# Evaluation of Black Drum (*Pogonias cromis*) chilling rates comparing slurry ice and flake ice

**Katheryn Parraga[1], Evelyn Watts[1,2]**

[1]Louisiana State University Agricultural Center, School of Nutrition and Food Sciences, Baton Rouge, LA. [2] Louisiana Sea Grant, Baton Rouge, LA

## INTRODUCTION

Seafood has a high-unsaturated lipid composition, this causes it to be highly perishable with a relatively short shelf life. Deterioration of seafood begins immediately upon catching. Chilling, storage and processing conditions are key factors to prevent deterioration. In Louisiana, flake ice is the most common process utilized to chill seafood. Slurry ice is a new technology that can reach subzero temperatures, providing a good application to chill and store aquatic food products. Slurry ice has two main advantages during handling and storage of seafood: a faster chilling rate compared to flake ice or refrigerated seawater, and reduced physical damage of seafood products. Slurry ice also reduces microbial growth and increases shelf life. Using slurry ice has been proven to extend shelf-life and quality in several seafood commodities such as Tuna, Salmon, Sardine, Arrowtooth, Flounder, Mackerel, Hake, Ray, and Anglerfish.

## OBJECTIVE

The purpose of this study was to evaluate Black Drum chilling rates comparing slurry ice and flake ice.

## MATERIALS AND METHODS

- Fresh Black Drum was purchased from local fishermen. It was transported to the Seafood Quality Laboratory at Louisiana State University, Baton Rouge, LA..
- Fish temperature was equilibrated to 23˚C.
- Chilling rates were evaluated by using 2:1 ratio of ice to fish. In addition, handling methods were evaluated which including: (1) pre-draining of meltwater with slurry ice (PDSI), (2) continuous drain with slurry ice (CDSI), (3) retention of meltwater with slurry ice (RSI), and (4) retention of meltwater with flake ice (RFI) (Figure 1).
- Fish were placed in plastic containers. Cooling time from 18 to 4°C, cooling time from 18 to 0°C, lowest product temperature, time to lowest product temperature, total product time at ≤0°C and ≤4°C were recorded.


**Figure 1. A) Slurry ice formation; B) Fish in slurry ice; C) Fish in flake ice.**

## RESULTS AND DISCUSSION

RSI showed a significantly ($p<0.05$) faster cooling rate compared to the RFI method. RSI cooling time from 18 to 0°C was 1.43±0.49 hours. RSI showed faster cooling rates and lowest temperatures compared to PDSI and CDSI, however it was not significantly ($p>0.05$) different. RFI mean cooling time from 18 to 4°C was of 1.72±0.78 hours, compared to PDSI 0.71±0.48 and RSI 0.54±0.34. The lowest temperature reached by RSI was -2.34±0.40°C. Even though, slurry ice showed the fastest cooling rates, flake ice showed a significantly ($p<0.05$) higher capacity to keep fish at ≤4°C without restocking, with a mean time of 14.49±0.64 hours. CDSI handling method was least effective in maintaining temperature ≤4°C with a mean time of 6.98±3.42 hours. Studies report that when super-chilled temperatures (below 0°C) are achieved, the shelf life of seafood products are extended approximately 5 and 11 days at -1.1 and -2.2°C, respectively. According to this study, the use of RSI would be a key factor in preventing deterioration.

**Table 1. Chilling rates and cooling curves using four ice handling techniques: (1) retention of meltwater with flake ice (RFI), (2) continuous drain with slurry ice (CDSI), (3) pre-draining of meltwater with slurry ice (PDSI), and (4) retention of meltwater with slurry ice (RSI) all having a 2:1 ice/fish ratio.**

| Handling technique | 18 to 4˚C (hours) | 18 to 0˚C (hours) | 18°C to Lowest temp. (hours) | Lowest temperature (˚C) | Time ≤ 0˚C (hours) | Time ≤ 4˚C |
|---|---|---|---|---|---|---|
| RFI | 1.72±0.78 [a] | 5.04±2.31 [a] | 6.40±1.21 [a] | -1.23±0.88 [ab] | 10.08±2.47 [a] | 14.49±0.64 [a] |
| CDSI | 1.11±0.24 [ab] | 3.02±0.83 [ab] | 3.08±0.98 [b] | -0.07±1.04 [a] | 5.87±2.83 [ab] | 6.98±3.42 [b] |
| PDSI | 0.71±0.48 [b] | 1.64±0.61 [b] | 2.86±0.73 [b] | -1.78±1.10 [b] | 4.46±1.34 [b] | 7.06±2.46 [b] |
| RSI | 0.54±0.34 [b] | 1.43±0.49 [b] | 3.75±1.15 [b] | -2.34±0.40 [b] | 5.96±2.23 [b] | 8.58±1.92 [b] |

[a-b]: Mean values followed by different letters in the same column are statistically significant ($p<0.05$).

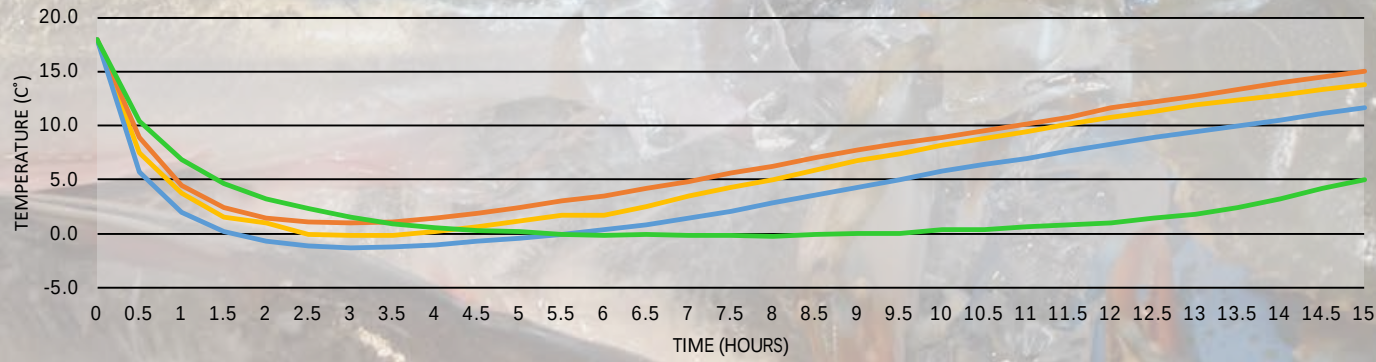


**Figure 2. Cooling curves of Black Drum fish stored in a 2:1 ice to fish ratio. Handling technique abbreviations: (PDSI) pre-drained with slurry ice, (CDSI) continuous drain with slurry ice, (RSI) retention of meltwater with slurry ice, and (RFI) retention of meltwater with flake ice.**

## CONCLUSION

Based on this study, slurry ice showed effective chilling rates when used at a 2:1 ice to fish ratio. The handling method is important in achieving the lowest temperature. In this study, the best handling method was retention of meltwater with slurry ice. In conclusion, both slurry ice and flake ice are effective at decreasing temperatures, however, slurry ice showed a faster chilling rate. The use of slurry ice will improve the shelf life of seafood by decreasing the time of chilling. However, slurry ice needs to be restock after chilling, to maintain a low temperature during storage.

## REFERENCES

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