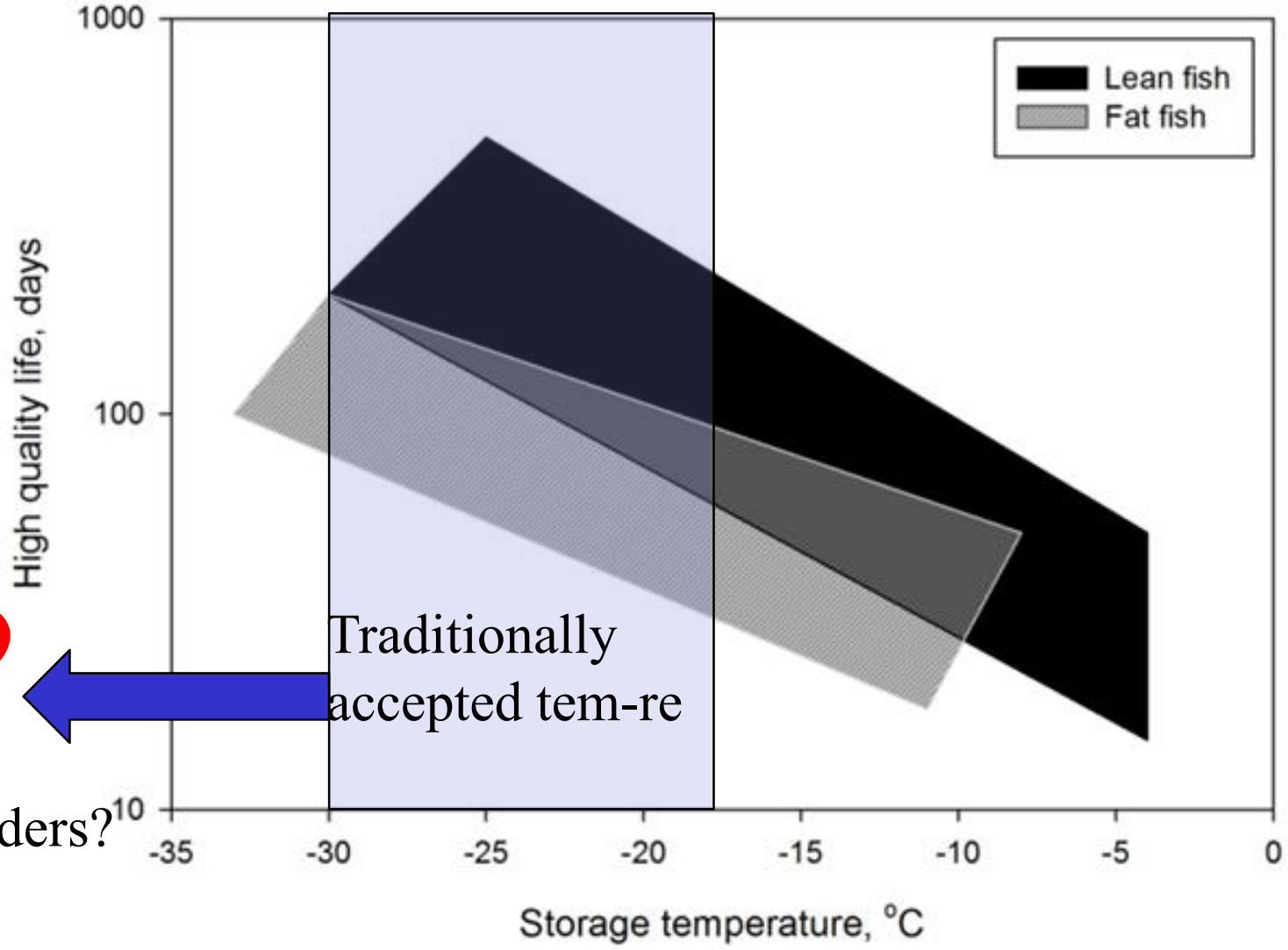
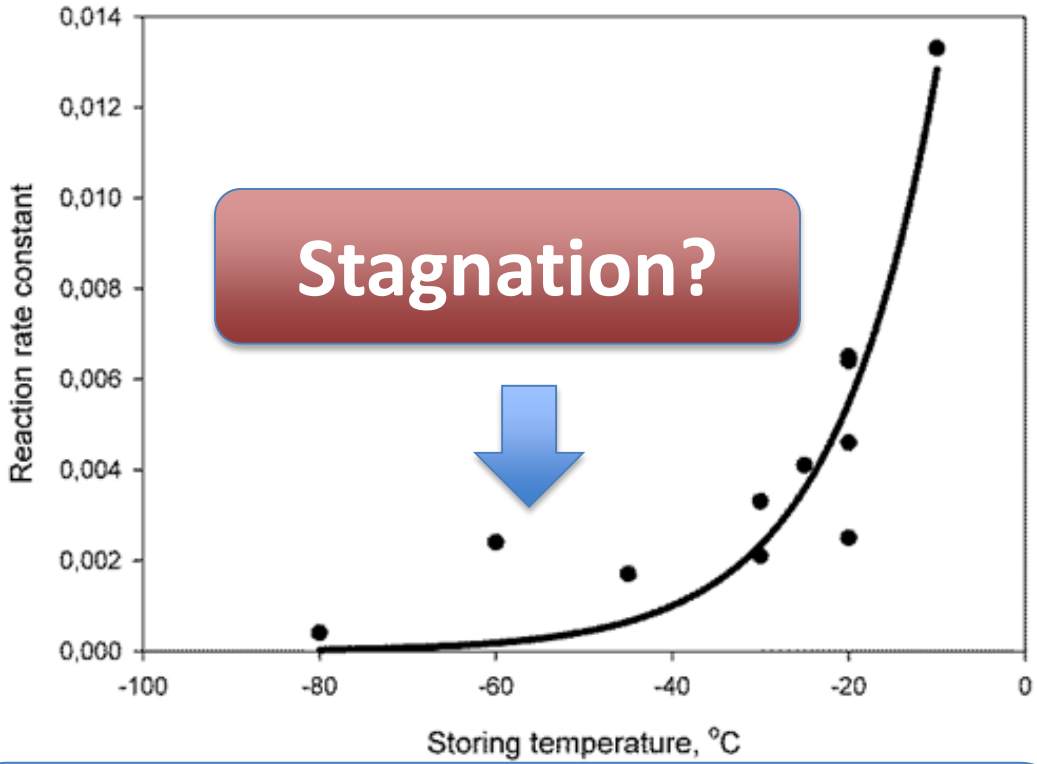
THE CHALLENGE USING THE ULTRA-LOW TEMPERATURES FOR FISH FREEZING AND STORAGE

Intro. High quality shelf-life: temperature borders



Does product stable below the borders?

Influence of temperature on Proteins and Fats



Stagnation?

Peroxide value formation in fats, (Atl. Trout and Salmon) adopted from literature

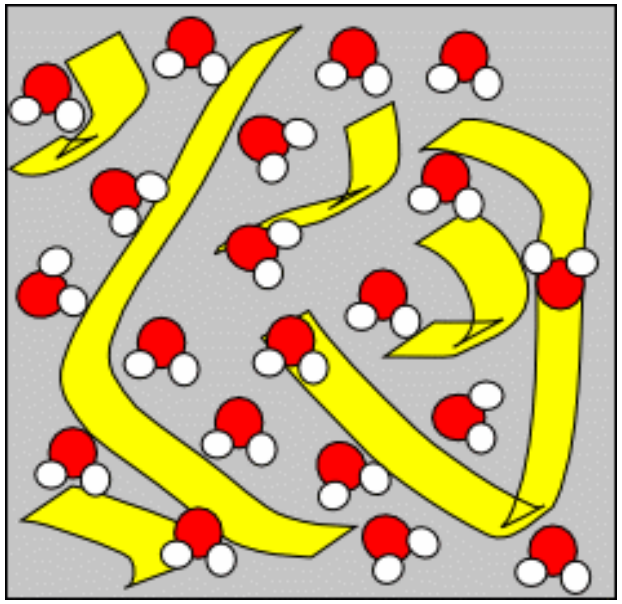
Significant oxidation of pelagic fish was detected even at -60.0 °C.

Protein denaturation significantly decreasing at -40.0 °C storage temperature.
At the same time the stabilization effect becomes negligible with temperature decreasing form -40.0 to -70 °C

Physical state of material

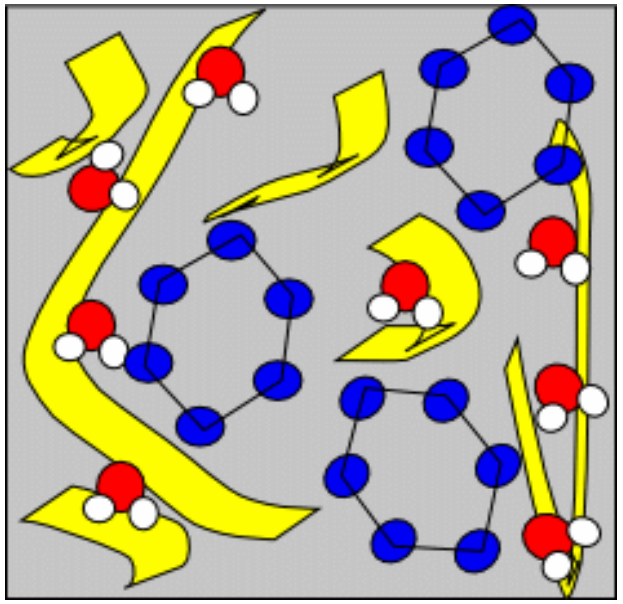
Fresh

+0.0..4.0 °C



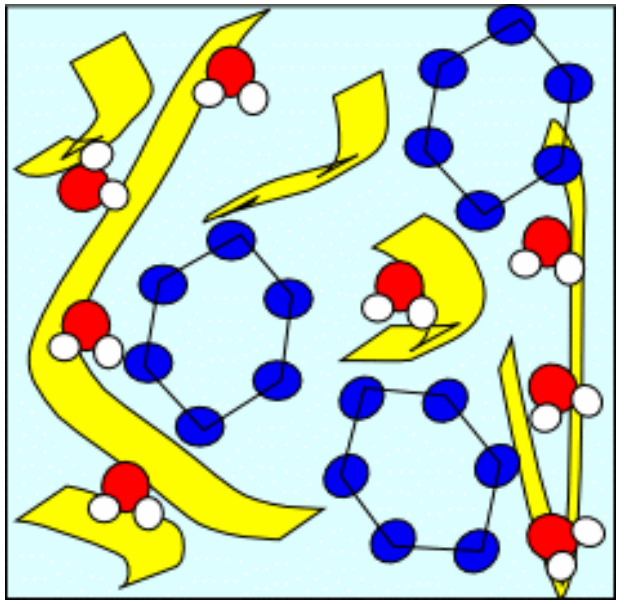
Frozen

-30.0..-18.0 °C



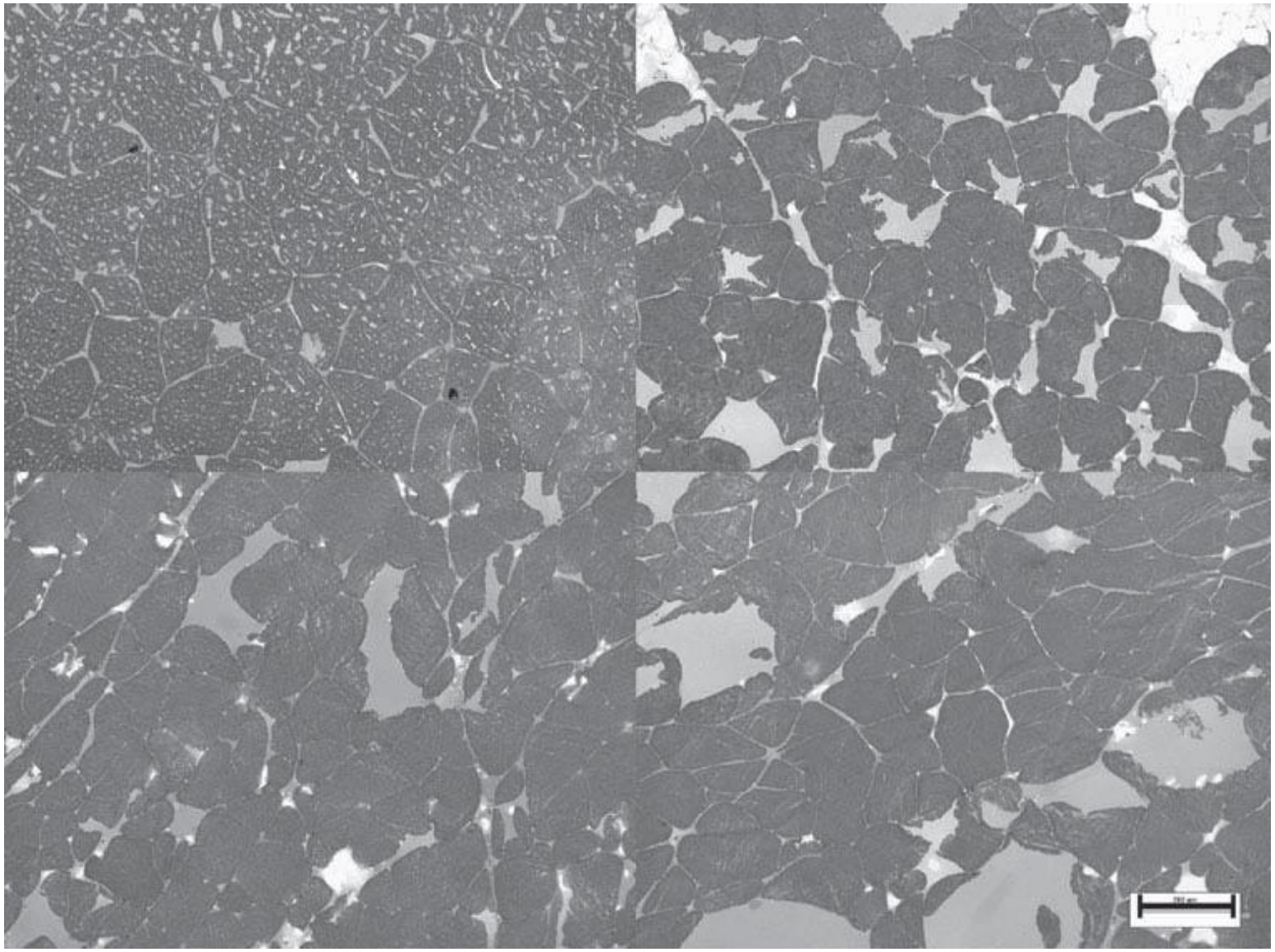
Glassy

-83.1..-54.2 °C



Decreasing the temperature and molecular mobility, decreasing of reaction rates

Microstructure of salmon muscles



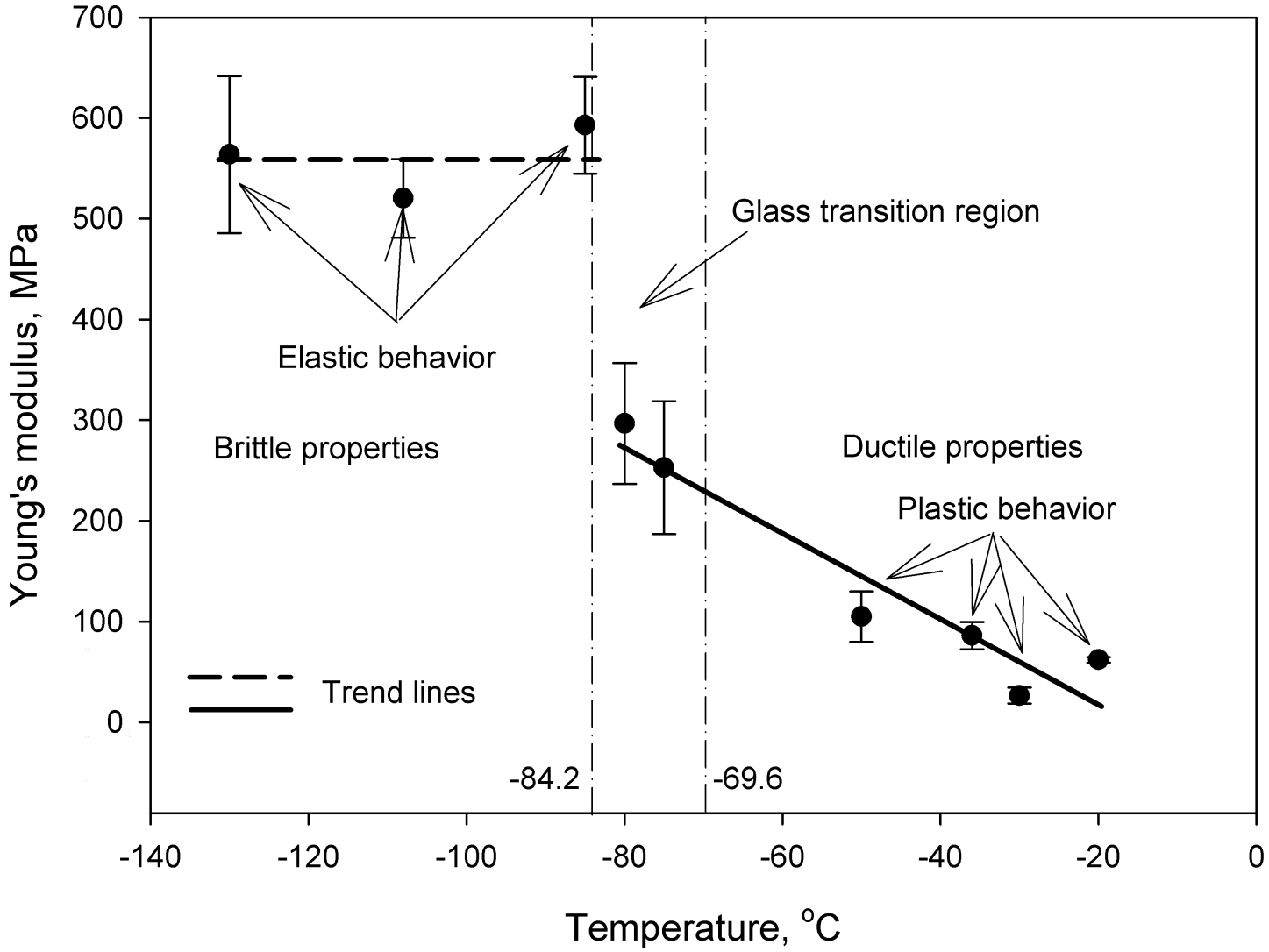
Nitrogen and -80 C

-40 C and -20 C

Influence of ULT on color and macro-structrue

-15; -20;-40;-80; liquid nitrogen

Mechanical properties at ULT, cod



Onset of glass transition correlates with the significant changes of mechanical properties. The samples showed only brittle behavior at such temperatures

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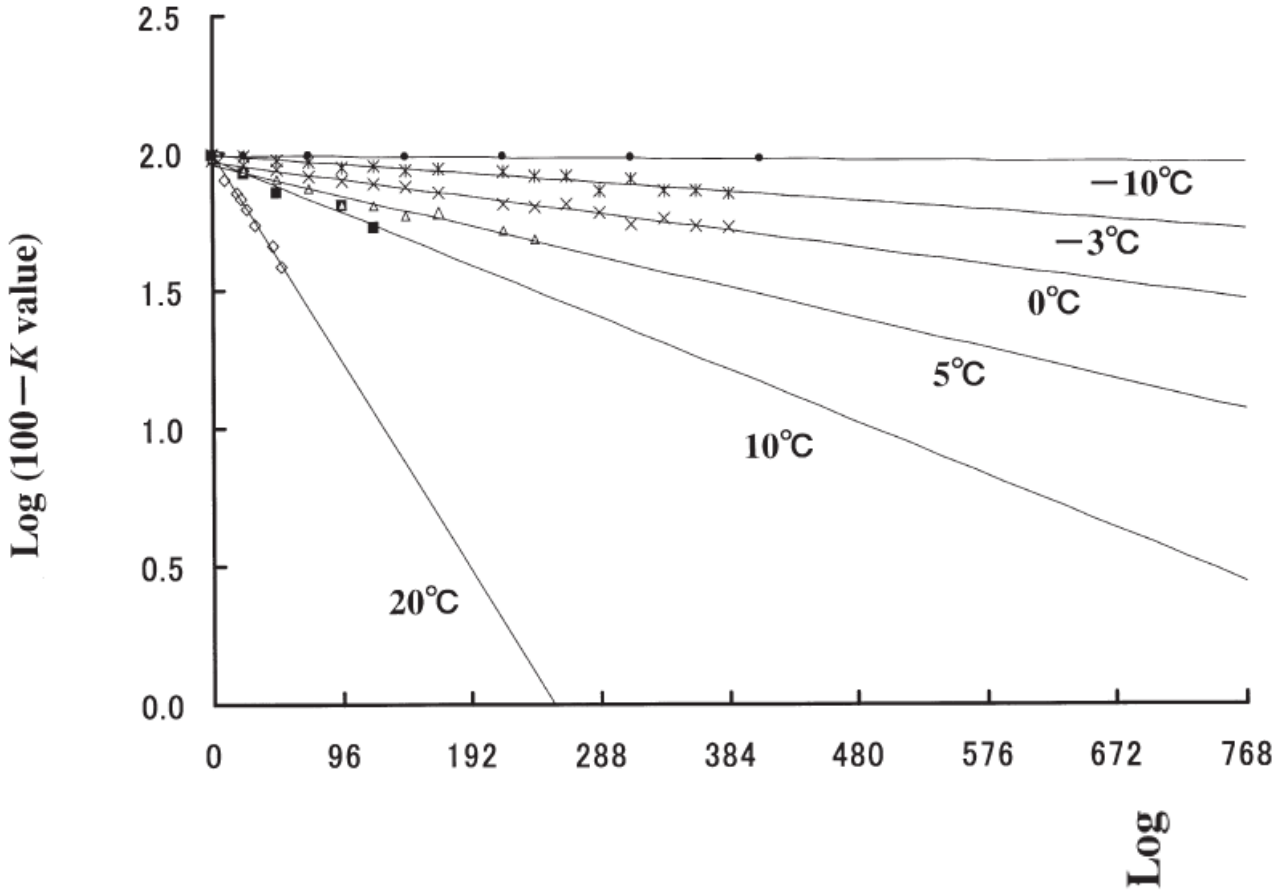
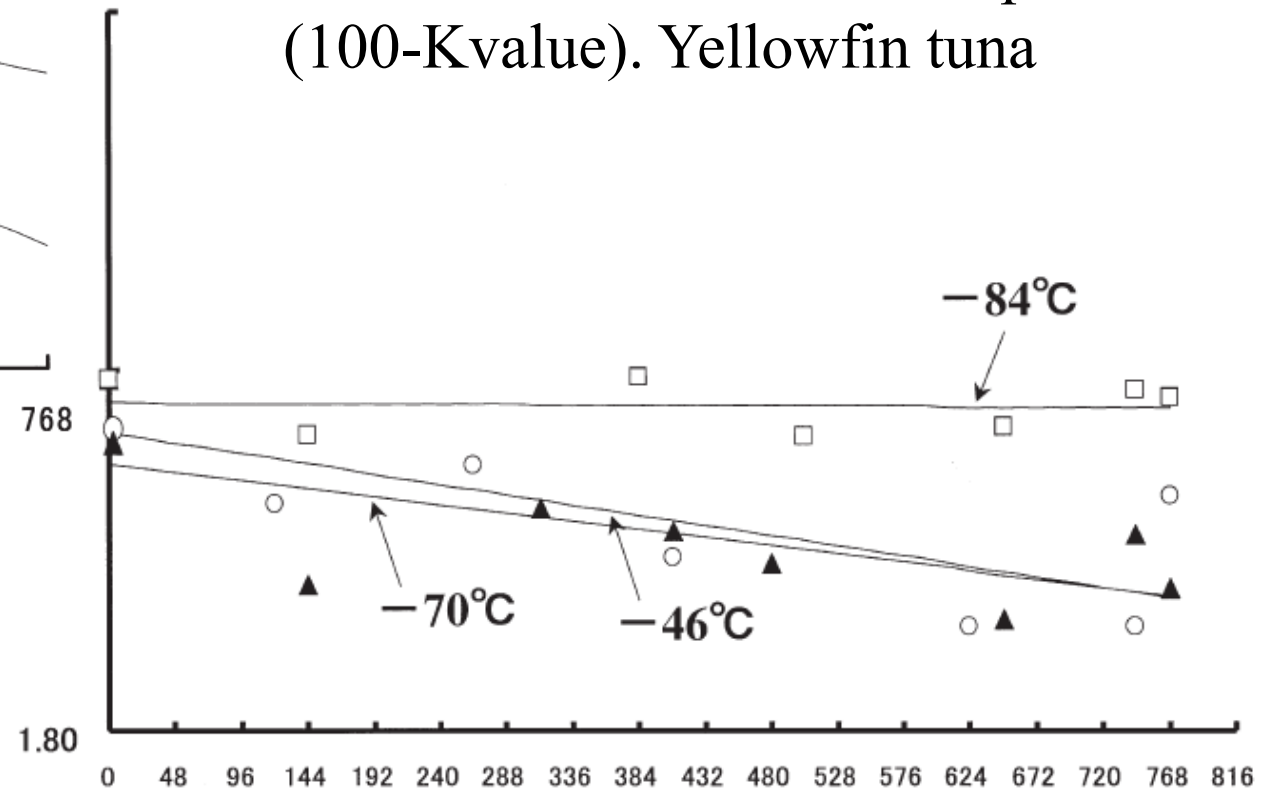
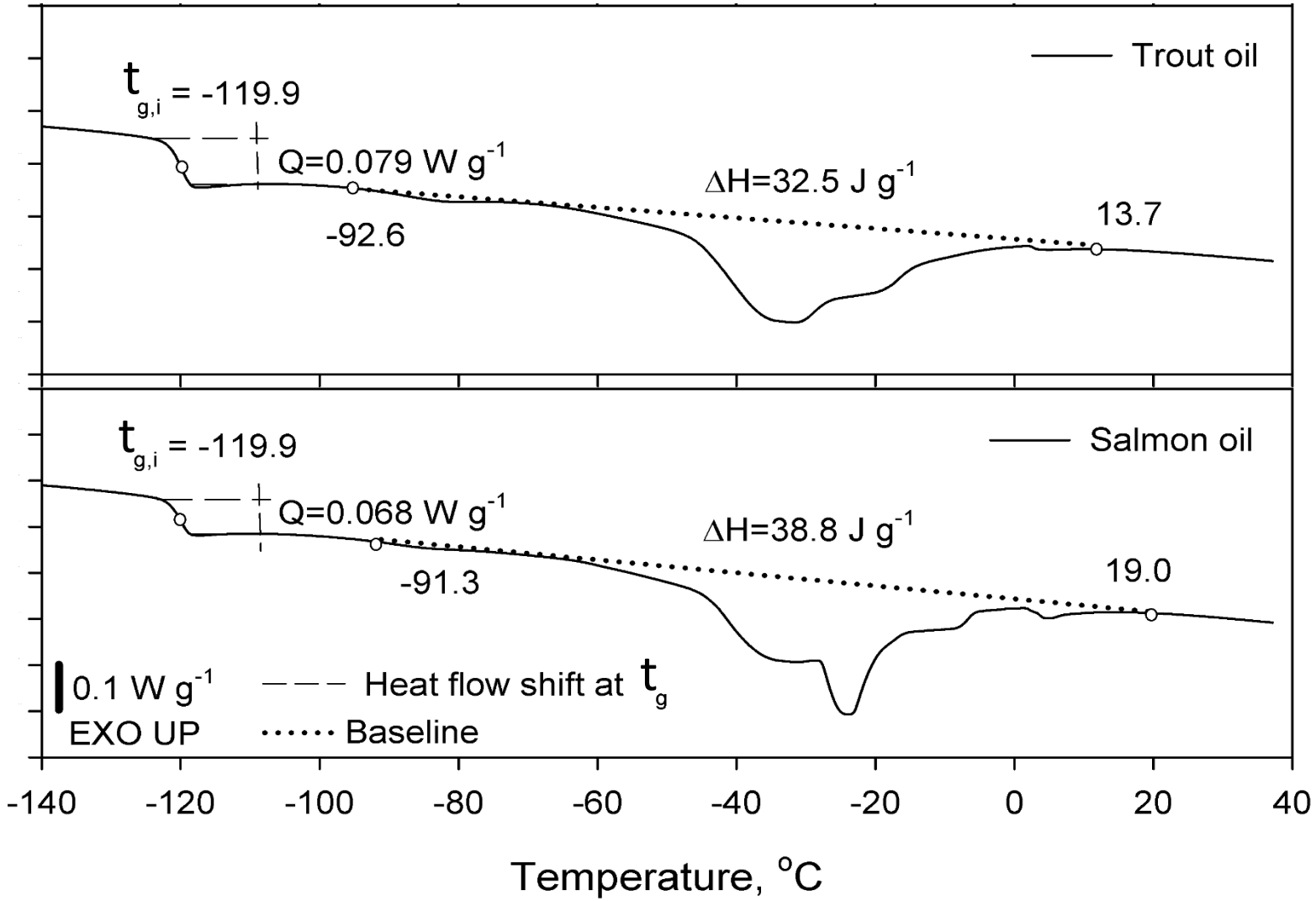
Reaction rate at different temperatures



Reaction rate of ATP decomposition (100-Kvalue). Yellowfin tuna



Behavior of fats at freezing temperatures



Outlet:

1. Each of the fish oil show the glass transition.
2. The melting temperature range is wide.
3. The glass transition shift also correlates with the amount of unfreezable fraction.
4. The oil is liquid even at ULT condition.

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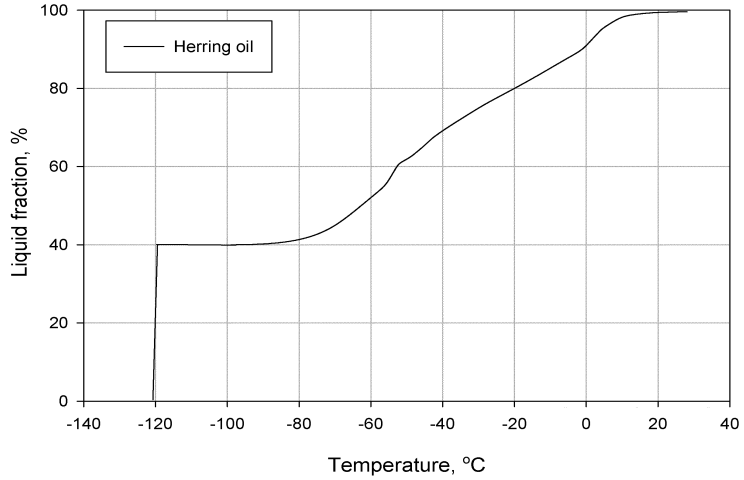
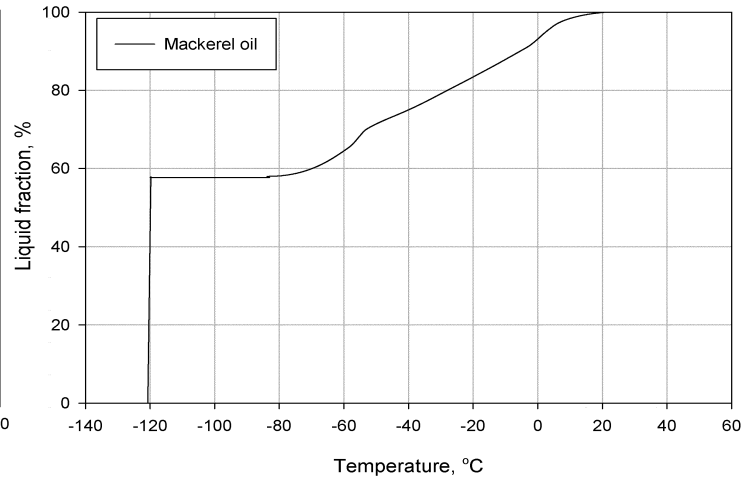
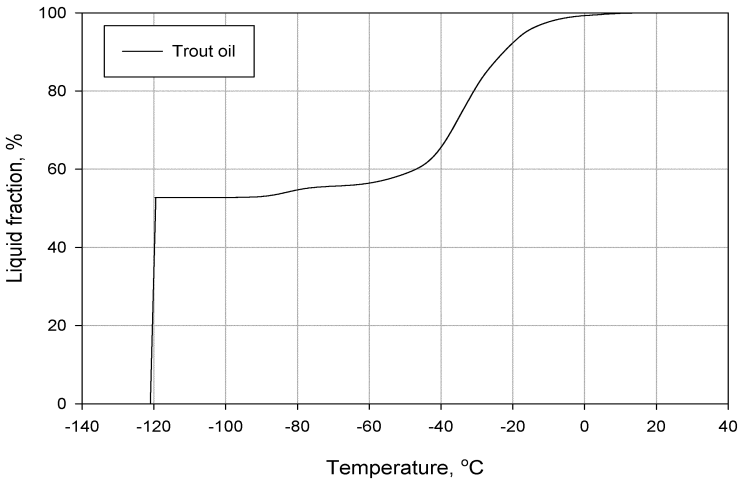
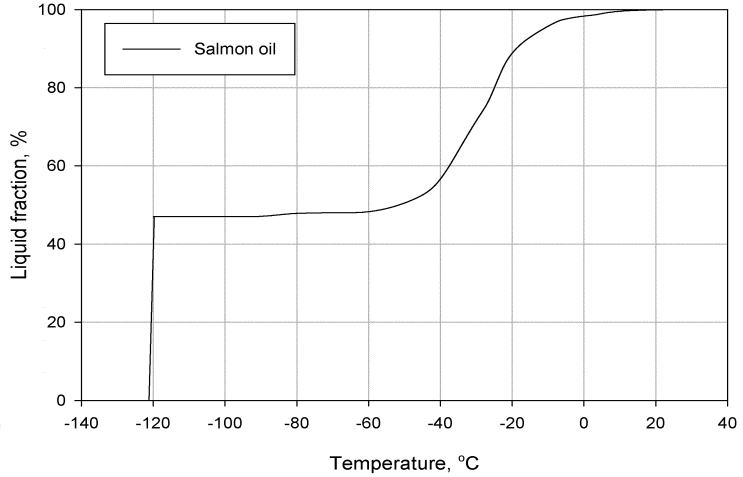
Behavior of fats at different temperatures









Outlet:

1. The unfreezable fraction mostly introduced by TAGs which contain ω-3 FA.
2. High possibility for oxidation at ULT
3. The error of determination is not exceed 7.0 %

One of the reasons of ULT application

Why?