

Extreme Summer Melt

Assessing the Habitability and Physical Structure of Rotting First-year Arctic Sea Ice

Narrator: Sea ice cover in the Arctic during summer is shrinking and thinning. The melt season is getting longer and the amount of “rotten ice” is on the rise.

Karen Junge: We are studying the ice as it melts. And we are really interested in studying a kind of an ice type that hasn’t been looked at before that we call rotten ice. So it’s like heavily melted ice.

Bonnie Light: My primary interest in being involved in this project is thinking about this ice and its survivability at the end of the season.

Narrator: A multi-disciplinary team of researchers is making a series of three monthly expeditions to Barrow, Alaska. They are there to measure the summertime melt processes that transform the physical properties of sea ice, which, in turn, transform the biological and chemical properties of the ice habitat.

Junge: And so here we are and it’s really important that it’s interdisciplinary because there’s the structure of the ice and the ice harbors these organisms — the algae and bacteria produce substances that are called polymers and gels and they all interact with each other and also they seem to interact with the ice structure.

Light: I’m warming up to the idea of thinking about this kind of whole system of these constituents in the ice because they’re very much a part of the ice system.

Narrator: Sea ice at the start of the melt season has been studied extensively. So, for the first trip to Barrow, the team used standard, accepted methods to take detailed measurements of the ice and the microbial communities within it.

Carie Frantz: We go out on the ice. And the first step is to find a good location. And out comes the big corer.

For each site we went to in May we drilled 22 different cores. Some of them were cut into little hockey pucks, which we then measured for density and salinity to understand how – as you go down a core – that changes.

Other ones were sliced up into tiny little thin sections that we put on glass slides to look at under the microscope to look for the algae, the bacteria, and those gels.”

Narrator: When the team members return later in the melt season, they will continue exploring uncharted territory. The measurements taken in May have never been done on severely melted or “rotten” ice.

Frantz: What we were looking for in May was kind of the baseline. This is ice that isn’t rotted. And so all those measurements that we were taking and all the observations we were doing was for comparison. When we go back in June and July, how are the cell counts changing? How is the structure changing? How are the organisms partitioning themselves within the brine channels?

And what is different in that rotted out ice from what it was in May in our winter samples?

Light: During the melt season, sea ice can melt from the top by absorbing solar radiation. It can melt from the bottom because the ocean around it absorbs solar radiation and heats up and then there's warm water underneath the ice. But it can also melt kinda from the inside out because of its microstructure. So it has these sort of conduits of fluid inclusions throughout it.

So if you warm up that water and increase the sort of connectivity of those fluid inclusions at the same time you're pumping heat — not just on the top and on the bottom, but in the interior of the ice.

So I think that's kind of where the name, the moniker, "rotten ice" came from because sometimes it can just literally melt from the inside out at the same time it's melting from the edges and the top and the bottom.

Light: There's ice and there's some critters within it. But to have the critters and the polymers actually affect the physics and affect the structure is really a very interesting and exciting idea.

This is APL The Applied Physics Laboratory at the University of Washington in Seattle.