

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

Supplementary information

DAVID BEAUCHESNE^{1*}, *PHILIPPE DESJARDINS-PROULX*²,
*PHILIPPE ARCHAMBAULT*³, and *DOMINIQUE GRAVEL*²

* email: david.beauchesne@ugr.ca

¹ *Université du Québec à Rimouski*

² *Université de Sherbrooke*

³ *Université Laval*

September 19, 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 hal- ibut	<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 myctophids 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 crus- taceans	<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. 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 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 algorithm (c).

References

Savenkoff, Claude, Hugo Bourdages, Douglas P. Swain, Simon-Pierre Despatie, J. Mark Hanson, Red Méthot, Lyne Morissette, and Mike O. Hammil (2004). *Input data and parameter estimates for ecosystem models of the southern Gulf of St. Lawrence (mid-1980s and mid-1990s)*. Tech. rep. Mont-Joli, Québec, Canada: Canadian Technical Report of Fisheries, Aquatic Sciences 2529, Department of Fisheries, and Oceans, p. 105.