Supplementary Material S1

# Evaluating the likelihood of exposure to oil.

Even though marine mammals may detect oil, they do not usually avoid surface slick and/or contaminated waters (Jarvela Rosenberger et al. 2017). Therefore, they could be exposed to oil during their normal surface behaviors (*i.e.,* breathing, resting, socializing, feeding, and traveling). Exposure pathways include contact, adhesion, inhalation, direct ingestion, and/or indirect ingestion:

*Contact.* Since marine mammals need air to breathe, they all spend time at or near the water surface, so the risk of encountering oil varies from moderate to high. This risk is higher for those species that exhibit surface behaviors, as well as for those that feed on epi- or mesopelagic prey.

*Adhesion.* There are three aspects that influence adhesion: 1) the texture of the exposed surface (*i.e.,* cetaceans’ skin, or presence of fur), 2) the frequency and duration of exposure, and 3) the characteristics of the oil. The criterion for assessing this pathway is skin texture and/or the presence of fur.

*Inhalation.* During an oil spill, marine mammals have a high likelihood of inhaling toxic fumes, since they spend time in the air-water interface to breathe. The criteria for assessing this pathway are the time at the air-water interface, the presence of blowhole, and the grooming behavior.

*Direct ingestion.* The feeding mechanism determines the amount of contaminated water ingestion. Toothed species do not swallow large amounts of seawater, unlike baleen whales, which ingest large amounts. Likewise, furred marine mammals (*e.g.,* sea otters) can consume large quantities of oil during grooming.

*Indirect ingestion.* Marine mammals could ingest oil products through contaminated prey that accumulate oil products. The criterion for assessing this pathway is the prey type: vertebrates are more efficient to metabolize petroleum compounds than invertebrates.

The uncertainty of the estimate was obtained using the data quality index of Patrick et al. (2010), which classifies information quality into five levels (Table S1). The index is calculated as the weighted average and varies from 1.00 to 5.00. Data quality is classified into three categories: poor (<2.0), moderate (2.0 – 3.5), and good (>3.5). Given that the exposure pathways are evaluated based on morphological, anatomical and/or behavioral traits of the species, the score assigned to all species for the first four (i. e., contact, adhesion, inhalation, and direct ingestion) was 5, since this information is independent of geographic area. The only route that can have values < 5 is indirect ingestion since the diet of a species can vary between ocean basins. Therefore, the quality of the data used was good for all species (Table S2).

**TABLE S1 |** Data quality levels. Based on Patrick et al. (2010).

|  |  |
| --- | --- |
| **Data quality score** | **Description** |
| 5 | **Best data.** Information is based on data collected in the Gulf of Mexico or ecological features described specifically for the species in question. |
| 4 | **Adequate data.** Information is based on collected data from the Atlantic Ocean basin.  |
| 3 | **Limited data.** Estimates based on collected data in other ocean basins or studies of similar taxa or life history strategies.  |
| 2 | **Very limited data.** Attribute score reflects the expert opinion of the reviewer or on a general literature review from a wide range of species. |
| 1 | **No data.** No information on which to make, even an expert opinion, then a middle score was assigned as a precautionary value. |

**TABLE S2** | Quality of the data used to estimate the likelihood of exposure to oil of eight odontocetes from the Gulf of Mexico.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Species** | **Contact** | **Adhesion** | **Inhalation** | **Direct ingestion** | **Indirect ingestion** | **Data-quality index** |
| Sperm whale | 5 | 5 | 5 | 5 | 3 | 4.60 |
| Short-finned pilot whale  | 5 | 5 | 5 | 5 | 4 | 4.80 |
| Risso’s dolphin | 5 | 5 | 5 | 5 | 3 | 4.60 |
| Pantropical spotted dolphin  | 5 | 5 | 5 | 5 | 3 | 4.60 |
| Clymene dolphin  | 5 | 5 | 5 | 5 | 4 | 4.80 |
| Atlantic spotted dolphin  | 5 | 5 | 5 | 5 | 4 | 4.80 |
| Rough-toothed dolphin  | 5 | 5 | 5 | 5 | 4 | 4.80 |
| Bottlenose dolphin  | 5 | 5 | 5 | 5 | 4 | 4.80 |

# References

Jarvela Rosenberger, A.L., MacDuffee, M., Rosenberger, A.G.J., and Ross, P.S. (2017). Oil spills and marine mammals in British Columbia, Canada: development and application of a risk-based conceptual framework. Arch. Environ. Contam. Toxicol. 73, 131–53. doi:10.1007/s00244-017-0408-7.

Patrick, W.S., Spencer, P., Link, J., Cope, J., Field, J., Kobayashi, D., Lawson, P., Gedamke, T., Cortés, E., Ormseth, O., Bigelow, K., and Overholtz, W. (2010). Using productivity and susceptibility indices to assess the vulnerability of the United States fish stocks to overfishing. Fish. Bull. 108, 305-322.