LOUISIANA DIRECT SEAFOOD
Your Freshest Catch

Freezing
Raw Seafood Products

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Creating Opportunities.

Outline

- Freezing
- Freezing zone
- Recrystallization
- Freezing methods
- Summary

Freezing (1)

- Fishery preservation method, which allows a longer shelf life of fishery products.
- Is the process of removing heat to lower the product temperature to -0.4°F (-18°C) or below.
- Reduces microbial and enzymatic activity.

Freezing (2)

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- To maintain the benefit of freezing, the frozen state must be kept. Cold chain should not be broken.
- Thawing is also a very important process for frozen seafood.
- Freezing is the most effective method to preserve the original quality of fish for longer periods.

Freezing zone or critical zone

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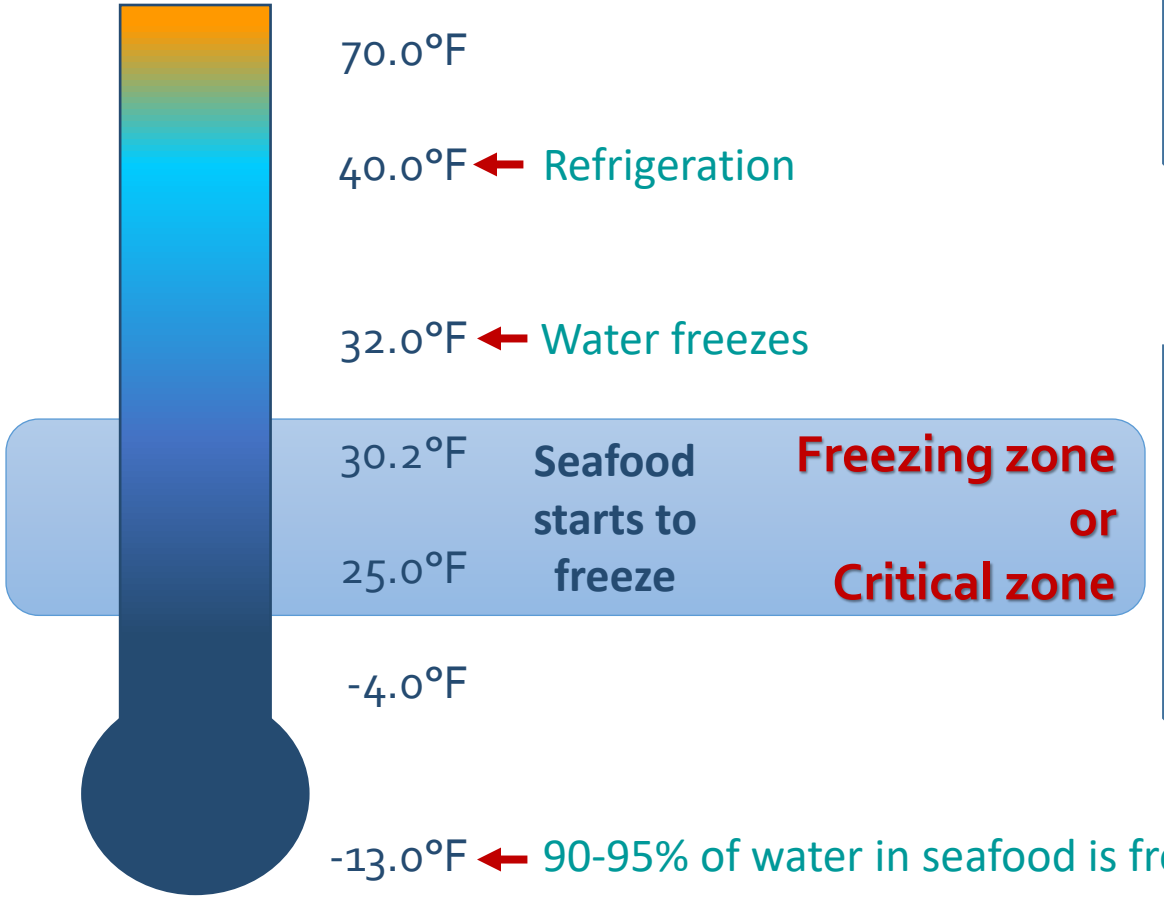

Recrystallization (1)

- Is the change in number, size, shape and orientation of the ice-crystals during storage.
- Small crystals disappearing, large crystals growing, and crystal fusing together.
- Fluctuating temperatures greatly enhance the process of recrystallization.

Recrystallization (2)

- Recrystallization can be minimized by maintaining a low and constant storage temperature.
- Can happened during thawing. Thawing process should be done rapidly to avoid undesirable effects of recrystallization.

Freezing methods

- Air blast freezing
- Indirect contact freezing
- Immersion freezing
- Cryogenic freezing

Air blast freezing (1)

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- Air is the medium for freezing.
- Air is cooled by the evaporator and circulated by fans over the product.
- Air should be 4-6 m/s for acceptable heat transfer and keep temperature of the medium at -22 to -40°F.
- Effective for packed foods.

Air blast freezing (2)

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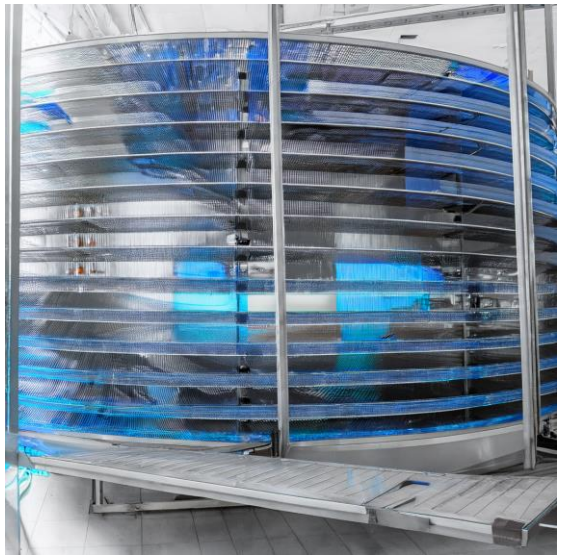
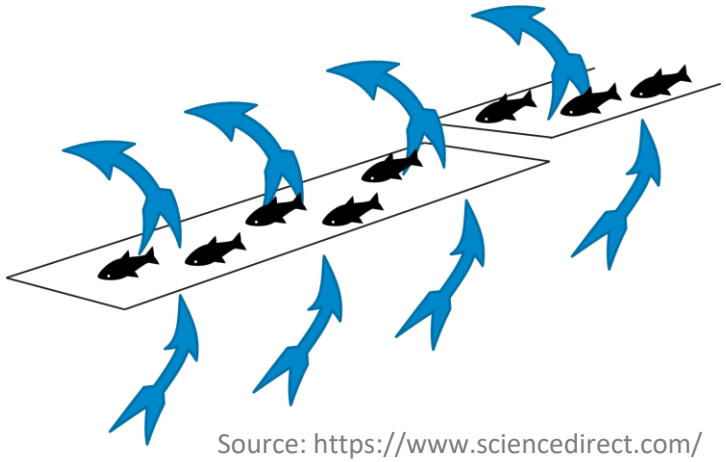
- Tunnel freezing



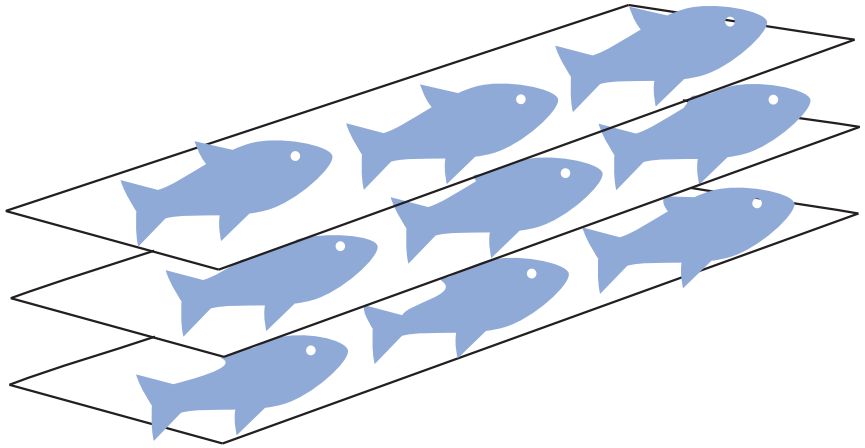
- Fluidized bed freezer (small sized seafood)



Source: https://www.sciencedirect.com/

Indirect contact freezing

- The product is separated from the cooling medium (refrigerant) by conducting plates.
- Product with regular geometry (rectangular cartons, slabs, fish sticks and fillets, or flat packages).
- Product can be placed between plates. A rapid freezing is provided on both sides.
- Batch or continuous mode.



Source: https://www.sciencedirect.com/

Immersion freezing (1)

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- Product is frozen by immersion in or by spraying with a freezing agent.
- Considers cost, flavor compatibility, safety, and ability to reduce solution freezing point.
- Immersion solutions are limited to:

  propylene glycol, glycerol, and mixtures of salt and sugar.
- Combined solutions of alcohol/water, water/glycerol/alcohol.

Immersion freezing (2)

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- Most widely use solution is sodium chloride (salt) brine.
- Freezes at -5.8°F.
- Disadvantage of salt brine solution is that fish absorbs some salt.
- Use for freezing tuna, shrimp and crab.

Cryogenic freezing (1)

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- Food is exposed directly to liquid boiling or solid subliming at a very low temperature.
- Most commonly used food grade cryogenic freezing agents are liquid carbon dioxide and liquid nitrogen.
- Boiling point:
  - ✓ Liquid Carbon dioxide -229°F
  - ✓ Liquid Nitrogen -320.8°F
- Non-toxic, inert, protects oxygenic reactions, no extra cooling equipment, ensures quick freezing at a very low temperature.

Cryogenic freezing (2)

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Summary

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- Rapid freezing:
  - ✓ Accomplishes a good quality frozen product.
  - ✓ Small ice-crystals among cells provide physical protection to the cell structure.
  - ✓ Critical zone must be passed rapidly.
  - ✓ Inhibition of microbial degradation.
- Recommended freezing and frozen storage temperatures for fish are -4 to -7.6°F.
- It is recommended to achieve 32 to 23°F in the center of the fish in less than 2 hours

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Sea Grant Louisiana

LSU AgCenter Research · Extension · Teaching

Louisiana Disaster Recovery Unit

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Thanks!!!

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