

Supplementary Appendix S1 - Overview of groups, abbreviations and pedigree values

Table S1-1. Overview of group numbers, name and species and taxa in groups for the year 2000 Ecopath model. For groups with many species, (e.g. benthic invertebrate groups) only some species are given

Gr no	Group name	Species and taxa
1	Polar bear	<i>Ursus maritimus</i>
2	Minke whale	<i>Balaenoptera acutorostrata</i>
3	Fin whale	<i>Balaenoptera physalus</i>
4	Blue whale	<i>Balaenoptera musculus</i>
5	Bowhead	<i>Balaena mysticetus</i>
6	Humpback whale	<i>Megaptera novaeangliae</i>
7	White whale	<i>Delphinapterus leucas</i>
8	Narwhale	<i>Monodon monoceros</i>
9	Dolphins	<i>Lagenorhynchus albirostris</i> , <i>Lagenorhynchus acutus</i>
10	Harbor porpoise	<i>Phocoena phocoena</i>
11	Killer whales	<i>Orcinus orca</i>
12	Sperm whale	<i>Physeter macrocephalus</i>
13	Harp seal	<i>Pagophilus groenlandicus</i>
14	Harbor seal	<i>Phoca vitulina</i>
15	Grey seal	<i>Halichoerus grypus</i>
16	Ringed seal	<i>Pusa hispida</i>
17	Bearded seal	<i>Erignathus barbatus</i>
18	Walrus	<i>Odobenus rosmarus</i>
19	Northern fulmar	<i>Fulmarus glacialis</i>
20	Black-legged kittiwake	<i>Rissa tridactyla</i>
21	Other gulls and surface feeders	<i>Larus argentatus</i> , <i>Larus canus</i> , <i>Larus fuscus</i> , <i>Larus hyperboreus</i> , <i>Larus marinus</i> , <i>Pagophila eburnea</i> , <i>Sterna paradisaea</i>
22	Little auk	<i>Alle alle</i>
23	Brunnich guillemot	<i>Uria lomvia</i>
24	Common guillemot and razorbill	<i>Alca torda</i> , <i>Uria aalge</i>
25	Atlantic puffin	<i>Fratercula arctica</i>
26	Benthic piscivore birds	<i>Cephus grille</i> , <i>Phalacrocorax aristotelis</i> , <i>Phalacrocorax carbo</i>
27	Benthic invertebrate feeding birds	<i>Polysticta stelleri</i> , <i>Somateria mollissima</i> , <i>Somateria spectabilis</i> ,
28	Greenland shark	<i>Somniosus microcephalus</i>
29	Northeast Arctic cod (3+)	<i>Gadus morhua</i>
30	Northeast Arctic cod (0-2)	
31	Coastal cod (2+)	
32	Coastal cod (0-1)	<i>Gadus morhua</i>
33	Saithe (3+)	
		<i>Pollachius virens</i>

34	Saithe (0-2)	
35	Haddock (3+)	<i>Melanogrammus aeglefinus</i>
36	Haddock (1-2)	
37	Other small gadoids	<i>Gadiculus argenteus</i> , <i>Melangius merlangus</i> , <i>Trisopterus esmarkii</i>
38	Large Greenland halibut	<i>Reinhardtius hippoglossoides</i>
39	Small Greenland halibut	
40	Other piscivorous fish	<i>Hippoglossus hippoglossus</i> , <i>Lophius piscatorius</i> , <i>Mova molva</i> , <i>Squalus acanthias</i>
41	Wolffishes	<i>Anarhichas denticulatus</i> , <i>A. lupus</i> , <i>A. minor</i>
42	Stichaeidae	<i>Anisarchus medius</i> , <i>Leptoclinus maculatus</i> , <i>Lumpenus fabricii</i> , <i>Lumpenus lampretaeformis</i>
43	Other small bentivorous fishes	<i>Lycodes vahlii</i> , <i>Lycodes seminudus</i> , <i>Lycodes polaris</i> , <i>Lycodes pallidus</i> , <i>Lycodes eudipleurostictus</i> , <i>Lycodes esmarkii</i> , <i>Lycodes reticulatus</i> , <i>Lycodes rossi</i> , <i>Eumicrotremus spinosus</i> , <i>Eumicrotremus derjugini</i> , <i>Cottunculus microps</i> , <i>Cottunculus sadko</i> , <i>Triglops murrayi</i> , <i>Triglops nybelini</i> , <i>Triglops pingelii</i> , <i>Gymnocanthus tricusps</i> , <i>Icelus bicornis</i> , <i>Icelus spatula</i> , <i>Myoxocephalus scorpius</i> , <i>Artediellus atlanticus</i> , <i>Leptagonus decagonus</i> , <i>Liparis gibbus</i> , <i>Liparis fabricii</i> , <i>Careproctus reinhardti</i>
44	Other large benthic invertebrate feeding fishes	<i>Amblyraja hyperborea</i> , <i>Bathyraja spinicauda</i> , <i>Brosme brosme</i> , <i>Chimaera monstrosa</i> , <i>Dipturus batis</i> , <i>Dipturus linteus</i> , <i>Etmopterus spinax</i> , <i>Macrourus berglax</i> , <i>Rajella fyllae</i> ,
45	Thorny skate	<i>Amblyraja radiata</i>
46	Long rough dab	<i>Hippoglossoides platessoides</i>
47	Other benthivore flatfish	<i>Glyptocephaus cynoglossus</i> , <i>Limanda limanda</i> , <i>Liopsetta glacialis</i> , <i>Platichys flesus</i> , <i>Pleuronectes platessa</i> , <i>Microstomus kitt</i>
48	Large herring	<i>Clupea harengus</i>
49	Small herring	
50	Capelin age 3+	<i>Mallotus villosus</i>
51	Capelin age 0-2	
52	Polar cod age 2+	<i>Boreogadus saida</i>
53	Polar cod age 0-2	
54	Blue whiting	<i>Micromesistius poutassou</i>
55	Sandeel	<i>Ammodytes marinus</i>
56	Other pelagic planktivorous fish	<i>Arctozenus risso</i> , <i>Argentina silus</i> , <i>Benthoosema glaciale</i> , <i>Maurollicus muelleri</i>
57	Lumpfish	<i>Cyclopterus lumpus</i>
58	Mackerel	<i>Scomber scombrus</i>
59	Large redfish	<i>Sebastes mentella</i> , <i>Sebastes norvegicus</i>
60	Small redfish	
61	Atlantic salmon	<i>Salmo salar</i>
62	Cephalopods	<i>Gonatus fabricii</i> , <i>Rossia palpebrosa</i>
63	Scyphomedusae	<i>Aurelia aurita</i> , <i>Cyanea capillata</i>

64	Chaetognaths	<i>Eukrohnia hamata</i> , <i>Parasagitta elegans</i>
65	<i>Thysanoessa</i>	<i>Thysanoessa inermis</i> , <i>T. longicaudata</i> , <i>T. raschii</i>
66	Large krill	<i>Meganyctiphanes norvegica</i>
67	Ctenophora	<i>Beroe cucumis</i> , <i>Bolinopsis infundibulum</i> , <i>Mertensia ovum</i>
68	Pelagic amphipods	<i>Themisto abyssorum</i> , <i>T. libellula</i> ,
69	Symphagic amphipods	<i>Apherusa glacialis</i> , <i>Gammarus wilkitzkii</i> , <i>Onismmus glacialis</i> , <i>Onismmus nansenii</i>
70	Pteropods	<i>Clione limacina</i> , <i>Limacina helicina</i>
71	Medium sized copepods	<i>Calanus finmarchicus</i> , <i>Metridia spp.</i>
72	Large calanoids	<i>Calanus glacialis</i> , <i>C. hyperboreus</i>
73	Small copepods	<i>Microsetella norvegica</i> , <i>Microcalanus spp.</i> , <i>Oithona spp.</i> , <i>Pseudocalanus spp.</i>
74	Other large zooplankton	Cladocera, meroplankton, pelagic foraminifera, pelagic polychaetes,
75	Appendicularians	<i>Fritillaria borealis</i> , <i>Oikopleura vanhoeffeni</i>
76	Ciliates	Oligotrichia, Tintinnidae, <i>Mesodinium rubrum</i>
77	Heterotrophic dinoflagellates	
78	Heterotrophic nanoflagellates (HNAN)	
79	Northern shrimp	<i>Pandalus borealis</i>
80	Crangonid and other shrimps	<i>Bythocaris biruli</i> , <i>Bythocaris payeri</i> , <i>Eualus gaimardii gaimardii</i> , <i>Eusergestes arcticus</i> , <i>Hymenodora glacialis</i> , <i>Lebbeus polaris</i> , <i>Pasiphaea multidentata</i> , <i>Pasiphaea tarda</i> , <i>Pontophilus norvegicus</i> , <i>Sabinea sarsii</i> , <i>Sabinea septemcarinata</i> , <i>Sclerocrangon boreas</i> , <i>Sclerocrangon ferox</i> , <i>Spirontocaris liljeborgii</i> , <i>Spirontocaris spinus</i>
81	Other large crustaceans	<i>Hyas araneus</i> , <i>Hyas coarctatus</i> , <i>Pagurus bernhardus</i> , <i>Pagurus pubescens</i> , <i>Lithodes maja</i> , <i>Munida sarsi</i>
82	Crinoids	<i>Bathycrinus carpenter</i> , <i>Heliomitra glacialis</i> , <i>Poliometra proluxa</i>
83	Predatory asteroids	<i>Asterias rubens</i> , <i>Crossaster papposus</i> , <i>Leptasterias muelleri</i> , <i>Solaster endeca</i> ,
84	Predatory gastropods	<i>Buccinum spp.</i> , <i>Colus sabini</i> , <i>Cryptonatica affinis</i> , <i>Euspira pallida</i> , <i>Neptunea antiqua</i> , <i>Neptunea despecta</i>
85	Predatory polychaetes	<i>Eunoe oerstedii</i> , Lumbrineridae, <i>Nephtys spp.</i> , <i>Nereis zonata</i> , <i>Scoloplos armiger</i> , Polynoidae, Phyllodocida
86	Other predatory benthic invertebrates	Gorgonacephalidae, Hydrozoa, Nemertini, Priapulidae, Pycnogonidae, predatory Anthozoa
87	Detritivorous polychaetes	<i>Ampharetidae</i> , <i>Amphicteis ninona</i> , <i>Capitella capitata</i> , <i>Cirratulidae</i> , <i>Cossura longocirrata</i> , <i>Maldane spp.</i> , <i>Myriochele oculata</i> , <i>Ophelina</i>

		<i>acuminata</i> , <i>Owenia fusiformis</i> , <i>Pectinaria</i> spp., Sabellidae, <i>Spiochaetopterus typicus</i> , Terebellidae, <i>Laonice cirrata</i> , <i>Travisia forbesi</i> ,
88	Small benthic crustaceans	<i>Balanus balanus</i> , <i>Balanus crenatus</i> , <i>Verruca stroemia</i> , benthic amphipods, Cumacea, Isopoda, Mysidae
89	Small benthic molluscs	Small bivalves < 30 mm adult size (<i>Axinopsida orbiculata</i> , <i>Liocyma fluctuosa</i> , <i>Margarites</i> sp., <i>Modiolula phaseolina</i> , <i>Nucula</i> sp., <i>Parvicardium minimum</i> , <i>Thyasira dunbari</i> , <i>Yoldiella</i> sp.), Caudofoveata, Polyplacophora, Scaphopoda, <i>Gibbula cineraria</i> , <i>Littorina obtusata</i> , <i>Patella vulgata</i> , <i>Testudinalia testudinalis</i> , <i>Velutina</i> sp.
90	Large bivalves	<i>Arctica islandica</i> , <i>Astarte</i> spp., <i>Bathyarca</i> sp., <i>Chlamys islandica</i> , <i>Clinocardium ciliatum</i> , <i>Hiatella arctica</i> , <i>Macoma calcarea</i> , <i>Mya truncata</i> , <i>Mya arenaria</i> , <i>Modiolus modiolus</i> , <i>Musculus niger</i> , <i>Nuculana pernula</i> , <i>Portlandia arctica</i> , <i>Pseudamussium peslutrae</i> , <i>Serripes groenlandicus</i> , <i>Similipecten greenlandicus</i> , <i>Yoldia hyperborea</i>
91	Detritivorous echinoderms	<i>Amphiura sundevalli</i> , <i>Ctenodiscus crispatus</i> , <i>Cucumaria frondosa</i> , <i>Henricia</i> sp., <i>Molpadia borealis</i> , <i>Ophiacantha bidentata</i> , <i>Ophiopholis aculeata</i> , <i>Ophioscolex glacialis</i> , <i>Ophiosten sericeum</i> , <i>Ophiura sarsi</i> , <i>Parastichopus tremulus</i> , <i>Pontaster tenuispinus</i> , <i>Strongylocentrotus pallidus</i> , <i>Strongylocentrotus droebachiensis</i> ,
92	Large epibenthic suspension feeders	Ascidia, Brachiopoda, Bryozoa, Porifera
93	Other benthic invertebrates	Echiura, <i>Golfingia</i> sp., Sipunculida,
94	Meiofauna	Harpacticoid copepods, Nematoda
95	Bacteria	
96	Benthic foraminifera	
97	Diatoms	<i>Chaetoceros</i> spp., <i>Navicula</i> spp., <i>Thalassiosira</i> spp.
98	Autotroph flagellates	<i>Emiliana huxleyi</i> , <i>Phaeocystis pouchetii</i>
99	Ice algae	<i>Melosira arctica</i> , <i>Nitzschia frigida</i>
100	Macroalgae	<i>Acrosiphonia flagellata</i> , <i>Alaria esculenta</i> , <i>Ascophyllum nodosum</i> , <i>Chorda filum</i> , <i>Devaleraea ramentacea</i> , <i>Desmarestia aculeata</i> , <i>Fucus distichus</i> , <i>Fucus serratus</i> , <i>Fucus vesiculosus</i> , <i>Laminaria hyperborea</i> , <i>Laminaria digitata</i> , <i>Odonthalia dentata</i> , <i>Phycodrys rubens</i> , <i>Polysiphonia lanosa</i> , <i>Ptilota serrata</i> , <i>Saccharina latissima</i> , <i>Saccorhiza dermatodea</i> , <i>Ulva intestinalis</i>
101	Snow crab	<i>Chionoecetes opilio</i>
102	Large red king crab	<i>Paralithodes camtschaticus</i>
103	Medium sized red king crab	

104	Small red king crab	
105	Dead carcasses	
106	Detritus from other sources	
107	Detritus ice algae	
108	Offal	

Table S1-2. List of abbreviations used in Supplements and input tables for the separate groups

Abbreviation	Explanation
B _m (kg ww)	Body mass in kg wet weight
W _p	proportions of diet by weight
F _{oc}	frequency of occurrence of prey group
N%	proportions of number of prey
ww	wet weight
dw	dry weight
C/WW	Carbon – wet weight ratio
P/B	Production/Biomass ratio (year ⁻¹)
P/Q	Production/Consumption ratio
Z	Total mortality rate (year ⁻¹)
UC	Proportion of unassimilated food
SD	Standard deviation
SAM-model	State-space Assessment Model

Procedures for pooling and averaging input parameter values and diet data sets

When multiple diet sets were available for a group, diet sets were averaged if they represented same time period. When data sets (e.g. stomach content data) were based on very different number of individuals, averaging were in some cases weighted by number of individuals in the samples.

Assessment of individual input parameters

Somatic production and somatic P/B, Ecopath model only accounts for somatic production, i.e. fate of spawning products of higher trophic levels are not explicitly modelled and accounted for in the model. The somatic P/Q has been used when somatic P/B has been calculated for calculating Q/B.

Assessment of uncertainty and pedigree

For assessment of pedigree representing uncertainty in input values, 95% confidence intervals or values for coefficient of variation (CV) were used when values were reported in the

literature and written in brackets (..) in the column for values in the group tables. In the column for pedigree, the pedigree value is shown. If available, the 95 % confidence interval in percentage of the point estimate (half the total confidence interval) is written in brackets to the right of the pedigree value.

95% confidence intervals were calculated from mean and CV as: upper 95 % CI = (mean + (mean*1.96*CV)) and lowerCI = (mean*1.96*CV). A pedigree category for each input value (Supplementary Appendix 2) was assessed by the modeler.

Confidence intervals in the Monte Carlo routine

In the Monte Carlo routine, values for CV were loaded. CV was linked to confidence intervals as follows: $CV = (CI/100)*1.96$.

Table S1-3. Overview of pedigree scores, description and confidence intervals (CI) (+/- %)

Input variable	Pedigree score	Description	CI (+/- %)
Biomass	1	Estimated by Ecopath	80
	2	From other model	80
	3	Guesstimate	80
	4	Approximate or indirect method	50
	5	Sampling locally, low precision	30
	6	Sampling locally, high precision	10
Production/biomass	1	Estimated by Ecopath	80
	2	Guesstimate	70
	3	From other model	60
	4	Empirical relationship	50
	5	Similar species, similar system, low precision	40
	6	Similar species, same system, low precision	30
	7	Similar species, similar system, high precision	20
	8	Similar species, same system, high precision	10
Consumption/ biomass	1	Estimated by Ecopath	80
	2	Guesstimate	70
	3	From other model	60
	4	Empirical relationship	50
	5	Similar species, similar system, low precision	40
	6	Similar species, same system, low precision	30
	7	Similar species, similar system, high precision	20
	8	Similar species, same system, high precision	10
Diet	1	General knowledge of related species	80
	2	From other model	80
	3	General knowledge for same group/species	60
	4	Qualitative diet composition study	50
	5	Quantitative but limited diet composition study	30
	6	Quantitative, detailed, diet composition study	10

Table S1-4. Overview of pedigres scores and confidence intervals for input values for the 1950-model

FG no.	Group name	Biomass	Production / biomass	Consumption / biomass	Diet
1	Polar bear	5	5	4	5
2	Minke whale	5	7	4	6
3	Fin whale	5	4	4	4
4	Blue whale	3	5	4	3
5	Bowhead	5	5	4	3
6	Humpback whale	5	6	4	4
7	White whale	3	4	4	4
8	Narwhale	5	4	4	4
9	White-beaked dolphin	5	4	4	3
10	Harbour porpoise	5	7	7	5
11	Killer whales	3	7	4	4
12	Sperm whale	5	4	4	4
13	Harp seal	6	8	4	6
14	Harbour seal	5	7	4	5
15	Grey seal	5	8	4	4
16	Ringed seal	3	8	4	5
17	Bearded seal	3	8	4	4
18	Walrus	6	7	7	4
19	Northern fulmar	5	7	8	4
20	Black legged kittiwake	5	8	8	6
21	Other gulls and surface feeders	5	7	8	5
22	Little auk	5	8	8	6
23	Brunnich guillemot	5	8	8	5
24	Common guillemot and razorbill	5	8	8	5
25	Atlantic puffin	6	8	8	5
26	Benthic piscivore birds	5	8	8	6
27	Benthic invert feed birds	5	8	8	5
28	Greenland shark	4	4	5	5
29	NEA_cod (3+)	6	8	8	6
30	NEA_cod (0-2)	4	8	8	6
31	NCC_2+	5	6	7	5
32	NCC_0-1	4	7	4	5
33	Saithe (3+)	6	8	5	6
34	Saithe (0-2)	4	5	4	5
35	Haddock (3+)	6	8	5	6
36	Haddock (0-2)	4	5	4	6
37	Other small gadoids	1	5	5	5
38	Large Greenland halibut	6	5	7	5
39	Small Greenland halibut	4	2	4	5
40	Other piscivorous fish	4	6	5	4

FG no.	Group name	Biomass	Production / biomass	Consumption / biomass	Diet
41	Wolffishes	1	8	6	5
42	Stichaidae	1	8	5	5
43	Other small bentivorous fishes	1	5	5	5
44	Other large bent inv feed fish	1	5	5	4
45	Thorny skate	5	3	5	6
46	Long rough dab	1	8	5	5
47	Other bentivore flatfish	1	8	6	5
48	Large herring	3	8	7	5
49	Small herring	5	4	6	5
50	Capelin(3+)	5	2	3	6
51	Capelin(0-2)	4	5	3	6
52	Polar cod (2+)	5	8	8	5
53	Polar cod (0-1)	4	5	4	5
54	Blue whiting	1	8	7	6
55	Sandeel	1	5	5	5
56	Other pelagic planktivorous fish	1	6	5	3
57	Lumpfish	6	4	5	3
58	Mackerel	1	5	7	5
59	Redfish large	5	8	6	6
60	Redfish small	4	5	4	5
61	Salmon	2	3	4	5
62	Cephalopods	1	7	3	4
63	Schypomedusae	5	5	5	3
64	Chaetognaths	1	7	8	6
65	<i>Thysanoessa</i>	1	3	3	4
66	Large krill	1	3	5	4
67	Ctenophora	5	7	5	4
68	Pelagic amphipods	5	4	5	4
69	Symphagic amphipods	1	8	5	4
70	Pteropods	1	4	2	4
71	Medium sized copepods	5	6	5	3
72	Large calanoids	5	6	5	3
73	Small copepods	4	6	5	3
74	Other large zooplankton	1	6	6	1
75	Appendicularians	1	5	5	3
76	Ciliates	5	6	5	3
77	Heter Dinoflagellates	5	6	5	3
78	HNAN	5	6	6	3
79	Northern shrimp	1	8	5	4
80	Crangonid shrimps	1	7	5	4
81	Other large crustaceans	1	7	5	3

FG no.	Group name	Biomass	Production / biomass	Consumption / biomass	Diet
82	Crinoids	5	5	5	3
83	Predatory asteroids	4	5	5	3
84	Predatory gastropods	5	5	5	3
85	Predatory polychaetes	5	5	5	3
86	Other predatory benthic invertebrates	5	5	5	3
87	Detritivore polychaetes	5	5	5	3
88	Small benthic crustaceans	5	5	5	3
89	Small molluscs	1	5	5	3
90	Large bivalves	5	5	5	3
91	Detritivore echinoderms	5	5	5	3
92	Large epibenthic suspension f.	5	5	5	3
93	Other Benthic invertebrates	5	5	6	3
94	Meiofauna	5	5	5	3
95	Bacteria	5	7	5	3
96	Benthic foraminifera	5	5	5	3
97	Diatoms	5	8		
98	Autotroph flagellates	5	8		
99	Ice algae	5	8		
100	Macroalgae	4	7		
105	Dead carcasses	4			
106	Detritus pelagic	4			
107	Detritus ice algae	4			
108	Offal	4			