeltal mit Seitentälern und Feldmark	5,400	54	459	1,633	Y	Y
Schweriner Seen	100	1	459	1,633	Y	Y
Sövdesjön	100	1	459	1,633	Y	Y
Vorpommersche Boddenlandschaft und nördlicher Strelasund	70,000	700	459	1,633	N	Y
Vramsåns mynningsområde	250	2.5	459	1,633	Y	Y
Warnowtal, Sternberger Seen und untere Mildenitz	50	0.5	459	1,633	Y	Y

7.13. Stage 2 of the apportioning assessment is presented in Table 7.6 incorporating those SPAs for which the 1% population threshold was exceeded in Stage 1. Stage 2 apportions the in-combination collision impact to all SPAs based on the contribution of each individual SPA population to the total flyway population. When the in-combination collision impact is apportioned to each of the 26 SPAs based on the size of the SPA population, the resulting impact does not exceed the 1% threshold of the SPA population for Scenario 1 but does so for Scenario 2 for all SPAs. As such, all 26 SPAs to are carried forward to Stage 3 of the assessment with respect to Scenario 2.

Table 7.6: Stage 2 of the apportioning assessment for SPAs with predicted connectivity to Kriegers Flak Offshore Wind Farm in-combination with other plans/projects.

SPA	SPA population (individuals)	1% SPA population (individuals)	SPA population as a proportion of the flyway population (%)	Collision estimate (birds per annum)		Collision risk apportioned to SPA		Include in Stage 3 assessment (Y/N)	
				Scenario 1	Scenario 2	Scenario 1	Scenario 2	Scenario 1	Scenario 2
Araslövssjöområdet	500	5.00	0.60	459	1,633	3	10	N	Y
Bagna Rozwarowskie	520	5.20	0.62	459	1,633	3	10	N	Y
Binnenbodden von Rügen	3,000	30.00	3.57	459	1,633	16	58	N	Y
Bøtø Nor	13	0.13	0.02	459	1,633	0.07	0.25	N	Y
Dolina Dolnej Odry	17	0.17	0.02	459	1,633	0.09	0.33	N	Y
Egeside-Pulken-Yngsjön	7,000	70.00	8.33	459	1,633	38	136	N	Y
Fulltofta-Ringsjön	1,680	16.80	2.00	459	1,633	9	33	N	Y
Greifswalder Bodden und südlicher Strelasund	5,000	50.00	5.95	459	1,633	27	97	N	Y
Großes Landgrabental, Galenbecker und Putzarer See	4,300	43.00	5.12	459	1,633	24	84	N	Y
Hammarsjöområdet	1,500	15.00	1.79	459	1,633	8	29	N	Y
Jezioro Świdwie	1,500	15.00	1.79	459	1,633	8	29	N	Y
Kariner Land	1,000	10.00	1.19	459	1,633	5	19	N	Y
Klingavälsån	200	2.00	0.24	459	1,633	1	4	N	Y
Koblentzer See	2,100	21.00	2.50	459	1,633	11	41	N	Y
Kuppiges Tollensegebiet zwischen Rosenow und Penzlin	1,100	11.00	1.31	459	1,633	6	21	N	Y
Mecklenburgische Schweiz und Kummerower See	2,500	25.00	2.98	459	1,633	14	49	N	Y
Nebel und Warinsee	200	2.00	0.24	459	1,633	1	4	N	Y
Nordvorpommersche Waldlandschaft	4,500	45.00	5.36	459	1,633	25	87	N	Y
Ostoja Ińska	2,000	20.00	2.38	459	1,633	11	39	N	Y
Peenetallandschaft	5,500	55.00	6.55	459	1,633	30	107	N	Y

SPA	SPA population (individuals)	1% SPA population (individuals)	SPA population as a proportion of the flyway	Collision estimate (birds per annum)		Collision risk apportioned to SPA		Include in Stage 3 assessment (Y/N)	
Recknitz- und Trebeltal mit Seitentälern und Feldmark	5,400	54.00	6.43	459	1,633	30	105	N	Y
Schweriner Seen	100	1.00	0.12	459	1,633	0.55	2	N	Y
Sövdesjön	100	1.00	0.12	459	1,633	0.55	2	N	Y
Vorpommersche Boddenlandschaft und nördlicher Strelasund	70,000	700	58.32		1,633		1361		Y
Vramsåns mynningsområde	250	2.50	0.30	459	1,633	1	5	N	Y
Warnowtal, Sternberger Seen und untere Mildenitz	50	0.50	0.06	459	1,633	0.27	0.97	N	Y

7.14. To progress with Stage 3 of the assessment, a PBR analysis has been conducted for the western Baltic flyway population of Common Crane to determine if there is an in-combination impact on this population (Table 7.7) presents the PBR for this population which consists of 84,000 individuals (N_{min} = 77,217). The western Baltic migratory flyway population of Common Crane is currently experiencing a moderate increase in terms of population size. As such, a recovery factor of 0.5 is considered the minimum appropriate for this population giving a PBR value of 2,413 individuals.

Table 7.7: Potential Biological Removal for the western Baltic flyway population of Common Crane

Species	Population size (N_{min})	Age of first breeding (α)	Annual adult survival (s)	Growth rate (λ_{max})	Population trend	Recovery factors		
						Rf = 0.1	Rf = 0.5	Rf = 1.0
Common Crane	77,217	4	0.9	1.125	Moderate increase	483	**2,413**	4,826

7.15. Stage 3 of the apportioning assessment is presented in Table 7.8 incorporating those SPAs for which the 1% population threshold was exceeded in Stage 2 (applies only to Scenario 2 where projects in all tiers are considered). The assessment expands upon the PBR calculation for the entire flyway population of common crane as presented in Table 7.7 and provides a PBR calculation for each SPA (again at Rf = 0.5). Apportioned collision risk estimates are then compared to these PBR values to determine LSE.

Table 7.8: Stage 3 of the apportioning assessment for SPAs with predicted connectivity to Kriegers Flak OWF in-combination with for other plans/projects.

SPA	SPA population (individuals)	SPA population as a proportion of the flyway population (%)	Collision risk (birds / annum)	Collision risk apportioned to SPA population	PBR at Rf = 0.5	LSE (Y/N)
			Scenario 2	Scenario 2	Scenario 2	Scenario 2
Araslövssjöområdet	500	0.60	1,633	10	14.36	N
Bagna Rozwarowskie	520	0.62	1,633	10	14.94	N
Binnenbodden von Rügen	3,000	3.57	1,633	58	86.18	N
Bøtø Nor	13	0.02	1,633	0.25	0.37	N
Dolina Dolnej Odry	17	0.02	1,633	0.33	0.49	N
Egeside-Pulken-Yngsjön	7,000	8.33	1,633	136	201.09	N
Fulltofta-Ringsjön	1,680	2.00	1,633	33	48.26	N
Greifswalder Bodden und südlicher	5,000	5.95	1,633	97	143.63	N

SPA	SPA population (individuals)	SPA population as a proportion of the flyway population (%)	Collision risk (birds / annum)	Collision risk apportioned to SPA population	PBR at Rf = 0.5	LSE (Y/N)
Strelasund						
Großes Landgrabental, Galenbecker und Putzarer See	4,300	5.12	1,633	84	123.52	N
Hammarsjöområdet	1,500	1.79	1,633	29	43.09	N
Jezioro Świdwie	1,500	1.79	1,633	29	43.09	N
Kariner Land	1,000	1.19	1,633	19	28.73	N
Klingavälsån	200	0.24	1,633	4	5.75	N
Koblentzer See	2,100	2.50	1,633	41	60.33	N
Kuppiges Tollensegebiet zwischen Rosenow und Penzlin	1,100	1.31	1,633	21	31.6	N
Mecklenburgische Schweiz und Kummerower See	2,500	2.98	1,633	49	71.82	N
Nebel und Warinsee	200	0.24	1,633	4	5.75	N
Nordvorpommersche Waldlandschaft	4,500	5.36	1,633	87	129.27	N
Ostoja Ińska	2,000	2.38	1,633	39	57.45	N
Peenetallandschaft	5,500	6.55	1,633	107	158	N
Recknitz- und Trebeltal mit Seitentälern und Feldmark	5,400	6.43	1,633	105	155.12	N
Schweriner Seen	100	0.12	1,633	2	2.87	N
Sövdesjön	100	0.12	1,633	2	2.87	N
Vorpommersche Boddenlandschaft und nördlicher Strelasund	70,000	58.319	1,633	1361	2010.85	N
Vramsåns mynningsområde	250	0.30	1,633	5	7.18	N

SPA	SPA population (individuals)	SPA population as a proportion of the flyway population (%)	Collision risk (birds / annum)	Collision risk apportioned to SPA population	PBR at Rf = 0.5	LSE (Y/N)
Warnowtal, Sternberger Seen und untere Mildenitz	50	0.06	1,633	0.97	1.44	N

7.16. When compared to the PBR values Rf = 0.5 no apportioned collision estimates for common crane breach these thresholds for any SPA. Apportioned collision rates for each SPA vary slightly but in general represent an approximate RF of c. 0.3 – 0.35. Therefore, no LSE is predicted for the current stable to increasing flyway population of common crane for any SPA designated for the species. For an LSE to be concluded for a given SPA either/or collision estimates would need to be c 50% higher than predicted or the population trend would need to show a notable decline (see section below).

Assessment of impacts on the flyway population of Common Crane

7.17. The western Baltic migratory flyway population of Common Crane is currently experiencing a moderate increase in terms of population size. As such, a recovery factor of 0.5 is considered the minimum appropriate for this population giving a PBR value of 2,413 individuals the derivation of which is presented in the previous section (paragraph 7.4).

7.18. The PBR value of 2,413 individuals represents 2.87% of the western Baltic flyway population of 84,000 Common Crane. It is therefore considered very unlikely that any SPA population designated for migratory Common Crane will suffer unsustainable mortality. This supports the conclusions as given above that no SPAs are considered to be subject to LSE in Stage 3 of the assessment.

7.19. With respect to an assessment using PBR on the entire flyway population, the estimated total in-combination collision impact using Scenario 1 is 459 individuals. A total mortality of 459 individuals represents an equivalent Rf value of 0.1, considerably below the Rf considered appropriate for this population. The total mortality using Scenario 1 also remains within sustainable limits if a lower recovery factor is considered for the flyway population.

7.20. Using Scenario 2, the estimated total in-combination impact is 1,633 individuals. This level of estimated mortality represents an equivalent Rf value of 0.34, below the Rf considered appropriate for this population. The total mortality calculated for Scenario 2 also remains within sustainable limits if a lower recovery factor is considered for the flyway population.

Integrity test of effects of projects considered in-combination

7.21. The potential collision effects of Kriegers Flak OWF have been assessed in-combination with other plans or projects. When applying scenario 2, the SPAs considered were carried forward to Stage 3 of the assessment (i.e. considering projects in all tiers). When considering Scenario 1 (tiers 1-2) 1% thresholds are not surpassed for the SPAs considered.

7.22. Stage 3 of the in-combination assessment was therefore aapplied to Scenario 2. This involved an apportioning approach based on the total migratory Common Crane flyway and concluded that PBR thresholds at Rf =0.5 are not surpassed for the SPAs considered.

7.23. It can therefore be concluded that based on the methodology applied that for scenario 1, considered the most appropriate analysis of projects considered in-combination, no adverse effects on Natura 2000 site integrity as a result of collision impacts on migratory Common Crane from Krieger's Flak OWF are expected. This conclusion is also reached when considereing scenario 2 when comparing against given PBR values (stage 3 of the assessment).

8. Conclusions

8.1. It is concluded that no adverse effects on any Natura 2000 site integrity as a result of collision impacts on migratory Common Crane from Kriegers Flak OWF either alone or in-combination with other projects are expected.

8.2. The calculated PBR value of 2,413 individuals represents 2.87% of the western Baltic flyway population of 84,000 Common Crane. It is therefore considered very unlikely that any SPA population designated for migratory Common Crane will suffer unsustainable mortality. This supports the conclusions as given above that no SPAs are carried forward to Stage 3 of the assessment when considering collision estimates from Kriegers Flak alone.

8.3. Kriegers Flak OWF contributes a proportion of estimated in combination estimated Common Crane mortality (64.5% of Scenario 1 or 18.1% of Scenario 2 totals). All 26 SPAs considered were carried forward to Stage 3 of the assessment with respect to Scenario 2 only (i.e. considering projects in all tiers). When considering Scenario 1 (tiers 1-2) 1% thresholds are not surpassed for any given SPA in Stage 2. Stage 3 applies an apportioning approach based on the total migratory Common Crane flyway and concludes that PBR thresholds at Rf =0.5 are not surpassed for any SPA under scenario 2.

8.4. Considering these conclusions with respect to Kriegers Flak OWF, no consideration of alternative options for the Project or application of mitigation is deemed to be necessary.

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