

Synthesis of Southern Ocean Food Webs

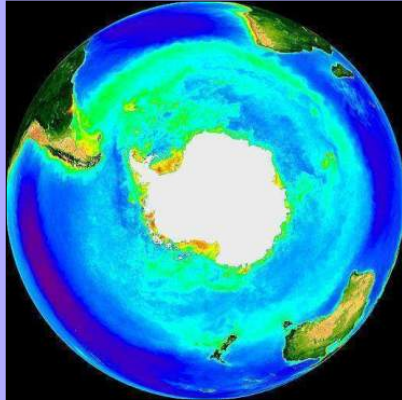
Eileen Hofmann
Eugene Murphy
Rachel Cavanaugh
Nadine Johnson



Outline of Presentation

- Challenges for Southern Ocean
- Implications of these for food webs
- Issues associated with modeling Southern Ocean food webs
- Issues associated with Southern Ocean end-to-end food web modeling

Challenges for Southern Ocean

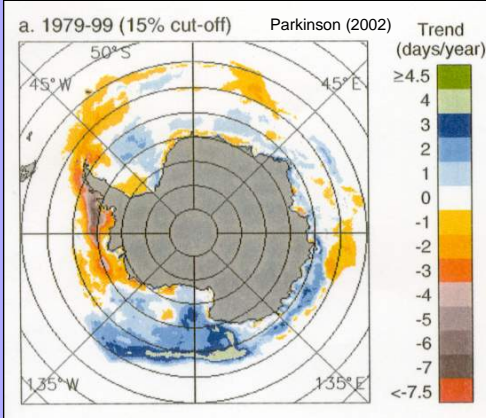


- Climate Impacts
- Harvesting effects
- Biogeochemistry
- Food Webs

Can we develop models to address these effects and interactions at a circumpolar scale?

Issues for Southern Ocean Food Webs

- How do Southern Ocean food webs respond to climate driven change?
- What determines the structure of Southern Ocean food webs?
- What is the structure of Southern Ocean food webs?

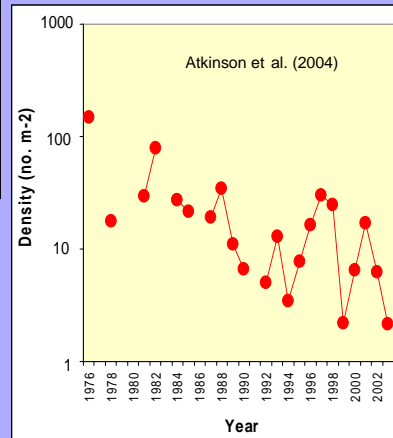


Southern Ocean is undergoing major environmental and biological changes

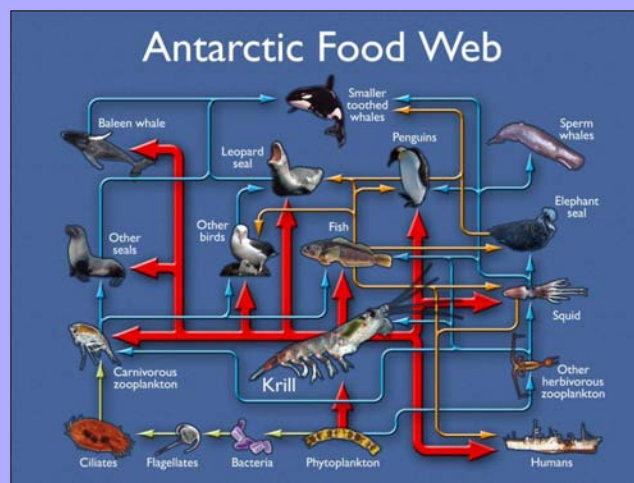
Changes in sea ice extent and concentration

West Antarctic Peninsula is one of the most rapidly warming areas on Earth

Decline in krill biomass



What is a Southern Ocean Food Web?

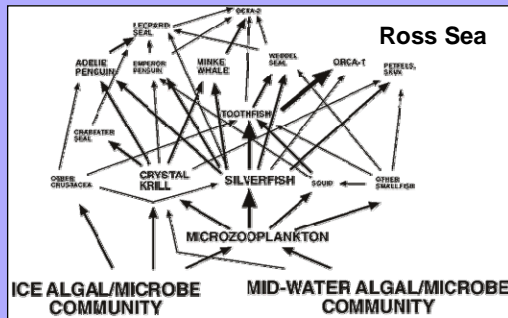
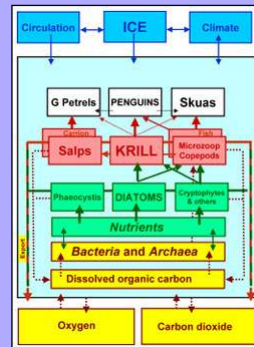


Is This the Only Food Web?

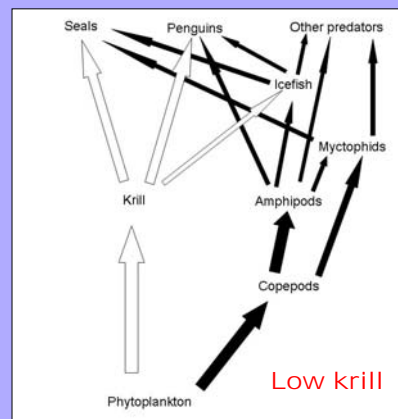
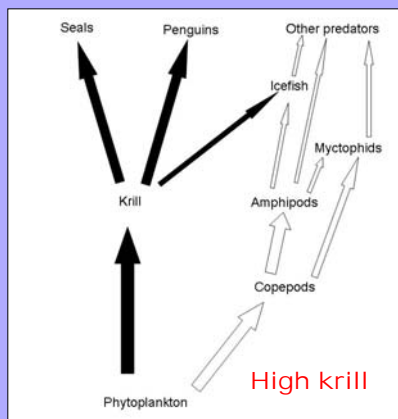
Classical Food Web



Western Antarctic Peninsula

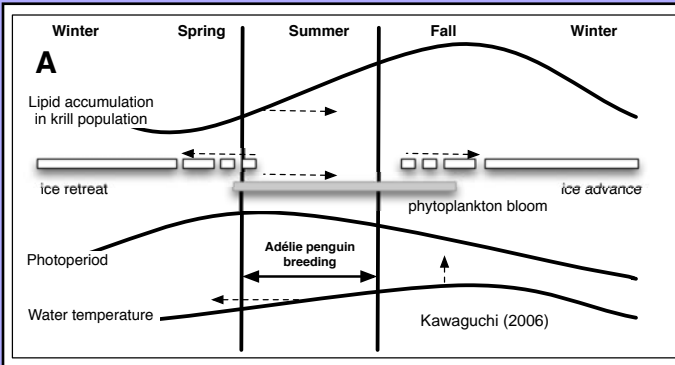


Alternative Food Web Pathways



Alternative pathways buffer change, but may not support long-term change
Need better quantification of alternative pathways

Alternative Food Web Structures



QuickTime™ and a TIFF (LZW) decompressor are needed to see this picture.

Based around biochemical composition of food web constituents and environmental conditions

Chapman (2008)

Why the Differences?

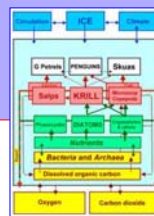
Seasonal length

Sub Antarctic

High Antarctic

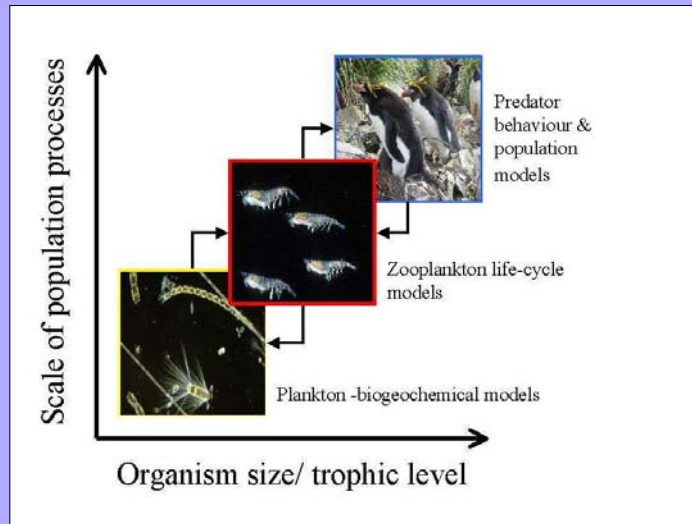
Low Production

High Production



Differences due to:
Circulation
Sea-ice
Biogeochemistry
Production
Seasonality

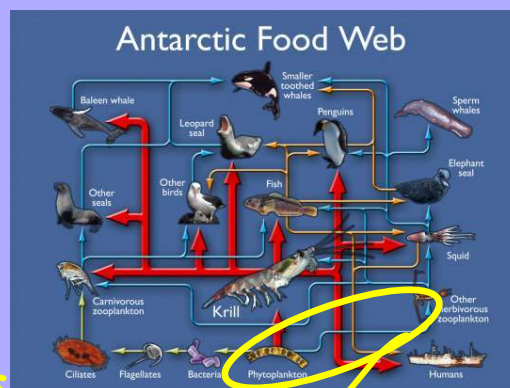
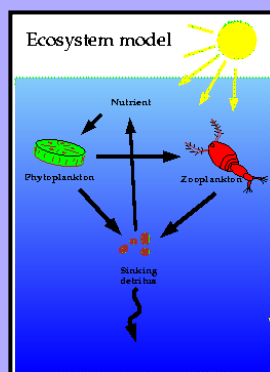
Incorporation of Scale Effects



Focus on issue of coupling between trophic levels

Relevance to Global Ecosystems

Global carbon budget models lack biological detail



Current models do not capture what is known about SO ecosystems

Key Points for Consideration

- Focus of food webs
 - What are the circumpolar structures
 - Where, Why, How?
- Responses to variation?
 - Seasonal, interannual and longer term
- Response to change?
- Importance of interaction effects
 - Can bottom-up vs top-down effects be determined/distinguished?
- Can a generic model for Southern Ocean food webs be developed?



- Circumpolar, interdisciplinary approach to understand climate interactions in the SO and implications for ecosystem function and feedbacks to biogeochemical cycles
- Implement circumpolar instrumentation and field studies
- Extend and further develop circulation, ecosystem, and biogeochemical models
- Stimulate capacity building

- Challenge is to combine ecosystem and biogeochemical communities



- Started process of developing basis for generating models of circumpolar Southern Ocean ecosystems
- Focus on Southern Ocean food web models - 1) structure of SO food webs, 2) how structure determined, 3) SO food web response to climate change
- Approaches from other systems

