What are the differences between the two polar regions? What is the main difference in the ice cover?
Charismatic megafauna

Polar bears

Picture: Don Perovich
Big mammals feed on small mammals...

In which season are polar bears more active: winter or summer?

photo: http://www.windows.ucar.edu/tourlink=earthpolararctic_marine_life.jpg
Narwhals and Inuit

“The whole existence of the Polar Eskimos depends on the narwhal...they get all of their necessaries of life from it.”

- Christian Vibe, 1940

Slides from Kristin Laidre
Which in turn feed on smaller animals... which ultimately feed on photosynthetic microorganisms.

Microscopic algae

Copepod

Cod

(Pictures not to scale!)

photos: http://www.windows.ucar.edu/tourlink=earthpolararctic_marine_life.jpg
Walrus
Arctic hare
Musk ox
Caribou
SEA ICE ECOSYSTEM

permanent ice cover
pond
snow algae
margin al ice zone

ice
pond
copenods
under-ice Fauna
gelatinous zooplankton

ice-edge bloom

benthos
sea floor
sedimentation

http://www.sfos.uaf.edu/research/arcdiv/
The presence of salts generates differences in the microscopic structure of the ice, allowing microorganisms to inhabit it.

- **High porosity**
- Higher fraction of liquid inclusions
- Brines

**Fresh water ice** vs **Sea ice**
Pores and channels ... a vast habitat

Highly connected network (even during the coldest season)

1- 20 % of the ice volume

Pores and channels: μm - cm size

Evolve seasonally

1 m$^3$ of sea ice:

- $10^{14} - 10^{15}$ compartments
- Total surface area of the channel system: $10^5 - 10^6$ m$^2$

As reviewed by Deming (2007), Trinks et al. (2005)
All trophic levels are found in sea ice: viruses, bacteria, microscopic algae, protists and small invertebrates. Melnikov et al. (2002), Wells & Deming (2006)
Photosynthesis under the ice

Trailer for “Encounters at the end of the world” (this is sea ice in the coast of Antarctica, though)

http://www.imdb.com/video/screenplay/vi300482841/

And remember... there is an ocean beneath the ice
http://www.imdb.com/video/screenplay/vi317260057/

Which is the ultimate source of energy in the Arctic ecosystem?
Sunrise, sunset, dawn and dusk times

Gates of the Arctic Natural Park and Preserve, Alaska, USA
Latitude: +67.75056

http://www.youtube.com/watch?v=x2WykpFGA3c&feature=channel_page
1.) Snow melts-- this allows light to pass through ice
2.) Ice algae bloom.
3.) Specially adapted predators scrap algae off ice
4.) Ice melts
5.) Water column phytoplankton get light
6.) Huge bloom of phytoplankton

Normal ocean bloom-- 3 mg/m³ chlorophyll max
Arctic ocean ice edge--20 mg/m³ maximum

Photosynthesis in permanent ice cover

Arctic Sea Ice Extent

(Area of ocean with at least 15% sea ice)

Extent (millions of square kilometers)

July August September October November

2007
2005 Record Low
1979–2000 Average
Current Ice Extent
09/16/2007

Total extent = 4.1 million sq km

median
ice edge
1998 was a warm year.

Less ice.

Earlier bloom.