Moose and Predators' Numerical Response to Anthropogenic Features in the Alberta Oil Sands Region

Best Practices Recommendations for PTAC

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With woodland caribou populations continuing to decline (Hervieux et al. 2013), Alberta government and industry are allocating substantial resources to management actions designed to halt this decline, include wolf culls (Hervieux et al. 2014) and habitat reclamation (Pyper et al. 2014, Ray 2014). As wolves are known to use linear features to hunt caribou, thereby increasing encounter rates and predation rates (Latham et al. 2011a, Whittington et al. 2011, McKenzie et al. 2012), much of the focus of expensive reclamation efforts has been on linear features, especially traditional (non-3D) seismic lines. The cost of reclaiming the entire seismic line network in Alberta is massive and likely prohibitive (Schneider et al. 2010), so recent effort has been invested in identifying specific locations in the boreal forest landscape where seismic line reclamation efforts can be most effective in preventing wolf predation on caribou, to stem ongoing declines. Our research suggests three main outcomes regarding this strategy.

First, wolves are not the only species markedly affected by anthropogenic features in the northeast boreal forest. All species examined, including other potential caribou predators (black bears, coyotes) and other prey species (moose, deer) that act as apparent competitors to caribou (Holt 1977, Holt and Kotler 1987, DeCesare et al. 2009, Serrouya et al. 2015) are both positively and negatively affected by the many feature types in this complex landscape. Managing a single predator – wolves – may not produce an effective outcome for caribou declines without also managing (in some way) the other potential predators on the landscape, as well as the alternate prey.

Second, seismic lines are not the only anthropogenic feature affecting mammals implicated in caribou declines. In fact, they may not be the most important feature. White-tailed deer are expanding in the boreal forest (Dawe et al. 2014, Fisher et al. 2015, Fisher et al. 2016) and bolstering wolf numbers (Latham et al. 2011b, Latham et al. 2013). Deer numbers increase with forest harvest cutblocks, industrial block features, and well sites. Moose may also be bolstering wolf numbers; their numbers increase with cutblocks, industrial block features, and 3D seismic lines. Black bears may also contribute to caribou declines in Alberta, as they do elsewhere in Canada (Rayl et al. 2015, Bastille-Rousseau et al. 2016, Mahoney et al. 2016). In the Alberta boreal forest, black bear numbers did not increase with any

specific feature, but decreased in conjunction with block features and 3D seismic lines. Coyotes may also play a role in declines (Bastille-Rousseau et al. 2016), and coyote numbers increased markedly in conjunction with roads and 3D seismic lines, as well as traditional seismic lines. In summary, an effective reclamation strategy designed to manage those species indicted in caribou declines will likely have to target several different anthropogenic features derived from three resource sectors: transportation infrastructure, forest harvesting, and petroleum extraction, as each has effects on caribou predators and apparent competitors.

Third, the size of the landscape in which anthropogenic features affect numerical responses to predators and alternate prey can extend well beyond a small area targeted for reclamation. We tested several local landscape sizes up to a 5-km radius around our sampling sites (78.5 km^2) and found that different species' abundances were related to landscapes measured at different sizes, as did Fisher et al. (2011). For example, the relative abundance of coyotes was affected by features within a 78.5 km^2 area around the sampling site. In other words, anthropogenic features within ¾ of a township parcel affect coyote abundance *at a single sampling site*. Wolf and lynx were affected by features within 16 km^2 of the sampling site. White-tailed deer, black bear, and moose were affected by features within a much smaller area. In summary, the areas targeted for feature reclamation will likely have to be larger than a township, and centred upon areas of higher predator and shared prey density, to have any effect on populations.

Finally, our study demonstrates the value of collecting high quality data across large spatial and temporal scales for multiple species within the boreal mammal community. We suggest that an integrated cycle of research and monitoring is critical to continuously test and improve our understanding of wildlife responses to the changing boreal landscape, and ultimately improve our management outcomes (Burton et al. 2014).

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