matís

Pacific cod shelf-life experiment report

– Effects of onboard slurry ice cooling and tub storage on quality parameters

Sæmundur Elíasson, Matís & the University of Akureyri
Kolbrún Sveinsdóttir, Matís

Report Matís nr. 04-25

March 2025
ISSN zzz
DOI nr. **10**.5281/zenodo.15017638

Skýrsluágrip Matís ohf.
Matvælarannsóknir

Report Summary
Icelandic Food and Biotech R&D

ISSN 1670-7192

Title	**Pacific cod shelf-life experiment report**		
Authors	Sæmundur Elíasson and Kolbrún Sveinsdóttir		
Report no.	04-25	*Date:*	March 2025
Project no.	60010		
Funding:	Unites States Department of Agriculture, Value-Added Producer Planning grant		
Executive Summary:	This report on the Pacific cod shelf-life experiment compares two methods of handling and preserving fish quality aboard fishing vessels: the traditional Kaia Fisheries method using refrigerated seawater tank onboard (RSW-OLD) and a new slurry ice method using plastic tubs for storage (SLURRY-NEW). The study aimed to evaluate improvements in handling and cooling to maintain higher fish quality and extend shelf life. Key findings from the experiment show that the slurry ice method can extend the Pacific cod's shelf-life by approximately six days longer than the traditional RSW method, with lower quality index scores and Torry scores indicating fresher, higher-quality fish throughout the testing period. The study concludes that the new slurry ice method could provide significant benefits to the seafood industry by maintaining a superior quality and longer shelf life of caught Pacific cod, leading to potential gains in market price and quality perception.		
English keywords:	*Pacific cod, shelf life, slurry ice, RSW, quality*		

matís

Table of Contents

1. INTRODUCTION

The experiment introduced in this report was designed and supervised by Matís. The aim of the study was to evaluate and validate the quality of the new onboard process by Kaia Fisheries using slurry ice and tubs (plastic containers) onboard their ships. Kaia fisheries has been working to improve onboard handling and cooling of their catch, as they are trying to promote better quality and higher prices in a fishery that has historically prioritized volume over premium products. A key element of this effort is introducing equipment and handling processes commonly used in Icelandic fisheries. Instead of the process traditional to Alaska pacific cod fisheries, using refrigerated seawater (RSW) holds for storing ungutted fish, they immediately bleed and gut the fish, then place them into slurry-ice baths in insulated tubs that keep fish at optimal temperatures until processing. The method is commonly used in Icelandic fisheries that are focused on fresh fish quality (Eliasson, S., 2022). Kaia fisheries have invested in an onboard slurry ice system from the KAPP Optimice and Saeplast plastic tubs (totes). They aim to use improved onboard handling and cooling to deliver premium quality fish onshore and maintain higher freshness for their Pacific cod (*Gadus macrocephalus*) catch.

Matís has done research on Atlantic cod (*Gadus morhua*) in Icelandic fisheries for a long time and used experiences from that work in this study. Although the two cod species have very different view in terms of markets and cultural traditions, they are similar in terms of many attributes (water content, lean fat content and many sensory attributes etc.). There was limited prior research found on similar Pacific cod quality studies but from older studies the shelf-life in ice or RSW was usually considered around 9-12 days from catch depending on handling and storage conditions (Doyle, J.P., 1995, Reppond & Collins, 1983). The importance of removing the fish guts immediately after catch and avoiding long term RSW storage of ungutted fish has been studied (Eliasson et al., 2024), and harvesters are advised to limit the RSW storage of whole-ungutted cod to 24 hours to mitigate the negative impacts on fillet quality.

The study reported here is a shelf-life experiment with two groups, the traditional process (RSW-OLD) and the new one being evaluated (SLURRY-NEW), comparing them using sensory evaluation. In the design of this study an attempt is made to compare the new slurry ice and tub storage process to a relatively optimal RSW test case, where fish were harvested and immediately placed in RSW tanks, then gutted within 48 hours, and promptly immersed in ice to maintain cold temperatures, as the aim is to improve on the best handling that the older process delivers. The RSW process used for comparison, therefore, included only a two day onboard storage period and then immediate transfer to shore, no pumping of the catch was used. It is, however, common for vessels to hold fish for a full three days, pump them to a tender who can hold the catch for another day, before transporting or pumping it into a processing plant. In the most extreme cases, the catch delivered to the processing plants can be double pumped and 3-6 days from landing at times. The pumping, as seen in figure 1, generally has a negative impact on the quality and it is also common for the boats to flood the fish holds with ambient temp water when pumping the fish off. The negative impacts are therefore both a temperature rise in the raw material and physical damages due to the external forces to the fish during the pumping.

Figure 1: Example of Pacific cod being pumped from a RSW tank in Alaskan fisheries

2. EXPERIMENTAL DESIGN

The experiment design was built on prior Matís studies used for Atlantic cod, using a combination of freshness evaluation of raw whole fish (Quality Index Method, QIM) and cooked fillets (Torry freshness score sheet). All the samples were taken at the same time, early on the fishing trip on January 24th from Dutch harbor. The sample fish were all taken from the same catch group/haul.

The two experimental groups were:

- **RSW-OLD:** The standard onboard procedure. After catching there is a gill cut made to the fish which is then stored ungutted in an onboard RSW tank for 48 hours.

- **SLURRY-NEW**: Fish from the same catch group were throat cut and gutted, bled out for 20 minutes in a tub with seawater. Then the fish was moved into a tub with slurry ice for cooling and onboard storage for 48 hours.

Each trial group included around 25 fish of similar size. The sample fish were labeled with zip tags attached to the tail end, so that they could be separated and identified after the fishing trip. Both sample groups were held onboard for 48 hours from catch before being unloaded from the boat. They were then boxed in for transport to Seattle for the shelf-life study (see Figure 2).

Both groups were contained in 10 Styrofoam boxes weighing a total of 617 lbs. The fish was well iced and packaged for transport. The boxed samples were stored in Coastal Transportation's chilled location in Dutch Harbor before transport. They were then flown out of Dutch harbor on January 28th, through Anchorage, and were received at PSQS (Puget Sound Quality Specialists) in Seattle on January 29th — the day the first test point was taken for evaluation. The samples were stored in a PSQS refrigerated cooler at 0°C (32°F) throughout the experiment timeline.

Figure 2: Samples in a styrofoam box with ice

Temperature measurements were done with a digital temperature probe:

- At the time of catch: on the RSW seawater, the slurry ice and the fish groups core temperature.
- After 5 hours from catch: on the RSW seawater, the slurry ice and the fish groups core temperature.
- At landing: on the RSW seawater, the slurry ice and the fish groups core temperature.

The experiment timeline is shown in Table 1.

Table 1: Experiment timeline

Days from harvest	Date	Slurry ice group (SLURRY-NEW)	RSW group (RSW-OLD)
0	January 24th	Harvest date – day of catching	
1	January 25th	Onboard tub storage in slurry ice	Onboard storage in an RSW tank
2	January 26th	Boat unloading and sample boxing	
3	January 27th	Storage at Dutch harbor cold store	
4	January 28th	Transport	
5	January 29th	Samples received in Seattle and 1st test point	
6	January 30th		
7	January 31st	2nd test point	
8	February 1st		
9	February 2nd		
10	February 3rd	3rd test point	
11	February 4th		
12	February 5th	4th test point (RSW-OLD Group failed sensory)	
13	February 6th		
14	February 7th	5th test point	
15	February 8th		
16	February 9th		
17	February 10th	6th test point (SLURRY-NEW Group failed sensory)	

3. EVALUATION METHODS

Analysis of sensory parameters were managed by PSQS (Puget Sound Quality Specialists) in Seattle. They received the fish in Styrofoam boxes and stored them in a cold store until the end of the experiment. Sensory evaluation included a Quality index method (QIM) for whole fish and the Torry method for cooked fish. Each sample set included 3 fish and the sensory analysis was performed by thee experienced sensory experts.

Quality Index method for whole raw fish

To estimate the freshness of the whole raw fish the Quality Index Method (QIM) was used. QIM is a freshness grading system originally developed by the Tasmanian Food Research Unit (Bremner, 1985) and adapted for whole gutted Atlantic cod (Jónsdóttir, 1992; Larsen and others, 1992). The QIM score chart used is shown in Table 2. It was modified in this trial to 0-15-point index as the gills quality parameters scores were skipped because some of the sample fish used did not have their gills intact. Three sensory experts conducted the sensory evaluation, and each test point included samples from three fish from each group. Each sample was coded without any information about the origin group.

Table 2: QIM score chart developed for whole gutted Atlantic cod. Text in red shows omitted quality parameters for whole ungutted Pacific cod

Quality parameter		Description	Points	Score *codes:*				
Appearance:	**Skin**	Bright, iridescent pigmentation	0					
		Rather dull, becoming discoloured	1					
		Dull	2					
	Stiffness	In rigor	0					
		Firm, elastic	1					
		Soft	2					
		Very soft	3					
Eyes:	**Cornea**	Clear	0					
		Opalescent	1					
		Milky	2					
	Form	Convex	0					
		Flat, slightly sunken	1					
		Sunken, concave	2					
	Colour of pupil	Black	0					
		Opaque	1					
		Grey	2					
Gills:	**Colour**	Bright	0					
		Less coloured, becoming discoloured	1					
		Discoloured, brown spots	2					
		Brown, discoloured	3					
	Smell	Fresh, seaweedy, metallic	0					
		Neutral, grassy, musty	1					
		Yeast, bread, beer, sour milk	2					
		Acetic acid, sulphuric, very sour	3					
	Mucus	Clear	0					
		Milky	1					
		Milky, dark, opaque	2					
Blood:	**Colour**	Red	0					
		Dark red	1					
		Brown	2					
Fillets:	**Colour**	Translucent, bluish	0					
		Waxy, milky	1					
		Opaque, yellow, brown spots	2					
Quality Index (0-23/0-15)			**Sum:**					

Torry score for cooked fish sensory evaluation

The Torry freshness score sheet, shown in Table 3, is based on the scheme developed by Shewan and others (1953), was used to assess cooked samples of cod.

Three fish sensory experts conducted the sensory evaluation, and each test point included samples from three fish from each group. The Torry freshness score sheet shows that freshness deterioration of fish is first characterized by the initial loss of the sweet, meaty fresh fish odour and flavour which is followed by the development of a neutral flavour (Torry score of 7 out of 10), leading to the detection of off-odour and -flavour (Torry score of 5 out of 10). End of shelf life is usually determined when sensory attributes related to spoilage such as sour, TMA odour and/or flavour become evident. The average Torry score of 5.5 has been used to determine the end of shelf life as at this point most panelists detect obvious spoilage attributes (Martinsdóttir et al., 2004).

Table 3: Torry score sheet for freshness evaluation of cooked lean fish

Odour	Flavour	score
Initially weak odour of sweet, boiled milk, starchy followed by strenghthening of these odours	Watery, metallic, starchy. Initially no sweetness but meaty flavours with slight sweetness may develop	**10**
Shellfish, seaweed, boiled meat	Sweet, meaty, characteristic	**9**
Loss of odour, neutral odour	Sweet and characteristic flavours but reduced in intensity	**8**
Woodshavings, woodsap, vanillin	Neutral	**7**
Condensed milk, boiled potato	Insipid	**6**
Milk jug odours, boiled clothes- like	Slight sourness, trace of off-flavours	**5**
Lactic acid, sour milk, TMA	Slight bitterness, sour, off-flavours, TMA	**4**
Lower fatty acids (eg acetic or butyric acids) composed grass, soapy, turnipy, tallowy	Strong bitter, rubber, slight sulphide	**3**

Salt content measurement

Salt Content was conducted by Micro-Chem Food Laboratories in Seattle, WA. Salt content was measured using the AOAC 971.19/976.19 method.

4. RESULTS AND DISCUSSION

The temperature recorded during the onboard process (Figure 3, 4) was 0,4°C (32,7°F) in the RSW tank and -1,4°C (29,5°F) in the slurry ice. The fish core temperature after 5 hours from catch was measured 1,1°C (33,9°F) in the RSW group and -1,1°C (30,0°F) in the slurry fish. At landing the core temperature of the fish was measured -0,1°C (31,9°F) in the RSW group and -1,2°C (29,8°F) in the slurry ice group. The cooling process for the slurry ice group was therefore more rapid compared to the RSW group. After landing the groups were both treated the same, boxed in ice at 0°C and after the samples were received at PSQS in Seattle they were stored in the same cold store, at an average temperature of 0,3°C ± 0,4°C throughout the experiment time. The difference between the groups should therefore be represented by different onboard handling and treatment prior to landing, after which they were treated the same.

Figure 3: Tagging sample fish onboard

Figure 4: Temperature measurements onboard

Salt content was measured similarly for both groups on Day 5 from catch, 0,15% for SLURRY-NEW and 0,14% for RSW-OLD. So, there is not an indication for extensive salt uptake during the cooling and storage process.

Results from the sensory evaluation for both QIM and Torry were received by Matís from PQSQ, who performed the evaluation and the original data is shown in this report Appendix. The results of the

freshness evaluation of whole samples applying the QIM are shown in Figure 5. For both groups it is low at the first evaluation point on Day 5 from catch, indicating high freshness and good condition of the whole raw fish. The development of the RSW-OLD group is showing a linear development to higher QIM score for the next evaluation points to Day 12 from catch. At that point the QIM score for the RSW-OLD is just over 10. The SLURRY-NEW group has a low QIM on Day 7 and then a QIM score of around 7 on Day 10. However, there is a variability within the group and the SLURRY-NEW samples on Day 12 have a much lower QIM score. On Day 14 the SLURRY-NEW sample still has a lower QIM score than the RSW-OLD on Day 10. On Day 17 the SLURRY-NEW group had a QIM score just over 12.

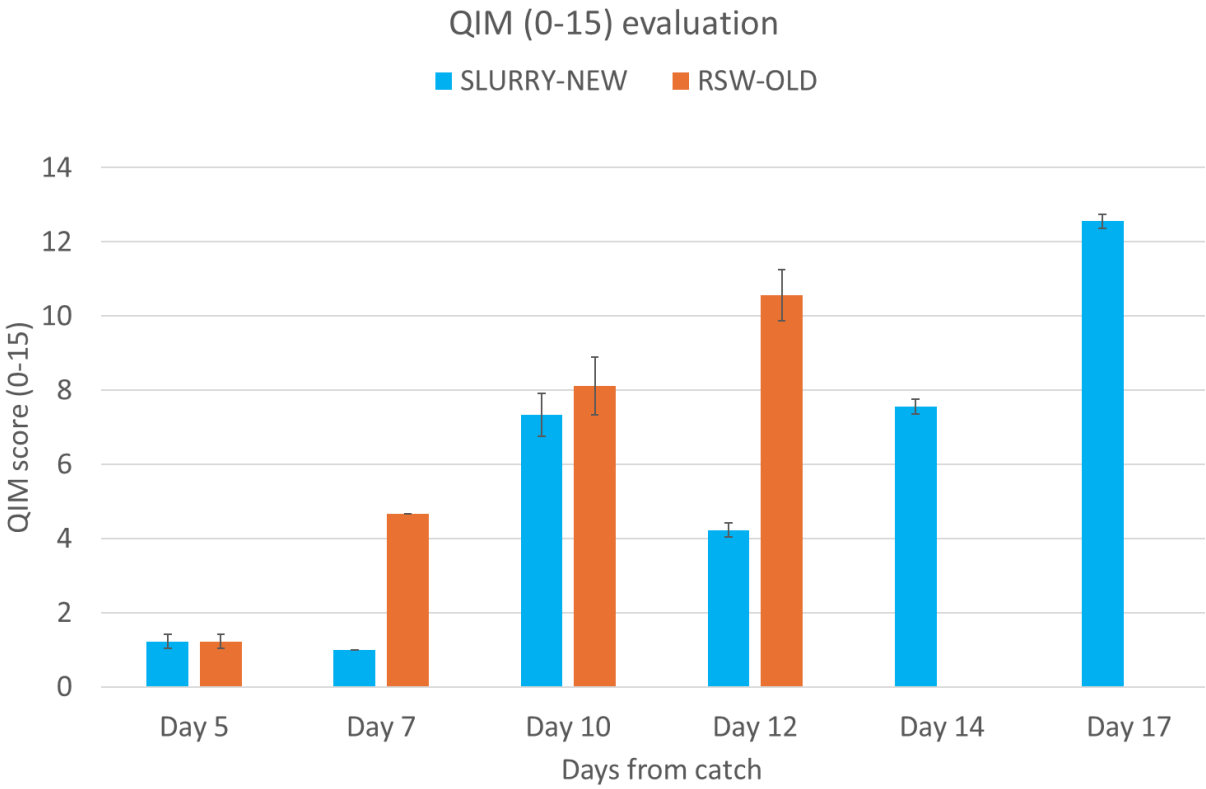

Figure 5: QIM score. Error bars show the sample (n=3) standard deviation.

The measurements for the cooked Torry score, shown in Figure 6, were the main shelf-life evaluation parameter of the study. The first evaluation point was on Day 5 from catch, at which time both groups show high freshness of a Torry score above 9. The RSW-OLD group falls linearly on the Torry scale and loses its freshness at around day 8 to 9. On Day 10 from catch, the RSW-OLD group is very close to spoilage and the sample is considered well below the spoilage limit at Day 12 from catch. The SLURRY-NEW group starts out similar on the first two test points but maintains freshness better compared to the RSW-OLD. The SLURRY-NEW scored above the freshness limit of greater than 7,0 until Day 14 from catch, and the sample was considered spoiled on the next evaluation point 3 days later.

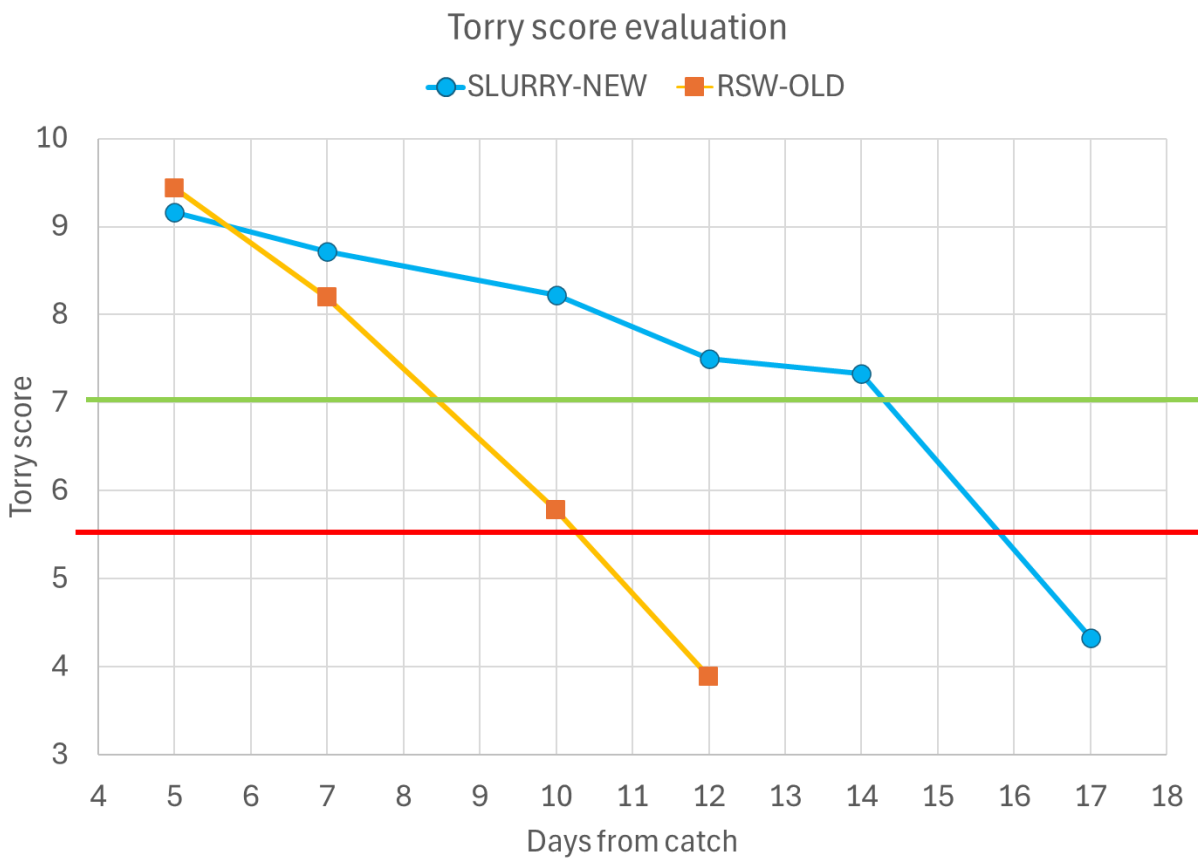

Figure 6: Torry score for the trial. The green horizontal line represents the freshness limit of Torry 7,0 and the red horizontal line the Torry 5,5 limit for spoilage

Based on the Torry evaluation, the SLURRY-NEW samples maintain freshness around 6 days longer than the RSW-OLD and it maintains a shelf-life at least 5 days longer.

5. CONCLUSIONS

The results overall showed that the SLURRY-NEW group longer remained of higher freshness and had a longer shelf life than the RSW-OLD. Both sensory methods, QIM for the whole raw fish and Torry for cooked tasting sensory, indicated at least 5 days longer shelf life for the SLURRY-NEW and an even longer extension of the freshness period. Due to the lower slurry ice temperature and comparing to other shelf-life studies (Elíasson et al., 2019) the SLURRY-NEW group shows some "superchilling effects" (Kaale et al., 2011) and a similar resulting shelf-life extension.

For context, this study compares the new handling process to a relatively optimal RSW scenario, as the test group did not involve the typical RSW pumping, holding tanks, or onboard storage beyond two days. In real-world conditions, the difference between these methods may be even more pronounced. The main advantages of the new process evaluated are considered that:

- The new process landing method using tubs eliminates the fish pumping, a process known to reduce quality, which could further extend shelf life compared to the average RSW-handled fish.

- The new process enhances stability and uniformity by storing catch in controlled 300 kg batches within tubs, rather than mixing fresh fish with older catch as is done in a larger RSW tank.

- A key improvement to the new process is the immediate removal of guts, a primary source of spoilage bacteria, significantly reducing contamination risk compared to traditional RSW storage, where ungutted fish remain in the tank for extended periods.

- The minimum of 5 days of extra shelf life and the additional extended freshness period should be of real value to the value chain and especially to the end users and sellers.

REFERENCES

Bremner H.A. (1985). A convenient easy to use system for estimating the quality of chilled seafood. Fish Processing Bulletin 7:59–70

Doyle, J.P., (1995). Seafood Shelf Life as a Function of Temperature. Alaska Sea Grant Marine Advisory Program. AGS-30. https://seafood.oregonstate.edu/sites/agscid7/files/snic/seafood-shelf-life-as-a-function-of-temperature-1995.pdf

Elíasson, S. (2022). Effects of onboard processing on groundfish quality. Faculty of Industrial Engineering, Mechanical Engineering and Computer Science. University of Iceland. Doctoral thesis. https://opinvisindi.is/handle/20.500.11815/3007

Elíasson, S., Arason, S., Margeirsson, B., & Palsson, O. P. (2024). Effects of Onboard Refrigerated Seawater Storage of Whole Ungutted Atlantic Cod (Gadus morhua) on Quality Parameters of Fillets. Journal of Aquatic Food Product Technology, 33(2), 194–204. https://doi.org/10.1080/10498850.2024.2318405

Eliasson, S., Arason, S., Margeirsson, B., Bergsson, A.B., Palsson, O.P., (2019). The effects of superchilling on shelf-life and quality indicators of whole Atlantic cod and fillets. LWT – Food Science and Technology 100 (1), 426-434. https://doi.org/10.1016/j.lwt.2018.10.062. https://www.sciencedirect.com/science/article/pii/S0023643818309083?via%3Dihub

Jonsdottir S. (1992). Quality index method and TQM system. In Proceedings from the COMETT conference course: Quality issues in the Fish industry, European cooperation (pp. 81–94). Reykjavik, Iceland.

Kaale, L., D., Eikevik, T.M., Rustad, T., Kolsaker, K. (2011). Superchilling of food: A review. Journal of Food Engineering, Volume 107, Issue 2, Pages 141-146. ISSN 0260-8774, https://doi.org/10.1016/j.jfoodeng.2011.06.004.

Larsen, E., Heldbo J., Jespersen C. M., Nielsen J. (1992). Development of a method for quality assessment of fish for human consumption based on sensory evaluation. In H. H. Huss, M. Jakobsen, & J. Liston (Eds.), Quality assurance in the Fish industry (pp. 351–358). Amsterdam: Elsevier Science Publishing.

Martinsdóttir E, Sveinsdóttir K, Luten J, Schelvis-Smith R, Hyldig G. 2004. Sensory Evaluation of Fish Freshness. Reference Manual for the Fish Sector. QIM-Eurofish

Reppond, K.D. and J. Collins (1983). Pacific cod (Gadus macrocephalus): Change in sensory and chemical properties when held in ice and in CO2 modified refrigerated seawater. J. Food Sci. 48, 1552-1553.

Shewan J.M., Macintosh R.G., Tucker C.G., Ehrenberg A.S.C. (1953). The development of a numerical scoring system for the sensory assessment of the spoilage of wet white fish stored in ice. Journal of Sci. Food Agr. 4(6): 283-298.

matís

APPENDIX

Refrigerated Shelf Life - Sensory Evaluation Detail
Slurry Ice vs. RSW Preparation

Analyst 1					USDC SENSORY SCALE ODOR (Raw Odor Descriptor - Groundfish)			TORRY SCALE - ODOR / FLAVOR (Cook Test Score)		
				Fish #	1	2	3	1	2	3
DAY	Type	Date	P	F						
1	S	29-Jan-25	X		Ocean Air	Fresh	Fresh	9.5	9.5	9.5
	RSW		X		Fresh-Neutral	Fresh-Neutral	Fresh-Neutral	9.5	9.5	9.5
3	S	31-Jan-25	X		Fresh-Neutral	Fresh-Neutral	Fresh-Neutral	9	9	9
	RWS		X		Stale-Oxidized	Stale-Oxidized	Stale-Oxidized	8.5	8	8
6	S	03-Feb-25	X		Slt Fishy	Slt Stale	Neutral	8.5	8.5	8.5
	RSW		X		Fishy-Oxidized	Fishy-Oxidized	Fishy-Oxidized	5.5	5.5	5.5
8	S	05-Feb-25	X		Neutral-Slt Stale	Ocean Air-Neutral	Neutral-Slt Stale	8	7.5	7
	RSW			X	Sour	Sour	Sour	3.5	4	4
10	S	07-Feb-25	X		Neutral-Slt Stale	Slt Fishy-Slt Stale	Neutral-Slt Stale	8	7.5	7.5
	RSW			X						
13	S	10-Feb-25			Slight Sour	Slight Sour	Slight Sour	4.5	3.5	4.5
	RSW			X						

Analyst 2					USDC SENSORY SCALE ODOR (Raw Odor Descriptor)			TORRY SCALE - ODOR / FLAVOR (Cook Test Score)		
				Fish #	1	2	3	1	2	3
DAY	Type	Date	P	F						
1	S	29-Jan-25	X		Fresh	Fresh	Fresh	9	9	9
	RSW		X		Neutral	Neutral	Neutral	9	10	9
3	S	31-Jan-25	X		Slt Stale	Slt Stael	Slt Stale	8.5	8.5	8.5
	RWS		X		Stale to Slt Fishy	Stale to Slt Fisht	Stale to Slt Fishy	8	8	8
6	S	03-Feb-25	X		Fishy	Fishy	Fishy	8	8	8
	RSW		X		Fleeting Sour	Fleeting Sour	Fleeting Sour	6	6	5.5
8	S	05-Feb-25	X		Mod-Strong Stale	Mod-Strong Stale	Mod-Strong Stale	8	7.5	7
	RSW			X	Sour-Acetic Acid	Sour-Acetic Acid	Sour-Acetic Acid	4	4	4
10	S	07-Feb-25	X		Slight Fishy	Fleeting Sour	Slight Fishy	7	7.5	7.5
	RSW			X						
13	S	10-Feb-25		X	Slight Sour	Slight Sour	Slight Sour	4	4	4.5
	RSW			X						

Analyst 3					USDC SENSORY SCALE ODOR (Raw Odor Descriptor)			TORRY SCALE - ODOR / FLAVOR (Cook Test Score)		
				Fish #	1	2	3	1	2	3
DAY	Type	Date	P	F						
1	S	29-Jan-25	X		Fresh-Neutral	Fresh-Neutral	Fresh-Neutral	9	9	9
	RSW		X		Fresh-Neutral	Fresh-Neutral	Fresh-Neutral	9.5	9.5	9.5
3	S	31-Jan-25	X		Neutral	Neutral	Neutral	8.5	9	8.5
	RWS		X		Stale-Oxidized	Stale-Oxidized	Stale-Oxidized	8.75	8.25	8.25
6	S	03-Feb-25	X		Fishy	Stale-Fishy	Neutral-Fishy	8.5	8	8
	RSW		X		Stale-Fishy	Stale-Fishy	Stale-Fishy	6	6	6
8	S	05-Feb-25*	X		Slt Stale	Mod. Stale	Mod. Stale	8	7.5	7
	RSW			X	Slt Sour	Sour - Yeast	Slight Sour	3.5	4	4
10	S	07-Feb-25	X		Slt Fishy	Slt. Fishy-Slt Sour	Slt Fishy	7.5	6	7.5
	RSW			X						
13	S	10-Feb-25*		X	Slt Sour, Yeast	Slt Sour, Yeast	Slt Sour, Yeast	4.5	4.5	5
	RSW			X						

Key: S = Slurry Ice Cod, RSW = Refrigerated Sea Water Cod, P = Pass, F = Fail
Date with an asterisk indicates substitute analyst (Katie Comer) due to weather (Snow)*

Refrigerated Shelf Life - QIM
Slurry Ice vs. RSW Preparation

Analyst 1			Appearance						Eyes									Blood			Fillets			Quality Index Sum		
			Skin			Stiffness			Cornea			Form			Colour of Pupil			Colour			Colour			QIM Modified (0-15)		
		Fish #	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
DAY	Type	Date																								
1	S	29-Jan-25	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1
	RSW		0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1
3	S	31-Jan-25	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1
	RWS		1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	0	5	5	4
6	S	03-Feb-25	1	1	1	2	2	2	1	1	1	1	1	1	0	0	0	1	1	1	1	1	1	7	7	7
	RSW		2	2	2	2	2	2	2	2	2	1	1	1	0	0	0	1	1	1	1	1	1	9	9	9
8	S	05-Feb-25	0	1	0	1	1	1	1	1	1	0	1	0	0	0	0	0	1	1	1	1	1	3	6	4
	RSW		2	2	2	2	2	2	2	2	2	1	1	1	0	0	0	1	1	1	2	2	2	10	10	10
10	S	07-Feb-25	1	1	1	2	2	2	2	1	1	1	1	1	0	0	0	1	1	1	1	1	1	8	7	7
	RSW																							---	---	---
13	S	10-Feb-25	2	2	2	2	2	2	2	2	2	2	2	2	2	1	2	1	2	2	1	1	1	12	12	13
	RSW																							---	---	---

Analyst 2			Appearance						Eyes									Blood			Fillets			Quality Index Sum		
			Skin			Stiffness			Cornea			Form			Colour of Pupil			Colour			Colour			QIM Modified (0-15)		
		Fish #	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
DAY	Type	Date																								
1	S	29-Jan-25	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1	2
	RSW		0	0	0	1	1	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	2	1	1
3	S	31-Jan-25	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1
	RWS		1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	0	5	5	4
6	S	03-Feb-25	1	1	1	2	2	2	1	1	1	1	1	1	0	0	0	1	1	1	1	1	1	7	7	7
	RSW		1	1	1	2	2	2	1	1	1	2	1	1	1	0	0	1	1	1	1	1	1	9	7	7
8	S	05-Feb-25	0	1	0	1	1	1	1	1	1	0	0	0	0	0	0	0	1	1	1	1	1	3	5	4
	RSW		2	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1	2	1	2	2	2	11	12	11
10	S	07-Feb-25	1	1	1	2	2	2	2	1	1	1	1	1	1	0	0	1	1	1	1	1	1	9	7	7
	RSW																							---	---	---
13	S	10-Feb-25	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	2	2	1	1	1	12	13	13
	RSW																							---	---	---

Analyst 3			Appearance						Eyes									Blood			Fillets			Quality Index Sum		
			Skin			Stiffness			Cornea			Form			Colour of Pupil			Colour			Colour			QIM Modified (0-15)		
		Fish #	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
DAY	Type	Date																								
1	S	29-Jan-25	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1	2
	RSW		0	0	0	1	1	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	2	1	1
3	S	31-Jan-25	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1
	RWS		1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	0	5	5	4
6	S	03-Feb-25	1	1	1	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	8	8	8
	RSW		1	1	1	2	2	2	1	1	1	2	1	1	1	0	0	1	1	1	1	1	1	9	7	7
8	S	05-Feb-25*	0	1	0	1	1	1	1	1	1	0	1	0	0	0	0	0	1	1	1	1	1	3	6	4
	RSW		2	2	2	2	2	2	2	2	2	1	1	1	1	0	0	1	1	1	2	2	2	11	10	10
10	S	07-Feb-25	1	1	1	2	2	2	2	1	1	1	1	1	1	0	0	1	1	1	1	1	1	9	7	7
	RSW																							---	---	---
13	S	10-Feb-25*	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	1	1	1	13	13	12
	RSW																							---	---	---

Key: S = Slurry Ice Cod, RSW = Refrigerated Sea Water Cod

Date with an asterisk indicates subsitutue analyst (Katie Comer) due to weather (snow).*