

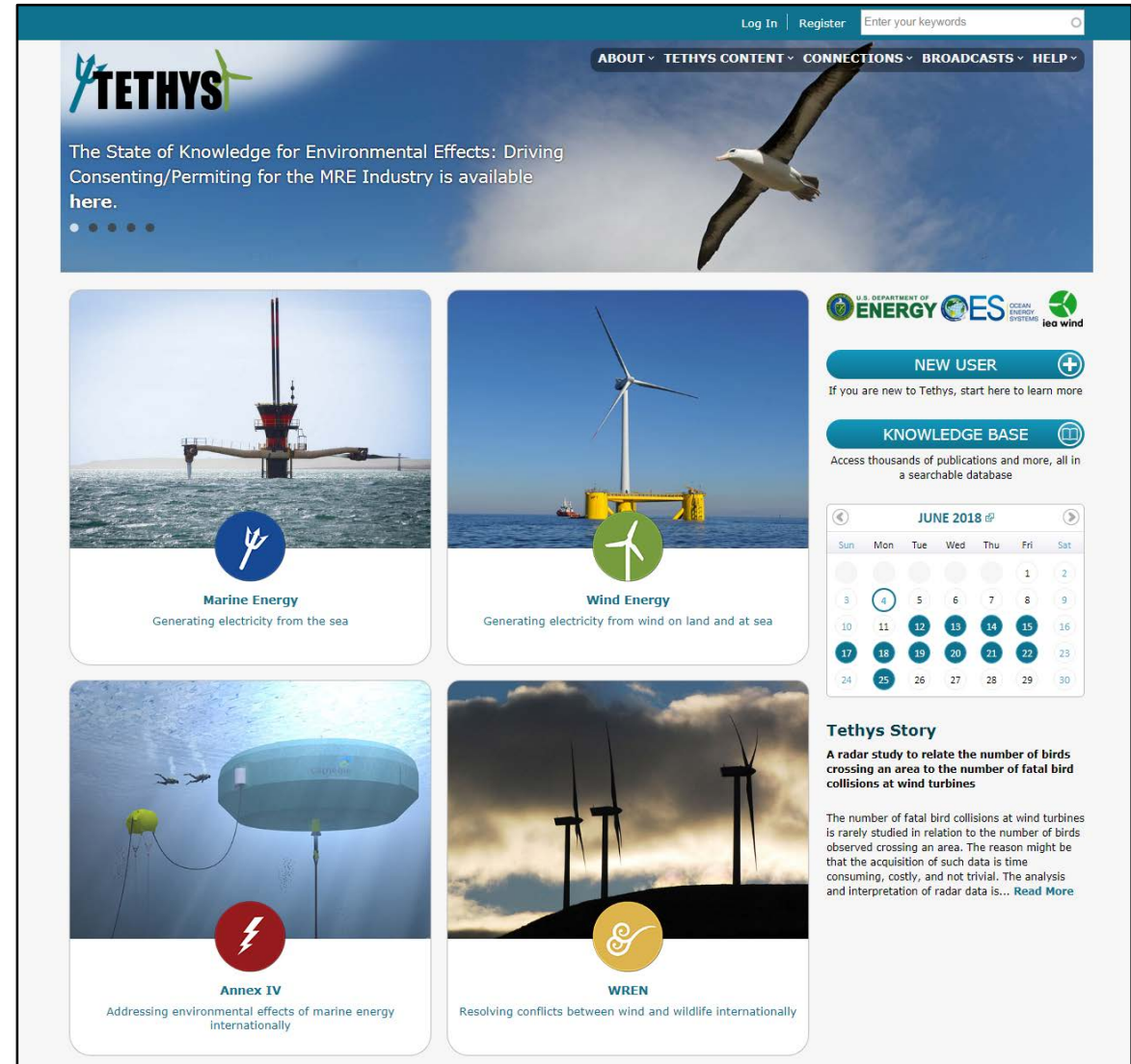
Tethys - Knowledge in Support of Wind Energy Development



Jonathan Whiting*, Andrea Copping, Mikaela Freeman, Alicia Gorton, Amy Woodbury
Pacific Northwest National Laboratory

Webinar Outline

- ▶ Purpose of *Tethys*
- ▶ Timeline of *Tethys* Development
- ▶ *Tethys* Content
- ▶ WREN International Collaboration
- ▶ *Tethys* Walkthrough
- ▶ Join the *Tethys* community



The screenshot shows the Tethys website homepage. At the top, there is a navigation bar with "Log In", "Register", and a search box. The main header features the Tethys logo and a banner with the text: "The State of Knowledge for Environmental Effects: Driving Consenting/Permitting for the MRE Industry is available here." Below the banner are four featured content cards: "Marine Energy" (Generating electricity from the sea), "Wind Energy" (Generating electricity from wind on land and at sea), "Annex IV" (Addressing environmental effects of marine energy internationally), and "WREN" (Resolving conflicts between wind and wildlife internationally). On the right side, there are links for "NEW USER" and "KNOWLEDGE BASE", a calendar for June 2018, and a "Tethys Story" section with a link to "Read More".

Log In Register Enter your keywords

TETHYS

ABOUT TETHYS CONTENT CONNECTIONS BROADCASTS HELP

The State of Knowledge for Environmental Effects: Driving Consenting/Permitting for the MRE Industry is available here.

U.S. DEPARTMENT OF ENERGY EES OCEAN ENERGY SYSTEMS IEO WIND

NEW USER +
If you are new to Tethys, start here to learn more

KNOWLEDGE BASE ⓘ
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JUNE 2018

Sun	Mon	Tue	Wed	Thu	Fri	Sat
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30

Tethys Story

A radar study to relate the number of birds crossing an area to the number of fatal bird collisions at wind turbines

The number of fatal bird collisions at wind turbines is rarely studied in relation to the number of birds observed crossing an area. The reason might be that the acquisition of such data is time consuming, costly, and not trivial. The analysis and interpretation of radar data is... [Read More](#)

***Tethys* is an online interactive Knowledge Management System**

<https://tethys.pnnl.gov>

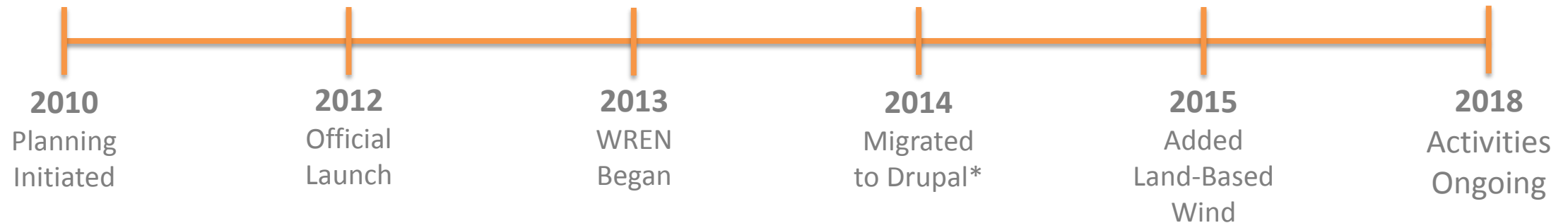
Purpose: To advance the wind energy and marine renewable energy industries by providing information on potential environmental effects to help inform permitting processes.



Timeline of *Tethys* Development

▶ *Tethys* Knowledge Management System

- Developed and managed by Pacific Northwest National Laboratory
- Funded by the US Department of Energy
- Last year had 145,000 visits from 190 countries viewing 580,000 pages

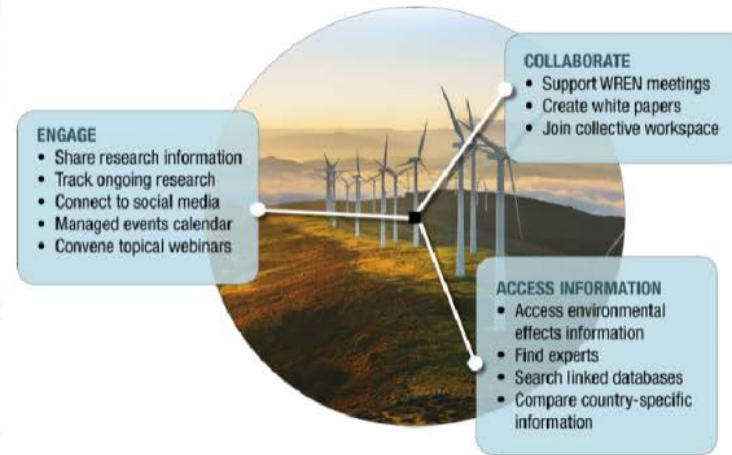


*Drupal is a flexible, open-source framework used by over a million websites

- ▶ **Tethys contains information on the environmental effects of wind energy**
 - 4000+ scientific papers, reports, and other publications (over 2600 relevant to wind)
 - Recordings of 16 environmental wind webinars
 - Calendar information for international events
 - Listing of 1300 organizations involved in environmental research
 - Links to 22 related wind energy databases



WREN (also known as Task 34)



- ▶ International Collaboration established by the IEA Wind Committee
 - 12 countries (Belgium, Canada, France, Ireland, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom, United States)
 - United States is the operating agent
 - Addresses environmental effects of land-based and offshore wind energy
 - Activities hosted on *Tethys* (<https://tethys.pnnl.gov/about-wren>)

- ▶ Developing White Papers
 - Adaptive Management
 - Cumulative Effects Assessment
 - Individual to Populations
 - Green vs. Green
 - Risk-Based Environmental Management
- ▶ Writing Short Science Summaries
 - Harbor porpoises and offshore wind
 - Others under development
- ▶ Hosting webinars
 - Reconstruction after Decommissioning
 - Smart Curtailment
 - Research Programs for Offshore Wind
 - BOEM's RODEO Study
- ▶ Hosting international workshops and seminars
 - Strategies and Concepts for Managing Wind and Wildlife Challenges, Estoril Portugal 2017
 - WREN Seminar, Dublin Ireland 2016

WREN SHORT SCIENCE SUMMARY
WORKING TOGETHER TO RESOLVE ENVIRONMENTAL EFFECTS OF WIND ENERGY

Harbor Porpoises and Offshore Wind Energy

The science associated with understanding and managing the effects of offshore wind energy on Harbor porpoise populations is introduced below.

THE SPECIES
Harbor porpoises (*Phocoena phocoena*) are a small and abundant cetacean species. Found throughout the temperate and subarctic waters of the northern hemisphere, they prefer shallow, coastal waters, and feed near the bottom on small fish, squid, and crustaceans. The population status worldwide is not of concern. Repeat surveys during the last two decades of the relatively coastal North Sea population off Western Europe suggest that this local population is healthy. The status of populations on the east and west coasts of Canada and the United States are largely unknown.

THE MECHANISM OF SPECIES RISK FROM WIND ENERGY
Most concerns about offshore wind energy and Harbor porpoises are associated with construction activities, particularly if pile driving is required to install turbine foundations. These loud impulsive sounds may affect an individual's survival and reproduction with the significance of the effect likely to vary according to the importance of the area. For example, animals may respond differently in important feeding areas than in other areas. These effects on individuals could lead to impacts at the population level. Studies have demonstrated that species abundance typically returns to previous levels soon after pile driving ceases. Some studies have recorded either long-term reductions or increases in abundance once a wind farm has begun operation. However, confidence in all these results is often low owing to the challenges of distinguishing between natural variability and the wind farm effect.



<https://tethys.pnnl.gov>

Rotating announcements to highlight notable products and events.

Quickly learn more about the international WREN collaboration or wind energy

The screenshot shows the Tethys website homepage. At the top, there is a navigation bar with 'ABOUT', 'TETHYS CONTENT', 'CONNECTIONS', 'BROADCASTS', and 'HELP'. A search bar is located in the top right corner. Below the navigation bar, there is a featured announcement box with a red border containing text about a WREN Environmental Webinar. The main content area is divided into four sections: 'Marine Energy' (Generating electricity from the sea), 'Wind Energy' (Generating electricity from wind on land and at sea), 'Annex IV' (Addressing environmental effects of marine energy internationally), and 'WREN' (Resolving conflicts between wind and wildlife internationally). To the right of these sections, there are buttons for 'NEW USER' and 'KNOWLEDGE BASE', and a small calendar for June 2018. Below the calendar is a 'Tethys Story' section with a red border, containing text about a radar study on bird collisions at wind turbines. At the bottom of the page, there is a contact form with fields for Name, Email, and Comment, a checkbox for 'I agree to the terms & conditions', a 'Submit' button, and a CAPTCHA widget. The footer includes social media icons for Facebook and Twitter, and logos for the U.S. Department of Energy, EES, and IEA Wind.

Quickly locate content with a keyword search, anytime

Small events calendar that provides more information when hovering over highlighted dates

Tethys stories are written by members of the community and are highlighted here.

Easily contact the Tethys team about anything

Home » Tethys Content » Search Knowledge Base

Search Knowledge Base

Title	Author*	Date**	Type of Content	Technology Type	Stressor	Receptor
Trends of Harbour Porpoise (<i>Phocoena phocoena</i>) Density in the Southern North Sea	Pesch					
A Methodology for Multi-Criteria Design of Multi-Use Offshore Platforms for Marine Renewable Energy Harvesting	Zanus					
Approaching Population Viability in Presence of Uncertainty: Assessing Displacement of Seabirds from Offshore Wind Farms	Buys					
Avian Collision Risk Models for Wind Energy Impact Assessments	Mas					
Valuation of Ecological and Amenity Impacts of an Offshore Windfarm as a Factor in Marine Planning	Börger, T., Hooper, T., Austen, M.	December 2015	Journal Article	Offshore Wind	N/A	Ecosystem, Socio-economics
Energy Systems and their Impacts on Marine Ecosystem Services	Papathanasopoulou, E., et al.	December 2015	Journal Article	Offshore Wind	N/A	Ecosystem
Influence of Concrete Mix Design on CO2 Emissions for Large Wind Turbine Foundations	Berndt, M.	November 2015	Journal Article	Offshore Wind	N/A	Socio-economics
Acoustic Indices for Biodiversity Assessments: Analyses of Bias Based on Simulated Bird Assemblages and	Gasc, R., et al.	November 2015	Journal Article	N/A	N/A	Birds, Ecosystem

Please select which content you are interested in viewing.

- Marine Energy Content
- Wind Energy Content
- All Content

Current search
Search found 2620 items

Targeted Search

Search All Fields

Choose an option to select a specific text field in which to search. Search finds items containing the exact terms entered, in any order. Phrases can be searched using quotations.

Search All

Enter terms to search for in all text fields.

- Technology Type ▾
- Offshore Wind (893)
 - Land-Based Wind (506)
 - Tidal (356)
 - MHC general (308)
 - Wave (290)
 - In-Stream (48)
 - GTEC (39)
 - Ocean Current (14)

Division of content to cater to technology type preferences.



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Access thousands of publications and more, all in a searchable database



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Home » Knowledge Base

Knowledge Base

You are currently viewing: **Wind Energy Content**

The Knowledge Base provides access to information about the environmental effects of marine and wind energy, supporting **Annex IV** and **WREN** initiatives. Relevant documents and Annex IV metadata forms are compiled into a user-friendly table with **advanced filtering**. Filters may be selected on the right, or keywords entered in the Search Text box. Content may also be sorted alphabetically by clicking on column headers. More entries will load as you scroll down.

As an alternative to the Knowledge Base, check out the **Map Viewer** to access geotagged content in a spatial view.

Title	Author*	Date**	Type of Content	Technology Types	Stressors	Receptors
Automated monitoring for birds in flight: Proof of concept with eagles at a wind power facility	McClure, C., Marinson, L., Allison, T.	August 2018	Journal Article	Wind Energy general, Land-Based Wind	N/A	Birds, Raptors
Site Selection for Offshore Wind Farms in the Southwest Coast of South Korea	Kim, C., Jang, S., Kim, T.	May 2018	Journal Article	Wind Energy general, Offshore Wind	N/A	N/A
The utility of point count surveys to predict wildlife interactions with wind energy facilities: An example focused on golden eagles	Sur, M., et al.	May 2018	Journal Article	Wind Energy general, Land-Based Wind	N/A	Birds, Raptors
Flight Response to Spatial and Temporal Correlates Informs Risk from Wind Turbines to the California Condor	Poessel, S., et al.	May 2018	Journal Article	Wind Energy general, Land-Based Wind	N/A	Birds, Raptors
Resolving environmental effects of wind energy	Sinclair, K., et al.	April 2018	Journal Article	Wind Energy general, Land-Based Wind, Offshore Wind	N/A	Bats, Birds, Marine Mammals
The Life-Cycle Energy and Environmental Emissions of a Typical Offshore Wind Farm in China	Yang, J., et al.	April 2018	Journal Article	Wind Energy general, Offshore Wind	Chemicals	Socio-economics, Climate Change
A Socio-Technical Framework for Examining the Consequences of Deforestation: A Case Study of Wind Project Development in Northern Europe	Enevoldsen, P.	April 2018	Journal Article	Wind Energy general, Land-Based Wind	N/A	Socio-economics
Wind Turbine Sensor Array for Monitoring Avian and Bat Collisions	Hu, C., Albertani, R., Suryan, R.	April 2018	Journal Article	Wind Energy general	Dynamic Device	Bats, Birds
Bird Collisions at Wind Turbines in a Mountainous Area Related to Bird Movement Intensities Measured by Radar	Aschwarden, J., et al.	April 2018	Journal Article	Wind Energy general, Land-Based Wind	Dynamic Device	Birds, Passerines
ORJIP Bird Collision and Avoidance Study	Skov, H., et al.	April 2018	Report	Wind Energy general, Offshore Wind	Dynamic Device	Birds, Seabirds
Mitigating the negative impacts of tall wind turbines on bats: Vertical activity profiles and relationships to wind speed	Wellig, S., et al.	March 2018	Journal Article	Wind Energy general, Land-Based Wind	Dynamic Device	Bats
Raptor Interactions with Wind Energy: Case Studies from Around the World	Watson, R., et al.	March 2018	Journal Article	Wind Energy general, Land-Based Wind	Dynamic Device	Birds, Raptors
Black Guillemot Ecology in Relation to Tidal Stream Energy Generation: An Evaluation of Current Knowledge and Information Gaps	Johnston, D., et al.	March 2018	Journal Article	Marine Energy general, Tidal	N/A	Birds, Seabirds
Wind turbines impact bat activity, leading to high losses of habitat use in a biodiversity hotspot	Million, L., et al.	March 2018	Journal Article	Wind Energy general, Land-Based Wind	Static Device	Bats, Nearfield Habitat
Collision sensitive niche profile of the worst affected bird-groups at wind turbine structures in the Federal State of Brandenburg, Germany	Bose, A., et al.	February 2018	Journal Article	Wind Energy general, Land-Based Wind	N/A	Birds
The effects of temporary exclusion of activity due to wind farm construction on a lobster (<i>Homarus gammarus</i>) fishery suggests a potential management approach	Roach, M., et al.	February 2018	Journal Article	Wind Energy general, Offshore Wind	N/A	Benthic Invertebrates, Fish, Socio-economics
Impacts of onshore wind energy production on birds	Laranjeiro, T.,	Februarv	Journal	Wind Energy	Dynamic	

Easy to switch between content selection.

Columns can be sorted by date or alphabetically.

Currently 2600+ wind documents in *Tethys*.

Text searches can be entered here to filter documents.

Documents can also be filtered by:

- Content Type
- Technology Type
- Receptors
- Stressors

Current search
Search found 2634 items

Targeted Search

Choose an option to select a specific text field in which to search. Search finds items containing the exact terms entered, in any order. Phrases can be searched using quotations.

Search All

Content Type

- Journal Article (1288)
- Report (948)
- Conference Paper (126)
- Book Chapter (68)
- Thesis (61)
- Presentation (50)
- Website (28)
- Book (26)
- Magazine Article (18)
- Workshop Article (16)
- Video (5)

Technology Type

- Wind Energy general (2063)
- Offshore Wind (929)
- Land-Based Wind (903)
- Marine Energy general (191)
- Wave (32)
- Tidal (23)
- OTEC (3)
- Ocean Current (2)
- Riverine (1)

Receptor

- Birds (1060)
- Bats (500)
- Socio-economics (404)
- Marine Mammals (376)
- Fish (259)

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ORJIP Bird Collision and Avoidance Study

Abstract:

The ORJIP BCA study, 2014 - 2017, has been designed to improve the evidence base for seabird avoidance behaviour and collisions around offshore wind farms, with the aim of informing impact assessment and supporting consenting applications for the offshore wind industry.

Driven by ambitious renewable energy targets and reduced costs, the offshore wind industry has experienced a significant growth over the last 20 years, particularly in Europe, where the majority of installed capacity can be found.

The consenting process of offshore wind projects requires the identification, prediction and evaluation of the environmental effects of those proposed projects. In this context, the risk of birds colliding with turbine blades during operation is potentially one of the most significant environmental impacts predicted. In order to quantify bird collision risk, collision risk models (CRM) are used and parametrised with technical specifications of the turbines, bird densities, morphology and flight behaviour of existing bird populations present on site. The CRM e.g. the Band model (Band 2012), provides an estimate of the potential number of bird collisions likely to occur at a proposed wind farm assuming that birds take no action to avoid colliding with the wind turbines. In order to obtain realistic risk estimates, the collision risk modelling is subsequently corrected to take account of behavioural responses of birds to the presence of wind farms (i.e. avoidance). However, there is considerable uncertainty over the scale of such impacts due to the relatively few offshore monitoring studies so far undertaken, that have gathered empirical evidence.

As the number of offshore wind farm projects increases, it is widely recognised that in order to minimise consenting risks for future project applications, further robust evidence on the avoidance behaviour of seabirds is required to inform CRM and environmental impact assessments.

This study has centred its work around four main phases:

1. Development of a bird monitoring system, that allows detecting and tracking bird movements at the species level in and around an operational offshore wind farm, including testing and validation of video monitoring coupled with radar technology under different weather and visibility conditions.
2. Monitoring of bird behaviour at Thanet Offshore Wind Farm, deploying a multiple sensor monitoring system partly operated by experienced seabird observers (laser rangefinders and radar equipment), and partly automated through the collection of video evidence, with a focus on five target species: Northern Gannet, Black-legged Kittiwake and three species of large gulls (Lesser Black-backed Gull, Herring Gull, Great Black-backed Gull).
3. Development of an appropriate methodology for data analysis to quantify empirical avoidance behaviour termed as empirical avoidance rates (EARs), based on existing research and equipment / data limitations.
4. Formulation of recommendations on the use of empirical evidence gathered by this study in support of collision risk assessments in offshore wind planning applications.

This report presents the final publication of the study and presents findings associated with these four phases.

[google scholar](#) [bibtext](#) [xml](#)

Report	
Title:	ORJIP Bird Collision and Avoidance Study
Authors:	Skov, H.; Heinänen, S.; Norman, T.; Ward, R.; Méndez-Roldán, S.; Ellis, I.
Publication Date:	April 01, 2018
Pages:	248
Affiliation:	Offshore Renewables Joint Industry Programme (ORJIP) Carbon Trust
Sponsoring Organization:	Dynamic Device
Stressor:	Birds, Seabirds
Receptor:	Avoidance
Interactions:	Wind Energy general, Offshore Wind

Document Access	
Website:	External Link
Attachment:	Access File (22 MB)

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Citation

Skov, H.; Heinänen, S.; Norman, T.; Ward, R.; Méndez-Roldán, S.; Ellis, I. (2018). ORJIP Bird Collision and Avoidance Study. Report by Offshore Renewables Joint Industry Programme (ORJIP). pp 248.

Click on the author name or affiliation to find other documents published by this author or organization.

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Glossary

Technology Types: The means by which energy is extracted from the system.

- **Marine Energy general** - The act of harnessing naturally occurring renewable energy in the ocean to generate electricity, excluding offshore wind.
 - **Ocean Current Energy** - Capturing oceanic currents with turbines.
 - **Ocean Thermal Energy Conversion** - Utilizing temperature gradients in deep oceans to generate electricity.
 - **Riverine Energy** - The flow of the river is captured with either dams or independent turbines.
 - **Salinity Gradient** - Utilizing salinity gradients where freshwater rivers meet seawater to generate electricity.
 - **Tidal Energy** - Capturing tidal fluctuations with turbines, reciprocating devices, kites, screws, barrages, or lagoons.
 - **Wave Energy** - Capturing energy from waves with a point absorber buoy, surface attenuator, oscillating water column, or overtopping device.
- **Wind Energy general** - The act of harnessing naturally occurring wind energy in the atmosphere to generate electricity.
 - **Land-Based Wind** - Harnessing wind energy in land environments.
 - **Offshore Wind** - Harnessing wind energy in offshore environments.

Stressors: Potential characteristics of renewable energy devices that can affect animals, habitats or ecosystem processes. **(What are stressors?)**

- **Chemicals** - An acute spill or chronic release of chemicals over time.
- **Dynamic Device** - Any part of the device that moves.
- **EMF** - An electromagnetic field created by electricity moving through cables.
- **Energy Removal** - Removal of energy from the physical system.
- **Lighting** - Light added for navigational purposes may attract or disorient organisms.
- **Noise** - Sounds created during construction and operation of device.
- **Static Device** - Any part of the device that does not move significantly.

Receptors: Organisms, habitats or ecosystem processes that may be affected by the presence or operation of renewable energy devices. **(What are receptors?)**

- **Bats** - Certain bat species have been known to migrate great distances offshore, at risk of collision with the device.
- **Benthic Invertebrates** - A broad term that encompasses cephalopods (squid, octopus), crustaceans (crabs, shrimp), mollusks (clams, barnacles), and various other benthic organisms.
- **Birds** - Generic term that applies to all types of birds.
 - **Ground-Nesting Birds** - Birds that nest and reside mostly on the ground, including quail, pheasants, and prairie chickens.
 - **Passerines** - The most common type of bird, known for perching.
 - **Raptors** - Birds of prey that hunt and feed on small animals.
 - **Seabirds** - Seabirds are birds that have adapted to life within the marine environment.
 - **Shorebirds** - Shorebirds are birds commonly found along sandy or rocky shorelines, mudflats, and shallow waters.
 - **Waterfowl** - Birds with webbed feet for aquatic environments, including ducks, geese, and swans.
- **Ecosystem** - The interaction between a community of organisms and their environment.
- **Farfield Environment** - The large-scale effects of a device beyond those affecting the direct site.
- **Fish** - Resident fish living near the device and migratory fish passing through the area.
- **Marine Mammals** - A broad term that encompasses pinnipeds (seals, sea lions), cetaceans (dolphins, whales), and sea otters.
- **Nearfield Habitat** - The physical environment surrounding a device.
- **Sea Turtles** - Sea turtles commonly utilize sea currents and travel great distances.
- **Socio-economics** - The effects on the local society and economy.
 - **Aesthetics** - Altering the existing landscape or seascape.
 - **Climate Change** - How renewable energy affects climate change caused by anthropogenic activities.
 - **Fishing** - Commercial fishing is an established industry in the marine environment.
 - **Legal and Policy** - How governing bodies handle renewable energy projects through policy and legal frameworks.
 - **Life Cycle Assessment** - Environmental Assessment through all stages of a project's life.
 - **Navigation** - Vessels moving in proximity to a renewable energy project.
 - **Recreation** - People enjoying activities in proximity to a renewable energy project.
 - **Stakeholder Engagement** - People and companies with an interest in a renewable energy project.
- **Terrestrial Mammals** - A broad term that encompasses carnivores (wolves, bears) and ungulates (deer, moose).

Interactions: Details of the relationship between stressors and receptors.

- **Attraction** - Animals can be drawn to devices for increased food, curiosity, or new habitat.
- **Avoidance** - Animals may temporarily or permanently avoid an area where devices are present.
- **Changes in Sediment Transport** - Altering ocean sediment transport and distribution by changing the flow.
- **Changes in Water Quality** - Altering water constituents such as temperature, salinity, nutrients, and contaminants.
- **Collision/Evasion** - Reaction by animals approaching a turbine to evade or collide with a blade.
- **Entrapment** - Large marine animals feeling trapped by mooring lines, anchors, and export cables.

Home » Map Viewer

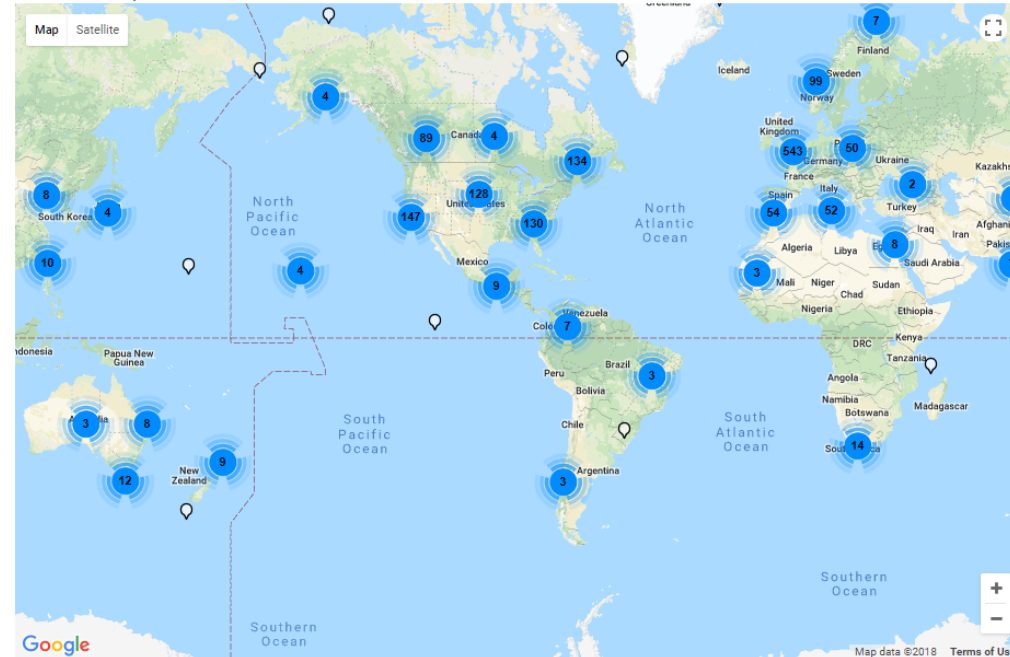
Map Viewer

Easy to switch between content selection.

You are currently viewing: **Wind Energy Content**

The Map Viewer provides a spatial view of information about the environmental effects of marine and wind energy, supporting **Annex IV** and **WREN** initiatives. Documents, project sites, and research studies associated with a geographic location are compiled into an interactive map with panning, zooming, and **advanced filtering**. Filters may be selected on the right, or keywords entered in the Search Text box. Clicking on a bubble will open a dialogue box with more information and a link to the document page.

Not all Tethys content is geotagged. Check out the **Knowledge Base** for access to the full suite of information on projects, reports, and research in Tethys.



Current search
Search found 1569 items

Currently 1500+ geotagged wind documents in *Tethys*.

Targeted Search

Choose an option to select a specific text field in which to search. Search finds items containing the exact terms entered, in any order. Phrases can be searched using quotations.

Search All

Enter terms to search for in all text fields

Similar keyword search and filtering capabilities to the Knowledge Base.

Legend

Documents (1569)

Closely-packed items are clustered together. Clicking on the cluster allows you to navigate individual items. You may zoom in to make smaller clusters.

Technology Type

- Wind Energy general (1262)
- Land-Based Wind (607)
- Offshore Wind (560)
- Marine Energy general (83)
- Wave (14)
- Tidal (12)

Country



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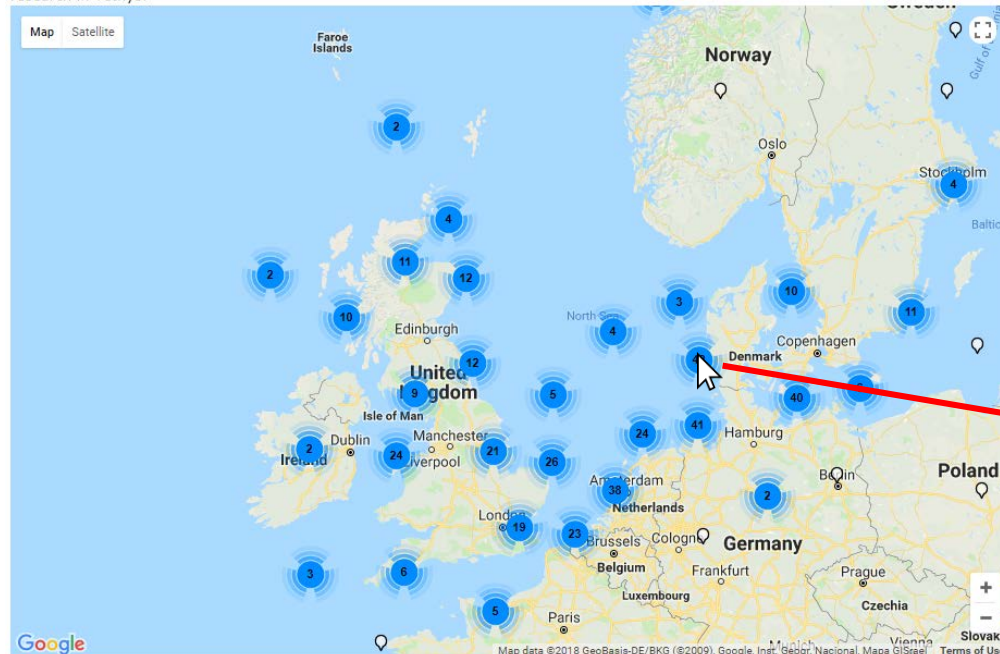
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Map Viewer

You are currently viewing: **Wind Energy Content**

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[Clear All Filters](#)

Current search

Search found 560 items

(-) Offshore Wind

Targeted Search

Choose an option to select a specific text field in which to search. Search finds items containing the exact terms entered, in any order. Phrases can be searched using quotations.

Search All

Enter terms to search for in all text fields

Legend

Documents (560)

Closely-packed items are clustered together. Clicking on the cluster allows you to navigate individual items. You may zoom in to make smaller clusters.

Technology Type

(-) Offshore Wind
Wind Energy general (559)
Marine Energy general (69)
Wave (8)
Tidal (5)

Country

As you zoom in, the blue "clusters" break apart into smaller clusters.

Filtered down to 560 documents related to offshore wind energy

Click on a cluster or bubble to view more information about the documents.



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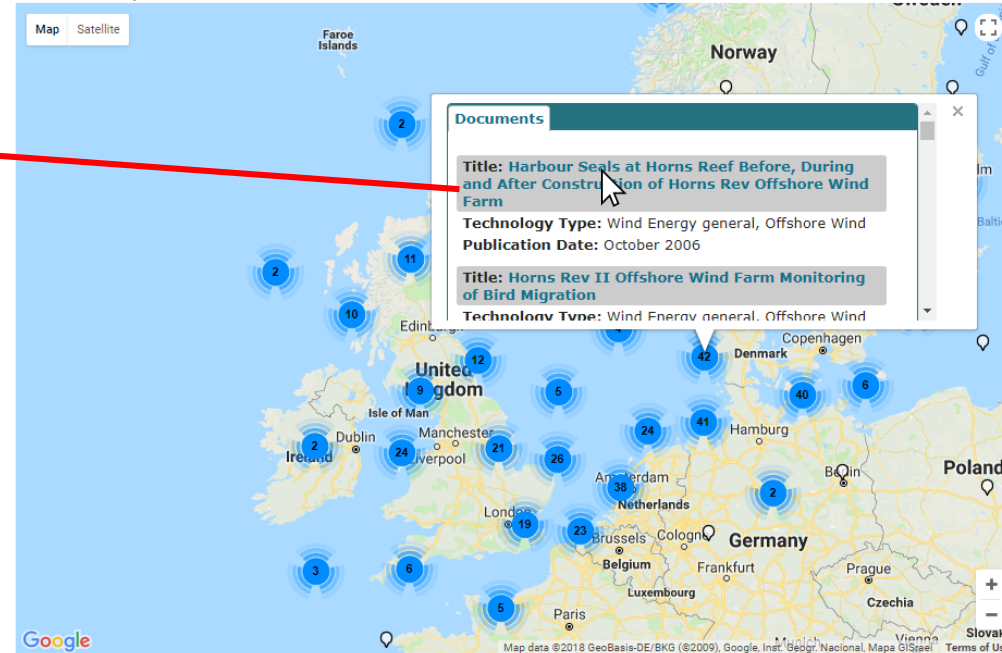
[Home](#) » [Offshore Wind](#) » [Map Viewer](#)

Map Viewer

You are currently viewing: Wind Energy Content

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Not all Tethys content is geotagged. Check out the **Knowledge Base** for access to the full suite of information on projects, reports, and research in Tethys.



You can then click on the title to access the document page.

[Clear All Filters](#)

Current search

Search found 560 items

(-) Offshore Wind

Targeted Search

Search All Fields ▾

Choose an option to select a specific text field in which to search. Search finds items containing the exact terms entered, in any order. Phrases can be searched using quotations.

Search All

Enter terms to search for in all text fields

Legend

Documents (560)

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 Tidal (5)

Country



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Harbour Seals at Horns Reef Before, During and After Construction of Horns Rev Offshore Wind Farm

Abstract:

Horns Rev offshore wind farm was constructed on Horns Reef in the northern German Bight in 2002. As part of a large environmental monitoring program 21 harbour seals were caught in the period 202-2005 on the island Rømø and equipped with satellite transmitters. In addition to satellite transmitters, 21 seals were equipped with a sophisticated datalogger in a cooperation with the University of Kiel. These loggers are capable of collecting high resolution information on the diving behaviour and movement of the seals. The loggers fall off the animals after a couple of months. To get the data the loggers have to be retrieved from the coast, where they wash up. At present, 7 of the deployed loggers have been retrieved.

The primary aim of the investigations was uncovering the importance of Horns Reef as foraging area for harbour seals from the Danish Wadden Sea. A secondary aim was to determine whether seals were present in the wind farm after construction and whether their behaviour was affected by the presence of the turbines.

Foraging of harbour seals from the Wadden Sea The study has documented that harbour seals from the island Rømø are foraging primarily outside the Wadden Sea in the period September to July. Individual seals appear to have strong preference for smaller, confined areas, which they will return to again and again on their foraging trips. The combined picture of many seals however, shows a more or less even distribution of seals primarily in an area from Rømø out to approximately 100 km from shore, stretching from Holmsland Klit in north to south of the Danish-German border. Similar results have been found in telemetry studies in Germany and the Netherlands and confirm that the entire eastern part of the German Bight is the primary foraging habitat for harbour seals from the International Wadden Sea. Horns Reef and thus also the wind farm is located in the centre of the foraging area of the seals from Rømø and the area is thus of importance to the seals. Nothing seems to indicate however, that the reef or the wind farm area is of greater importance than the surrounding areas.

Effects of construction and operation of the wind farm The accuracy of the positions retrieved from satellite transmitters and dataloggers turned out to be insufficient to conclude with certainty on the degree to which the construction of the wind farm has affected the seals. However, it is close to certain that one or more of the tagged seals were inside the wind farm area during the period the transmitters were active. Visual observations from ship surveys, conducted as part of the monitoring program on harbour porpoises, supports this, as seals were observed inside the wind farm area in numbers not readily different from the surrounding waters. An exception from this was the construction period in spring and summer 2002, where very few seals were observed inside and in the immediate surroundings of the wind farm. Seals were most likely staying away from the construction site due to the very high levels of underwater noise generated by the pile driving operations and the associated mitigation.

Underwater noise from the turbines appears to be the only potential negative source of impact of practical relevance. The scale of this impact is considered to be marginal, based on measurements of the emitted noise from the turbines and compared to the other sourced of underwater noise in the area, caused by e.g. ship traffic. It is believed that the artificial reef formed on the foundations and scour protection potentially will benefit the seals in the area through an increase in food availability.

- [Environmental Webinars](#)
- [Conferences and Workshops](#)
- [Expert Forums](#)
- [Tethys Blasts](#)
- [Tethys Stories](#)

Report

Title: Harbour Seals at Horns Reef Before, During and After Construction of Horns Rev Offshore Wind Farm

Authors: Tougaard, J.; Tougaard, S.; Jensen, R.; Jensen, T.; Teilmann, J.; Adelung, D.; Liebsch, N.; Müller, G.

Publication Date: October 01, 2006

Pages: 67

Affiliation: National Environmental Research Institute (NERI), University of Southern Denmark, Vattenfall

Stressor: Static Device

Receptor: Marine Mammals

Technology Type: Wind Energy general, Offshore Wind

Document Access

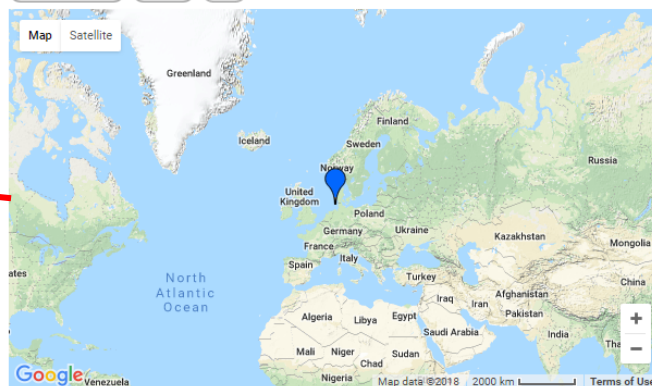
Attachment: [Access File](#) (4 MB)

Notice: This material may be protected by Copyright Law.

Citation

Tougaard, J.; Tougaard, S.; Jensen, R.; Jensen, T.; Teilmann, J.; Adelung, D.; Liebsch, N.; Müller, G. (2006). Harbour Seals at Horns Reef Before, During and After Construction of Horns Rev Offshore Wind Farm. Report by National Environmental Research Institute (NERI), University of Southern Denmark, and Vattenfall. pp 67.

[google scholar](#) [bibtex](#) [xml](#)



As a geotagged document, a mini map shows up at the bottom of the page

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Environmental Webinars

[All](#) | [Water](#) | [Wind](#)

Tethys hosts regular webinars pertaining to topic of environmental concern, as a means to effectively disseminate new information and research efforts to a large international audience of stakeholders. Anyone is welcome to attend these live webinars and participate in a live question and answer session with the presenters. Information for attending these live webinars is distributed to a public mailing list (separate lists for wind and water). Ongoing webinars on Tethys are sponsored by [Annex IV](#) and [WREN](#).

[You can sign up to receive invitations to live webinars here.](#)

Below is a list of past webinars, containing video/audio files of the presentations and Q&A sessions when available.

Webinar Archive

Sponsored By	Title	Date	Description
Tethys Webinar	Using Underwater Video to Monitor Fish Around Ocean and River Energy Devices	Jul 2, 2018	This webinar will discuss guidelines for using underwater video effectively and present a new software tool, EyeSea, developed specifically for underwater video analysis.
Tethys Webinar	Tethys Wind Webinar	Jun 25, 2018	This webinar will showcase the content and resources available on Tethys, from a wind energy perspective.
WREN Webinar #14	Reconstruction after Decommissioning - A Cross-Industry Perspective	May 4, 2018	The speakers will discuss reconstruction after decommissioning from both the offshore wind, land-based wind and adjacent industry perspectives.
WREN Webinar #13	Smart Curtailment - A Global Perspective	Jan 17, 2018	The speakers will discuss smart curtailment from both the European and North American perspective.
OES Annex IV Webinar #15	Tools and Resources for Environmental Assessments	Dec 12, 2017	This webinar will discuss three tools that can be employed for environmental assessments: RADMAP, a spatial data management, display and analysis tool; the Impact Assessment Tool (IMPACT) developed in the United Kingdom; and Tethys Management Measures developed in the United States and the United Kingdom as part of the Annex IV initiative .
OES Annex IV Webinar #14	Information Collection and Consenting Processes for Wave and Tidal Deployments - Lessons from the Field	Sep 21, 2017	This webinar addresses consenting wave projects in Sweden with the necessary collection of environmental and socio-economic data and on consenting tidal projects in Canada with the necessary collection of economic data.
WREN Webinar #12	Upscaling Wind and Wildlife Individual Interactions to Population-Level Impacts	Sep 20, 2017	This webinar covers a manuscript produced by the WREN collaborative on individual to population impacts and WEST's development of a quantitative assessment of the direct effects of wind energy on small passerines and diurnal raptors in North America.
WREN Webinar #11	Research Programs to Understand the Environmental Impacts of Offshore Wind, Part 2	Jun 20, 2017	This webinar is the second of a two-part series covering research programs designed to understand the environmental impacts of offshore wind.
OES Annex IV Webinar #13	Fisheries Interactions with Marine Renewable Energy Devices	Jun 19, 2017	This webinar will look at the socio-economic impacts of marine renewable energy (MRE) projects around commercial fisheries by exploring the attitudes of fishermen towards MRE projects under development and perceived socio-economic impacts and opportunities, as well as the co-occurrence and nature of potential interactions between these two industries.
OES Annex IV Webinar #12	Artificial Reefs and Benthic Changes in Relation to MRE	Apr 25, 2017	This webinar will look at the environmental effects of marine renewable energy (MRE) devices related to benthic habitat and community changes, and the effects of artificial reefs, specifically focusing on marine fish and crustaceans.
WREN Webinar #10	BOEM Efforts to Collect and Analyze Offshore Wind Data in a Holistic Manner, as Demonstrated through the RODEO Study	Mar 28, 2017	This webinar will cover The United States Bureau of Ocean Energy Management's (BOEM) Real-time Opportunity for Development Environmental Observations (RODEO) study.
OES Annex IV Webinar #11	Recent Research of Interest to the MRE Industry	Jan 18, 2017	This webinar will feature two recent sets of research findings that will further elucidate the importance of EMF from cables and fish interaction with devices to the industry.

This quick filter allows you to limit to just wind or MRE webinars

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Environmental Webinars

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Webinar Archive

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WREN Webinar #14	Reconstruction after Decommissioning - A Cross-Industry Perspective	May 4, 2018	The speakers will discuss reconstruction after decommissioning from both the offshore wind, land-based wind and adjacent industry perspectives.
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WREN Webinar #10	BOEM Efforts to Collect and Analyze Offshore Wind Data in a Holistic Manner, as Demonstrated through the RODEO Study	Mar 28, 2017	This webinar will cover The United States Bureau of Ocean Energy Management's (BOEM) Real-time Opportunity for Development Environmental Observations (RODEO) study.
WREN Webinar #9	Adaptive Management in the Wind Energy Industry	Nov 16, 2016	A recent review of Adaptive Management (AM) has clarified fundamental differences in the definition of AM, and its application to projects or planning processes. This webinar sets out to explore these experiences and suggest the possibility of a common definition and framework for AM that is capable of supporting the needs of wind energy development where there are potential conflicts with wildlife. It will examine how AM has been applied to wind energy development around the world, with a focus on examples from the US and UK.
WREN Webinar #8	Assessing Marine and Avian Wildlife Off the New York Coast	Jul 21, 2016	In an effort to ensure that potential offshore wind development protects the environment and addresses the concerns of coastal communities, the New York State Energy Research and Development Authority (NYSERDA) is conducting a multi-year aerial survey of wildlife in this area. Regional-scale baseline information on seasonal wildlife distributions, abundance and movements will inform the relative biodiversity of the development sites. The surveys will also provide a better understanding of the potential effects of individual projects, as well as the potential cumulative effects of multiple projects. This webinar will outline the planned scope of the survey project and provide insights in the technical aspects of image collection, processing, species identification and data presentation.
WREN Webinar #7	Wind Energy Development Impacts on Marine Environment	Jun 28, 2016	This webinar will discuss noise monitoring research and mitigation to help protect marine life from the impacts of wind energy development-related sounds produced during the building phases and types of foundations.
WREN Webinar #6	Monitoring Bat Activity Offshore	Mar 01, 2016	This webinar details techniques for monitoring bat activities offshore, in order to determine the impact that offshore wind may have on bat populations.
WREN Webinar	Wildlife Monitoring and Wind Energy	Dec 02, 2015	This webinar details monitoring tools and large-scale monitoring efforts related to offshore wind energy.

For upcoming webinars, you can find login information and a downloadable calendar item


For past webinars, you can download presentations and watch a video recording


You can easily subscribe to receive webinar notifications

Home » Upscaling Wind and Wildlife Individual Interactions to Population-Level Impacts

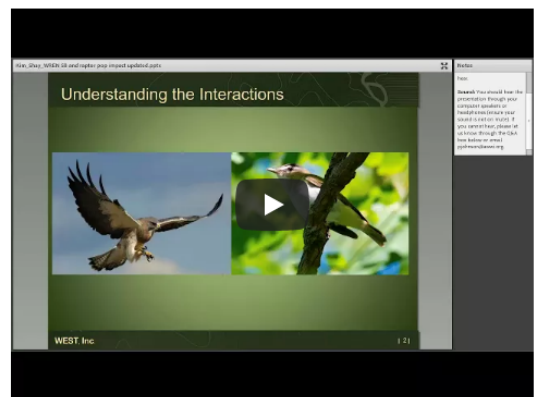
Upscaling Wind and Wildlife Individual Interactions to Population-Level Impacts

Webinar #12 in WREN Environmental Webinar Series
September 20, 2017 @ 15:00 - 16:30 UTC (8:00 am PT/11:00 am ET)

Upscaling wind and wildlife interactions to population impacts 
Finlay Bennet, Marine Scotland Science
Finlay will present a summary of a manuscript produced by the WREN collaborative on individual to population impacts. The manuscript provides an overview of how populations are defined, impacts measured, predicted and verified, and how impact thresholds can be applied for decision-making in the context of wind energy development.

Understanding the Population Impacts Between Birds and Wind Turbines 
Kimberly Bay and **Shay Howlin**, West, Inc.
Kim and Shay will present on WEST's development of a quantitative assessment of the direct effects of wind energy on small passerines and diurnal raptors in North America. In this assessment, they used advanced statistical analyses to estimate the annual rate of small passerines and diurnal raptor fatalities and provided an understanding of how wind energy directly effects species populations.

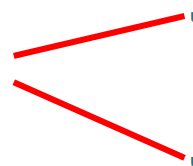
A video recording of this webinar is available here:



Event	
Title:	Upscaling Wind and Wildlife Individual Interactions to Population-Level Impacts
Location:	Online
Date:	September 20, 2017 15:00-16:30 UTC+00:00
Technology Type:	Wind Energy general

- Environmental Webinars
- Conferences and Workshops
- Expert Forums
- [Tethys Blasts](#)
- Tethys Stories

Download presentations



Recording of live webinar can be watched right here



When webinar is associated with a series, quickly link to other events in the series here



Past Events in the Series

- [Research Programs to Understand the Environmental Impacts of Offshore Wind, Part 2 - Vattenfall's Environmental Research Programme at the European Offshore Wind Deployment Centre \(EOWDC\) and the Dutch Offshore Wind Ecological Programme \(Wozep\)](#), Online, June 20, 2017 15:00-16:30 UTC+0000
- [BOEM Efforts to Collect and Analyze Offshore Wind Data in a Holistic Manner, as Demonstrated through the RODEO Study](#), Online, March 28, 2017 15:00-16:30 UTC+0000
- [Adaptive Management in the Wind Energy Industry](#), Online, November 16, 2016 16:00-17:30 UTC+0000
- [Assessing Marine and Avian Wildlife Off the New York Coast](#), Online, July 21, 2016 15:00-16:30 UTC+0000
- [Wind Energy Development Impacts on Marine Environment](#), Online, June 28, 2016 15:00-16:30 UTC+0000
- [Monitoring Bat Activity Offshore](#), Online, March 1, 2016 16:00-17:30 UTC+0000
- [Wildlife Monitoring and Wind Energy](#), Online, December 2, 2015 16:00-17:30 UTC+0000
- [Avian Sensitivity Mapping and Wind Energy](#), Online, August 27, 2015 15:00-16:30 UTC+0000
- [Understanding Avian Collision Rate Modeling and Discussing what this Means in a Population Context at Land-Based and Offshore Windfarms](#), Online, April 2, 2015 15:00-16:30 UTC+0000
- [Attraction and Interaction of Marine Mammals and Seabirds to Offshore Wind Farms Webinar](#), Online, December 9, 2014 16:00-17:30 UTC+0000
- [Bats and Wind Energy Webinar](#), Online, September 3, 2014 15:30-16:30 UTC+0000



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Tethys Blasts

Used as a tool to promote engagement and disseminate information among the Tethys community, Tethys Blasts are sent every 2 weeks. Tethys Blasts keep users updated on new content and features on Tethys, as well as convey current news articles of international interest on wind and marine renewable energy. Tethys Blasts provide an opportunity to connect with colleagues as well as an effective means for introducing users to new research, new contacts, and ongoing milestones related to the development of the wind and marine renewable energy industry worldwide.

[You can sign up to join this mailing list here.](#)

Archived Tethys Blasts:

- [June 1, 2018](#)
- [May 18, 2018](#)
- [May 4, 2018](#)
- [April 20, 2018](#)
- [April 6, 2018](#)
- [March 23, 2018](#)
- [March 9, 2018](#)
- [February 23, 2018](#)
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- [January 26, 2018](#)
- [January 12, 2018](#)
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- [September 16, 2016](#)
- [September 2, 2016](#)
- [August 19, 2016](#)

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Archive of past Tethys Blasts

New Documents on Tethys

New documents are regularly added to Tethys, hand-selected for environmental effects of wind and marine renewable energy. Selected popular documents are listed below, accessible by the accompanying link.

[Do birds in flight respond to \(ultraviolet\) lighting? – May et al.](#)

Concerns for bird collisions with wind turbines affect the construction and operation phase, functional mitigation efficiently reduces bird mortality. Vision is the primary cause for a number of species also includes the ultraviolet spect known to collide with offshore wind turbines are sensitive spectrum.

[Understanding the Effectiveness of Acoustic Deterrent Devices \(ADDs\) – Laranjeiro et al.](#)

Increasing scale and complexity of offshore wind farms (OWFs) in European Protected Species (EPS) has led to interest in mitigation strategies to commonly used visual observation and acoustic marine mammals. Acoustic Deterrent Devices (ADDs) have potentially effective tool for a number of small cetaceans lacking for some other key species that occur within protected areas.

[Impacts of onshore wind energy production on birds and bats life cycle impact assessment developments – Laranjeiro et al.](#)

Models for quantifying impacts on biodiversity from renewable energy lacking within life cycle impact assessment (LCIA). We investigate the effects of wind energy on birds and bats, with a focus on the effects of wind energy on birds and bats, with a focus on the effects of wind energy on birds and bats. Furthermore, we investigate and provide the necessary data integrated into new developments of LCIA models in future.

[Observing Fish Using Underwater Camera at the Test Site for Generation – Yoshida et al. 2017](#)

Assessment of local ocean environment is significant when devices of marine renewable energy are installed at a demonstration site. A concern about how these devices affect the existence of fish is remained among local fishermen. To confirm variation of fish before and after installing the devices of marine renewable energy, we investigated fish using an underwater camera before installation as a main objective of this paper. First, fish-eye video camera was tested to monitor in a fish cage off Kamaiishi city, Iwate prefecture, Japan. We aimed to observe the abundance of fish and to specify the species of fish.



June 1, 2018

The bi-weekly Tethys Blast will update you with new information on Tethys, news article of international interest, and opportunities in wind and marine renewable energy. We hope you find this a valuable tool to keep you connected to colleagues, new research, opportunities, and industry milestones.

Upcoming Tethys Wind Webinar

An upcoming Tethys webinar will showcase the content and resources available on Tethys, with a focus on wind energy. Whether you are new to Tethys or have been involved for years, you are sure to learn something new. The webinar will be on 25 June 2018 at 16:00-17:00 UTC (9am PDT, 12pm EDT, 5pm BST). [Login instructions are available on Tethys.](#)

Annex IV Workshop at ICOE

OES-Annex IV invites you to a workshop in Cherbourg, France on June 12th from 9am-12:30pm (CEST) in conjunction with the International Conference on Ocean Energy (ICOE). The workshop focuses on ways to “transfer” data, information, and learning on environmental effects from early MRE projects to extend learning from these early projects and to reduce the high costs of environmental monitoring and accelerate consenting for future projects. To register, email mikaels.freeman@pnl.gov. More information on the workshop can be [found here](#).

Marine Energy Data

Do you use data and information associated with marine energy? Please help the US Department of Energy national laboratories develop the most useful system for storing and discovering data. Please take our survey at <https://goo.gl/RkZm5>.

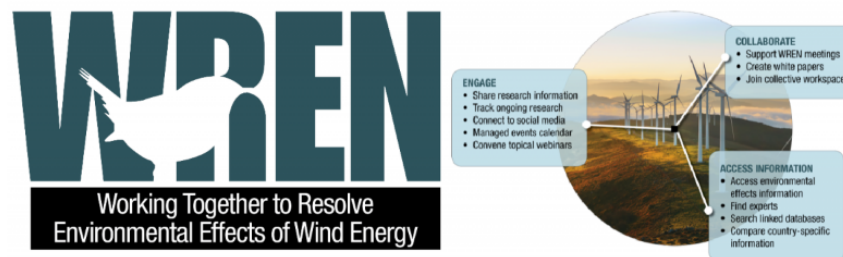
MHK Maritime Markets Report

The US Department of Energy Waterpower Technologies Office has published a report on 12 maritime markets that represent potential opportunities for providing marine energy for new and emerging markets, most smaller than utility scale electricity market. They are [seeking comments and input on the content](#). Please download the report and comment on any portions of the report you like, the deadline for online comments has been extended to July 21st.

Example of a recent Tethys Blast

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About WREN



WREN (**W**orking Together to **R**esolve **E**nvironmental Effects of Wind Energy), also known as [Task 34](#), was established by the [IEA Wind](#) Committee in October 2012 to address environmental issues associated with commercial development of land based and offshore wind energy projects. As the operating agent for WREN, the US leads this effort with support from [Pacific Northwest National Laboratory \(PNNL\)](#), the [National Renewable Energy Lab \(NREL\)](#), and the [US Department of Energy's](#) Wind Energy Technologies Office (WETO).

The primary objective of WREN is to facilitate international collaboration and advance global understanding of potential environmental effects of wind energy. To support this effort, *Tethys* was expanded to serve as a collaborative outreach and engagement space, and to disseminate knowledge and information. While most WREN information and content is publicly accessible, some space is reserved for WREN member nations for collaborative work, under password-protection.

To access member-only material, visit the [WREN Members Page](#).

Countries Currently Involved in WREN (12)

- [Belgium](#)
- [Canada](#)
- [France](#)
- [Ireland](#)
- [Netherlands](#)
- [Norway](#)
- [Portugal](#)
- [Spain](#)
- [Sweden](#)
- [Switzerland](#)
- [United Kingdom](#)
- [United States](#)

List of 12 countries currently involved in WREN

WREN White Papers

WREN White Paper: Environmental Effects of Wind Energy: A Review of the Literature and Recommendations for Further Research

Links to various
WREN documents

WREN White Papers

WREN is producing a series of white papers that address common problems facing wind and wildlife interactions, for which solutions are often elusive, and that do not fall within the purviews of industry, regulators, or researchers. The list of white papers is available below. As each paper is produced, it will be made available on *Tethys*. Each white paper is also summarized into a 2-page fact sheet, also available on *Tethys*. The summaries are translated into additional languages, representing the WREN network.

WREN White Papers:

Adaptive Management

- [2016 Adaptive Management White Paper](#)
- [Adaptive Management Fact Sheet](#)

Individual to Populations (expected in 2018)

Cumulative Effects Assessment (expected in 2018)

Green versus Green (expected in 2018)

Risk-Based Environmental Management (expected in 2019)

Tethys Fact Sheet

To highlight *Tethys* content, key functions, use of the site, and growth, a fact sheet with a summary and assessment of *Tethys* over the past 4 years, 2012 to 2016, was created.

- [Tethys Fact Sheet 2017](#)

WREN Short Science Summaries

WREN seeks to summarize the current state of the science on interactions between wind energy development (land-based and offshore) and wildlife. A series of short science summaries are being prepared and made available for download on *Tethys*:

- [Harbor Porpoises and Offshore Wind Energy](#)

WREN Webinars

WREN hosts quarterly webinars on the environmental concerns that are of importance to the land-based and offshore wind energy industries, as a means to effectively disseminate new information and research efforts to a large international audience of stakeholders.

[You can sign up to receive invitations to live webinars here.](#)

Presentations from past wind energy webinars are hosted on *Tethys*, along with the associated video, as well as questions and answers. [Visit the archive.](#)

Knowledge Base and Map Viewer

Tethys has collected over 2,400 documents related to the environmental effects of wind energy (land-based and offshore). All documents are available in a table format via the [Tethys Knowledge Base](#), which can be easily filtered to find documents relevant to specific searches such as document type, technology type, or environmental effect. Any documents related to a spatial location have been geotagged and made available on the [Tethys Map Viewer](#) (note: the Map Viewer contains only a subset of the documents available in the Knowledge Base).

Meetings

As an international initiative with 11 countries participating, in-person meetings among WREN country representatives are an important aspect as we work together to achieve the goals of WREN. These meetings occur twice a year, often in conjunction with related international conferences. The following is a list of all WREN meetings – both past and upcoming:

- [WREN 2017 Meeting - Estoril, Portugal](#): September 4-5, 2017
- [WREN 2017 Meeting - Gotland, Sweden](#): June 14-15, 2017
- [WREN 2016 Meeting - Broomfield, US](#): November 28-29, 2016
- [WREN 2016 Meeting - Dublin, Ireland](#): April 4-5, 2016
- [WREN 2015 Meeting - Bern, Switzerland](#): October 21-22, 2015

Quick links to wind-
filtered webinars,
Knowledge Base, and
Map Viewer

Home » Fact Sheet: Adaptive Management for Wind and Wildlife Interactions

Fact Sheet: Adaptive Management for Wind and Wildlife Interactions



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- Organizations
- Databases
- Regulatory

Adaptive management (AM) is a learning-based management approach that is used to reduce scientific uncertainty, and has been applied to many types of development including filling of wetlands and various forms of renewable energy. AM has been identified as a tool to advance the wind energy industry. The AM summary (fact sheet) was created to provide a broad summary of the WREN AM white paper and to highlight AM as an approach to tackling environmental impacts of wind energy developments. The table below contains the literature relevant to AM for the wind energy industry and will continue to be updated as new literature is added to *Tethys*.

- [Download the Adaptive Management Fact Sheet](#)
- [Download the Adaptive Management Fact Sheet - French Translation](#)
- [Download the Adaptive Management Fact Sheet - German Translation](#)

Translated fact sheets

Sources of Information on Adaptive Management:

Title	Author	Date	Type of Content	Technology Type	Stressor	Receptor
Tafila Region Wind Power Projects: Cumulative Effects Assessment	International Finance Corporation	January 2017	Report	Land-Based Wind	N/A	Birds, Farfield Environment
Synopsis des internationalen Kenntnisstandes zum Einfluss der Windenergie auf Fledermäuse und Vögel und Spezifizierung für die Schweiz	Muller, J., et al.	November 2015	Report	Land-Based Wind	Dynamic Device, Static Device	Bats, Birds
Repowering Smøla Wind-Power Plant: An Assessment of Avian Conflicts	Dahl, E., et al.	June 2015	Report	Land-Based Wind	Dynamic Device, Static Device	Raptors
Key Learnings from Ten Years of Monitoring and Management Interventions at the Bluff Point and Studland Bay Wind Farms: Results of a Review	Sims, C., et al.	January 2015	Book Chapter	Land-Based Wind	N/A	N/A
Biodiversity & Wind Energy: A Bird's and Bat's Perspective	Mascarenhas, M., et al.	January 2015	Book	Land-Based Wind	N/A	Bats, Birds
Wind of Change or Wind of Challenges: Implementation Factors Regarding Wind Energy Development, an International Perspective	Gartman, V., et al.	December 2014	Journal Article	Land-Based Wind	N/A	Socio-economics
Upland Land Use Predicts Population Decline in a Globally Near-Threatened Wader	Douglas, D., et al.	February 2014	Journal Article	Land-Based Wind	Static Device	Birds
Assessing Risk to Birds from Industrial Wind Energy Development via Paired Resource Selection Models	Miller, T., et al.	January 2014	Journal Article	Land-Based Wind	Dynamic Device, Static Device	Birds
Searchlight Wind Energy Project Bird and Bat Conservation Strategy	Tetra Tech Inc	November 2012	Report	Land-Based Wind	Dynamic Device, Static	Bats, Birds

A table of relevant literature to the topic that automatically updates as new content is added to *Tethys*

WREN WHITE PAPER ON WIND ENERGY DEVELOPMENT

Adaptive Management for Wind and Wildlife Interactions

ADAPTIVE MANAGEMENT
Adaptive management (AM) is a learning-based management approach that is used to reduce scientific uncertainty, and has been applied to many types of development including filling of wetlands and various forms of renewable energy. AM has been identified as a tool to advance the wind energy industry, although its application in practice has been limited. AM has primarily been actively implemented in the United States, while other nations have applied some of the principles of AM. Many wind energy projects use the mitigation hierarchy or the precautionary principle to guide development, both of which focus on mitigating or avoiding project-related risks or impacts. Overall, AM allows wind energy projects to adapt monitoring and mitigation over time, leading to improved decision-making. The WREN network has developed a white paper on AM that explores how AM principles are used by the wind energy industry in several nations, and identifies ways the process and its implementation may be improved. See <https://wren.org/> about wren and https://www.lewisd.org/leak_11.html for more information.

AM IS DEFINED FOR THIS ANALYSIS AS:
"Adaptive Management is a decision process that promotes flexible decision-making that can be adjusted to the face of uncertainties as informed from management actions and other events become better understood. Careful monitoring of these outcomes both advances scientific understanding and helps adjust actions or operations as part of an iterative learning process." —AGC 2004, Williams et al. 2009

BENEFITS AND CHALLENGES OF IMPLEMENTING AM
The implementation of AM in wind energy development faces challenges, including a universal lack of legislation and regulations that require and define AM, as well as a lack of tools to assist with consistent implementation. Wind energy developers applying AM to their projects are faced with having to reconcile an adaptable and flexible AM process with one that might impact project financing and efficiency of the permitting process. Efforts to prescribe mitigation measures and reduce financial uncertainty up front can be infeasible and potentially add substantial costs. On the other hand, it can be difficult to create an adaptive process when cost or other operators, once power purchase contracts or agreements are signed. These alternatives could lead to increased costs or loss of production. Most wind energy projects face the combined challenges of the cost of implementing AM, including ongoing costs for monitoring, and potential loss of revenue due to mitigation.

RECOMMENDATIONS
The WREN AM paper calls for the need to:

- Adopt a universal definition of AM that is coupled with an agreed-upon set of eligibility criteria and is consistent with the regulatory context in which it is being applied;
- Optimize the spatial and temporal scales over which AM is applied to reduce scientific uncertainty;
- Guide the application of AM by the need to minimize undue financial pressure on projects while ensuring that the natural resources of the turbine or region are protected; and
- Establish formal processes and structures within national or regional regulatory bodies to make use of environmental impact data from existing projects to generate knowledge that can be applied to the planning and management of future projects.

AM to be applied at an individual project level, however, challenges associated with monitoring change over the spatial and temporal scales for the resource of concern may limit the ability of an individual project to meaningfully reduce scientific uncertainty and facilitate an iterative learning process.

To be most effective, the implementation of AM should also be considered at a larger spatial and temporal scale than individual projects, including collection and analysis of research data at the ecosystem scale with that of data collected at individual wind farms.

By implementing AM for wind energy projects, scientific uncertainty can be reduced, and lessons learned can be applied to aid new wind energy development around the world.

You can find the full text of the Adaptive Management White Paper online on WREN Hub: <https://wren.org/connections/adaptive-management-white-paper/>

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Organizations Involved in Marine and Wind Energy and the Environment

This list compiles organizations from around the world that are involved in environmental research pertaining to marine and wind energy. Clicking on the organization will direct you to a page which includes additional information on the organization as well as a list of all documents in Tethys affiliated with the organization. The organizations list is not exhaustive, and will be updated as needed. If you have comments on incorrect or missing material, please email jonathan.whiting@pnnl.gov.

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Organization Type
Country
Search Names

Organization ▲	Organization Type	Website	Country
1-Tech	Private	http://www.1-tech.eu/	Belgium
Aalborg University	Academic	http://www.en.aau.dk/	Denmark
Aarhus University	Academic	http://www.au.dk/en/	Denmark
Abasaheb Garware College	Academic	http://mesgarwarecollege.org/	India
Abbott Risk Consulting Ltd (ARC)	Private	http://www.consultarc.com/home	United Kingdom
Abengoa Seapower	Private	http://www.abengoa.com/web/en/index3.html	Spain
Aberystwyth University	Academic	http://www.aber.ac.uk/en/	United Kingdom
ABP Marine Environmental Research Ltd (ABPmer)	Private	http://www.abpmer.co.uk/	United Kingdom
ABR Inc	Private	http://www.abrinc.com/	United States of America
Acadia Centre for Estuarine Research (ACER)	Other	http://acer.acadiau.ca/	Canada
Acadia Tidal Energy Institute	Non-Profit	http://tidalenergy.acadiau.ca/	Canada
Acadia University	Academic	http://www2.acadiau.ca/	Canada
Accipiter Radar Technologies Inc	Private	http://www.accipiterradar.com/page/home	United States of America
Acoustical Society of America	Non-Profit	http://acousticalsociety.org/	United States of America
AECOM	Private	http://www.aecom.com/	United States of America
AES Geo Energy	Private	http://www.aesgeoenergy.com/site/index.html	Bulgaria
Agence des Aires Marines Protégées	Government Research	http://www.aires-marines.fr/	France
AGH University of Science and Technology	Academic	https://www.agh.edu.pl/en/	Poland
Airicole	Private	http://www.eon.com/en/sustainability/regional-activities/sweden.html	Sweden
Aix-Marseille University	Academic	https://www.univ-amu.fr/en	France
Alaska Center for Energy and Power (ACEP)	Academic	http://acep.uaf.edu/	United States of America
Alaska Department of Fish & Game	Government	http://www.adfg.alaska.gov/	United States of America
Alaska Energy Authority	Private	http://www.akenergyauthority.org/	United States of America
Alden Research Laboratory	Private	https://www.aldenlab.com/	United States of America
Alderney Commission for Renewable Energy	Government	http://www.acre.gov.gg/	United Kingdom
Alfred Wegener Institute (AWI)	Government Research	http://www.awi.de/en	Germany
Alstom	Private	http://www.alstom.com/	France

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Database Connections

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The list below compiles and provides access to external databases. While the respective scopes of each of the databases are varied, all convey information relevant to wind energy. The list of databases is not exhaustive, and will be updated as needed. If you have comments on incorrect or missing content, please email jonathan.whiting@pnnl.gov with corrections.

Database Name	Focus	Country	Description
4C Offshore Database	Offshore Wind	United Kingdom	4C Offshore is an international offshore wind farm database which contains locations, primary stakeholders, news, and port information for over a thousand offshore wind projects in 43 different countries. The database also contains an interactive map allowing the user to search for different offshore wind farms, proposed projects, major ports, wind speed, water depth, and more.
American Wind and Wildlife Institute Library	Wind Energy	United States	The AWWIC documents library includes peer-reviewed wind-wildlife research, published articles and reports, and publicly available but un-published reports prepared for wind energy facilities in North America (both before and after construction).
Atlantic Offshore Seabird Dataset Catalog	Offshore Wind	United States	Driven by a need to adequately evaluate spatial and temporal distribution of avian species within the context of potential impacts from activities such as offshore wind development, the database brings together historical and contemporary datasets on avian distribution along the Atlantic Outer Continental Shelf.
California Offshore Wind Energy Gateway	Offshore Wind	United States	The Offshore Renewable Wind Energy Gateway assembles geospatial information on ocean wind resources, ecological and natural resources, ocean commercial and recreational uses and community values. This information will help identify areas off of California that are potentially suitable for wind energy generation.
COWRIE	Offshore Wind	United Kingdom	COWRIE (Collaborative Offshore Wind Research into the Environment) was set up by The Crown Estate as an independent body to carry out research into the impact of offshore wind farm development on the environment and wildlife. COWRIE evolved into a charity which gained global recognition for its scientific and educational work. COWRIE ended in 2009, but reports are still available.
Data Basin	Wind Energy	International	Data Basin is a science-based mapping and analysis platform that supports learning, research, and sustainable environmental stewardship, hosting public and private spatial datasets for various organizations and groups around the world.
EMODnet Human Activities	Marine Renewable Energy, Offshore Wind	International	This database includes the geographical position and spatial extent of a series of activities related to the sea, their temporal variation, time when data was provided, and attributes to indicate the intensity of each activity.
ESPIS	Marine Renewable Energy, Offshore Wind	United States	The Environmental Studies Program Information System (ESPIS) provides access to completed Bureau of Ocean Energy Management (BOEM) environmental studies reports. Technical summaries of over 700 BOEM-sponsored environmental research projects, as well as full pdf documents of over 2,000 research reports, are available for online full text search.
LORC Knowledge	Offshore Wind	Denmark	LORC Knowledge is an international offshore wind farm database that provides blade tip speeds, voltage levels, gearbox ratios, and hundreds of other details on wind farms across the world. They provide a searchable map, searchable lists, and statistics.
Marine Cadastre	Marine Renewable Energy, Offshore Wind	United States	Developed through a joint partnership between the U.S.'s National Oceanic and Atmospheric Administration (NOAA) and Bureau of Ocean Energy Management (BOEM), the Marine Cadastre is an integrated marine information system that provides ocean information such as energy potential, offshore boundaries, infrastructure, and biological data sets.
Marine Data Exchange	Offshore Wind	United Kingdom	Source for the environmental data and information generated under the Crown Estate's second Licensing Round for offshore wind.
Northeast Ocean Data Portal	Offshore Wind	United States	The Northeast Ocean Data website is a decision support and information system for managers, planners, scientists, and stakeholders involved in ocean planning in the region from the Gulf of Maine to Long Island Sound. It features a data viewer and easy-to-use interactive maps on topics such as aquaculture, energy, marine mammals, and maritime commerce.
	Marine		

How can you get involved with Tethys?

- ▶ Subscribe to a mailing list: *Tethys* Blasts, Wind Webinars, MRE Webinars
 - <https://tethys.pnnl.gov/tethys-blasts/join>

- ▶ Please send in publications when they are available
 - Email to tethys@pnnl.gov

- ▶ Register for an account on *Tethys*
 - <https://tethys.pnnl.gov/user/register>

- ▶ Look for WREN workshops at international conferences

Thank You!

Visit: <https://tethys.pnnl.gov>

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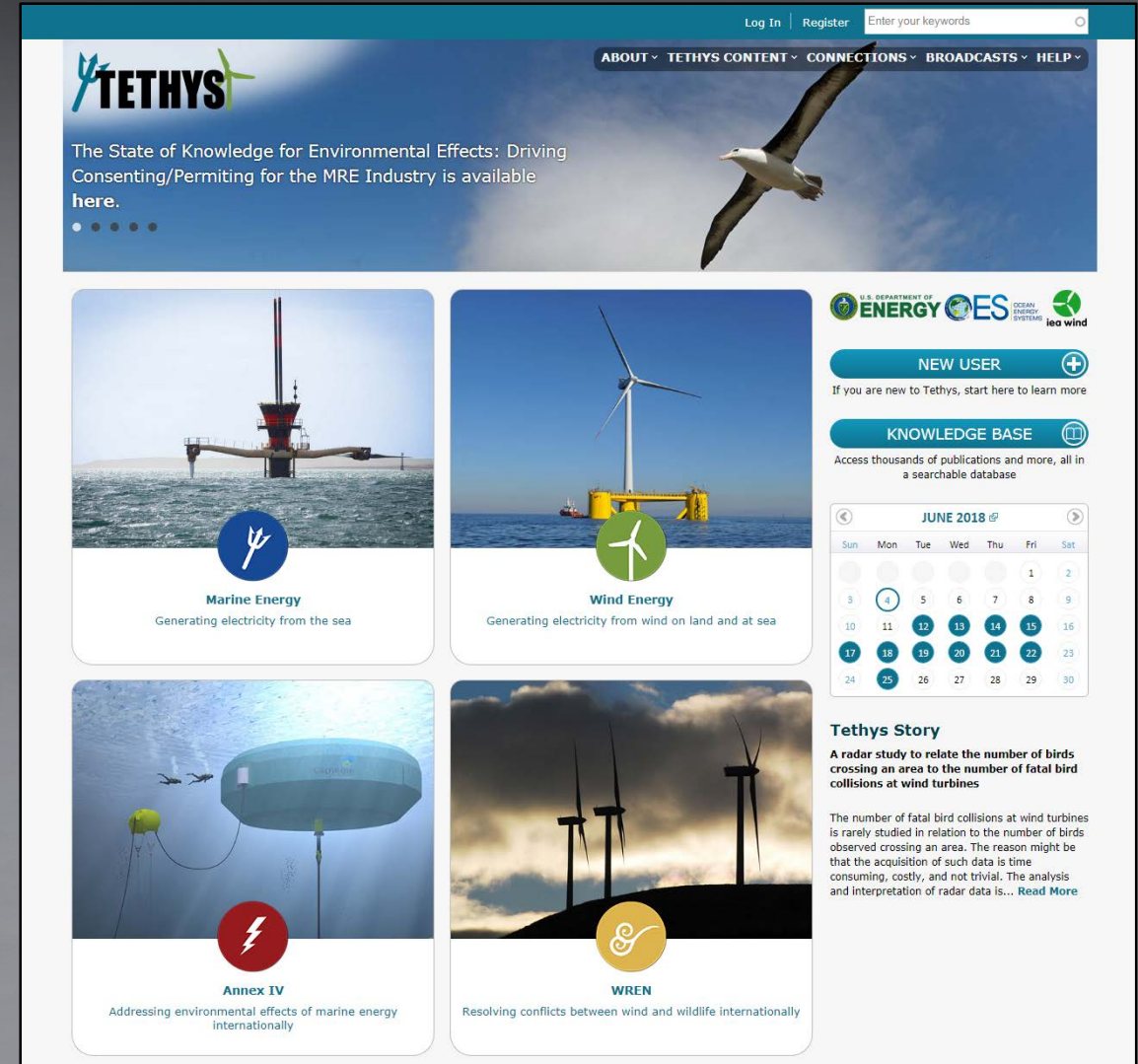
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Questions?



The screenshot shows the TETHYS website homepage. At the top, there is a navigation bar with "Log In", "Register", and a search box. Below the navigation bar is the TETHYS logo and a main banner with the text: "The State of Knowledge for Environmental Effects: Driving Consenting/Permitting for the MRE Industry is available here." Below the banner are four featured content cards: "Marine Energy" (Generating electricity from the sea), "Wind Energy" (Generating electricity from wind on land and at sea), "Annex IV" (Addressing environmental effects of marine energy internationally), and "WREN" (Resolving conflicts between wind and wildlife internationally). On the right side, there are links for "NEW USER" and "KNOWLEDGE BASE", a calendar for June 2018, and a "Tethys Story" section with a link to "Read More".