

EWMA blog piece 16.10.2016

Morgan Elizabeth Bender

PhD candidate at Depart of Arctic and Marine Biology at UiT The Arctic University of Norway

Recent publication in polar cod sensitivity to petroleum

While the ability to reproduce defines life- polar cod just try harder. This extra effort may put them at a distinct disadvantage in the dynamic future of the Arctic. However, a [recent study](#) published in the journal, *Aquatic Toxicology*, found that exposure to low doses of petroleum slowed the sperm swimming speed in polar cod, an Arctic key species.



Polar Cod - an important fraction

Polar cod, the most abundant fish in the Arctic waters¹, thrive throughout the all the seas surrounding this seasonal and chilly place. While polar cod are only a fraction of the size of their more temperate and tasty older brother, Atlantic cod, this fish plays a unique and central role in feeding whales, seals, and seabirds of the Arctic². Their unique function as a food source is eclipsed only but their huge gonads. The result is a ripe fish shaped like a zeppelin balloon.

But the blissful reproduction focused lives of polar cod may be at risk. As shipping, tourism and oil and gas exploration expand in all areas of the Arctic, the risk of an accidental spill grows accordingly. Oil spilled in ice-covered waters are difficult to clean up and may be trapped, and ferried around to areas where Arctic feeding frenzies on and for polar cod occur in the spring³. The cold temperatures and dark polar nights may preserve the petroleum in its toxic form, which prolongs the time organisms like polar cod and its food can come in contact with petroleum compounds. These contaminants can interfere with endocrine signaling systems and are known to be carcinogenic.

A recent study by [Bender et al.](#) exposed wild polar cod to low doses of petroleum mixed in with their natural diet for seven months following the period of reproductive development. This was done by spending long days in the lab rigged up like polar night, huddled with a small headlamp, down jacket and the sweet smell of salty fish flowering the air. Reproductive endpoints of gonadal development, somatic indices, sex hormone levels and sperm motility were compared between the unexposed and four different petroleum dosage groups. Results reveal that polar cod maturation may have influenced

the measures of petroleum exposure. However, males exposed to petroleum had slower sperm swimming speeds compared to the unexposed, which could reduce the ability of sperm to find and fertilize eggs⁴. No alterations were found in hormone levels between the exposed fish and the unexposed fish. Oocytes and spermatocytes development appeared normal in all groups compared to what we know about polar cod gonad development, which isn't actually very much.

While reproductive development in polar cod reveals a relative insensitivity to this chronic dietary exposure to petroleum, we still wonder what effect this exposure would have on the next generation of polar cod. Even yet while this while this study aimed at an environmental realistic experiment in nature polar cod are simultaneously under pressure to find food, avoid predation and to recent changes in ocean temperatures and reduction in sea ice^{5,6}. These additional changes may reach beyond the flexibility of polar cod, a species uniquely adapted to life at the top of the world, and such the future of the polar cod and the ecosystem it supports is in uncertain waters.

References

- ¹ Bradstreet, M.S., 1982. Occurrence, habitat use, and behavior of seabirds, marine mammals, and arctic cod at the Pond Inlet ice edge. *Arctic* 35, 28–40. doi:10.1016/0198-0254(82)90265-5
- ² Bradstreet, M.S.W., Cross, W.E., 1982. Trophic Relationships at High Arctic Ice Edges. *Arctic* 35, 1–12. doi:10.1016/0266-9838(93)90013-8
- ³ AMAP, 2009. Arctic Pollution 2009, Arctic Monitoring and Assessment Programme.
- ⁴ Bender, M.L., Frantzen, M., Vieweg, I., Falk-Petersen, Johnsen, H.K., Rudolfson, G., Tollefsen, K.E., Dubourg, P., Nahrgang, J., 2016. Effects of chronic dietary petroleum exposure on reproductive development in polar cod (*Boreogadus saida*). *Aquatic Toxicology*. <http://dx.doi.org/10.1016/j.aquatox.2016.10.005>.
- ⁵ Stroeve, J., Holland, M.M., Meier, W., Scambos, T., Serreze, M., 2007. Arctic sea ice decline: Faster than forecast. *Geophys. Res. Lett.* 34, 1–5. doi:10.1029/2007GL029703
- ⁶ Bouchard, C., Fortier, L., 2011. Circum-arctic comparison of the hatching season of polar cod *Boreogadus saida*: A test of the freshwater winter refuge hypothesis. *Prog. Oceanogr.* 90, 105–116. doi:10.1016/j.pocean.2011.02.008