

1 **Context for Offshore Wind Energy Development**
2 **Pathways of Effects Model**

3 Pathways of Effects (PoE) models are tools used for illustrating the ways that human
4 activities cause changes to the environment. Models consist of a visual diagram to
5 illustrate cause-effect pathways between components. Cause-effect pathways are
6 represented by arrows that connect related components. An accompanying narrative is
7 included in the review package to explain the specific pathways in greater detail.

8 Additionally, PoE models come with some limitations:

- 9 - They do not include cumulative effects from other marine industries or activities
10 outside of offshore wind energy development.
- 11 - They do not offer any quantification (magnitude/significance) of effects.
- 12 - They assume no species-specific pathways. Examples are provided for marine birds
13 and bats for select stressors, but knowledge gaps remain and can be a limitation for
14 other stressors.



15
16 Figure 1: The components of a PoE model.

17 Activities: an anthropogenic undertaking that can cause positive or negative impacts to the
18 environment (Government of Canada, 2012). Offshore wind energy development projects
19 will consist of multiple phases, including pre-construction, construction, operation, and
20 decommissioning. An additional category has been included separately for accidents and
21 spills that might occur throughout each project phase.

22 Stressors: any chemical, physical or biological entity that can cause an adverse effect on a
23 measurable endpoint (Government of Canada, 2012). Additional terms such as pressure,
24 impact-producing factor, and hazard are also used across disciplines (EPA, 1998; Orr et al.,
25 2020).

26 Effects: a measurable change to an ecosystem component or function caused by human
27 induced stressors that is positive or negative (Government of Canada, 2012). To simplify
28 the model diagrams, effects are grouped into 1) change in habitat, 2) change in individual
29 fitness, and 3) mortality (Table 1). Effects are further described in the accompanying
30 narrative.

31 Table 1: Groupings used for identified effects.

Effect Category	Explanation	Source
Change in Habitat	Change in the physical habitat of the marine environment. This includes habitat loss and change (increase or decrease) in habitat quality.	Hannah et al., 2020
Change in Individual Fitness	Non-lethal change to the physiological condition of an organism that improves or reduces the ability to grow, survive to reproductive age, and/or produce or rear offspring. Included are behavioural effects, changes to organism health and reproduction, and injury.	Adapted from Hannah et al., 2020
Mortality	Refers to the death of an organism or group of organisms. Mortality can be an immediate or delayed response after exposure to a stressor. Mortality can also occur due to a change in individual fitness.	Adapted from Hannah et al., 2020

32

33 Measurable endpoints: According to the National Guidelines for PoE models, measurable
 34 endpoints are environmental state indicators used to measure and track changes over time
 35 with respect to the objective (Government of Canada, 2012).