

THINKING OUTSIDE THE BOX - PREDICTING BIOTIC INTERACTIONS IN DATA-POOR ENVIRONMENTS

Supplementary information

DAVID BEAUCHESNE^{1}, PHILIPPE DESJARDINS-PROULX²,
PHILIPPE ARCHAMBAULT³, and DOMINIQUE GRAVEL²*

** email: david.beauchesne@uqar.ca*

¹ Université du Québec à Rimouski

² Université de Sherbrooke

³ Université Laval

September 17, 2016

| Functional group name | Functional group main taxa composition |
|-------------------------------------|---|
| Cetaceans | <i>Balaenoptera physalus</i> , <i>B. acutorostrata</i> , <i>Megaptera novaeangliae</i> , <i>Phocoena phocoena</i> , <i>Lagenorhynchus acutus</i> , <i>L. albirostris</i> |
| Harp seals | <i>Pagophilus groenlandicus</i> |
| Hooded seals | <i>Cystophora cristata</i> |
| Grey seals | <i>Halichoerus grypus</i> |
| Harbour seals | <i>Phoca vitulina</i> |
| Seabirds | <i>Phalacrocorax carbo</i> , <i>P. auritus</i> , <i>Larus delawarensis</i> , <i>L. argentatus</i> , <i>L. marinus</i> , <i>Sterna hirundo</i> , <i>S. paradisaea</i> , <i>Cepphus grylle</i> , <i>Oceanodroma leucorhoa</i> , <i>Morus bassanus</i> , <i>Rissa tridactyla</i> , <i>Uria aalge</i> , <i>Alca torda</i> , <i>Fratercula arctica</i> |
| Atlantic cod | <i>Gadus morhua</i> |
| Greenland halibut | <i>Reinhardtius hippoglossoides</i> |
| American plaice | <i>Hippoglossoides platessoides</i> |
| Flounders | <i>Limanda ferruginea</i> , <i>Glyptocephalus cynoglossus</i> , <i>Pseudopleuronectes americanus</i> |
| Skates | <i>Amblyraja radiata</i> , <i>Malacoraja senta</i> , <i>Leucoraja ocellata</i> |
| Redfish | <i>Sebastes mentella</i> , <i>S. fasciatus</i> |
| Large demersal feeders | <i>Urophycis tenuis</i> , <i>Melanogrammus aeglefinus</i> , <i>Centroscyllium fabricii</i> , <i>Anarhichassp.</i> , <i>Cyclopterus lumpus</i> , <i>Lycodessp.</i> , <i>Macrouridae</i> , <i>Zoarcidae</i> , <i>Lophius americanus</i> , <i>Hippoglossus hippoglossus</i> |
| Small demersal feeders | <i>Myoxocephalussp.</i> , <i>Tautogolabrus adspersus</i> , <i>Zoarcasamericanus</i> , large demersal juveniles |
| Capelin | <i>Mallotus villosus</i> |
| Large pelagic feeders | <i>Squalus acanthias</i> , <i>Pollachius virens</i> , <i>Merluccius bilinearis</i> , <i>Cetorhinus maximus</i> |
| Piscivorous small pelagic feeders | <i>Scomber scombrus</i> , <i>Illex illecebrosus</i> , piscivorous myctophids and other mesopelagics, piscivorous large pelagic juveniles |
| Planktivorous small pelagic feeders | <i>Clupea harengus harengus</i> , <i>Scomberesox saurus</i> , <i>Gonatussp.</i> , planktivorous myctiphids and other mesopelagics, planktivorous large pelagic juveniles |
| Shrimp | <i>Argis dentata</i> , <i>Eualus macilentus</i> , <i>E. gaimardi</i> , <i>Pandalus montagui</i> |
| Large crustaceans | <i>Chionoecetes opilio</i> , <i>Hyassp.</i> |
| Echinoderms | <i>Echinarachnius parma</i> , <i>Stronglyocentrotus pallidus</i> , <i>Ophiura robusta</i> |

| Functional group name | Functional group main taxa composition |
|-----------------------|--|
| Molluscs | <i>Mesodesma deauratum</i> , <i>Cyrtodaria siliqua</i> |
| Polychates | <i>Parexogone hebes</i> |
| Small zooplankton | <i>Oithona similis</i> , <i>Temora longicornis</i> , <i>Pseudocalanus</i> sp., <i>Calanus finmarchicus</i> , tunicates, meroplankton, heterotrophic protozoa |
| Phytoplankton | <i>Chaetoceros affinis</i> , <i>Chaetoceros</i> sp., <i>Leptocylindrus minimus</i> , <i>Thalassiosira nordenskioldii</i> , <i>Thalassiosira</i> sp., <i>Fragilariopsis</i> sp., other diatoms, mixture of autotrophic and mixotrophic organisms including Cryptophytes, dinoflagellates, Prasinophytes and Prymnesiophytes |

Table S1: List of functional groups included in the dataset presented in Savenkoff et al. (2004) with their taxa composition. Only taxa that were at least at the scale of the family were used to predict interactions using the XXX algorithm. List adapted from Savenkoff et al. (2004).

| Consumer | Resource |
|-------------------------------------|-------------------------------------|
| Skates | Skates |
| Atlantic cod | Skates |
| Hooded seals | Shrimp |
| Piscivorous small pelagic feeders | Shrimp |
| Planktivorous small pelagic feeders | Phytoplankton |
| Planktivorous small pelagic feeders | Large crustaceans |
| Hooded seals | Large crustaceans |
| Echinoderms | Large crustaceans |
| Flounders | Large crustaceans |
| Seabirds | Large crustaceans |
| Greenland halibut | Large crustaceans |
| Piscivorous small pelagic feeders | Large crustaceans |
| Redfish | Large crustaceans |
| Planktivorous small pelagic feeders | Planktivorous small pelagic feeders |
| American plaice | Planktivorous small pelagic feeders |
| Echinoderms | Echinoderms |
| Large demersal feeders | Echinoderms |
| Planktivorous small pelagic feeders | Atlantic cod |
| American plaice | Atlantic cod |
| Flounders | Atlantic cod |
| Greenland halibut | Atlantic cod |
| Piscivorous small pelagic feeders | Atlantic cod |
| Cetaceans | American plaice |
| Planktivorous small pelagic feeders | American plaice |
| Hooded seals | American plaice |
| American plaice | American plaice |
| Flounders | American plaice |
| Harbour seals | American plaice |
| Piscivorous small pelagic feeders | American plaice |
| Redfish | American plaice |
| Large pelagic feeders | American plaice |
| Cetaceans | Flounders |
| Planktivorous small pelagic feeders | Flounders |
| American plaice | Flounders |
| Flounders | Flounders |
| Piscivorous small pelagic feeders | Flounders |
| Redfish | Flounders |
| Large crustaceans | Capelin |
| Planktivorous small pelagic feeders | Capelin |
| Piscivorous small pelagic feeders | Small demersal feeders |

| Consumer | Resource |
|-------------------------------------|-----------------------------------|
| Cetaceans | Small zooplankton |
| Large crustaceans | Small zooplankton |
| Large pelagic feeders | Small zooplankton |
| Large demersal feeders | Small zooplankton |
| Atlantic cod | Seabirds |
| Seabirds | Seabirds |
| Large demersal feeders | Seabirds |
| Harbour seals | Harbour seals |
| Skates | Greenland halibut |
| Cetaceans | Greenland halibut |
| Planktivorous small pelagic feeders | Greenland halibut |
| Atlantic cod | Greenland halibut |
| American plaice | Greenland halibut |
| Flounders | Greenland halibut |
| Small demersal feeders | Greenland halibut |
| Harbour seals | Greenland halibut |
| Piscivorous small pelagic feeders | Greenland halibut |
| Redfish | Greenland halibut |
| Large pelagic feeders | Greenland halibut |
| Planktivorous small pelagic feeders | Piscivorous small pelagic feeders |
| American plaice | Piscivorous small pelagic feeders |
| Flounders | Piscivorous small pelagic feeders |
| Small demersal feeders | Piscivorous small pelagic feeders |
| Piscivorous small pelagic feeders | Piscivorous small pelagic feeders |
| Atlantic cod | Redfish |
| Harp seals | Redfish |
| Seabirds | Redfish |
| Redfish | Redfish |
| Large pelagic feeders | Redfish |
| Skates | Large pelagic feeders |
| Planktivorous small pelagic feeders | Large pelagic feeders |
| Hooded seals | Large pelagic feeders |
| Atlantic cod | Large pelagic feeders |
| American plaice | Large pelagic feeders |
| Flounders | Large pelagic feeders |
| Small demersal feeders | Large pelagic feeders |
| Harp seals | Large pelagic feeders |
| Seabirds | Large pelagic feeders |
| Greenland halibut | Large pelagic feeders |
| Piscivorous small pelagic feeders | Large pelagic feeders |

| Consumer | Resource |
|-------------------------------------|------------------------|
| Redfish | Large pelagic feeders |
| Large pelagic feeders | Large pelagic feeders |
| Large demersal feeders | Large pelagic feeders |
| Skates | Large demersal feeders |
| Cetaceans | Large demersal feeders |
| Planktivorous small pelagic feeders | Large demersal feeders |
| Atlantic cod | Large demersal feeders |
| American plaice | Large demersal feeders |
| Flounders | Large demersal feeders |
| Small demersal feeders | Large demersal feeders |
| Seabirds | Large demersal feeders |
| Greenland halibut | Large demersal feeders |
| Piscivorous small pelagic feeders | Large demersal feeders |
| Redfish | Large demersal feeders |
| Large pelagic feeders | Large demersal feeders |
| Large demersal feeders | Large demersal feeders |

Table S2: List of functional groups for which interactions were predicted by the XXX algorithm, but not observed in Savenkoff et al. (2004) (b).

| Consumer | Resource |
|------------------------|-------------------------------------|
| Grey seals | Skates |
| Seabirds | Skates |
| Harbour seals | Skates |
| Cetaceans | Shrimp |
| Shrimp | Phytoplankton |
| Mollusks | Phytoplankton |
| Polychaetes | Phytoplankton |
| Grey seals | Large crustaceans |
| Flounders | Planktivorous small pelagic feeders |
| Flounders | Echinoderms |
| Small demersal feeders | Echinoderms |
| Grey seals | American plaice |
| Hooded seals | Flounders |
| Harp seals | Flounders |
| Skates | Mollusks |
| Large crustaceans | Mollusks |
| Atlantic cod | Mollusks |
| American plaice | Mollusks |
| Flounders | Mollusks |
| Small demersal feeders | Mollusks |
| Harbour seals | Mollusks |
| Seabirds | Small zooplankton |
| Skates | Polychaetes |
| Shrimp | Polychaetes |
| Large crustaceans | Polychaetes |
| Atlantic cod | Polychaetes |
| American plaice | Polychaetes |
| Flounders | Polychaetes |
| Small demersal feeders | Polychaetes |
| Polychaetes | Polychaetes |
| Large pelagic feeders | Polychaetes |
| Large demersal feeders | Polychaetes |
| Grey seals | Piscivorous small pelagic feeders |
| Greenland halibut | Piscivorous small pelagic feeders |
| Redfish | Piscivorous small pelagic feeders |

Table S3: List of functional groups for which observed interactions in Savenkoff et al. (2004) were not predicted by the XXX algorithm (c).