

## **APPENDIX 1**

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Date: 24 May 2007

**DEPARTMENT OF CONSUMER & SENSORY SCIENCE**

**CONFIDENTIAL REPORT**

**SENSORY QUALITY EVALUATION  
OF HIGH PRESSURE PROCESSED NEPHROPS**

Report No. S/REP/95900/1

Prepared by : Sue Burling

Checked &  
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## SUMMARY

The aim of the project was to understand the effect of High Pressure Processing (HPP) on the sensory quality of a variety of fish and shellfish species.

Each species was subjected to a range of pressure/time/temperature combinations and a selection of samples were then evaluated to determine the effect on the sensory quality in terms of appearance, odour, flavour and texture.

This report details the results for Nethrops.

## SAMPLE INFORMATION

Date samples received: 26<sup>th</sup> January 2007

Condition on receipt: Good

Storage conditions: Chiller J

Date samples tested: 26<sup>th</sup> January 2007

<b>FMT Label</b>	<b>Pressure (MPa)</b>	<b>Time (mins)</b>	<b>Temp (°C)</b>
Control	n/a	n/a	n/a
Untreated (water)	n/a	n/a	n/a
Run 1	250	2.5	-3.3
Run 2	280	1.0	0.4
Run 3	220	1.0	0.2
Run 4	250	2.5	0.5
Run 5	220	4.0	0.1
Run 6	280	4.0	0.1

## Sample Preparation

Each sample was received from the FMT department raw and evaluated uncooked. The sample was then placed in a Pyrex bowl, covered and placed in a steamer, over a litre of boiling water in the base and steamed for 6 minutes.

## MATERIALS AND METHODS

### Sensory Quality Grading (TES-S-021)

For each evaluation 12 tails were assessed. All samples were presented under three-digit code to a panel of three experienced sensory assessors.

Each assessor independently described the uncooked appearance and odour and awarded an overall quality grade for the raw sample (using the scale shown below). The sample was then steamed and the assessors described the appearance, odour, flavour and texture/mouthfeel and awarded a quality grade for the cooked assessment. The consensus scores were calculated and the individual comments combined.

### Assessment Scale – Sensory Quality

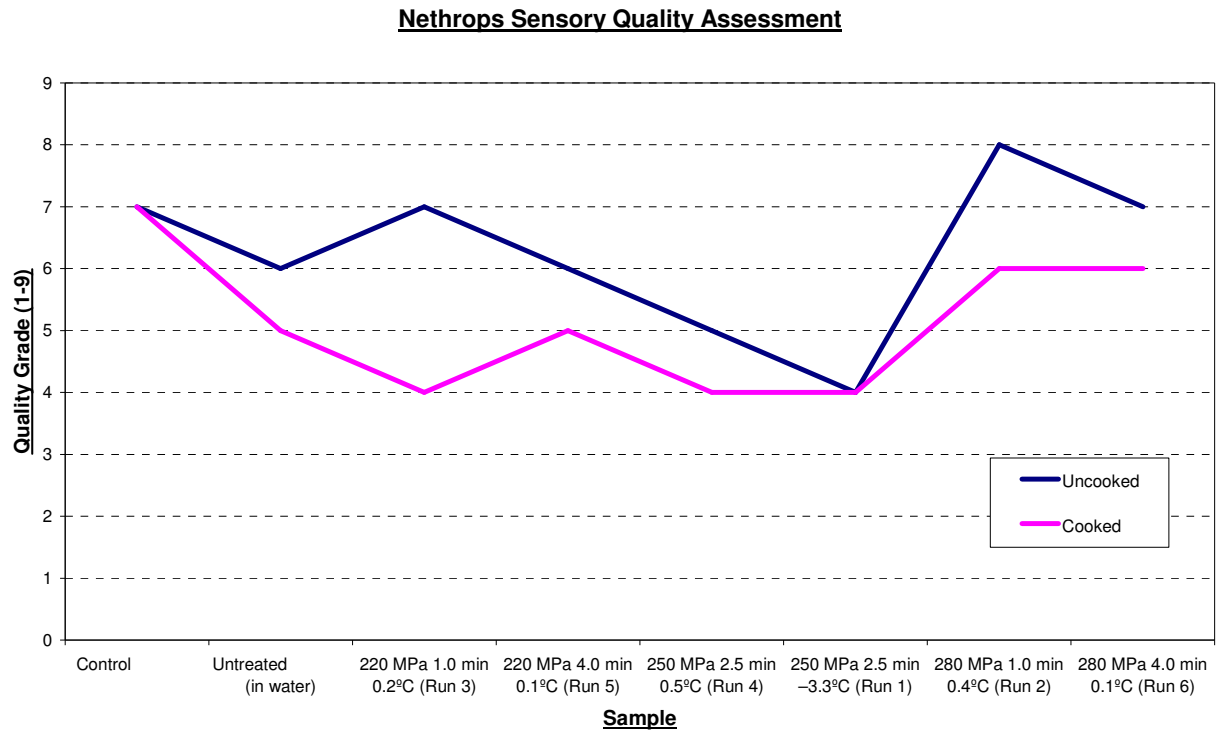
9	Excellent Quality
8	Very Good Quality
7	Good Quality
6	Fairly Good Quality
5	Satisfactory Quality
4	Just Acceptable Quality
3	Poor Quality
2	Very Poor Quality
1	Bad Quality

## RESULTS AND DISCUSSION

A summary of the grades awarded are detailed in the following table:

Sample Name	Treatment Details	Uncooked Quality Grade	Cooked Quality Grade
Control	Untreated	7	7
Untreated	Placed in water	6	5
Run 1	250 MPa 2.5 min -3.3°C	4	4
Run 2	280 MPa 1.0 min 0.4°C	8	6
Run 3	220 MPa 1.0 min 0.2°C	7	4
Run 4	250 MPa 2.5 min 0.5°C	5	4
Run 5	220 MPa 4.0 min 0.1°C	6	5
Run 6	280 MPa 4.0 min 0.1°C	7	6

The following graph shows both the uncooked and cooked assessment scores for ascending pressure treatments.



For the uncooked assessment Run 2 was graded the highest and slightly higher than the Control. This sample was brighter and slightly less translucent. Run 3 and Run 6 were graded equal to the Control, however both samples were showing signs of shape loss.

Run 5, Run 4, Run 1 and the untreated sample were graded lower than the Control, all had lost their shape.

For the cooked assessment, the Control was graded the highest followed by Run 2 and Run 6. These were both slightly less bright, had lost the slight seawater odour present in the Control and were both slightly more gritty in texture. Run 6 also has a slightly astringent mouthfeel.

All other samples were graded lower than Run 2 and Run 6 due to changes in appearance; dirty grey coloration, less bright and more shape loss, odour and flavour; off odours and sour/acid flavour, texture/mouthfeel; more fibrous and gritty, astringent notes present and one described as rubbery/chewy.

# **APPENDIX**

*Individual Comments and Quality Grades  
for the Raw and Cooked Assessments*

	<b>Raw Assessment Control (no water)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Moderately/very bright</li> <li>• Moderately moist</li> <li>• Moderately pink with very slight yellow tints</li> <li>• Moderately translucent</li> <li>• Plump with very little shape loss (i.e. excellent shape retention)</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Moderate/strong fresh odour</li> <li>• Slight seawater note</li> </ul>
<b>Overall Quality</b>	<b>7 (Good)</b>

	<b>Cooked Assessment Control (no water)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Moderately/very bright</li> <li>• Moderately pink and uniform in colour</li> <li>• Slight shape loss</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Moderate/strong fresh odour</li> <li>• Slight seawater note</li> </ul>
<b>Flavour</b>	<ul style="list-style-type: none"> <li>• Moderate/strong shellfish flavour</li> <li>• Moderately sweet</li> <li>• Slightly salty</li> </ul>
<b>Texture/Mouthfeel</b>	<ul style="list-style-type: none"> <li>• Moderately firm bite</li> <li>• Moderately/very moist</li> <li>• Slightly fibrous</li> <li>• Very slightly gritty</li> </ul>
<b>Overall Quality</b>	<b>7 (Good)</b>

	<b>Raw Assessment Untreated (in water)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Slightly bright</li> <li>• Moderately moist</li> <li>• Moderate pink colour with slight yellow tints</li> <li>• Moderately translucent</li> <li>• Slight shape loss</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Moderate/strong fresh odour</li> <li>• Slight seawater note</li> </ul>
<b>Overall Quality</b>	<b>6 (Fairly Good)</b>

	<b>Cooked Assessment Untreated (in water)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Moderately bright</li> <li>• Moderately pink and uniform in colour</li> <li>• Slight shape loss</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Moderate/strong fresh odour</li> <li>• Slight seawater note</li> </ul>
<b>Flavour</b>	<ul style="list-style-type: none"> <li>• Moderate/strong shellfish flavour</li> <li>• Moderately sweet</li> <li>• Slightly salty</li> </ul>
<b>Texture/Mouthfeel</b>	<ul style="list-style-type: none"> <li>• Very slight firm bite</li> <li>• Slightly/moderately moist</li> <li>• Slightly fibrous</li> <li>• Very slightly gritty</li> </ul>
<b>Overall Quality</b>	<b>5 (Satisfactory)</b>



	<b>Raw Assessment</b> <b>250 MPa 2.5 min -3.3°C (Run 1)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Slightly bright</li> <li>• Moderately moist</li> <li>• Slight/moderate pink colour with moderate blue/grey tints</li> <li>• Slightly/moderately translucent</li> <li>• Moderate shape loss</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Moderate/strong fresh odour</li> <li>• Slight seawater note</li> </ul>
<b>Overall Quality</b>	<b>4 (Just Acceptable)</b>

	<b>Cooked Assessment</b> <b>250 MPa 2.5 min -3.3°C (Run 1)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Slightly/moderately bright</li> <li>• Moderate pink, uniform colour, but slightly dirty grey</li> <li>• Slight shape loss</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Moderate/strong fresh odour</li> <li>• Slight seawater note</li> </ul>
<b>Flavour</b>	<ul style="list-style-type: none"> <li>• Moderate/strong shellfish flavour</li> <li>• Moderately sweet</li> <li>• Slightly salty</li> </ul>
<b>Texture/Mouthfeel</b>	<ul style="list-style-type: none"> <li>• Moderately firm bite</li> <li>• Slightly/moderately moist</li> <li>• Moderately fibrous</li> <li>• Slightly/moderately gritty</li> <li>• Slightly astringent mouthfeel</li> </ul>
<b>Overall Quality</b>	<b>4 (Just Acceptable)</b>

	<b>Raw Assessment</b> <b>280 MPa 1.0 min 0.4°C (Run 2)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Very bright</li> <li>• Moderately moist</li> <li>• Moderately pink with very slight yellow tints blue/grey tints</li> <li>• Slightly/moderately translucent</li> <li>• Plump with very little shape loss (i.e. excellent shape retention)</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Moderate/strong fresh odour</li> <li>• Slight seawater note</li> </ul>
<b>Overall Quality</b>	<b>8 (Very Good)</b>

	<b>Cooked Assessment</b> <b>280 MPa 1.0 min 0.4°C (Run 2)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Moderately bright</li> <li>• Moderate pink, uniform colour</li> <li>• Slight shape loss</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Moderate/strong fresh odour</li> </ul>
<b>Flavour</b>	<ul style="list-style-type: none"> <li>• Moderate/strong shellfish flavour</li> <li>• Moderately sweet</li> <li>• Slightly salty</li> </ul>
<b>Texture/Mouthfeel</b>	<ul style="list-style-type: none"> <li>• Moderately firm bite</li> <li>• Moderately/very moist</li> <li>• Slightly fibrous</li> <li>• Slightly gritty</li> </ul>
<b>Overall Quality</b>	<b>6 (Fairly Good)</b>

	<b>Raw Assessment</b> <b>220 MPa 1.0 min 0.2°C (Run 3)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Moderately bright</li> <li>• Moderately moist</li> <li>• Moderate pink colour with slight yellow tints</li> <li>• Slightly translucent</li> <li>• Slight shape loss</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Moderate/strong fresh odour</li> <li>• Slight seawater note</li> </ul>
<b>Overall Quality</b>	<b>7 (Good)</b>

	<b>Cooked Assessment</b> <b>220 MPa 1.0 min 0.2°C (Run 3)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Moderately bright</li> <li>• Moderate pink, uniform colour, but slightly dirty grey</li> <li>• Moderate shape loss</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Moderate/strong fresh odour</li> <li>• Slight seawater note</li> </ul>
<b>Flavour</b>	<ul style="list-style-type: none"> <li>• Moderate/strong shellfish flavour</li> <li>• Moderately sweet</li> <li>• Slightly salty</li> </ul>
<b>Texture/Mouthfeel</b>	<ul style="list-style-type: none"> <li>• Moderately firm bite</li> <li>• Slightly moist</li> <li>• Moderately fibrous</li> <li>• Slightly rubbery and chewy</li> <li>• Slightly gritty</li> <li>• Slightly astringent mouthfeel</li> </ul>
<b>Overall Quality</b>	<b>4 (Just Acceptable)</b>

	<b>Raw Assessment 250 MPa 2.5 min 0.5°C (Run 4)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Slightly bright</li> <li>• Moderately moist</li> <li>• Moderate pink colour with slight yellow and blue/grey tints</li> <li>• Slightly/moderately translucent</li> <li>• Moderate shape loss</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Moderate/strong fresh odour</li> <li>• Slight seawater note</li> </ul>
<b>Overall Quality</b>	<b>5 (Satisfactory)</b>

	<b>Cooked Assessment 250 MPa 2.5 min 0.5°C (Run 4)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Slightly/moderately bright</li> <li>• Moderate pink, uniform colour, but slightly dirty grey</li> <li>• Moderate shape loss</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Moderate/strong fresh odour</li> <li>• Slight eggy note</li> </ul>
<b>Flavour</b>	<ul style="list-style-type: none"> <li>• Moderate shellfish flavour</li> <li>• Moderately sweet</li> <li>• Slightly salty</li> <li>• Very slight acidic/sour note</li> </ul>
<b>Texture/Mouthfeel</b>	<ul style="list-style-type: none"> <li>• Moderately firm bite</li> <li>• Slightly/moderately moist</li> <li>• Moderately fibrous</li> <li>• Slightly gritty</li> <li>• Slightly astringent mouthfeel</li> </ul>
<b>Overall Quality</b>	<b>4 (Just Acceptable)</b>

	<b>Raw Assessment</b> <b>220 MPa 4.0 min 0.1°C (Run 5)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Moderately bright</li> <li>• Moderately moist</li> <li>• Moderate pink colour with slight/moderate yellow and very slight blue/grey tints</li> <li>• Slightly translucent</li> <li>• Slight shape loss</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Moderate/strong fresh odour</li> <li>• Slight seawater note</li> </ul>
<b>Overall Quality</b>	<b>6 (Fairly Good)</b>

	<b>Cooked Assessment</b> <b>220 MPa 4.0 min 0.1°C (Run 5)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Moderately bright</li> <li>• Slight/moderate pink, uniform colour, but very slight dirty grey</li> <li>• Slight shape loss</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Moderate/strong fresh odour</li> </ul>
<b>Flavour</b>	<ul style="list-style-type: none"> <li>• Moderate/strong shellfish flavour</li> <li>• Moderately sweet</li> <li>• Slightly salty</li> </ul>
<b>Texture/Mouthfeel</b>	<ul style="list-style-type: none"> <li>• Moderately firm bite</li> <li>• Moderately moist</li> <li>• Slightly fibrous</li> <li>• Slightly gritty</li> </ul>
<b>Overall Quality</b>	<b>5 (Satisfactory)</b>

	<b>Raw Assessment 280 MPa 4.0 min 0.1°C (Run 6)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Moderately/very bright</li> <li>• Moderately moist</li> <li>• Moderate pink colour with very slight yellow and blue/grey tints</li> <li>• Slightly translucent</li> <li>• Plump with little shape loss (i.e. good shape retention)</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Moderate/strong fresh odour</li> <li>• Slight seawater note</li> </ul>
<b>Overall Quality</b>	<b>7 (Good)</b>

	<b>Cooked Assessment 280 MPa 4.0 min 0.1°C (Run 6)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Moderately bright</li> <li>• Moderate pink, uniform colour</li> <li>• Slight shape loss</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Moderate/strong fresh odour</li> </ul>
<b>Flavour</b>	<ul style="list-style-type: none"> <li>• Moderate/strong shellfish flavour</li> <li>• Moderately sweet</li> <li>• Slightly salty</li> </ul>
<b>Texture/Mouthfeel</b>	<ul style="list-style-type: none"> <li>• Moderately firm bite</li> <li>• Moderately moist</li> <li>• Slight/moderately fibrous</li> <li>• Slightly gritty</li> <li>• Slightly astringent mouthfeel</li> </ul>
<b>Overall Quality</b>	<b>6 (Fairly Good)</b>

## **APPENDIX 2**

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Date: 24 May 2007

**DEPARTMENT OF CONSUMER & SENSORY SCIENCE**

**CONFIDENTIAL REPORT**

**SENSORY QUALITY EVALUATION  
OF HIGH PRESSURE PROCESSED MUSSELS**

Report No. S/REP/95900/2

Prepared by : Sue Burling

Checked &  
authorised by :

Name : Lucy Brown

<b>Authorised Signatories:</b>	L. Brown	Sensory Services Manager
	S. Purcell	Sensory Projects Group Manager
	J. Menneer	Sensory Training Group Manager
	E. Allchurch	Data Analyst

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## SUMMARY

The aim of the project was to understand the effect of High Pressure Processing (HPP) on the sensory quality of a variety of fish and shellfish species.

Each species was subjected to a range of pressure/time/temperature combinations and a selection of samples were then evaluated to determine the effect on the sensory quality in terms of appearance, odour, flavour and texture.

This report details the results for Mussels.

## SAMPLE INFORMATION

Date samples received: 15th February 2007

Condition on receipt: Good

Storage conditions: Chiller J

Date samples tested: 15th February 2007

<b>FMT Label</b>	<b>Pressure (MPa)</b>	<b>Time (mins)</b>	<b>Temp (°C)</b>
Control	n/a	n/a	n/a
Untreated (water)	n/a	n/a	n/a
Run 1	250	2.5	8.7
Run 2	280	1.0	13.2
Run 3	220	1.0	9.3
Run 4	250	2.5	9.2
Run 5	220	4.0	14
Run 6	280	4.0	13.6

## Sample Preparation

Each sample was received from the FMT department raw and evaluated uncooked. The sample was then placed in a Pyrex bowl, covered and placed in a steamer, over a litre of boiling water in the base and steamed for 6 minutes.

## MATERIALS AND METHODS

### Sensory Quality Grading (TES-S-021)

For each evaluation 9 mussels were assessed. All samples were presented under three-digit code to a panel of three experienced sensory assessors.

Each assessor independently described the uncooked appearance and odour and awarded an overall quality grade for the raw sample (using the scale shown below). The sample was then steamed and the assessors described the appearance, odour, flavour and texture/mouthfeel and awarded a quality grade for the cooked assessment. The consensus scores were calculated and the individual comments combined.

### Assessment Scale – Sensory Quality

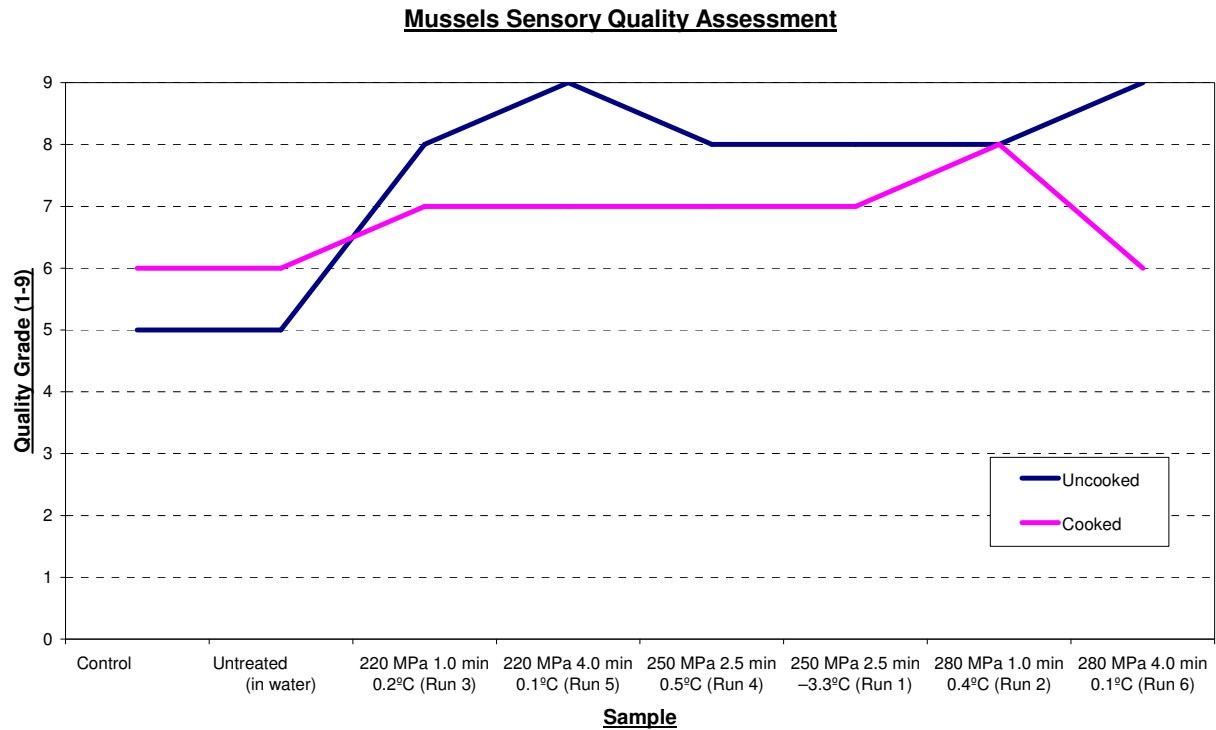
9	Excellent Quality
8	Very Good Quality
7	Good Quality
6	Fairly Good Quality
5	Satisfactory Quality
4	Just Acceptable Quality
3	Poor Quality
2	Very Poor Quality
1	Bad Quality

## RESULTS AND DISCUSSION

A summary of the grades awarded are detailed order in the following table:

Sample Name	Treatment Details	Uncooked Quality Grade	Cooked Quality Grade
Control	Untreated	5	6
Untreated	Placed in water	5	6
Run 1	250 MPa 2.5 min -3.3°C	8	7
Run 2	280 MPa 1.0 min 0.4°C	8	8
Run 3	220 MPa 1.0 min 0.2°C	8	7
Run 4	250 MPa 2.5 min 0.5°C	8	7
Run 5	220 MPa 4.0 min 0.1°C	9	7
Run 6	280 MPa 4.0 min 0.1°C	9	6

The following graph shows both the uncooked and cooked assessment scores for ascending pressure treatments.



For the uncooked assessment all treated samples were consistently graded higher than the Control, with Run 5 and Run 6 graded the highest. All treated samples appeared plump and retained their shape much better than the Control. Run 5 and Run 6 were graded higher as they had a brighter appearance.

For the cooked assessment, again all treated samples were graded higher than the Control with the exception of Run 6 which was graded equally. Appearance was important, along with the texture. The treated samples retained their shape better, they were brighter and were all slightly less chewy than the Control. Run 2 was graded higher as it had a retained its shape better than the other runs.

Overall Run 2 appears to be the treatment with the most consistent effect on increasing sensory quality when compared to the Control sample.

# **APPENDIX**

*Individual Comments and Quality Grades  
for the Raw and Cooked Assessments*

	<b>Raw Assessment Control (no water)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Very bright</li> <li>• Very moist</li> <li>• Range of colours from pale to deep beige/orange</li> <li>• Moderate shape loss</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Moderate/strong fresh odour</li> </ul>
<b>Overall Quality</b>	<b>5 (Satisfactory)</b>

	<b>Cooked Assessment Control (no water)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Very bright</li> <li>• Range of colours from pale to deep beige/orange</li> <li>• Moderately uniform in size</li> <li>• Slight shape loss</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Moderate/strong fresh odour</li> </ul>
<b>Flavour</b>	<ul style="list-style-type: none"> <li>• Moderate mussel flavour</li> <li>• Moderately sweet</li> <li>• Moderately salty</li> <li>• Very slightly bitter</li> </ul>
<b>Texture/Mouthfeel</b>	<ul style="list-style-type: none"> <li>• Moderately firm bite</li> <li>• Moderately moist</li> <li>• Moderately chewy/rubbery</li> <li>• Slightly/moderately fibrous</li> </ul>
<b>Overall Quality</b>	<b>6 (Fairly Good)</b>

	<b>Raw Assessment Untreated (in water)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Very bright</li> <li>• Very moist</li> <li>• Range of colours from pale to deep beige/orange</li> <li>• Moderate shape loss</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Moderate/strong fresh odour</li> </ul>
<b>Overall Quality</b>	<b>5 (Satisfactory)</b>

	<b>Cooked Assessment Untreated (in water)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Very bright</li> <li>• Range of colours from pale to deep beige/orange</li> <li>• Moderately uniform in size</li> <li>• Moderate shape loss</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Moderate/strong fresh odour</li> </ul>
<b>Flavour</b>	<ul style="list-style-type: none"> <li>• Moderate mussel flavour</li> <li>• Moderately sweet</li> <li>• Moderately salty</li> <li>• Very slightly bitter</li> </ul>
<b>Texture/Mouthfeel</b>	<ul style="list-style-type: none"> <li>• Moderately firm bite</li> <li>• Moderately moist</li> <li>• Moderately chewy/rubbery</li> <li>• Slightly/moderately fibrous</li> </ul>
<b>Overall Quality</b>	<b>6 (Fairly Good)</b>

	<b>Raw Assessment</b> <b>250 MPa 2.5 min -8.7°C (Run 1)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Very bright</li> <li>• Very moist</li> <li>• Range of colours from pale to deep beige/orange</li> <li>• Plump with very little shape loss (i.e. excellent shape retention)</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Moderate/strong fresh odour</li> </ul>
<b>Overall Quality</b>	<b>8 (Very Good)</b>

	<b>Cooked Assessment</b> <b>250 MPa 2.5 min -8.7°C (Run 1)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Very bright</li> <li>• Range of colours from pale to deep beige/orange</li> <li>• Moderately/very uniform in size</li> <li>• Plump with little shape loss (i.e. good shape retention)</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Moderate/strong fresh odour</li> </ul>
<b>Flavour</b>	<ul style="list-style-type: none"> <li>• Moderate mussel flavour</li> <li>• Moderately sweet</li> <li>• Moderately salty</li> <li>• Very slightly bitter</li> </ul>
<b>Texture/Mouthfeel</b>	<ul style="list-style-type: none"> <li>• Moderately firm bite</li> <li>• Moderately moist</li> <li>• Slightly chewy/rubbery</li> <li>• Slightly/moderately fibrous</li> </ul>
<b>Overall Quality</b>	<b>7 (Very Good)</b>

	<b>Raw Assessment</b> <b>280 MPa 1.0 min 13.2°C (Run 2)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Very bright</li> <li>• Very moist</li> <li>• Range of colours from pale to deep beige/orange</li> <li>• Plump with very little shape loss (i.e. excellent shape retention)</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Moderate/strong fresh odour</li> </ul>
<b>Overall Quality</b>	<b>8 (Very Good)</b>

	<b>Cooked Assessment</b> <b>280 MPa 1.0 min 13.2°C (Run 2)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Very bright</li> <li>• Range of colours from pale to deep beige/orange</li> <li>• Moderately/very uniform in size</li> <li>• Plump with very little shape loss (i.e. excellent shape retention)</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Moderate/strong fresh odour</li> </ul>
<b>Flavour</b>	<ul style="list-style-type: none"> <li>• Moderate mussel flavour</li> <li>• Moderately sweet</li> <li>• Moderately salty</li> <li>• Very slightly bitter</li> </ul>
<b>Texture/Mouthfeel</b>	<ul style="list-style-type: none"> <li>• Moderately firm bite</li> <li>• Moderately moist</li> <li>• Slightly chewy/rubbery</li> <li>• Slightly/moderately fibrous</li> </ul>
<b>Overall Quality</b>	<b>8 (Very Good)</b>



	<b>Raw Assessment 220 MPa 1.0 min 9.3 °C (Run 3)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Very bright</li> <li>• Very moist</li> <li>• Range of colours from pale to deep beige/orange</li> <li>• Plump with very little shape loss (i.e. excellent shape retention)</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Moderate/strong fresh odour</li> </ul>
<b>Overall Quality</b>	<b>8 (Very Good)</b>

	<b>Cooked Assessment 220 MPa 1.0 min 9.3°C (Run 3)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Very bright</li> <li>• Range of colours from pale to deep beige/orange</li> <li>• Moderately/very uniform in size</li> <li>• Plump with little shape loss (i.e. good shape retention)</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Moderate/strong fresh odour</li> </ul>
<b>Flavour</b>	<ul style="list-style-type: none"> <li>• Moderate mussel flavour</li> <li>• Moderately sweet</li> <li>• Moderately salty</li> <li>• Very slightly bitter</li> </ul>
<b>Texture/Mouthfeel</b>	<ul style="list-style-type: none"> <li>• Moderately firm bite</li> <li>• Moderately moist</li> <li>• Slightly chewy/rubbery</li> <li>• Slightly/moderately fibrous</li> </ul>
<b>Overall Quality</b>	<b>7 (Very Good)</b>

	<b>Raw Assessment</b> <b>250 MPa 2.5 min 9.2°C (Run 4)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Very bright</li> <li>• Very moist</li> <li>• Range of colours from pale to deep beige/orange</li> <li>• Plump with very little shape loss (i.e. excellent shape retention)</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Moderate/strong fresh odour</li> </ul>
<b>Overall Quality</b>	<b>8 (Very Good)</b>

	<b>Cooked Assessment</b> <b>250 MPa 2.5 min 9.2°C (Run 4)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Very bright</li> <li>• Range of colours from pale to deep beige/orange</li> <li>• Moderate/very uniform in size</li> <li>• Plump with little shape loss (i.e. good shape retention)</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Moderate/strong fresh odour</li> </ul>
<b>Flavour</b>	<ul style="list-style-type: none"> <li>• Moderate mussel flavour</li> <li>• Moderately sweet</li> <li>• Moderately salty</li> <li>• Very slightly bitter</li> </ul>
<b>Texture/Mouthfeel</b>	<ul style="list-style-type: none"> <li>• Moderately firm bite</li> <li>• Moderately moist</li> <li>• Slightly chewy/rubbery</li> <li>• Slightly/moderately fibrous</li> </ul>
<b>Overall Quality</b>	<b>7 (Very Good)</b>

	<b>Raw Assessment</b> <b>220 MPa 4.0 min 14 °C (Run 5)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Extremely bright</li> <li>• Very moist</li> <li>• Range of colours from pale to deep beige/orange</li> <li>• Very plump with very little shape loss (i.e. excellent shape retention)</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Moderate/strong fresh odour</li> </ul>
<b>Overall Quality</b>	<b>9 (Excellent)</b>

	<b>Cooked Assessment</b> <b>220 MPa 4.0 min 14°C (Run 5)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Very bright</li> <li>• Range of colours from pale to deep beige/orange</li> <li>• Moderate/very uniform in size</li> <li>• Plump with little shape loss (i.e. good shape retention)</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Moderate/strong fresh odour</li> </ul>
<b>Flavour</b>	<ul style="list-style-type: none"> <li>• Moderate mussel flavour</li> <li>• Moderately sweet</li> <li>• Moderately salty</li> <li>• Very slightly bitter</li> </ul>
<b>Texture/Mouthfeel</b>	<ul style="list-style-type: none"> <li>• Moderately firm bite</li> <li>• Moderate/very moist</li> <li>• Slightly chewy/rubbery</li> <li>• Moderately fibrous</li> </ul>
<b>Overall Quality</b>	<b>7 (Very Good)</b>

	<b>Raw Assessment</b> <b>280 MPa 4.0 min 13.6°C (Run 6)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Extremely bright</li> <li>• Very moist</li> <li>• Range of colours from pale to deep beige/orange</li> <li>• Very plump with very little shape loss (i.e. excellent shape retention)</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Moderate/strong fresh odour</li> </ul>
<b>Overall Quality</b>	<b>9 (Excellent)</b>

	<b>Cooked Assessment</b> <b>280 MPa 4.0 min 13.6°C (Run 6)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Moderately bright</li> <li>• Range of colours from pale to deep beige/orange</li> <li>• Moderately uniform in size</li> <li>• Little shape loss (i.e. good shape retention), some slightly shrivelled</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Moderate/strong fresh odour</li> </ul>
<b>Flavour</b>	<ul style="list-style-type: none"> <li>• Moderate mussel flavour</li> <li>• Moderately sweet</li> <li>• Moderately salty</li> <li>• Very slightly bitter</li> </ul>
<b>Texture/Mouthfeel</b>	<ul style="list-style-type: none"> <li>• Moderately firm bite</li> <li>• Moderately moist</li> <li>• Slightly chewy/rubbery</li> <li>• Moderately fibrous</li> </ul>
<b>Overall Quality</b>	<b>6 (Fairly Good)</b>

## **APPENDIX 3**

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Date: 24 May 2007

**DEPARTMENT OF CONSUMER & SENSORY SCIENCE**

**CONFIDENTIAL REPORT**

**SENSORY QUALITY EVALUATION  
OF HIGH PRESSURE PROCESSED OYSTERS**

Report No. S/REP/95900/3

Prepared by : Sue Burling

Checked &  
authorised by :

Name : Lucy Brown

<b>Authorised Signatories:</b>	L. Brown	Sensory Services Manager
	S. Purcell	Sensory Projects Group Manager
	J. Menneer	Sensory Training Group Manager
	E. Allchurch	Data Analyst

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## SUMMARY

The aim of the project was to understand the effect of High Pressure Processing (HPP) on the sensory quality of a variety of fish and shellfish species.

Each species was subjected to a range of pressure/time/temperature combinations and a selection of samples were then evaluated to determine the effect on the sensory quality in terms of appearance, odour, flavour and texture.

This report details the results for Oysters.

## SAMPLE INFORMATION

Date samples received: 7th March 2007

Condition on receipt: Good

Storage conditions: Chilled

Date samples tested: 7th March 2007

<b>FMT Label</b>	<b>Pressure (MPa)</b>	<b>Time (mins)</b>	<b>Temp (°C)</b>
Control	n/a	n/a	n/a
Untreated (water)	n/a	n/a	n/a
Run 1	250	2.5	12.3
Run 2	280	1.0	12.1
Run 3	220	1.0	11.3
Run 4	250	2.5	12.4
Run 5	220	4.0	12.1
Run 6	280	4.0	13.4

## Sample Preparation

Each sample was received from the FMT department raw and evaluated uncooked. The sample was then placed in a Pyrex bowl, covered and placed in a steamer, over a litre of boiling water in the base and steamed for 6 minutes.

## MATERIALS AND METHODS

### Sensory Quality Grading (TES-S-021)

For each evaluation eight oysters were assessed. All samples were presented under three-digit code to a panel of three experienced sensory assessors.

Each assessor independently described the uncooked appearance and odour and awarded an overall quality grade for the raw sample (using the scale shown below). The sample was then steamed and the assessors described the appearance, odour, flavour and texture/mouthfeel and awarded a quality grade for the cooked assessment. The consensus scores were calculated and the individual comments combined.

### Assessment Scale – Sensory Quality

9	Excellent Quality
8	Very Good Quality
7	Good Quality
6	Fairly Good Quality
5	Satisfactory Quality
4	Just Acceptable Quality
3	Poor Quality
2	Very Poor Quality
1	Bad Quality

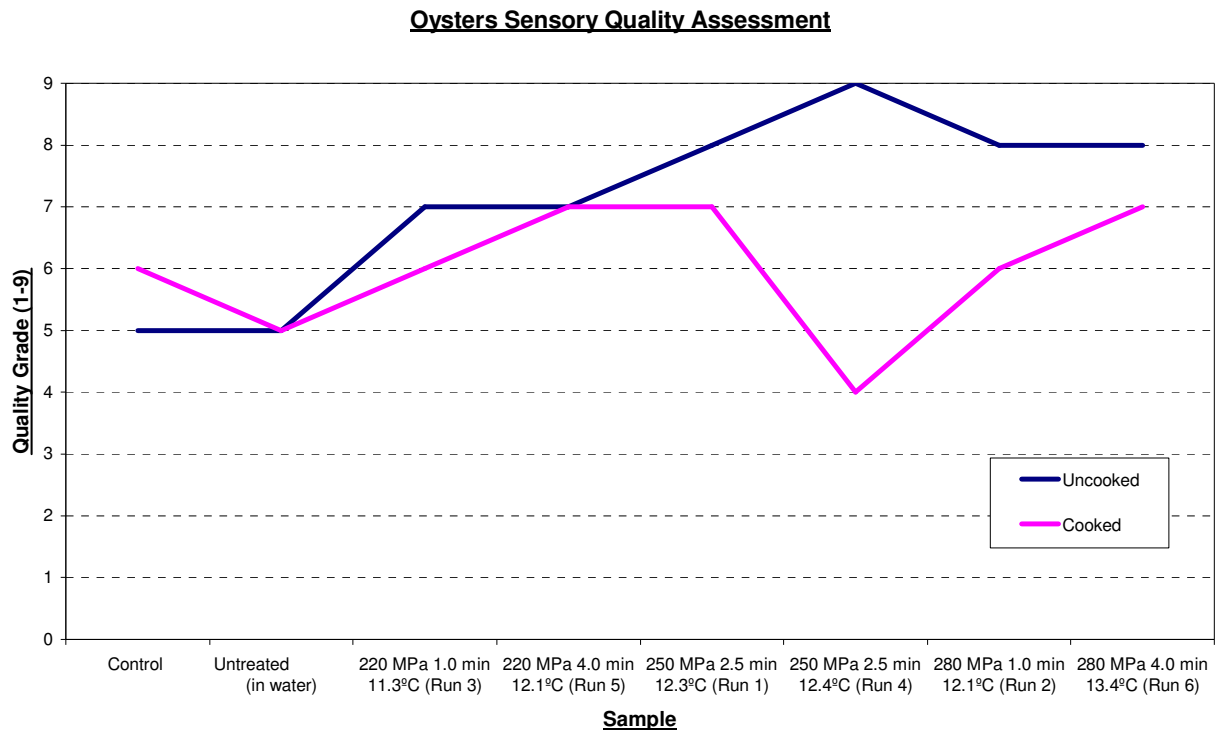
## RESULTS AND DISCUSSION

A summary of the grades awarded are detailed in the following table:

Sample Name	Treatment Details	Uncooked Quality Grade	Cooked Quality Grade
Control	Untreated	5	6
Untreated	Placed in water	5	5
Run 1	250 MPa 2.5 min 12.3°C	8	7
Run 2	280 MPa 1.0 min 12.1°C	8	6
Run 3	220 MPa 1.0 min 11.3°C	7	6
Run 4	250 MPa 2.5 min 12.4°C	9	4
Run 5	220 MPa 4.0 min 12.1°C	7	7
Run 6	280 MPa 4.0 min 13.4°C	8	7



The following graph shows both the uncooked and cooked assessment scores for ascending pressure treatments.



For the uncooked assessment all the treated samples were graded higher than the Control, with Run 4 being graded the highest. All samples were brighter than the Control, very plump with little shape loss and all had a stronger fresh odour.

For the cooked assessment, Run 1, Run 5 and Run 6 were all graded higher than the Control as they were all plump with little shape loss and all had a stronger fresh odour. Run 1 was also described as brighter than the Control and less gritty. Run 4 was graded the lowest for the cooked assessment due to the presence of an off odour.

Overall, Run 1 and Run 6 appear to be the treatments with the most consistent effect on increasing sensory quality when compared to the Control sample. It may be worth considering Run 4 also, as it was only the off odour that resulted in the downgrade of the cooked sample, this may be due to natural variation within the raw material.

# **APPENDIX**

*Individual Comments and Quality Grades  
for the Raw and Cooked Assessments*

	<b>Raw Assessment Control (no water)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Moderately bright</li> <li>• Moderately moist</li> <li>• Range of colours from beige to grey/brown with distinct black frilled edges</li> <li>• Slight shape loss</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Moderate fresh odour</li> </ul>
<b>Overall Quality</b>	<b>5 (Satisfactory)</b>

	<b>Cooked Assessment Control (no water)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Moderately bright</li> <li>• Moderately dark in colour</li> <li>• Slightly shrivelled</li> <li>• Slight shape loss</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Moderate fresh odour</li> </ul>
<b>Flavour</b>	<ul style="list-style-type: none"> <li>• Moderate oyster flavour</li> <li>• Slightly sweet</li> <li>• Moderately salty and savoury</li> <li>• Slightly bitter</li> </ul>
<b>Texture/Mouthfeel</b>	<ul style="list-style-type: none"> <li>• Moderately firm bite</li> <li>• Moderately moist</li> <li>• Slightly fibrous</li> <li>• Slightly gritty</li> </ul>
<b>Overall Quality</b>	<b>6 (Fairly Good)</b>

	<b>Raw Assessment Untreated (in water)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Moderately bright</li> <li>• Moderately moist</li> <li>• Range of colours from beige to grey/brown with distinct black frilled edges</li> <li>• Slight shape loss</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Moderate fresh odour</li> </ul>
<b>Overall Quality</b>	<b>5 (Satisfactory)</b>

	<b>Cooked Assessment Untreated (in water)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Moderately bright</li> <li>• Moderately dark in colour</li> <li>• Slightly shrivelled</li> <li>• Moderate shape loss</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Moderate fresh odour</li> </ul>
<b>Flavour</b>	<ul style="list-style-type: none"> <li>• Moderate oyster flavour</li> <li>• Slightly sweet</li> <li>• Moderately salty and savoury</li> <li>• Slightly bitter</li> </ul>
<b>Texture/Mouthfeel</b>	<ul style="list-style-type: none"> <li>• Moderately firm bite</li> <li>• Moderately moist</li> <li>• Slightly fibrous</li> <li>• Slightly gritty</li> </ul>
<b>Overall Quality</b>	<b>5 (Satisfactory)</b>

	<b>Raw Assessment 250 MPa 2.5 min 12.3°C (Run 1)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Very bright</li> <li>• Very moist</li> <li>• Range of colours from beige to grey/brown with distinct black frilled edges</li> <li>• Very plump with no loss of shape</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Strong fresh odour</li> </ul>
<b>Overall Quality</b>	<b>8 (Very Good)</b>

	<b>Cooked Assessment 250 MPa 2.5 min 12.3°C (Run 1)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Very bright</li> <li>• Moderately dark in colour</li> <li>• Very plump with no loss of shape</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Strong fresh odour</li> </ul>
<b>Flavour</b>	<ul style="list-style-type: none"> <li>• Moderate oyster flavour</li> <li>• Slightly sweet</li> <li>• Moderately salty and savoury</li> <li>• Slightly bitter</li> </ul>
<b>Texture/Mouthfeel</b>	<ul style="list-style-type: none"> <li>• Moderately firm bite</li> <li>• Moderately moist</li> <li>• Slightly fibrous</li> <li>• Slightly gritty</li> </ul>
<b>Overall Quality</b>	<b>7 (Good Quality)</b>

	<b>Raw Assessment 280 MPa 1.0 min 12.1°C (Run 2)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Very bright</li> <li>• Very moist</li> <li>• Range of colours from beige to grey/brown with distinct black frilled edges</li> <li>• Very plump with no loss of shape</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Strong fresh odour</li> </ul>
<b>Overall Quality</b>	<b>8 (Very Good)</b>

	<b>Cooked Assessment 280 MPa 1.0 min 12.1°C (Run 2)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Very bright</li> <li>• Moderately dark in colour</li> <li>• Very plump with no loss of shape</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Strong fresh odour</li> </ul>
<b>Flavour</b>	<ul style="list-style-type: none"> <li>• Moderate oyster flavour</li> <li>• Slightly sweet</li> <li>• Moderately salty and savoury</li> <li>• Slightly bitter</li> </ul>
<b>Texture/Mouthfeel</b>	<ul style="list-style-type: none"> <li>• Moderately firm bite</li> <li>• Moderately moist</li> <li>• Slightly fibrous</li> <li>• Very slightly gritty</li> </ul>
<b>Overall Quality</b>	<b>6 (Fairly Good)</b>

	<b>Raw Assessment</b> <b>220 MPa 1.0 min 11.3°C (Run 3)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Very bright</li> <li>• Very moist</li> <li>• Range of colours from beige to grey/brown with distinct black frilled edges</li> <li>• Very plump with very slight loss of shape</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Strong fresh odour</li> </ul>
<b>Overall Quality</b>	<b>7 (Good)</b>

	<b>Cooked Assessment</b> <b>220 MPa 1.0 min 11.3°C (Run 3)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Very bright</li> <li>• Slightly dark in colour</li> <li>• Very plump with no loss of shape</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Strong fresh odour</li> </ul>
<b>Flavour</b>	<ul style="list-style-type: none"> <li>• Moderate oyster flavour</li> <li>• Slightly sweet</li> <li>• Moderately salty and savoury</li> <li>• Slightly bitter</li> </ul>
<b>Texture/Mouthfeel</b>	<ul style="list-style-type: none"> <li>• Moderately firm bite</li> <li>• Moderately moist</li> <li>• Slightly fibrous</li> <li>• Very slightly gritty</li> </ul>
<b>Overall Quality</b>	<b>6 (Fairly Good)</b>

	<b>Raw Assessment 250 MPa 2.5 min 12.4°C (Run 4)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Very bright</li> <li>• Very moist</li> <li>• Range of colours from beige to grey/brown with distinct black frilled edges</li> <li>• Extremely plump with no loss of shape</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Strong fresh odour</li> </ul>
<b>Overall Quality</b>	<b>9 (Excellent)</b>

	<b>Cooked Assessment 250 MPa 2.5 min 12.4°C (Run 4)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Moderately bright</li> <li>• Moderately dark in colour</li> <li>• Very plump with no loss of shape</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Slight skatole/sewage note</li> </ul>
<b>Flavour</b>	<ul style="list-style-type: none"> <li>• Moderate oyster flavour</li> <li>• Very slightly sweet</li> <li>• Moderately salty and savoury</li> <li>• Slightly bitter</li> </ul>
<b>Texture/Mouthfeel</b>	<ul style="list-style-type: none"> <li>• Moderately firm bite</li> <li>• Moderately moist</li> <li>• Slightly fibrous</li> <li>• Very slightly gritty</li> </ul>
<b>Overall Quality</b>	<b>4 (Just Acceptable)</b>



	<b>Raw Assessment 220 MPa 4.0 min 12.1°C (Run 5)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Very bright</li> <li>• Very moist</li> <li>• Range of colours from pale beige to grey/brown with distinct black frilled edges</li> <li>• Very plump with very slight loss of shape</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Strong fresh odour</li> </ul>
<b>Overall Quality</b>	<b>7 (Good)</b>

	<b>Cooked Assessment 220 MPa 4.0 min 12.1°C (Run 5)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Moderately bright</li> <li>• Moderately dark in colour</li> <li>• Very plump with no loss of shape</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Strong fresh odour</li> </ul>
<b>Flavour</b>	<ul style="list-style-type: none"> <li>• Moderate oyster flavour</li> <li>• Slightly sweet</li> <li>• Moderately salty and savoury</li> <li>• Slightly bitter</li> </ul>
<b>Texture/Mouthfeel</b>	<ul style="list-style-type: none"> <li>• Moderately firm bite</li> <li>• Moderately moist</li> <li>• Slightly fibrous</li> <li>• Slightly gritty</li> </ul>
<b>Overall Quality</b>	<b>7 (Good Quality)</b>

	<b>Raw Assessment 280 MPa 4.0 min 13.4°C (Run 6)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Very bright</li> <li>• Very moist</li> <li>• Range of colours from beige to grey/brown with distinct black frilled edges</li> <li>• Very plump with no loss of shape</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Strong fresh odour</li> </ul>
<b>Overall Quality</b>	<b>8 (Very Good)</b>

	<b>Cooked Assessment 280 MPa 4.0 min 13.4°C (Run 6)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Moderately bright</li> <li>• Moderately dark in colour</li> <li>• Very plump with no loss of shape</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Strong fresh odour</li> </ul>
<b>Flavour</b>	<ul style="list-style-type: none"> <li>• Moderate oyster flavour</li> <li>• Slightly sweet</li> <li>• Moderately salty and savoury</li> <li>• Slightly bitter</li> </ul>
<b>Texture/Mouthfeel</b>	<ul style="list-style-type: none"> <li>• Moderately firm bite</li> <li>• Moderately moist</li> <li>• Slightly fibrous</li> <li>• Slightly gritty</li> </ul>
<b>Overall Quality</b>	<b>7 (Good Quality)</b>

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Date: 15th June 2007

**DEPARTMENT OF CONSUMER & SENSORY SCIENCE**

**CONFIDENTIAL REPORT**

**SENSORY QUALITY EVALUATION  
OF HIGH PRESSURE PROCESSED CRAB**

Report No. S/REP/95900/4

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Checked &  
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## SUMMARY

The aim of the project was to understand the effect of High Pressure Processing (HPP) on the sensory quality of a variety of fish and shellfish species.

Each species was subjected to a range of pressure/time/temperature combinations and a selection of samples were then evaluated to determine the effect on the sensory quality in terms of appearance, odour, flavour and texture.

This report details the results for Crab.

## SAMPLE INFORMATION

Date samples received: 27th March 2007

Condition on receipt: Good

Storage conditions: Chilled

Date samples tested: 27th March 2007

<b>FMT Label</b>	<b>Pressure (MPa)</b>	<b>Time (mins)</b>	<b>Temp (°C)</b>
Control	n/a	n/a	n/a
Run 1	250	2.5	12.1
Run 2	280	1.0	13.3
Run 3	220	1.0	12.8
Run 4	250	2.5	13
Run 5	220	4.0	12.3
Run 6	280	4.0	12.3

## Sample Preparation

Each sample was received from the FMT department raw and evaluated uncooked, except for the control sample that was received cooked by the FMT department. The sample was then placed in a Pyrex bowl, covered and placed in a steamer, over a litre of boiling water in the base and steamed for 6 minutes.

## MATERIALS AND METHODS

### Sensory Quality Grading (TES-S-021)

For each evaluation four claws were assessed. All samples were presented under three-digit code to a panel of three experienced sensory assessors.

Each assessor independently described the uncooked appearance and odour and awarded an overall quality grade for the raw sample (using the scale shown below). The sample was then steamed and the assessors described the appearance, odour, flavour and texture/mouthfeel and awarded a quality grade for the cooked assessment. The consensus scores were calculated and the individual comments combined.

### Assessment Scale – Sensory Quality

9	Excellent Quality
8	Very Good Quality
7	Good Quality
6	Fairly Good Quality
5	Satisfactory Quality
4	Just Acceptable Quality
3	Poor Quality
2	Very Poor Quality
1	Bad Quality

## RESULTS AND DISCUSSION

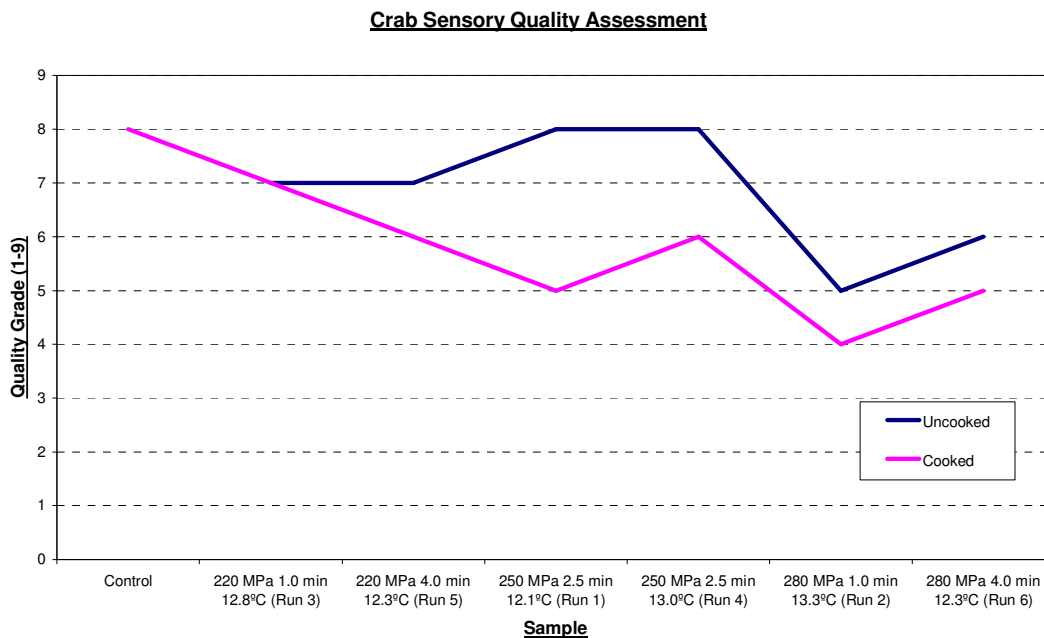
The weights were recorded before and after cooking, and the % weight loss calculated, for runs 3 - 6.

Sample Name	Treatment Details	Weight Raw	Weight Cooked	Weight Loss	% Weight Loss
Run 3	220 MPa 1.0 min 12.8°C	65.7g	61.6g	4.1g	6.24%
Run 4	250 MPa 2.5 min 13.0°C	66.0g	61.8g	4.2g	6.36%
Run 5	220 MPa 4.0 min 12.3°C	77.7g	72.5g	5.2g	6.69%
Run 6	280 MPa 4.0 min 12.3°C	62.4g	58.6g	3.8g	6.09%

A summary of the grades awarded are detailed in the following table:

Sample Name	Treatment Details	Uncooked Quality Grade	Cooked Quality Grade
Control	Untreated	Not Assessed	8
Run 1	250 MPa 2.5 min 12.1°C	8	5
Run 2	280 MPa 1.0 min 13.3°C	5	4
Run 3	220 MPa 1.0 min 12.8°C	7	7
Run 4	250 MPa 2.5 min 13.0°C	8	6
Run 5	220 MPa 4.0 min 12.3°C	7	6
Run 6	280 MPa 4.0 min 12.3°C	6	5

The following graph shows both the uncooked and cooked assessment scores for ascending pressure treatments.



For the uncooked assessment there was no Control sample for comparison. Run 1 and Run 4 were graded the highest, with less shape loss than the other samples. Run 2 was graded the lowest, with the most noticeable shape loss.

For the cooked assessment, none of the runs was graded as high as the Control. Run 3 had the highest grade, with a very fresh odour, and strong crab notes, with only slight loss of shape. Run 2 was graded the lowest, with marked loss of shape, and very slight bitter notes.

## **APPENDIX**

### *Individual Comments and Quality Grades for the Raw and Cooked Assessments*



	<b>Raw Assessment Control</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Not Assessed</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Not Assessed</li> </ul>

	<b>Cooked Assessment Control</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Moderately bright</li> <li>• Pink/cream in colour</li> <li>• Very slight shape loss</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Very fresh odour</li> </ul>
<b>Flavour</b>	<ul style="list-style-type: none"> <li>• Strong crab flavour</li> <li>• Slightly sweet</li> <li>• Moderately salty</li> <li>• Very slightly bitter</li> </ul>
<b>Texture/Mouthfeel</b>	<ul style="list-style-type: none"> <li>• Moderately firm bite</li> <li>• Moderately moist</li> <li>• Slightly fibrous</li> </ul>
<b>Overall Quality</b>	<b>8 (Very Good)</b>

	<b>Raw Assessment 250 MPa 2.5 min 12.1°C (Run 1)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Moderately bright</li> <li>• Moderately moist</li> <li>• Range of colours from grey/brown to pink/cream</li> <li>• Very slight shape loss</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Very fresh odour</li> </ul>
	<b>8 (Very Good)</b>

	<b>Cooked Assessment 250 MPa 2.5 min 12.1°C (Run 1)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Moderately bright</li> <li>• Pink/cream in colour</li> <li>• Slight shape loss</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Moderate fresh odour</li> </ul>
<b>Flavour</b>	<ul style="list-style-type: none"> <li>• Moderate crab flavour</li> <li>• Slightly sweet</li> <li>• Moderately salty</li> <li>• Very slightly bitter</li> </ul>
<b>Texture/Mouthfeel</b>	<ul style="list-style-type: none"> <li>• Slightly firm bite</li> <li>• Moderately moist</li> <li>• Slightly fibrous</li> <li>• Very slightly gritty</li> </ul>
<b>Overall Quality</b>	<b>5 (Satisfactory)</b>

	<b>Raw Assessment 280 MPa 1.0 min 13.3°C (Run 2)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Moderately bright</li> <li>• Moderately moist</li> <li>• Range of colours from grey/brown to pink/cream</li> <li>• High amount of shape loss</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Very fresh odour</li> </ul>
<b>Overall Quality</b>	<b>5 (Satisfactory)</b>

	<b>Cooked Assessment 280 MPa 1.0 min 13.3°C (Run 2)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Moderately bright</li> <li>• Pink/cream in colour</li> <li>• High amount of shape loss</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Moderate fresh odour</li> </ul>
<b>Flavour</b>	<ul style="list-style-type: none"> <li>• Moderate crab flavour</li> <li>• Slightly sweet</li> <li>• Moderately salty</li> <li>• Very slightly bitter</li> </ul>
<b>Texture/Mouthfeel</b>	<ul style="list-style-type: none"> <li>• Very slightly firm bite</li> <li>• Moderately moist</li> <li>• Slightly fibrous</li> <li>• Moderately gritty</li> </ul>
<b>Overall Quality</b>	<b>4 (Just Acceptable)</b>

	<b>Raw Assessment</b> <b>220 MPa 1.0 min 12.8°C (Run 3)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Moderately bright</li> <li>• Moderately moist</li> <li>• Range of colours from grey/brown to pink/cream</li> <li>• Slight shape loss</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Very fresh odour</li> </ul>
<b>Overall Quality</b>	<b>7 (Good)</b>

	<b>Cooked Assessment</b> <b>220 MPa 1.0 min 12.8°C (Run 3)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Moderately bright</li> <li>• Pink/cream in colour</li> <li>• Slight shape loss</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Very fresh odour</li> </ul>
<b>Flavour</b>	<ul style="list-style-type: none"> <li>• Strong crab flavour</li> <li>• Slightly sweet</li> <li>• Moderately salty</li> <li>• Very slightly bitter</li> </ul>
<b>Texture/Mouthfeel</b>	<ul style="list-style-type: none"> <li>• Moderately firm bite</li> <li>• Moderately moist</li> <li>• Slightly fibrous</li> </ul>
<b>Overall Quality</b>	<b>7 (Good)</b>

	<b>Raw Assessment 250 MPa 2.5 min 13°C (Run 4)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Moderately bright</li> <li>• Moderately moist</li> <li>• Range of colours from grey/brown to pink/cream</li> <li>• Very slight shape loss</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Very fresh odour</li> </ul>
<b>Overall Quality</b>	<b>8 (Very Good)</b>

	<b>Cooked Assessment 250 MPa 2.5 min 13°C (Run 4)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Moderately bright</li> <li>• Pink/cream in colour</li> <li>• Very slight shape loss</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Moderate fresh odour</li> </ul>
<b>Flavour</b>	<ul style="list-style-type: none"> <li>• Strong crab flavour</li> <li>• Slightly sweet</li> <li>• Moderately salty</li> <li>• Very slightly bitter</li> <li>• Very slight eggy note</li> </ul>
<b>Texture/Mouthfeel</b>	<ul style="list-style-type: none"> <li>• Moderately firm bite</li> <li>• Moderately moist</li> <li>• Slightly fibrous</li> </ul>
<b>Overall Quality</b>	<b>6 (Fairly Good)</b>

	<b>Raw Assessment 220 MPa 4.0 min 12.3°C (Run 5)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Moderately bright</li> <li>• Moderately moist</li> <li>• Range of colours from grey/brown to pink/cream</li> <li>• Slight shape loss</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Very fresh odour</li> </ul>
<b>Overall Quality</b>	<b>7 (Good)</b>

	<b>Cooked Assessment 220 MPa 4.0 min 12.3°C (Run 5)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Moderately bright</li> <li>• Pink/cream in colour</li> <li>• Slight shape loss</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Very fresh odour</li> </ul>
<b>Flavour</b>	<ul style="list-style-type: none"> <li>• Strong crab flavour</li> <li>• Slightly sweet</li> <li>• Moderately salty</li> <li>• Very slightly bitter</li> <li>• Very slight eggy note</li> </ul>
<b>Texture/Mouthfeel</b>	<ul style="list-style-type: none"> <li>• Moderately firm bite</li> <li>• Moderately moist</li> <li>• Slightly fibrous</li> </ul>
<b>Overall Quality</b>	<b>6 (Fairly Good)</b>

	<b>Raw Assessment</b> <b>280 MPa 4.0 min 12.3°C (Run 6)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Slightly bright</li> <li>• Moderately moist</li> <li>• Range of colours from grey/brown to pink/cream</li> <li>• Slight amount of shape loss</li> <li>• Slightly sticky</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Very fresh odour</li> </ul>
<b>Overall Quality</b>	<b>6 (Fairly Good)</b>

	<b>Cooked Assessment</b> <b>280 MPa 4.0 min 12.3°C (Run 6)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Moderately bright</li> <li>• Pink/cream in colour</li> <li>• High amount of shape loss</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Very fresh odour</li> </ul>
<b>Flavour</b>	<ul style="list-style-type: none"> <li>• Strong crab flavour</li> <li>• Slightly sweet</li> <li>• Moderately salty</li> <li>• Very slightly bitter</li> <li>• Very slight eggy note</li> </ul>
<b>Texture/Mouthfeel</b>	<ul style="list-style-type: none"> <li>• Slightly firm bite</li> <li>• Moderately moist</li> <li>• Slightly fibrous</li> <li>• Slightly gritty</li> </ul>
<b>Overall Quality</b>	<b>5 (Satisfactory)</b>

## **APPENDIX 5**



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Date: 15th June 2007

**DEPARTMENT OF CONSUMER & SENSORY SCIENCE**

**CONFIDENTIAL REPORT**

**SENSORY QUALITY EVALUATION  
OF HIGH PRESSURE PROCESSED COLD WATER PRAWNS**

Report No. S/REP/95900/5

Prepared by : Sue Burling

Checked &  
authorised by :

Name : Lucy Brown

<b>Authorised Signatories:</b>	L. Brown	Sensory Services Manager
	S. Purcell	Sensory Projects Group Manager
	J. Menneer	Sensory Training Group Manager
	E. Allechurch	Data Analyst

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## SUMMARY

The aim of the project was to understand the effect of High Pressure Processing (HPP) on the sensory quality of a variety of fish and shellfish species.

Each species was subjected to a range of pressure/time/temperature combinations and a selection of samples were then evaluated to determine the effect on the sensory quality in terms of appearance, odour, flavour and texture.

This report details the results for Cold Water Prawns.

## SAMPLE INFORMATION

Date samples received: 19th April 2007

Condition on receipt: Good

Storage conditions: Chilled

Date samples tested: 19th April 2007

<b>FMT Label</b>	<b>Pressure (MPa)</b>	<b>Time (mins)</b>	<b>Temp (°C)</b>
Control (untreated in water)	n/a	n/a	n/a
Run 1	250	2.5	9.8
Run 2	280	1.0	12.7
Run 3	220	1.0	5.2
Run 4	250	2.5	10
Run 5	220	4.0	11
Run 6	280	4.0	8.7

## Sample Preparation

Each sample was received from the FMT department raw and evaluated uncooked. The sample was then directly placed in a steamer, over half a litre of boiling water in the base and steamed for 1.5 minutes.

## MATERIALS AND METHODS

### Sensory Quality Grading (TES-S-021)

For each evaluation approximately 60g of prawns were assessed. All samples were presented under three-digit code to a panel of three experienced sensory assessors.

Each assessor independently described the uncooked appearance and odour and awarded an overall quality grade for the raw sample (using the scale shown below). The sample was then steamed and the assessors described the appearance, odour, flavour and texture/mouthfeel and awarded a quality grade for the cooked assessment. The consensus scores were calculated and the individual comments combined.

### Assessment Scale – Sensory Quality

9	Excellent Quality
8	Very Good Quality
7	Good Quality
6	Fairly Good Quality
5	Satisfactory Quality
4	Just Acceptable Quality
3	Poor Quality
2	Very Poor Quality
1	Bad Quality

## RESULTS AND DISCUSSION

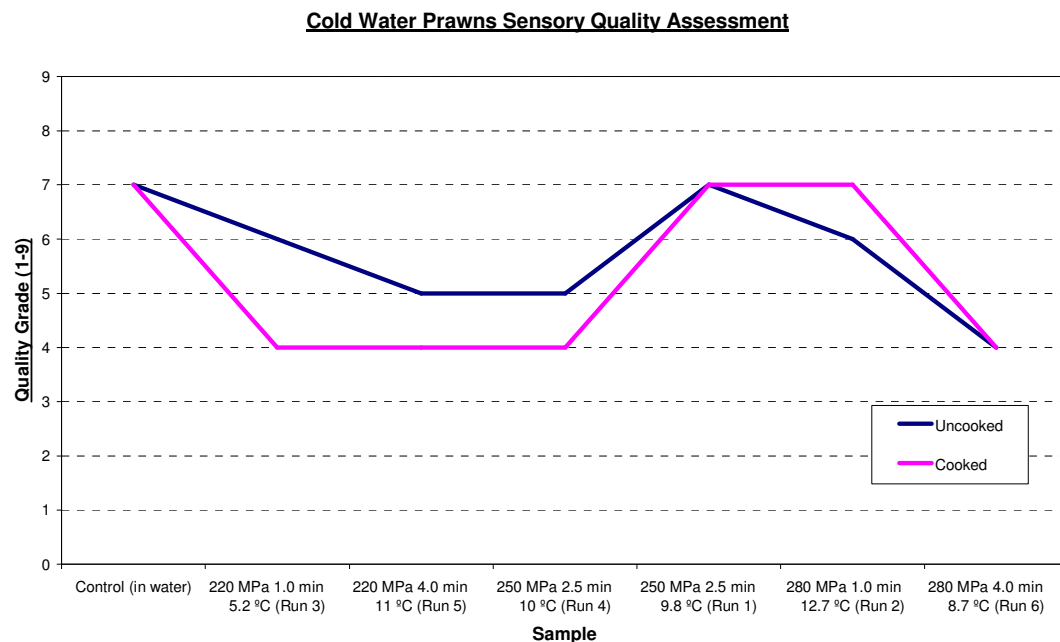
The weights were recorded before and after cooking, and the % weight loss calculated.

Sample Name	Treatment Details	Weight Raw (g)	Weight Cooked (g)	Weight Loss (g)	% Weight Loss
Control	Placed in water	68.9	47.3	21.6	31.3
Run 1	250 MPa 2.5 min 9.8 °C	68.5	48.2	20.3	29.6
Run 2	280 MPa 1.0 min 12.7 °C	69.2	49.3	19.9	28.8
Run 3	220 MPa 1.0 min 5.2 °C	63.5	47.7	15.8	24.9
Run 4	250 MPa 2.5 min 10 °C	62.5	39.9	22.6	36.2
Run 5	220 MPa 4.0 min 11 °C	65.3	40.5	24.8	38.0
Run 6	280 MPa 4.0 min 8.7 °C	61.8	41.6	20.2	32.7

A summary of the grades awarded are detailed in the following table:

Sample Name	Treatment Details	Uncooked Quality Grade	Cooked Quality Grade
Control	Untreated placed in water	7	7
Run 1	250 MPa 2.5 min 9.8 °C	7	7
Run 2	280 MPa 1.0 min 12.7 °C	6	7
Run 3	220 MPa 1.0 min 5.2 °C	6	4
Run 4	250 MPa 2.5 min 10 °C	5	4
Run 5	220 MPa 4.0 min 11 °C	5	4
Run 6	280 MPa 4.0 min 8.7 °C	4	4

The following graph shows both the uncooked and cooked assessment scores for ascending pressure treatments.



For the uncooked assessment none of the runs was graded higher than the Control. Run 1 was graded equal to the Control sample, and all other Runs were graded lower than the Control, with Run 6 achieving the lowest grade. This was due to less retention of the tip end, and more shape loss.

For the cooked assessment the Control, Run 1 and Run 2 were graded the highest. The other runs were all graded as 'Just Acceptable' due to some eggy notes in the odour, and less prawn flavour.

## **APPENDIX**

### *Individual Comments and Quality Grades for the Raw and Cooked Assessments*

	<b>Raw Assessment Control (in water)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Very bright</li> <li>• Moderately moist</li> <li>• Moderately pink in colour</li> <li>• Slightly translucent</li> <li>• High retention of tip end</li> <li>• Moderate amount of retained membrane</li> <li>• Slight shape loss</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Very fresh odour</li> </ul>
<b>Overall Quality</b>	<b>7 (Good)</b>

	<b>Cooked Assessment Control (in water)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Moderately bright</li> <li>• Moderately pink in colour</li> <li>• Slight shape loss</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Very fresh odour</li> </ul>
<b>Flavour</b>	<ul style="list-style-type: none"> <li>• Strong prawn flavour</li> <li>• Moderately sweet</li> <li>• Slightly salty</li> </ul>
<b>Texture/Mouthfeel</b>	<ul style="list-style-type: none"> <li>• Moderately firm bite</li> <li>• Moderately moist</li> <li>• Slightly fibrous</li> </ul>
<b>Overall Quality</b>	<b>7 (Good)</b>

	<b>Raw Assessment</b> <b>250 MPa 2.5 min 9.8 °C (Run 1)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Very bright</li> <li>• Moderately moist</li> <li>• Moderately pink in colour</li> <li>• Slightly translucent</li> <li>• High retention of tip end</li> <li>• High amount of retained membrane</li> <li>• Slight shape loss</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Very fresh odour</li> </ul>
<b>Overall Quality</b>	<b>7 (Good)</b>

	<b>Cooked Assessment</b> <b>250 MPa 2.5 min 9.8 °C (Run 1)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Moderately bright</li> <li>• Moderately pink in colour</li> <li>• Moderate shape loss</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Very fresh odour</li> </ul>
<b>Flavour</b>	<ul style="list-style-type: none"> <li>• Strong prawn flavour</li> <li>• Moderately sweet</li> <li>• Slightly salty</li> </ul>
<b>Texture/Mouthfeel</b>	<ul style="list-style-type: none"> <li>• Moderately firm bite</li> <li>• Moderately moist</li> <li>• Slightly fibrous</li> </ul>
<b>Overall Quality</b>	<b>7 (Good)</b>

	<b>Raw Assessment</b> <b>280 MPa 1.0 min 12.7 °C (Run 2)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Moderately bright</li> <li>• Moderately moist</li> <li>• Moderately pink in colour</li> <li>• Slightly translucent</li> <li>• Moderate retention of tip end</li> <li>• Moderate amount of retained membrane</li> <li>• Moderate shape loss</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Very fresh odour</li> </ul>
<b>Overall Quality</b>	<b>6 (Fairly Good)</b>

	<b>Cooked Assessment</b> <b>280 MPa 1.0 min 12.7 °C (Run 2)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Moderately bright</li> <li>• Moderately pink in colour</li> <li>• Moderate shape loss</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Very fresh odour</li> </ul>
<b>Flavour</b>	<ul style="list-style-type: none"> <li>• Strong prawn flavour</li> <li>• Moderately sweet</li> <li>• Slightly salty</li> </ul>
<b>Texture/Mouthfeel</b>	<ul style="list-style-type: none"> <li>• Moderately firm bite</li> <li>• Moderately moist</li> <li>• Slightly fibrous</li> </ul>
<b>Overall Quality</b>	<b>7 (Good)</b>



	<b>Raw Assessment</b> <b>220 MPa 1.0 min 5.2 °C (Run 3)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Very bright</li> <li>• Moderately moist</li> <li>• Moderately pink in colour</li> <li>• Slightly translucent</li> <li>• Moderate retention of tip end</li> <li>• Moderate amount of retained membrane</li> <li>• Slight shape loss</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Very fresh odour</li> </ul>
<b>Overall Quality</b>	<b>6 (Fairly Good)</b>

	<b>Cooked Assessment</b> <b>220 MPa 1.0 min 5.2 °C (Run 3)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Slightly bright</li> <li>• Moderately pink in colour</li> <li>• Moderate shape loss</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Moderate fresh odour</li> <li>• Slightly gassy/eggy note</li> </ul>
<b>Flavour</b>	<ul style="list-style-type: none"> <li>• Moderate prawn flavour</li> <li>• Slightly sweet</li> <li>• Slightly salty</li> <li>• Slight eggy note</li> </ul>
<b>Texture/Mouthfeel</b>	<ul style="list-style-type: none"> <li>• Moderately firm bite</li> <li>• Slightly moist</li> <li>• Slightly fibrous</li> </ul>
<b>Overall Quality</b>	<b>4 (Just Acceptable)</b>

	<b>Raw Assessment</b> <b>250 MPa 2.5 min 10 °C (Run 4)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Moderately bright</li> <li>• Moderately moist</li> <li>• Moderately pink in colour</li> <li>• Slightly translucent</li> <li>• Slight retention of tip end</li> <li>• Moderate amount of retained membrane</li> <li>• Moderate shape loss</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Moderate fresh odour</li> </ul>
<b>Overall Quality</b>	<b>5 (Satisfactory)</b>

	<b>Cooked Assessment</b> <b>250 MPa 2.5 min 10 °C (Run 4)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Moderately bright</li> <li>• Moderately pink in colour</li> <li>• Moderate shape loss</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Moderate fresh odour</li> </ul>
<b>Flavour</b>	<ul style="list-style-type: none"> <li>• Moderate prawn flavour</li> <li>• Slightly sweet</li> <li>• Slightly salty</li> <li>• Slight eggy, seawater, bitter notes</li> </ul>
<b>Texture/Mouthfeel</b>	<ul style="list-style-type: none"> <li>• Moderately firm bite</li> <li>• Moderately moist</li> <li>• Moderately fibrous</li> </ul>
<b>Overall Quality</b>	<b>4 (Just Acceptable)</b>

	<b>Raw Assessment</b> <b>220 MPa 4.0 min 11 °C (Run 5)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Moderately bright</li> <li>• Moderately moist</li> <li>• Moderately pink in colour</li> <li>• Slightly translucent</li> <li>• Slight retention of tip end</li> <li>• Moderate amount of retained membrane</li> <li>• Moderate shape loss</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Moderate fresh odour</li> </ul>
<b>Overall Quality</b>	<b>5 (Satisfactory)</b>

	<b>Cooked Assessment</b> <b>220 MPa 4.0 min 11 °C (Run 5)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Slightly bright</li> <li>• Moderately pink in colour</li> <li>• High shape loss</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Moderate fresh odour</li> <li>• Slight eggy note</li> </ul>
<b>Flavour</b>	<ul style="list-style-type: none"> <li>• Moderate prawn flavour</li> <li>• Slightly sweet</li> <li>• Slightly salty</li> <li>• Slight eggy note</li> </ul>
<b>Texture/Mouthfeel</b>	<ul style="list-style-type: none"> <li>• Moderately firm bite</li> <li>• Slightly moist</li> <li>• Slightly fibrous</li> </ul>
<b>Overall Quality</b>	<b>4 (Just Acceptable)</b>

	<b>Raw Assessment</b> <b>280 MPa 4.0 min 8.7 °C (Run 6)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Moderately bright</li> <li>• Moderately moist</li> <li>• Moderately pink in colour</li> <li>• Slightly translucent</li> <li>• Very slight retention of tip end</li> <li>• Slight amount of retained membrane</li> <li>• Moderate shape loss</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Moderate fresh odour</li> </ul>
<b>Overall Quality</b>	<b>4 (Just Acceptable)</b>

	<b>Cooked Assessment</b> <b>280 MPa 4.0 min 8.7 °C (Run 6)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Slightly bright</li> <li>• Moderately pink in colour</li> <li>• Moderate shape loss</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Moderate fresh odour</li> </ul>
<b>Flavour</b>	<ul style="list-style-type: none"> <li>• Moderate prawn flavour</li> <li>• Slightly sweet</li> <li>• Slightly salty</li> <li>• Slight eggy note</li> </ul>
<b>Texture/Mouthfeel</b>	<ul style="list-style-type: none"> <li>• Moderately firm bite</li> <li>• Slightly moist</li> <li>• Slightly fibrous</li> </ul>
<b>Overall Quality</b>	<b>4 (Just Acceptable)</b>

## **APPENDIX 6**

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Date: 15th June 2007

**DEPARTMENT OF CONSUMER & SENSORY SCIENCE**

**CONFIDENTIAL REPORT**

**SENSORY QUALITY EVALUATION  
OF HIGH PRESSURE PROCESSED LOBSTER**

Report No. S/REP/95900/6

Prepared by : Sue Burling

Checked &  
authorised by :

Name : Lucy Brown

<b>Authorised Signatories:</b>	L. Brown	Sensory Services Manager
	S. Purcell	Sensory Projects Group Manager
	E. Allchurch	Data Analyst

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## SUMMARY

The aim of the project was to understand the effect of High Pressure Processing (HPP) on the sensory quality of a variety of fish and shellfish species.

Each species was subjected to a range of pressure/time/temperature combinations and a selection of samples were then evaluated to determine the effect on the sensory quality in terms of appearance, odour, flavour and texture.

This report details the results for Lobster.

## SAMPLE INFORMATION

Date samples received: 1st May 2007

Condition on receipt: Good

Storage conditions: Chilled

Date samples tested: 1st May 2007

<b>FMT Label</b>	<b>Pressure (MPa)</b>	<b>Time (mins)</b>	<b>Temp (°C)</b>
Control	n/a	n/a	n/a
Run 1	250	2.5	18.1
Run 2	280	1.0	16.5
Run 3	220	1.0	6.1
Run 4	250	2.5	16.7
Run 5	220	4.0	17
Run 6	280	4.0	16

## Sample Preparation

Each sample was received from the FMT department raw and evaluated uncooked except for the control sample, which was received cooked by FMT. The sample was placed in a polythene bag, sealed and placed in a steamer, over a litre of boiling water in the base and steamed for 15 minutes.

## MATERIALS AND METHODS

### Sensory Quality Grading (TES-S-021)

For each evaluation one tail was assessed. All samples were presented under three-digit code to a panel of three experienced sensory assessors.

Each assessor independently described the uncooked appearance and odour and awarded an overall quality grade for the raw sample (using the scale shown below). The sample was then steamed and the assessors described the appearance, odour, flavour and texture/mouthfeel and awarded a quality grade for the cooked assessment. The consensus scores were calculated and the individual comments combined.

### Assessment Scale – Sensory Quality

9	Excellent Quality
8	Very Good Quality
7	Good Quality
6	Fairly Good Quality
5	Satisfactory Quality
4	Just Acceptable Quality
3	Poor Quality
2	Very Poor Quality
1	Bad Quality

## RESULTS AND DISCUSSION

The weights were recorded before and after cooking and the % weight loss calculated.

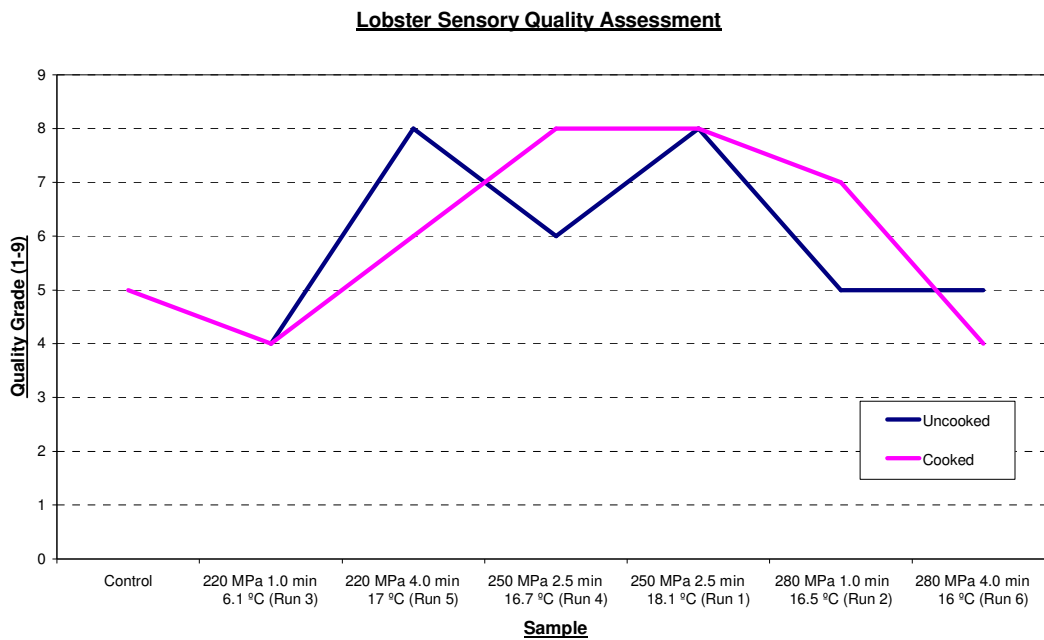
Sample Name	Treatment Details	Weight Raw (g)	Weight Cooked (g)	Weight Loss (g)	% Weight Loss
Control	N/A	N/A	N/A	N/A	N/A
Run 1	250 MPa 2.5 min 18.1 °C	126.5	111.1	15.4	12.2
Run 2	280 MPa 1.0 min 16.5 °C	119.9	101.5	18.4	15.3
Run 3	220 MPa 1.0 min 6.1 °C	110.9	93	17.9	16.1
Run 4	250 MPa 2.5 min 16.7 °C	117.3	99.2	18.1	15.4
Run 5	220 MPa 4.0 min 17 °C	100.2	85.1	15.1	15.1
Run 6	280 MPa 4.0 min 16 °C	123.7	109.8	13.9	11.2



A summary of the grades awarded are detailed in the following table:

Sample Name	Treatment Details	Uncooked Quality Grade	Cooked Quality Grade
Control	Untreated	Not Assessed	5
Run 1	250 MPa 2.5 min 18.1 °C	8	8
Run 2	280 MPa 1.0 min 16.5 °C	5	7
Run 3	220 MPa 1.0 min 6.1 °C	4	4
Run 4	250 MPa 2.5 min 16.7 °C	6	8
Run 5	220 MPa 4.0 min 17 °C	8	6
Run 6	280 MPa 4.0 min 16 °C	5	4

The following graph shows both the uncooked and cooked assessment scores for ascending pressure treatments.



For the uncooked assessment there was no Control sample for comparison. Run 1 and Run 5 were graded the highest, with bright clean, white flesh and no loss of shape. Run 2, Run 3 and Run 6 were graded the lowest, with some grey tints in the flesh, and some loss of shape, which was most noticeable in Run 3, which showed complete breakdown.

For the cooked assessment, four runs were graded higher than the Control, which was found to be very fibrous, chewy and rubbery in texture. Runs 1 and Run 4 were graded the highest, with bright, clean flesh, slightly sweet fresh lobster flavour, and some fibrousness. Run 2 and Run 5 were also graded higher than the Control, with moderately bright flesh, with only slight yellow or grey tints. Run 3 and

Run 6 were graded the lowest, both with some sewage/skatole notes in the odour, and complete shape loss in Run 3.

## **APPENDIX**

### *Individual Comments and Quality Grades for the Raw and Cooked Assessments*

	<b>Raw Assessment Control</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Not Assessed</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Not Assessed</li> </ul>

	<b>Cooked Assessment Control</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Moderately bright</li> <li>• Flesh grey/brown tints</li> <li>• Slight shape loss</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Very fresh odour</li> </ul>
<b>Flavour</b>	<ul style="list-style-type: none"> <li>• Strong lobster flavour</li> <li>• Slightly sweet</li> <li>• Slightly salty</li> </ul>
<b>Texture/Mouthfeel</b>	<ul style="list-style-type: none"> <li>• Moderately firm bite</li> <li>• Slightly moist</li> <li>• Very fibrous, chewy and rubbery</li> </ul>
<b>Overall Quality</b>	<b>5 (Satisfactory)</b>

	<b>Raw Assessment</b> <b>250 MPa 2.5 min 18.1 °C (Run 1)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Very bright</li> <li>• Moderately moist</li> <li>• Flesh clean and white</li> <li>• No loss of shape</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Very fresh odour</li> </ul>
<b>Overall Quality</b>	<b>8 (Very Good)</b>

	<b>Cooked Assessment</b> <b>250 MPa 2.5 min 18.1°C (Run 1)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Very bright</li> <li>• Flesh white and clean</li> <li>• Very slight shape loss</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Moderately fresh odour</li> </ul>
<b>Flavour</b>	<ul style="list-style-type: none"> <li>• Strong lobster flavour</li> <li>• Slightly sweet</li> <li>• Slightly salty</li> </ul>
<b>Texture/Mouthfeel</b>	<ul style="list-style-type: none"> <li>• Moderately firm bite</li> <li>• Moderately moist</li> <li>• Slightly fibrous</li> </ul>
<b>Overall Quality</b>	<b>8 (Very Good)</b>

	<b>Raw Assessment</b> <b>280 MPa 1.0 min 16.5 °C (Run 2)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Moderately bright</li> <li>• Slightly moist</li> <li>• Flesh grey with yellow tints</li> <li>• Slight shape loss</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Moderately fresh odour</li> </ul>
<b>Overall Quality</b>	<b>5 (Satisfactory)</b>

	<b>Cooked Assessment</b> <b>280 MPa 1.0 min 16.5 °C (Run 2)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Moderately bright</li> <li>• Flesh white with yellow tints</li> <li>• Very slight shape loss</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Moderately fresh odour</li> </ul>
<b>Flavour</b>	<ul style="list-style-type: none"> <li>• Moderate lobster flavour</li> <li>• Slightly sweet</li> <li>• Slightly salty</li> </ul>
<b>Texture/Mouthfeel</b>	<ul style="list-style-type: none"> <li>• Moderately firm bite</li> <li>• Moderately moist</li> <li>• Moderately fibrous</li> </ul>
<b>Overall Quality</b>	<b>7 (Good)</b>

	<b>Raw Assessment 220 MPa 1.0 min 6.1 °C (Run 3)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Moderately bright</li> <li>• Moderately moist</li> <li>• Flesh grey with yellow tints</li> <li>• Complete shape loss (broken down)</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Very fresh odour</li> </ul>
<b>Overall Quality</b>	<b>4 (Just Acceptable)</b>

	<b>Cooked Assessment 220 MPa 1.0 min 6.1 °C (Run 3)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Moderately bright</li> <li>• Flesh grey/green tints</li> <li>• Complete shape loss (broken down)</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Slightly fresh odour</li> <li>• Slight sewage/skatole note</li> </ul>
<b>Flavour</b>	<ul style="list-style-type: none"> <li>• Moderate lobster flavour</li> <li>• Slightly sweet</li> <li>• Slightly salty</li> </ul>
<b>Texture/Mouthfeel</b>	<ul style="list-style-type: none"> <li>• Moderately firm bite</li> <li>• Moderately moist</li> <li>• Moderately fibrous</li> </ul>
<b>Overall Quality</b>	<b>4 (Just Acceptable)</b>

	<b>Raw Assessment</b> <b>250 MPa 2.5 min 16.7°C (Run 4)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Moderately bright</li> <li>• Very moist</li> <li>• Flesh grey with yellow tints</li> <li>• No loss of shape</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Moderate fresh odour</li> </ul>
<b>Overall Quality</b>	<b>6 (Fairly Good)</b>

	<b>Cooked Assessment</b> <b>250 MPa 2.5 min 16.7°C (Run 4)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Very bright</li> <li>• Flesh clean and white with slight pink tints</li> <li>• No loss of shape</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Very fresh odour</li> </ul>
<b>Flavour</b>	<ul style="list-style-type: none"> <li>• Strong lobster flavour</li> <li>• Moderately sweet</li> <li>• Slightly salty</li> </ul>
<b>Texture/Mouthfeel</b>	<ul style="list-style-type: none"> <li>• Moderately firm bite</li> <li>• Moderately moist</li> <li>• Moderately fibrous</li> </ul>
<b>Overall Quality</b>	<b>8 (Very Good)</b>



	<b>Raw Assessment</b> <b>220 MPa 4.0 min 17 °C (Run 5)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Moderately bright</li> <li>• Moderately moist</li> <li>• Flesh clean and white</li> <li>• No loss of shape</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Moderate fresh odour</li> </ul>
<b>Overall Quality</b>	<b>8 (Very Good)</b>

	<b>Cooked Assessment</b> <b>220 MPa 4.0 min 17 °C (Run 5)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Moderately bright</li> <li>• Flesh grey tints</li> <li>• Slight shape loss</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Moderately fresh odour</li> </ul>
<b>Flavour</b>	<ul style="list-style-type: none"> <li>• Moderate lobster flavour</li> <li>• Slightly sweet</li> <li>• Slightly salty</li> </ul>
<b>Texture/Mouthfeel</b>	<ul style="list-style-type: none"> <li>• Moderately firm bite</li> <li>• Moderately moist</li> <li>• Moderately fibrous</li> </ul>
<b>Overall Quality</b>	<b>6 (Fairly Good)</b>

	<b>Raw Assessment</b> <b>280 MPa 4.0 min 16 °C (Run 6)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Moderately bright</li> <li>• Moderately moist</li> <li>• Flesh grey/blue tints</li> <li>• Slight shape loss</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Moderate fresh odour</li> </ul>
<b>Overall Quality</b>	<b>5 (Satisfactory)</b>

	<b>Cooked Assessment</b> <b>280 MPa 4.0 min 16 °C (Run 6)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Very bright</li> <li>• Flesh white with pink tints</li> <li>• No loss of shape</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Slightly fresh odour</li> <li>• Slight sewage/skatole note</li> </ul>
<b>Flavour</b>	<ul style="list-style-type: none"> <li>• Moderate lobster flavour</li> <li>• Slightly sweet</li> <li>• Slightly salty</li> </ul>
<b>Texture/Mouthfeel</b>	<ul style="list-style-type: none"> <li>• Moderately firm bite</li> <li>• Moderately moist</li> <li>• Moderately fibrous</li> </ul>
<b>Overall Quality</b>	<b>4 (Just Acceptable)</b>

## **APPENDIX 7**

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Date: 15<sup>th</sup> June 2007

**DEPARTMENT OF CONSUMER & SENSORY SCIENCE**

**CONFIDENTIAL REPORT**

**SENSORY QUALITY EVALUATION  
OF HIGH PRESSURE PROCESSED WARM WATER PRAWNS**

Report No. S/REP/95900/7

Prepared by : Sue Burling

Checked &  
authorised by :

Name : Lucy Brown

<b>Authorised Signatories:</b>	L. Brown	Sensory Services Manager
	S. Purcell	Sensory Projects Group Manager
	J. Menneer	Sensory Training Group Manager
	E. Allechurch	Data Analyst

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## SUMMARY

The aim of the project was to understand the effect of High Pressure Processing (HPP) on the sensory quality of a variety of fish and shellfish species.

Each species was subjected to a range of pressure/time/temperature combinations and a selection of samples were then evaluated to determine the effect on the sensory quality in terms of appearance, odour, flavour and texture.

This report details the results for Warm Water Prawns.

## SAMPLE INFORMATION

Date samples received: 17<sup>th</sup> May 2007

Condition on receipt: Good

Storage conditions: Chilled

Date samples tested: 17<sup>th</sup> May 2007

<b>FMT Label</b>	<b>Pressure (MPa)</b>	<b>Time (mins)</b>	<b>Temp (°C)</b>
Control (untreated in water)	n/a	n/a	n/a
Run 1	250	2.5	14.4
Run 2	280	1.0	11.9
Run 3	220	1.0	2.8
Run 4	250	2.5	12
Run 5	220	4.0	13.6
Run 6	280	4.0	7.4

## Sample Preparation

Each sample was received from the FMT department raw and evaluated uncooked. The sample was then placed directly in a steamer, over half a litre of boiling water in the base and steamed for 1.75 minutes.

## MATERIALS AND METHODS

### Sensory Quality Grading (TES-S-021)

For each evaluation 8 warm water prawns were assessed. All samples were presented under three-digit code to a panel of three experienced sensory assessors.

Each assessor independently described the uncooked appearance and odour and awarded an overall quality grade for the raw sample (using the scale shown below). The sample was then steamed and the assessors described the appearance, odour, flavour and texture/mouthfeel and awarded a quality grade for the cooked assessment. The consensus scores were calculated and the individual comments combined.

### Assessment Scale – Sensory Quality

9	Excellent Quality
8	Very Good Quality
7	Good Quality
6	Fairly Good Quality
5	Satisfactory Quality
4	Just Acceptable Quality
3	Poor Quality
2	Very Poor Quality
1	Bad Quality

## RESULTS AND DISCUSSION

The weights were recorded before and after cooking, and the % weight loss calculated.

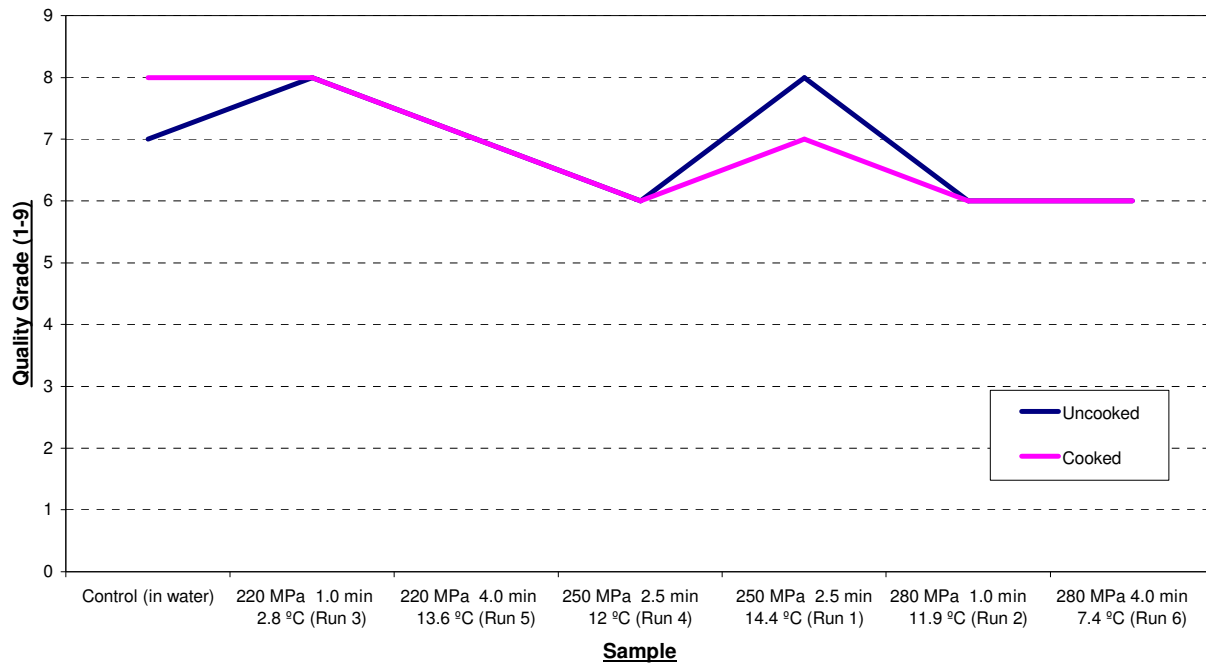
Sample Name	Treatment Details	Weight Raw (g)	Weight Cooked (g)	Weight Loss (g)	% Weight Loss
Control	N/A	102.6	96.8	5.8	5.7
Run 1	250 MPa 2.5 min 14.4 °C	105.9	104.2	1.7	1.6
Run 2	280 MPa 1.0 min 11.9 °C	106.1	105.0	1.1	1.0
Run 3	220 MPa 1.0 min 2.8 °C	108.0	103.3	4.7	4.4
Run 4	250 MPa 2.5 min 12 °C	104.2	96.9	7.3	7.0
Run 5	220 MPa 4.0 min 13.6 °C	105.8	100.9	4.9	4.6
Run 6	280 MPa 4.0 min 7.4 °C	102.6	95.4	7.2	7.0

A summary of the grades awarded are detailed in the following table:

Sample Name	Treatment Details	Uncooked Quality Grade	Cooked Quality Grade
Control	Untreated placed in water	7	8
Run 1	250 MPa 2.5 min 14.4 °C	8	7
Run 2	280 MPa 1.0 min 11.9 °C	6	6
Run 3	220 MPa 1.0 min 2.8 °C	8	8
Run 4	250 MPa 2.5 min 12 °C	6	6
Run 5	220 MPa 4.0 min 13.6 °C	7	7
Run 6	280 MPa 4.0 min 7.4 °C	6	6

The following graph shows both the uncooked and cooked assessment scores for ascending pressure treatments.

**Warm Water Prawns Sensory Quality Assessment**



For the uncooked assessment Run 1 and Run 3 were both graded higher than the Control sample, both had better retention of the tips ends. Run 5 was graded equal to the Control, whereas Run 2, Run 4 and Run 6 were all graded lower. These were all less grey with green/yellow tints and they had more shape loss and less retained membrane.

For the cooked assessment the Control and Run 3 were graded the highest. The others all displayed shape loss and a woollier appearance.

# **APPENDIX**

*Individual Comments and Quality Grades  
for the Raw and Cooked Assessments*



	<b>Raw Assessment Control</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Moderately bright</li> <li>• Moderately moist</li> <li>• Moderately grey/blue in colour</li> <li>• Slightly translucent</li> <li>• Very slight retention of tip end</li> <li>• High amount of retained membrane</li> <li>• Slight shape loss</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Very fresh odour</li> </ul>
<b>Overall Quality</b>	<b>7 (Good)</b>

	<b>Cooked Assessment Control</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Moderately bright</li> <li>• Moderately coral pink in colour</li> <li>• Very slight shape loss</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Very fresh odour</li> </ul>
<b>Flavour</b>	<ul style="list-style-type: none"> <li>• Strong prawn flavour</li> <li>• Moderately sweet</li> <li>• Slightly salty</li> </ul>
<b>Texture/Mouthfeel</b>	<ul style="list-style-type: none"> <li>• Moderately firm bite</li> <li>• Moderately moist</li> <li>• Slightly fibrous</li> </ul>
<b>Overall Quality</b>	<b>8 (Very Good)</b>

	<b>Raw Assessment</b> <b>250 MPa 2.5 min 14.4 °C (Run 1)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Moderately bright</li> <li>• Moderately moist</li> <li>• Moderately grey/blue in colour</li> <li>• Slightly translucent</li> <li>• Moderate retention of tip end</li> <li>• High amount of retained membrane</li> <li>• Slight shape loss</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Very fresh odour</li> </ul>
<b>Overall Quality</b>	<b>8 (Very Good)</b>

	<b>Cooked Assessment</b> <b>250 MPa 2.5 min 14.4 °C (Run 1)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Moderately bright</li> <li>• Moderately coral pink in colour</li> <li>• Slight shape loss with a slightly woolly appearance</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Very fresh odour</li> </ul>
<b>Flavour</b>	<ul style="list-style-type: none"> <li>• Strong prawn flavour</li> <li>• Moderately sweet</li> <li>• Slightly salty</li> </ul>
<b>Texture/Mouthfeel</b>	<ul style="list-style-type: none"> <li>• Moderately firm bite</li> <li>• Moderately moist</li> <li>• Slightly fibrous</li> </ul>
<b>Overall Quality</b>	<b>7 (Good)</b>

	<b>Raw Assessment</b> <b>280 MPa 1.0 min 11.9 °C (Run 2)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Moderately bright</li> <li>• Moderately moist</li> <li>• Slightly grey/blue in colour with green/yellow</li> <li>• Slightly translucent</li> <li>• Moderate retention of tip end</li> <li>• High amount of retained membrane</li> <li>• Slight shape loss</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Very fresh odour</li> </ul>
<b>Overall Quality</b>	<b>6 (Fairly Good)</b>

	<b>Cooked Assessment</b> <b>280 MPa 1.0 min 11.9 °C (Run 2)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Slightly bright</li> <li>• Moderately coral pink in colour with slight grey tints</li> <li>• Very slight shape loss with a slightly woolly appearance</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Moderately fresh odour</li> </ul>
<b>Flavour</b>	<ul style="list-style-type: none"> <li>• Strong prawn flavour</li> <li>• Slightly sweet and slightly savoury</li> <li>• Slightly salty</li> </ul>
<b>Texture/Mouthfeel</b>	<ul style="list-style-type: none"> <li>• Moderately firm bite</li> <li>• Moderately moist</li> <li>• Slightly fibrous</li> </ul>
<b>Overall Quality</b>	<b>6 (Fairly Good)</b>

	<b>Raw Assessment</b> <b>220 MPa 1.0 min 2.8 °C (Run 3)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Moderately bright</li> <li>• Moderately moist</li> <li>• Moderately grey/blue in colour very slight green/yellow tints</li> <li>• Slightly translucent</li> <li>• 100% retention of tip end</li> <li>• High amount of retained membrane</li> <li>• Slight shape loss</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Very fresh odour</li> </ul>
<b>Overall Quality</b>	<b>8 (Very Good)</b>

	<b>Cooked Assessment</b> <b>220 MPa 1.0 min 2.8 °C (Run 3)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Moderately bright</li> <li>• Moderately coral pink in colour</li> <li>• Very slight shape loss</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Very fresh odour</li> </ul>
<b>Flavour</b>	<ul style="list-style-type: none"> <li>• Strong prawn flavour</li> <li>• Moderately sweet</li> <li>• Slightly salty</li> </ul>
<b>Texture/Mouthfeel</b>	<ul style="list-style-type: none"> <li>• Moderately firm bite</li> <li>• Moderately moist</li> <li>• Slightly fibrous</li> </ul>
<b>Overall Quality</b>	<b>8 (Very Good)</b>

	<b>Raw Assessment</b> <b>250 MPa 2.5 min 12 °C (Run 4)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Moderately bright</li> <li>• Moderately moist</li> <li>• Slightly grey/blue in colour with green/yellow tints</li> <li>• Slightly translucent</li> <li>• Moderate retention of tip end</li> <li>• High amount of retained membrane</li> <li>• Slight shape loss</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Very fresh odour</li> </ul>
<b>Overall Quality</b>	<b>6 (Fairly Good)</b>

	<b>Cooked Assessment</b> <b>250 MPa 2.5 min 12 °C (Run 4)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Moderately bright</li> <li>• Moderately coral pink in colour</li> <li>• Very slight shape loss with a slightly woolly appearance</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Very fresh odour</li> </ul>
<b>Flavour</b>	<ul style="list-style-type: none"> <li>• Strong prawn flavour</li> <li>• Moderately sweet</li> <li>• Slightly salty</li> </ul>
<b>Texture/Mouthfeel</b>	<ul style="list-style-type: none"> <li>• Moderately firm bite</li> <li>• Moderately moist</li> <li>• Slightly fibrous</li> </ul>
<b>Overall Quality</b>	<b>6 (Fairly Good)</b>

	<b>Raw Assessment</b> <b>220 MPa 4.0 min 13.6 °C (Run 5)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Moderately bright</li> <li>• Moderately moist</li> <li>• Moderately grey/blue in colour with very slight green/yellow tints</li> <li>• Slightly translucent</li> <li>• High retention of tip end</li> <li>• High amount of retained membrane</li> <li>• Slight shape loss</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Very fresh odour</li> </ul>
<b>Overall Quality</b>	<b>7 (Good)</b>

	<b>Cooked Assessment</b> <b>220 MPa 4.0 min 13.6 °C (Run 5)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Moderately bright</li> <li>• Moderately coral pink in colour</li> <li>• Slight shape loss with a slightly woolly appearance</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Very fresh odour</li> </ul>
<b>Flavour</b>	<ul style="list-style-type: none"> <li>• Strong prawn flavour</li> <li>• Moderately sweet</li> <li>• Slightly salty</li> </ul>
<b>Texture/Mouthfeel</b>	<ul style="list-style-type: none"> <li>• Moderately firm bite</li> <li>• Moderately moist</li> <li>• Slightly fibrous</li> </ul>
<b>Overall Quality</b>	<b>7 (Good)</b>

	<b>Raw Assessment</b> <b>280 MPa 4.0 min 7.4 °C (Run 6)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Moderately bright</li> <li>• Moderately moist</li> <li>• Moderately grey/blue in colour with slight yellow/green tints</li> <li>• Slightly translucent</li> <li>• Slight retention of tip end</li> <li>• High amount of retained membrane</li> <li>• Slight shape loss</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Very fresh odour</li> </ul>
<b>Overall Quality</b>	<b>6 (Fairly Good)</b>

	<b>Cooked Assessment</b> <b>280 MPa 4.0 min 7.4 °C (Run 6)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Moderately bright</li> <li>• Moderately coral pink in colour</li> <li>• Slight shape loss with a slightly woolly appearance</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Very fresh odour</li> </ul>
<b>Flavour</b>	<ul style="list-style-type: none"> <li>• Strong prawn flavour</li> <li>• Moderately sweet</li> <li>• Slightly salty</li> </ul>
<b>Texture/Mouthfeel</b>	<ul style="list-style-type: none"> <li>• Moderately firm bite</li> <li>• Moderately moist</li> <li>• Slightly fibrous</li> </ul>
<b>Overall Quality</b>	<b>6 (Fairly Good)</b>

## **APPENDIX 8**



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Date: 15th June 2007

**DEPARTMENT OF CONSUMER & SENSORY SCIENCE**

**CONFIDENTIAL REPORT**

**SENSORY QUALITY EVALUATION  
OF HIGH PRESSURE PROCESSED SALMON**

Report No. S/REP/95900/8

Prepared by : Sue Burling

Checked &  
authorised by :

Name : Lucy Brown

<b>Authorised Signatories:</b>	L. Brown	Sensory Services Manager
	S. Purcell	Sensory Projects Group Manager
	E. Allchurch	Data Analyst

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## SUMMARY

The aim of the project was to understand the effect of High Pressure Processing (HPP) on the sensory quality of a variety of fish and shellfish species.

Each species was subjected to a range of pressure/time/temperature combinations and a selection of samples were then evaluated to determine the effect on the sensory quality in terms of appearance, odour, flavour and texture.

This report details the results for Salmon.

## SAMPLE INFORMATION

Date samples received: 12th June 2007

Condition on receipt: Good

Storage conditions: Chilled

Date samples tested: 13th June 2007

<b>FMT Label</b>	<b>Pressure (MPa)</b>	<b>Time (mins)</b>	<b>Temp (°C)</b>
Control	n/a	n/a	n/a
Run 1	425	3	6
Run 8	250	3	12
Run 10	425	5	13
Run 11	425	3	13
Run 14	600	3	14
Run 20	425	3	17

## Sample Preparation

Each sample was received from the FMT department raw and evaluated uncooked. The sample was then placed directly in a steamer, over half a litre of boiling water in the base and steamed for between 7 and 13 minutes.

## MATERIALS AND METHODS

### Sensory Quality Grading (TES-S-021)

For each evaluation one fillet was assessed. All samples were presented under three-digit code to a panel of three experienced sensory assessors.

Each assessor independently described the uncooked appearance and odour and awarded an overall quality grade for the raw sample (using the scale shown below). The sample was then steamed and the assessors described the appearance, odour, flavour and texture/mouthfeel and awarded a quality grade for the cooked assessment. The consensus scores were calculated and the individual comments combined.

### Assessment Scale – Sensory Quality

9	Excellent Quality
8	Very Good Quality
7	Good Quality
6	Fairly Good Quality
5	Satisfactory Quality
4	Just Acceptable Quality
3	Poor Quality
2	Very Poor Quality
1	Bad Quality

## RESULTS AND DISCUSSION

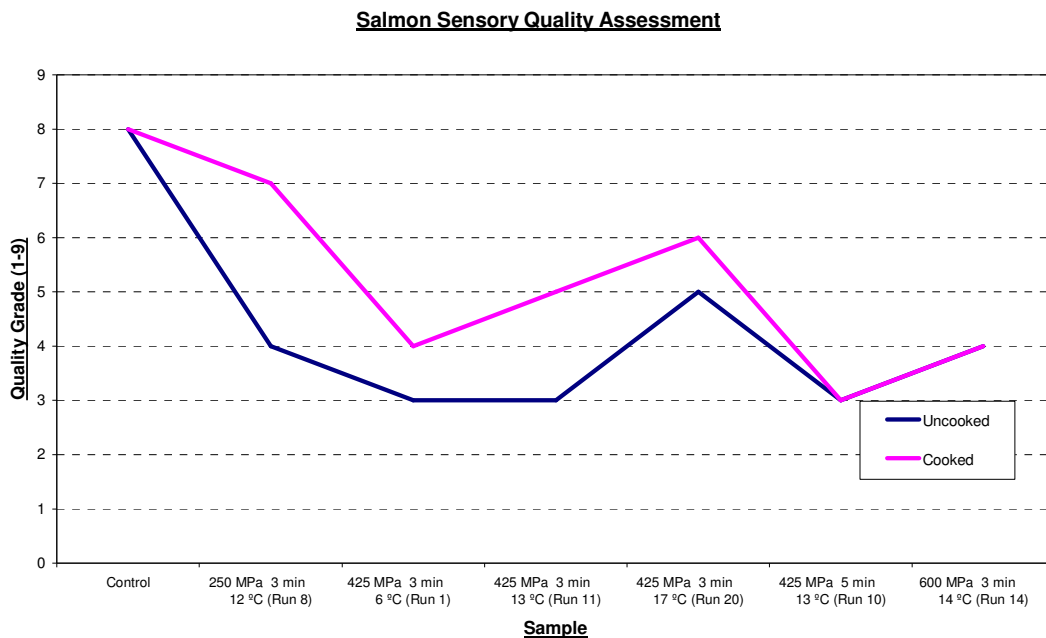
The weights were recorded before and after cooking and the % weight loss calculated.

Sample Name	Treatment Details	Weight Raw (g)	Weight Cooked (g)	Weight Loss (g)	% Weight Loss
Control	n/a	179.2	148.8	30.4	17.0
Run 1	425 Mpa 3 min 6 °C	171.5	144.8	26.7	15.6
Run 8	250 Mpa 3 min 12 °C	242.2	201.6	40.6	16.8
Run 10	425 Mpa 5 min 13 °C	176.9	150.9	26	14.7
Run 11	425 Mpa 3 min 13 °C	146.0	124.1	21.9	15.0
Run 14	600 Mpa 3 min 14 °C	178.5	141.5	37	20.7
Run 20	425 Mpa 3 min 17 °C	129.3	108.7	20.6	15.9

A summary of the grades awarded are detailed in the following table:

Sample Name	Treatment Details	Uncooked Quality Grade	Cooked Quality Grade
Control	N/A	8	8
Run 1	425 MPa 3 min 6 °C	3	4
Run 8	250 MPa 3 min 12 °C	4	7
Run 10	425 MPa 5 min 13 °C	3	3
Run 11	425 MPa 3 min 13 °C	3	5
Run 14	600 MPa 3 min 14 °C	4	4
Run 20	425 MPa 3 min 17 °C	5	6

The following graph shows both the uncooked and cooked assessment scores for ascending pressure treatments.



For the uncooked assessment none of the samples were graded as high as the Control, which was bright and moist. Run 20 was graded the highest, with dense, moderately bright flesh. Run 1 and Run 11 were graded the lowest, with very dense, compressed flesh, and no defined flake structure.

For the cooked assessment none of the samples were graded as high as the Control, which was bright and moist, with a very fresh odour. Run 8 and Run 20 were graded the highest, with moderately bright flesh, and expected balanced flavour. Run 1, Run 10 and Run 14 were graded the lowest, being pale in colour, and with a very fibrous, tough texture.

# **APPENDIX**

## *Individual Comments and Quality Grades for the Raw and Cooked Assessments*

	<b>Raw Assessment Control</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Very bright</li> <li>• Moderately moist</li> <li>• Moderately pink/orange in colour</li> <li>• Well defined flakes</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Very fresh odour</li> </ul>
<b>Overall Quality</b>	<b>8 (Very Good)</b>

	<b>Cooked Assessment Control</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Moderately bright</li> <li>• Slightly pale pink in colour</li> <li>• Slight shape loss</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Very fresh odour</li> </ul>
<b>Flavour</b>	<ul style="list-style-type: none"> <li>• Moderate salmon flavour</li> <li>• Slightly sweet</li> <li>• Slightly salty</li> <li>• Slightly earthy</li> </ul>
<b>Texture/Mouthfeel</b>	<ul style="list-style-type: none"> <li>• Slightly firm bite</li> <li>• Moderately moist</li> <li>• Slightly fibrous</li> </ul>
<b>Overall Quality</b>	<b>8 (Very Good)</b>

	<b>Raw Assessment</b> <b>425 MPa 3 min 6 °C (Run 1)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Moderately bright</li> <li>• Moderately moist</li> <li>• Pale creamy pink in colour</li> <li>• No defined flakes</li> <li>• Very dense, smooth and compressed to shape of packaging</li> <li>• Does not resemble a raw fresh salmon fillet</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Moderately fresh odour</li> </ul>
<b>Overall Quality</b>	<b>3 (Poor)</b>

	<b>Cooked Assessment</b> <b>425 MPa 3 min 6 °C (Run 1)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Slightly bright</li> <li>• Moderately pale pink in colour with grey tints</li> <li>• Retained moulded packaging shape</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Very fresh odour</li> </ul>
<b>Flavour</b>	<ul style="list-style-type: none"> <li>• Moderate salmon flavour</li> <li>• Slightly sweet</li> <li>• Slightly salty</li> <li>• Slightly earthy</li> <li>• Slightly oily</li> </ul>
<b>Texture/Mouthfeel</b>	<ul style="list-style-type: none"> <li>• Moderately firm bite</li> <li>• Moderately moist</li> <li>• Very fibrous, moderately tough and chewy</li> </ul>
<b>Overall Quality</b>	<b>4 (Just Acceptable)</b>

	<b>Raw Assessment</b> <b>250 MPa 3 min 12 °C (Run 8)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Moderately bright</li> <li>• Moderately moist</li> <li>• Moderately creamy pink with purple tints in colour</li> <li>• Slight defined flakes</li> <li>• Slightly dense, smooth and compressed to shape of packaging</li> <li>• Does not resemble a raw fresh salmon fillet</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Moderately fresh odour</li> </ul>
<b>Overall Quality</b>	<b>4 (Just Acceptable)</b>

	<b>Cooked Assessment</b> <b>250 MPa 3 min 12 °C (Run 8)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Moderately bright</li> <li>• Slightly pale pink in colour</li> <li>• Slight shape loss</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Moderately fresh odour</li> </ul>
<b>Flavour</b>	<ul style="list-style-type: none"> <li>• Moderate salmon flavour</li> <li>• Slightly sweet</li> <li>• Slightly salty</li> <li>• Slightly earthy</li> <li>• Slightly oily</li> </ul>
<b>Texture/Mouthfeel</b>	<ul style="list-style-type: none"> <li>• Slightly firm bite</li> <li>• Moderately moist</li> <li>• Slightly fibrous</li> </ul>
<b>Overall Quality</b>	<b>7 (Good)</b>



	<b>Raw Assessment</b> <b>425 MPa 5 min 13 °C (Run 10)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Moderately bright</li> <li>• Moderately moist</li> <li>• Moderately creamy pink with purple tints in colour</li> <li>• Slight defined flakes</li> <li>• Very dense, smooth and compressed to shape of packaging</li> <li>• Does not resemble a raw fresh salmon fillet</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Moderately fresh odour</li> </ul>
<b>Overall Quality</b>	<b>3 (Poor)</b>

	<b>Cooked Assessment</b> <b>425 MPa 5 min 13 °C (Run 10)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Very slightly bright</li> <li>• Very pale pink in colour with white patches</li> <li>• Retained moulded packaging shape</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Moderate fresh odour</li> </ul>
<b>Flavour</b>	<ul style="list-style-type: none"> <li>• Moderate salmon flavour</li> <li>• Slightly sweet</li> <li>• Slightly salty</li> <li>• Slightly earthy</li> <li>• Slightly oily</li> </ul>
<b>Texture/Mouthfeel</b>	<ul style="list-style-type: none"> <li>• Moderately firm bite</li> <li>• Moderately moist</li> <li>• Very fibrous, very tough and chewy</li> </ul>
<b>Overall Quality</b>	<b>3 (Poor)</b>

	<b>Raw Assessment</b> <b>425 MPa 3 min 14 °C (Run 11)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Moderately bright</li> <li>• Moderately moist</li> <li>• Moderately creamy pink with purple tints in colour</li> <li>• No defined flakes</li> <li>• Very dense, smooth and compressed to shape of packaging</li> <li>• Does not resemble a raw fresh salmon fillet</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Slightly fresh odour</li> </ul>
<b>Overall Quality</b>	<b>3 (Poor)</b>

	<b>Cooked Assessment</b> <b>425 MPa 3 min 14 °C (Run 11)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Slightly bright</li> <li>• Moderately pale pink in colour with grey tints</li> <li>• Retained moulded packaging shape</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Very fresh odour</li> </ul>
<b>Flavour</b>	<ul style="list-style-type: none"> <li>• Moderate salmon flavour</li> <li>• Slightly sweet</li> <li>• Slightly salty</li> <li>• Slightly earthy</li> <li>• Slightly oily</li> </ul>
<b>Texture/Mouthfeel</b>	<ul style="list-style-type: none"> <li>• Moderately firm bite</li> <li>• Moderately moist</li> <li>• Very fibrous, slightly tough and chewy</li> </ul>
<b>Overall Quality</b>	<b>5 (Satisfactory)</b>

	<b>Raw Assessment 600 MPa 3 min 17 °C (Run 14)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Moderately bright</li> <li>• Moderately moist</li> <li>• Moderately creamy pink with purple tints in colour</li> <li>• Slight defined flakes</li> <li>• Slightly dense, smooth and compressed to shape of packaging</li> <li>• Does not resemble a raw fresh salmon fillet</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Moderately fresh odour</li> </ul>
<b>Overall Quality</b>	<b>4 (Just Acceptable)</b>

	<b>Cooked Assessment 600 MPa 3 min 17 °C (Run 14)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Slightly bright</li> <li>• Moderately pale pink in colour with creamy brown curd</li> <li>• Retained moulded packaging shape</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Moderately fresh odour</li> </ul>
<b>Flavour</b>	<ul style="list-style-type: none"> <li>• Moderate salmon flavour</li> <li>• Slightly sweet</li> <li>• Slightly salty</li> <li>• Slightly earthy</li> <li>• Slightly oily</li> </ul>
<b>Texture/Mouthfeel</b>	<ul style="list-style-type: none"> <li>• Moderately firm bite</li> <li>• Slightly moist</li> <li>• Very fibrous, slightly tough and chewy</li> </ul>
<b>Overall Quality</b>	<b>4 (Just Acceptable)</b>

	<b>Raw Assessment</b> <b>425 MPa 3 min 17 °C (Run 20)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Moderately bright</li> <li>• Moderately moist</li> <li>• Moderately creamy pink with purple tints in colour</li> <li>• Slight defined flakes</li> <li>• Very slightly dense, smooth and compressed to shape of packaging</li> <li>• Does not resemble a raw fresh salmon fillet</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Moderately fresh odour</li> </ul>
<b>Overall Quality</b>	<b>5 (Satisfactory)</b>

	<b>Cooked Assessment</b> <b>425 MPa 3 min 17 °C (Run 20)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Slightly bright</li> <li>• Slightly pale creamy pink in colour with cream curd</li> <li>• Slight shape loss</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Moderately fresh odour</li> </ul>
<b>Flavour</b>	<ul style="list-style-type: none"> <li>• Moderate salmon flavour</li> <li>• Slightly sweet</li> <li>• Slightly salty</li> <li>• Slightly earthy</li> <li>• Slightly oily</li> </ul>
<b>Texture/Mouthfeel</b>	<ul style="list-style-type: none"> <li>• Slightly firm bite</li> <li>• Moderately moist</li> <li>• Slightly fibrous</li> </ul>
<b>Overall Quality</b>	<b>6 (Fairly Good)</b>

## **APPENDIX 9**

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Date: 8<sup>th</sup> August 2007

**DEPARTMENT OF CONSUMER & SENSORY SCIENCE**

**CONFIDENTIAL REPORT**

**SENSORY QUALITY EVALUATION  
OF HIGH PRESSURE PROCESSED SQUID**

Report No. S/REP/95900/10

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## SUMMARY

The aim of the project was to understand the effect of High Pressure Processing (HPP) on the sensory quality of a variety of fish and shellfish species.

Each species was subjected to a range of pressure/time/temperature combinations and a selection of samples were then evaluated to determine the effect on the sensory quality in terms of appearance, odour, flavour and texture.

This report details the results for Squid.

## SAMPLE INFORMATION

Date samples received: 24th July 2007

Condition on receipt: Good

Storage conditions: Chilled

Date samples tested: 24th July 2007

<b>FMT Label</b>	<b>Pressure (MPa)</b>	<b>Time (mins)</b>	<b>Temp (°C)</b>
Control	n/a	n/a	n/a
Run 1	400	5	21
Run 2	200	2.5	21.2
Run 3	600	2.5	18.7
Run 4	400	2.5	19.4
Run 5	400	2.5	22.8
Run 6	400	2.5	21.3

## **SAMPLE PREPARATION**

Each sample was received from the FMT department raw and evaluated uncooked. The sample was then directly placed in a steamer, over a litre of boiling water in the base and steamed from 3.5 to 5 minutes according to the size of the squid.

## **MATERIALS AND METHODS**

### **Sensory Quality Grading (TES-S-021)**

For each evaluation one squid was assessed. All samples were presented under three-digit code to a panel of three experienced sensory assessors.

Each assessor independently described the uncooked appearance and odour and awarded an overall quality grade for the raw sample (using the scale shown below). The sample was then steamed and the assessors described the appearance, odour, flavour and texture/mouthfeel and awarded a quality grade for the cooked assessment. The consensus scores were calculated and the individual comments combined.

### **Assessment Scale – Sensory Quality**

9	Excellent Quality
8	Very Good Quality
7	Good Quality
6	Fairly Good Quality
5	Satisfactory Quality
4	Just Acceptable Quality
3	Poor Quality
2	Very Poor Quality
1	Bad Quality



## RESULTS AND DISCUSSION

A summary of the grades awarded are detailed in the following table:

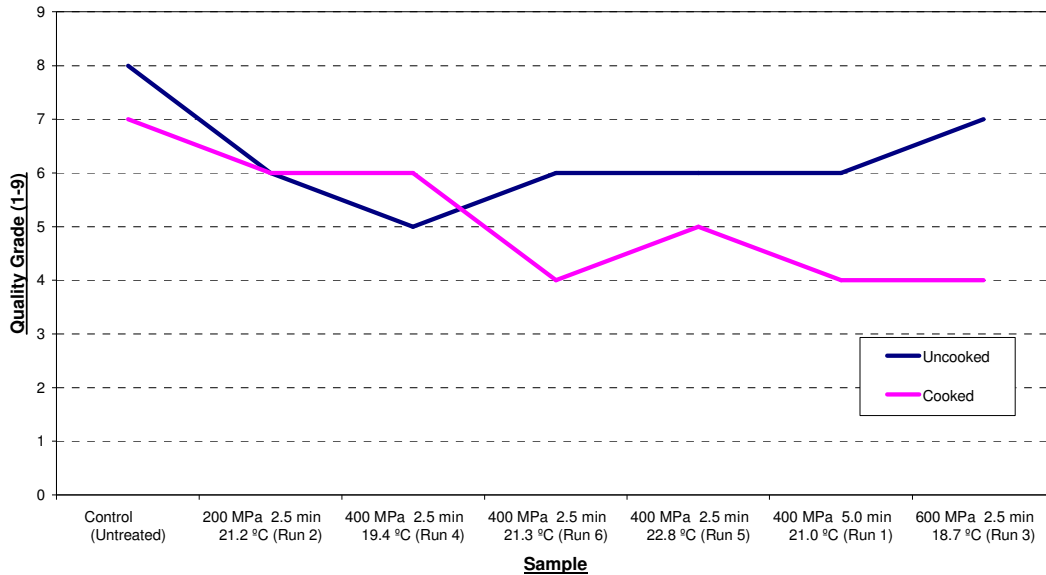
Sample Name	Treatment Details	Uncooked Quality Grade	Cooked Quality Grade
Control	Untreated	8	7
Run 1	400 MPa 5.0 min 21°C	6	6
Run 2	200 MPa 2.5 min 21.2 °C	5	6
Run 3	600 MPa 2.5 min 18.7 °C	6	4
Run 4	400 MPa 2.5 min 19.4 °C	6	5
Run 5	400 MPa 2.5 min 22.8 °C	6	4
Run 6	400 MPa 2.5 min 21.3 °C	7	4

The weights were recorded before and after cooking, and the % weight loss calculated.

Sample Name	Treatment Details	Weight Raw (g)	Weight Cooked (g)	Weight Loss (g)	% Weight Loss
Control	N/A	152.6	111.1	41.5	27.2
Run 1	400 MPa 5.0 min 21°C	132.6	95.1	37.5	28.3
Run 2	200 MPa 2.5 min 21.2 °C	149.9	116.7	33.2	22.1
Run 3	600 MPa 2.5 min 18.7 °C	155.9	99.3	56.6	36.3
Run 4	400 MPa 2.5 min 19.4 °C	160.0	108	52	32.5
Run 5	400 MPa 2.5 min 22.8 °C	93.1	68.2	24.9	26.7
Run 6	400 MPa 2.5 min 21.3 °C	108.8	75.1	33.7	31.0

The following graph shows both the uncooked and cooked assessment scores for ascending pressure treatments.

### Squid Sensory Quality Assessment



For the uncooked assessment none of the samples was graded as high as the Control, which was very bright and moist, with the expected milky white colour. The Run 6 sample was graded the highest, being moderately bright and moist, with very little loss of shape. The Run 2 sample was graded the lowest, with a denser, slightly dirty flesh, and slight loss of shape.

For the cooked assessment none of the samples were graded as high as the Control, which was moderately bright and moist, with very little loss of shape, and a balanced salty and sweet flavour. Run 1 and Run 2 were graded the highest, having a similar bright and moist appearance to that of the control, but with more bitterness in the flavour. Run 3, Run 5 and Run 6 were graded the lowest. Runs 3 and 5 were badly cleaned internally, and had some protein cook-out present, a moderately bitter flavour, and extremely fibrous texture. Run 6 also had an extremely fibrous texture, but a cleaner appearance, and was also very bitter.

# **APPENDIX**

## *Individual Comments and Quality Grades for the Raw and Cooked Assessments*

	<b>Raw Assessment Control</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Very bright</li> <li>• Moderately moist</li> <li>• Moderately milky white in colour with pale pink patches</li> <li>• Clean, flat and dense</li> <li>• No shape loss</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Moderate seafood odour</li> </ul>
<b>Overall Quality</b>	<b>8 (Very Good)</b>

	<b>Cooked Assessment Control</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Moderately bright</li> <li>• Moderately moist</li> <li>• External, moderately milky white in colour with pale pink patches</li> <li>• Flesh white and dense</li> <li>• Very little shape loss</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Moderate seafood odour</li> </ul>
<b>Flavour</b>	<ul style="list-style-type: none"> <li>• Moderate squid flavour</li> <li>• Slightly sweet</li> <li>• Slightly salty</li> <li>• Slightly bitter with an eggy note</li> </ul>
<b>Texture/Mouthfeel</b>	<ul style="list-style-type: none"> <li>• Very firm bite</li> <li>• Moderately moist</li> <li>• Very fibrous, chewy and rubbery</li> </ul>
<b>Overall Quality</b>	<b>7 (Good)</b>

	<b>Raw Assessment 400 MPa 5 min 21 °C (Run 1)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Very bright</li> <li>• Moderately moist</li> <li>• Moderately milky white in colour with pink patches</li> <li>• Slightly frothy residue, flat and dense</li> <li>• Slight shape loss</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Moderate seafish odour</li> </ul>
<b>Overall Quality</b>	<b>6 (Fairly Good)</b>

	<b>Cooked Assessment 400 MPa 5 min 21 °C (Run 1)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Moderately bright</li> <li>• Moderately moist</li> <li>• External, moderately milky white in colour with pale pink patches</li> <li>• Flesh white and dense</li> <li>• Very little shape loss</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Moderate seafish odour</li> </ul>
<b>Flavour</b>	<ul style="list-style-type: none"> <li>• Moderate squid flavour</li> <li>• Slightly sweet</li> <li>• Slightly salty</li> <li>• Moderately bitter with an eggy note</li> </ul>
<b>Texture/Mouthfeel</b>	<ul style="list-style-type: none"> <li>• Very firm bite</li> <li>• Moderately moist</li> <li>• Very fibrous, chewy and rubbery</li> </ul>
<b>Overall Quality</b>	<b>6 (Fairly Good)</b>

	<b>Raw Assessment</b> <b>200 MPa 2.5 min 18.7 °C (Run 2)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Moderately bright</li> <li>• Moderately moist</li> <li>• Moderately milky white in colour with pink patches</li> <li>• Slightly dirty, flat and dense</li> <li>• Slight shape loss</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Moderate seafood odour</li> </ul>
<b>Overall Quality</b>	<b>5 (Satisfactory)</b>

	<b>Cooked Assessment</b> <b>200 MPa 2.5 min 18.7 °C (Run 2)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Moderately bright</li> <li>• Moderately moist</li> <li>• External, moderately milky white in colour with dark pink/grey patches</li> <li>• Flesh white and dense</li> <li>• Very little shape loss</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Moderate seafood odour</li> </ul>
<b>Flavour</b>	<ul style="list-style-type: none"> <li>• Moderate squid flavour</li> <li>• Slightly sweet</li> <li>• Slightly salty</li> <li>• Moderately bitter with an eggy note</li> </ul>
<b>Texture/Mouthfeel</b>	<ul style="list-style-type: none"> <li>• Very firm bite</li> <li>• Moderately moist</li> <li>• Very fibrous, chewy and rubbery</li> </ul>
<b>Overall Quality</b>	<b>6 (Fairly Good)</b>

	<b>Raw Assessment</b> <b>600 MPa 2.5 min 18.7 °C (Run 3)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Moderately bright</li> <li>• Moderately moist</li> <li>• Moderately milky white in colour with pink/purple patches</li> <li>• Slightly frothy residue, flat and dense</li> <li>• Slight shape loss</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Moderate seafood odour</li> </ul>
<b>Overall Quality</b>	<b>6 (Fairly Good)</b>

	<b>Cooked Assessment</b> <b>600 MPa 2.5 min 18.7 °C (Run 3)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Moderately bright</li> <li>• Moderately moist</li> <li>• External, moderately milky white in colour with pink/grey patches</li> <li>• Flesh white and dense</li> <li>• Unclean internally with protein cook out present</li> <li>• Very little shape loss</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Moderate seafood odour</li> </ul>
<b>Flavour</b>	<ul style="list-style-type: none"> <li>• Moderate squid flavour</li> <li>• Slightly sweet</li> <li>• Slightly salty</li> <li>• Moderately bitter with an eggy note</li> </ul>
<b>Texture/Mouthfeel</b>	<ul style="list-style-type: none"> <li>• Extremely firm bite</li> <li>• Moderately moist</li> <li>• Extremely fibrous, chewy and rubbery</li> </ul>
<b>Overall Quality</b>	<b>4 (Just Acceptable)</b>

	<b>Raw Assessment</b> <b>400 MPa 2.5 min 19.4 °C (Run 4)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Moderately bright</li> <li>• Moderately moist</li> <li>• Moderately milky white in colour with pale pink patches</li> <li>• Clean, flat and dense with a tear to centre</li> <li>• Very slight shape loss</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Moderate seafood odour</li> </ul>
<b>Overall Quality</b>	<b>6 (Fairly Good)</b>

	<b>Cooked Assessment</b> <b>400 MPa 2.5 min 19.4 °C (Run 4)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Moderately bright</li> <li>• Moderately moist</li> <li>• External, moderately milky white in colour with pink/grey patches</li> <li>• Flesh white and dense</li> <li>• Unclean internally with protein cook out present</li> <li>• Very little shape loss</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Moderate seafood odour</li> </ul>
<b>Flavour</b>	<ul style="list-style-type: none"> <li>• Moderate squid flavour</li> <li>• Slightly sweet</li> <li>• Slightly salty</li> <li>• Moderately bitter with an eggy note</li> </ul>
<b>Texture/Mouthfeel</b>	<ul style="list-style-type: none"> <li>• Very firm bite</li> <li>• Moderately moist</li> <li>• Very fibrous, chewy and rubbery</li> </ul>
<b>Overall Quality</b>	<b>5 (Satisfactory)</b>



	<b>Raw Assessment</b> <b>400 MPa 2.5 min 22.8 °C (Run 5)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Moderately bright</li> <li>• Moderately moist</li> <li>• Moderately milky white in colour with pale pink/grey patches</li> <li>• Clean, flat and dense</li> <li>• Slight shape loss</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Moderate seafood odour</li> </ul>
<b>Overall Quality</b>	<b>6 (Fairly Good)</b>

	<b>Cooked Assessment</b> <b>400 MPa 2.5 min 22.8 °C (Run 5)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Moderately bright</li> <li>• Moderately moist</li> <li>• External, moderately milky white in colour with pink/grey patches</li> <li>• Flesh white and dense</li> <li>• Unclean internally with protein cook out present</li> <li>• Very little shape loss</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Moderate seafood odour</li> </ul>
<b>Flavour</b>	<ul style="list-style-type: none"> <li>• Moderate squid flavour</li> <li>• Slightly sweet</li> <li>• Slightly salty</li> <li>• Moderately bitter and metallic with an eggy note</li> </ul>
<b>Texture/Mouthfeel</b>	<ul style="list-style-type: none"> <li>• Very firm bite</li> <li>• Moderately moist</li> <li>• Extremely fibrous, chewy and rubbery</li> </ul>
<b>Overall Quality</b>	<b>4 (Just Acceptable)</b>

	<b>Raw Assessment</b> <b>400 MPa 2.5 min 21.3°C (Run 6)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Moderately bright</li> <li>• Moderately moist</li> <li>• Moderately milky white in colour with pale pink patches</li> <li>• Clean, flat and dense</li> <li>• Very slight shape loss</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Moderate seafood odour</li> </ul>
<b>Overall Quality</b>	<b>7 (Good)</b>

	<b>Cooked Assessment</b> <b>400 MPa 2.5 min 21.3°C (Run 6)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Moderately bright</li> <li>• Moderately moist</li> <li>• External, moderately milky white in colour with pink/grey patches</li> <li>• Flesh white and dense</li> <li>• Very little shape loss</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Moderate seafood odour</li> </ul>
<b>Flavour</b>	<ul style="list-style-type: none"> <li>• Moderate squid flavour</li> <li>• Slightly sweet</li> <li>• Slightly salty</li> <li>• Very bitter with an eggy note</li> </ul>
<b>Texture/Mouthfeel</b>	<ul style="list-style-type: none"> <li>• Very firm bite</li> <li>• Moderately moist</li> <li>• Extremely fibrous, chewy and rubbery</li> </ul>
<b>Overall Quality</b>	<b>4 (Just Acceptable)</b>

## **APPENDIX 10**

**CCFRA Technology Limited**

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Date: 11<sup>th</sup> October 2007

**DEPARTMENT OF CONSUMER & SENSORY SCIENCE**

**CONFIDENTIAL REPORT**

**SENSORY QUALITY EVALUATION  
OF HIGH PRESSURE PROCESSED MACKEREL**

Report No. S/REP/95900/9a

This report, Ref. No. S/REP/95900/9a, dated 11<sup>th</sup> October 2007, supersedes the previous report Ref. No. S/REP/95900/9, dated 8<sup>th</sup> August 2007. Amendments have been made to page 5 regarding correction to the Sensory Quality Assessment graph..

Prepared by : Sue Burling

Checked &  
authorised by :

Name : Peter Burgess

<b>Authorised Signatories:</b>	P. Burgess	Head of Department
	S. Purcell	Sensory Projects Group Manager
	E. Allchurch	Data Analyst

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## SUMMARY

The aim of the project was to understand the effect of High Pressure Processing (HPP) on the sensory quality of a variety of fish and shellfish species.

Each species was subjected to a range of pressure/time/temperature combinations and a selection of samples were then evaluated to determine the effect on the sensory quality in terms of appearance, odour, flavour and texture.

This report details the results for Mackerel.

## SAMPLE INFORMATION

Date samples received: 20th July 2007

Condition on receipt: Good

Storage conditions: Chilled

Date samples tested: 20th July 2007

<b>FMT Label</b>	<b>Pressure (MPa)</b>	<b>Time (mins)</b>	<b>Temp (°C)</b>
Control	n/a	n/a	n/a
Run 1	400	5	n/a
Run 2	200	2.5	20.5
Run 3	600	2.5	20.7
Run 4	400	2.5	21.3
Run 5	400	2.5	20.4
Run 6	400	2.5	23.3

## **SAMPLE PREPARATION**

Each sample was received from the FMT department raw and evaluated uncooked. The sample was then directly placed in a steamer, over a litre of boiling water in the base and steamed for 4.5 minutes.

## **MATERIALS AND METHODS**

### **Sensory Quality Grading (TES-S-021)**

For each evaluation one fillet was assessed. All samples were presented under three-digit code to a panel of three experienced sensory assessors.

Each assessor independently described the uncooked appearance and odour and awarded an overall quality grade for the raw sample (using the scale shown below). The sample was then steamed and the assessors described the appearance, odour, flavour and texture/mouthfeel and awarded a quality grade for the cooked assessment. The consensus scores were calculated and the individual comments combined.

### **Assessment Scale – Sensory Quality**

9	Excellent Quality
8	Very Good Quality
7	Good Quality
6	Fairly Good Quality
5	Satisfactory Quality
4	Just Acceptable Quality
3	Poor Quality
2	Very Poor Quality
1	Bad Quality

## RESULTS AND DISCUSSION

A summary of the grades awarded are detailed in the following table:

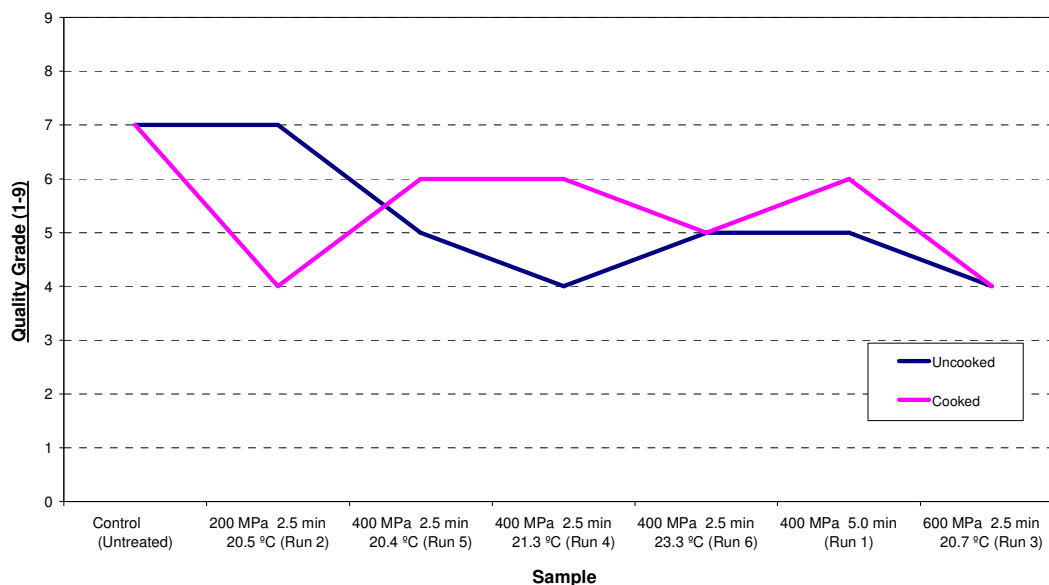
Sample Name	Treatment Details	Uncooked Quality Grade	Cooked Quality Grade
Control	Untreated	7	7
Run 1	400 MPa 5.0 min	5	6
Run 2	200 MPa 2.5 min 20.5 °C	7	4
Run 3	600 MPa 2.5 min 20.7 °C	4	4
Run 4	400 MPa 2.5 min 21.3 °C	4	6
Run 5	400 MPa 2.5 min 20.4 °C	5	6
Run 6	400 MPa 2.5 min 23.3 °C	5	5

The weights were recorded before and after cooking, and the % weight loss calculated.

Sample Name	Treatment Details	Weight Raw (g)	Weight Cooked (g)	Weight Loss (g)	% Weight Loss
Control	N/A	91.8	76.9	14.9	16.2
Run 1	400 MPa 5.0 min	68.4	61.6	6.8	9.9
Run 2	200 MPa 2.5 min 20.5 °C	111.8	97.7	14.1	12.6
Run 3	600 MPa 2.5 min 20.7 °C	97.1	83.1	14	14.4
Run 4	400 MPa 2.5 min 21.3 °C	78.7	67	11.7	14.9
Run 5	400 MPa 2.5 min 20.4 °C	92	85.8	6.2	6.7
Run 6	400 MPa 2.5 min 23.3 °C	84.7	76.2	8.5	10.0

The following graph shows both the uncooked and cooked assessment scores for ascending pressure treatments.

### Mackerel Sensory Quality Assessment



For the uncooked assessment only the Run 2 sample was graded as high as the control, being bright and moist, with very little loss of shape. Run 3 and Run 4 were graded the lowest, with very dense flesh, and little defined flake structure.

For the cooked assessment none of the samples were graded as high as the Control, which was bright and moist, with a well-balanced, typically oily flavour. Run 1, Run 4 and Run 5 were graded the highest, with moderately bright flesh, and expected balanced flavour, with only slight acidity. Run 2 and Run 3 were graded the lowest, being less bright, with some loss of shape. The Run 2 sample had a dry, open appearance, and the Run 3 sample was very dense and compressed.



## **APPENDIX**

### *Individual Comments and Quality Grades for the Raw and Cooked Assessments*

	<b>Raw Assessment Control</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Moderately bright</li> <li>• Moderately moist</li> <li>• Moderately cloudy flesh, moderately pink/beige-brown in colour</li> <li>• Skin bright and shiny with high definition of markings</li> <li>• Moderate flake definition, some bones visible</li> <li>• Very slight shape loss</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Moderate mackerel odour</li> </ul>
<b>Overall Quality</b>	<b>7 (Good)</b>

	<b>Cooked Assessment Control</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Moderately bright</li> <li>• Moderately pink/beige with slight grey/brown tints</li> <li>• Very slight shape loss</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Moderate mackerel odour</li> </ul>
<b>Flavour</b>	<ul style="list-style-type: none"> <li>• Moderate mackerel flavour, slightly oily</li> <li>• Slightly sweet</li> <li>• Slightly salty</li> </ul>
<b>Texture/Mouthfeel</b>	<ul style="list-style-type: none"> <li>• Moderately firm bite</li> <li>• Moderately moist</li> <li>• Slightly fibrous</li> </ul>
<b>Overall Quality</b>	<b>7 (Good)</b>

	<b>Raw Assessment 400 MPa 5.0 min (Run 1)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Moderately bright</li> <li>• Moderately moist</li> <li>• Dense, cooked appearance</li> <li>• Moderately cloudy flesh, pale pink/beige-brown in colour</li> <li>• Skin bright and shiny with moderate definition of markings</li> <li>• Very low flake definition, no bones visible</li> <li>• Very slight shape loss</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Moderate mackerel odour</li> </ul>
<b>Overall Quality</b>	<b>5 (Satisfactory)</b>

	<b>Cooked Assessment 400 MPa 5.0 min (Run 1)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Moderately bright</li> <li>• Slightly pink/beige with moderate grey/brown tints</li> <li>• Very slight shape loss with a compressed appearance</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Moderate mackerel odour</li> </ul>
<b>Flavour</b>	<ul style="list-style-type: none"> <li>• Moderate mackerel flavour, moderately oily</li> <li>• Slightly sweet</li> <li>• Slightly salty and acidic</li> </ul>
<b>Texture/Mouthfeel</b>	<ul style="list-style-type: none"> <li>• Moderately firm bite</li> <li>• Slightly moist</li> <li>• Moderately fibrous</li> </ul>
<b>Overall Quality</b>	<b>6 (Fairly Good)</b>

	<b>Raw Assessment</b> <b>200 MPa 2.5 min 20.5 °C (Run 2)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Moderately bright</li> <li>• Moderately moist</li> <li>• Moderately cloudy flesh, pink/beige-brown in colour</li> <li>• Skin bright and shiny with high definition of markings</li> <li>• Moderate flake definition, some bones visible</li> <li>• Very slight shape loss</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Moderate mackerel odour</li> </ul>
<b>Overall Quality</b>	<b>7 (Good)</b>

	<b>Cooked Assessment</b> <b>200 MPa 2.5 min 20.5 °C (Run 2)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Moderately bright</li> <li>• Slightly pink/beige with moderate grey/brown tints</li> <li>• Very slight shape loss with a dry open appearance</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Moderate mackerel odour</li> </ul>
<b>Flavour</b>	<ul style="list-style-type: none"> <li>• Moderate mackerel flavour, moderately oily</li> <li>• Slightly sweet</li> <li>• Slightly salty and acidic</li> </ul>
<b>Texture/Mouthfeel</b>	<ul style="list-style-type: none"> <li>• Moderately firm bite</li> <li>• Moderately moist</li> <li>• Moderately fibrous</li> </ul>
<b>Overall Quality</b>	<b>4 (Just Acceptable)</b>

	<b>Raw Assessment</b> <b>600 MPa 2.5 min 20.7 °C (Run 3)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Slightly bright</li> <li>• Slightly moist</li> <li>• Dense, cooked appearance with scum deposits</li> <li>• Moderately cloudy flesh, orange/beige-brown in colour</li> <li>• Skin dull with low definition of markings</li> <li>• Very low flake definition, no bones visible</li> <li>• Slight shape loss</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Low mackerel odour</li> </ul>
<b>Overall Quality</b>	<b>4 (Just Acceptable)</b>

	<b>Cooked Assessment</b> <b>600 MPa 2.5 min 20.7 °C (Run 3)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Slightly bright</li> <li>• Slightly pink/beige with moderate grey/brown tints</li> <li>• Moderate shape loss with a dense appearance</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Moderate mackerel odour</li> </ul>
<b>Flavour</b>	<ul style="list-style-type: none"> <li>• Moderate mackerel flavour, moderately oily</li> <li>• Slightly sweet</li> <li>• Slightly salty and acidic</li> </ul>
<b>Texture/Mouthfeel</b>	<ul style="list-style-type: none"> <li>• Moderately firm bite</li> <li>• Moderately moist</li> <li>• Moderately fibrous</li> </ul>
<b>Overall Quality</b>	<b>4 (Just Acceptable)</b>

	<b>Raw Assessment</b> <b>400 MPa 2.5 min 21.3 °C (Run 4)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Slightly bright</li> <li>• Moderately moist</li> <li>• Dense, cooked appearance with scum deposits</li> <li>• Moderately cloudy flesh, pale pink/beige-brown in colour</li> <li>• Skin bright and shiny with moderate definition of markings</li> <li>• Very low flake definition, no bones visible</li> <li>• Very slight shape loss</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Low mackerel odour</li> </ul>
<b>Overall Quality</b>	<b>4 (Just Acceptable)</b>

	<b>Cooked Assessment</b> <b>400 MPa 2.5 min 21.3 °C (Run 4)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Moderately bright</li> <li>• Slightly pink/beige with moderate grey/brown tints</li> <li>• Very slight shape loss with a compressed appearance</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Moderate mackerel odour</li> </ul>
<b>Flavour</b>	<ul style="list-style-type: none"> <li>• Moderate mackerel flavour, moderately oily</li> <li>• Slightly sweet</li> <li>• Slightly salty and acidic</li> </ul>
<b>Texture/Mouthfeel</b>	<ul style="list-style-type: none"> <li>• Moderately firm bite</li> <li>• Slightly moist</li> <li>• Moderately fibrous</li> </ul>
<b>Overall Quality</b>	<b>6 (Fairly Good)</b>

	<b>Raw Assessment</b> <b>400 MPa 2.5 min 20.4 °C (Run 5)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Moderately bright</li> <li>• Moderately moist</li> <li>• Dense, cooked appearance</li> <li>• Moderately cloudy flesh, pale pink/beige-brown in colour</li> <li>• Skin bright and shiny with moderate definition of markings</li> <li>• Very low flake definition, no bones visible</li> <li>• Very slight shape loss</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Moderate mackerel odour</li> </ul>
<b>Overall Quality</b>	<b>5 (Satisfactory)</b>

	<b>Cooked Assessment</b> <b>400 MPa 2.5 min 20.4 °C (Run 5)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Moderately bright</li> <li>• Slightly pink/beige with moderate grey/brown tints</li> <li>• Very slight shape loss with a compressed appearance</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Moderate mackerel odour</li> </ul>
<b>Flavour</b>	<ul style="list-style-type: none"> <li>• Moderate mackerel flavour, moderately oily</li> <li>• Slightly sweet</li> <li>• Slightly salty and acidic</li> </ul>
<b>Texture/Mouthfeel</b>	<ul style="list-style-type: none"> <li>• Moderately firm bite</li> <li>• Slightly moist</li> <li>• Moderately fibrous</li> </ul>
<b>Overall Quality</b>	<b>6 (Fairly Good)</b>

	<b>Raw Assessment</b> <b>400 MPa 2.5 min 23.3 °C (Run 6)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Moderately bright</li> <li>• Moderately moist</li> <li>• Dense, cooked appearance</li> <li>• Moderately cloudy flesh, pale pink/beige-brown in colour</li> <li>• Skin bright and shiny with moderate definition of markings</li> <li>• Very low flake definition, no bones visible</li> <li>• Very slight shape loss</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Moderate mackerel odour</li> </ul>
<b>Overall Quality</b>	<b>5 (Satisfactory)</b>

	<b>Cooked Assessment</b> <b>400 MPa 2.5 min 23.3 °C (Run 6)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Slightly bright</li> <li>• Slightly pink/beige with moderate grey/brown tints</li> <li>• Slight shape loss with a compressed appearance</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Moderate mackerel odour</li> </ul>
<b>Flavour</b>	<ul style="list-style-type: none"> <li>• Moderate mackerel flavour, moderately oily</li> <li>• Slightly sweet</li> <li>• Slightly salty and acidic</li> </ul>
<b>Texture/Mouthfeel</b>	<ul style="list-style-type: none"> <li>• Moderately firm bite</li> <li>• Slightly moist</li> <li>• Moderately fibrous</li> </ul>
<b>Overall Quality</b>	<b>5 (Satisfactory)</b>



## **APPENDIX 11**

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Date: 12th October 2007

**DEPARTMENT OF CONSUMER & SENSORY SCIENCE**

**CONFIDENTIAL REPORT**

**SENSORY QUALITY EVALUATION  
OF HIGH PRESSURE PROCESSED COD**

Report No. S/REP/95900/11

Prepared by : Sue Burling

Checked &  
authorised by :

Name : Peter Burgess

**Authorised Signatories:**

P. Burgess	Head of Consumer & Sensory Science Department
S. Purcell	Sensory Projects Group Manager
E. Allchurch	Data Analyst

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## SUMMARY

The aim of the project was to understand the effect of High Pressure Processing (HPP) on the sensory quality of a variety of fish and shellfish species.

Each species was subjected to a range of pressure/time/temperature combinations and a selection of samples was then evaluated to determine the effect on the sensory quality in terms of appearance, odour, flavour and texture.

This report details the results for Cod.

## SAMPLE INFORMATION

Date samples received: 25th September 2007

Condition on receipt: Good

Storage conditions: Chilled

Date samples tested: 25th September 2007

<b>FMT Label</b>	<b>Pressure (MPa)</b>	<b>Time (mins)</b>	<b>Temp (°C)</b>
Control	n/a	n/a	n/a
Run 1	400	5	13
Run 2	200	2.5	12.8
Run 3	600	2.5	10.9
Run 4	400	2.5	12.4
Run 5	400	2.5	11.3
Run 6	400	2.5	11

## **SAMPLE PREPARATION**

Each sample was received from the FMT department raw and evaluated uncooked. The sample was then directly placed in a steamer, over 700 ml of boiling water in the base and steamed for 5 minutes.

## **MATERIALS AND METHODS**

### **Sensory Quality Grading (TES-S-021)**

For each evaluation one cod fillet was assessed. All samples were presented under three-digit code to a panel of three experienced sensory assessors.

Each assessor independently described the uncooked appearance and odour and awarded an overall quality grade for the raw sample (using the scale shown below). The sample was then steamed and the assessors described the appearance, odour, flavour and texture/mouthfeel and awarded a quality grade for the cooked assessment. The consensus scores were calculated and the individual comments combined.

### **Assessment Scale – Sensory Quality**

9	Excellent Quality
8	Very Good Quality
7	Good Quality
6	Fairly Good Quality
5	Satisfactory Quality
4	Just Acceptable Quality
3	Poor Quality
2	Very Poor Quality
1	Bad Quality

## RESULTS AND DISCUSSION

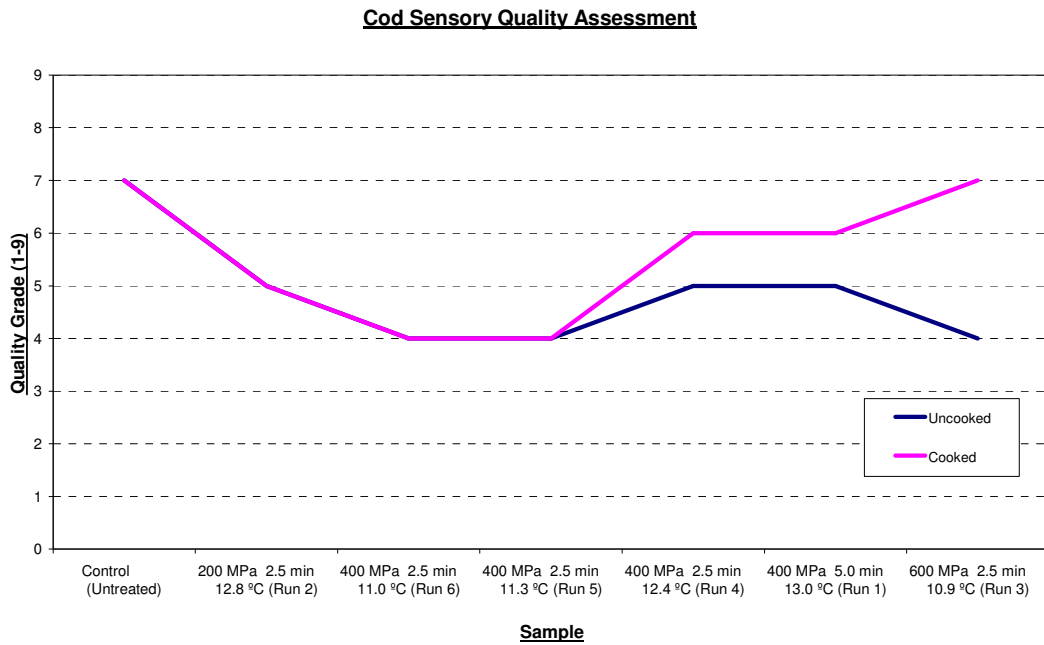
A summary of the grades awarded are detailed in the following table:

Sample Name	Treatment Details	Uncooked Quality Grade	Cooked Quality Grade
Control	Untreated	7	7
Run 1	400 MPa 5 min 13 °C	5	6
Run 2	200 MPa 2.5 min 12.8 °C	5	5
Run 3	600 MPa 2.5 min 10.9 °C	4	7
Run 4	400 MPa 2.5 min 12.4 °C	5	6
Run 5	400 MPa 2.5 min 11.3 °C	4	4
Run 6	400 MPa 2.5 min 11 °C	4	4

The weights were recorded before and after cooking, and the % weight loss calculated.

Sample Name	Treatment Details	Weight Raw (g)	Weight Cooked (g)	Weight Loss (g)	% Weight Loss
Control	N/A	112.5	93.9	18.6	16.5
Run 1	400 MPa 5 min 13 °C	105.2	95.3	9.9	9.4
Run 2	200 MPa 2.5 min 12.8 °C	100.1	90.2	9.9	9.9
Run 3	600 MPa 2.5 min 10.9 °C	118.6	101.9	16.7	14.1
Run 4	400 MPa 2.5 min 12.4 °C	128.0	118.7	9.3	7.3
Run 5	400 MPa 2.5 min 11.3 °C	129.4	114.6	14.8	11.4
Run 6	400 MPa 2.5 min 11 °C	134.7	123.8	10.9	8.1

The following graph shows both the uncooked and cooked assessment scores for ascending pressure treatments.



NB. Data points for the Uncooked Scores of the Control, Run 2, Run 6 and Run 5 samples are hidden by those of the Cooked Scores.

For the uncooked assessment, none of the samples were graded as high as the Control which was bright and moist, with good retention of fillet shape. Run 3, Run 5 and Run 6 were graded the lowest, with moderate loss of brightness and little defined flake structure.

For the cooked assessment, only Run 3 was graded as high as the control, being moist with well defined flakes, and a well-balanced flavour and soft, moist texture. Run 5 and Run 6 were graded the lowest having a drier appearance. Run 5 also had a firm, dry, fibrous texture and Run 6 had acidic and bitter notes in the flavour.

# **APPENDIX**

*Individual Comments and Quality Grades  
for the Raw and Cooked Assessments*

	<b>Raw Assessment Control</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Moderately bright</li> <li>• Moderately moist</li> <li>• Pale off-white flesh with grey/brown tints</li> <li>• Skin bright and shiny, silver grey with gold flecks</li> <li>• Dense flesh</li> <li>• Good retention of fillet shape</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Moderate fresh cod odour</li> </ul>
<b>Overall Quality</b>	<b>7 (Good)</b>

	<b>Cooked Assessment Control</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Slight loss of brightness</li> <li>• White flesh with slight grey tints</li> <li>• Slightly open structure</li> <li>• Moist, flakes well</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Moderate fresh cod odour</li> </ul>
<b>Flavour</b>	<ul style="list-style-type: none"> <li>• Slightly weak cod flavour</li> <li>• Slightly sweet</li> <li>• Slightly salty</li> </ul>
<b>Texture/Mouthfeel</b>	<ul style="list-style-type: none"> <li>• Slightly soft bite</li> <li>• Moderately moist</li> <li>• Slightly fibrous</li> </ul>
<b>Overall Quality</b>	<b>7 (Good)</b>



	<b>Raw Assessment 400 MPa 5 min 13 °C (Run 1)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Slight loss of brightness</li> <li>• Moderately moist</li> <li>• White flesh with slight pink tints and a cooked 'opaque' appearance</li> <li>• Skin slightly dull with slight shrinkage</li> <li>• Dense flesh with retained packaging shape</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Moderate fresh cod odour</li> </ul>
<b>Overall Quality</b>	<b>5 (Satisfactory)</b>

	<b>Cooked Assessment 400 MPa 5 min 13 °C (Run 1)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Moderately bright</li> <li>• White flesh</li> <li>• Slight protein cook out</li> <li>• Moist, slightly soft when separated</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Moderate fresh cod odour</li> </ul>
<b>Flavour</b>	<ul style="list-style-type: none"> <li>• Moderate cod flavour</li> <li>• Slightly sweet</li> <li>• Slightly salty</li> <li>• Slightly acidic</li> </ul>
<b>Texture/Mouthfeel</b>	<ul style="list-style-type: none"> <li>• Moderately firm bite</li> <li>• Moderately moist</li> <li>• Slightly fibrous</li> </ul>
<b>Overall Quality</b>	<b>6 (Fairly Good)</b>

	<b>Raw Assessment</b> <b>200 MPa 2.5 min 12.8 °C (Run 2)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Moderate loss of brightness</li> <li>• Slightly moist</li> <li>• White flesh with slight green tints and some small white spots visible</li> <li>• Skin dull and dry, with some slightly slimy and bloody patches</li> <li>• Good retention of shape</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Moderate fresh cod odour</li> </ul>
<b>Overall Quality</b>	<b>5 (Satisfactory)</b>

	<b>Cooked Assessment</b> <b>200 MPa 2.5 min 12.8 °C (Run 2)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Slight loss of brightness</li> <li>• White flesh with slight grey tints</li> <li>• Slightly open structure</li> <li>• Very moist, flakes fairly well</li> <li>• Very slight protein cook out</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Moderate fresh cod odour</li> </ul>
<b>Flavour</b>	<ul style="list-style-type: none"> <li>• Moderate cod flavour</li> <li>• Slightly sweet</li> <li>• Slightly salty</li> <li>• Moderately acidic/sour</li> <li>• Slightly harsh/bitter</li> </ul>
<b>Texture/Mouthfeel</b>	<ul style="list-style-type: none"> <li>• Moderately firm bite</li> <li>• Moderately moist</li> <li>• Moderately fibrous</li> <li>• Slightly chewy</li> </ul>
<b>Overall Quality</b>	<b>5 (Satisfactory)</b>

	<b>Raw Assessment</b> <b>600 MPa 2.5 min 10.9 °C (Run 3)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Moderate loss of brightness</li> <li>• Moderately moist</li> <li>• Milky 'cooked' appearance with moderate pink tints</li> <li>• Skin slightly dull with slight shrinkage</li> <li>• Dense flesh with retained packaging shape</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Moderate fresh cod odour</li> </ul>
<b>Overall Quality</b>	<b>4 (Just Acceptable)</b>

	<b>Cooked Assessment</b> <b>600 MPa 2.5 min 10.9 °C (Run 3)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Slight loss of brightness</li> <li>• White flesh with slight grey tints</li> <li>• Slightly open structure</li> <li>• Moist, flakes fairly well</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Moderate fresh cod odour</li> </ul>
<b>Flavour</b>	<ul style="list-style-type: none"> <li>• Moderate cod flavour</li> <li>• Slightly sweet</li> <li>• Slightly salty</li> </ul>
<b>Texture/Mouthfeel</b>	<ul style="list-style-type: none"> <li>• Slightly soft bite</li> <li>• Moderately moist</li> <li>• Slightly fibrous</li> </ul>
<b>Overall Quality</b>	<b>7 (Good)</b>

	<b>Raw Assessment 400 MPa 2.5 min 12.4 °C (Run 4)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Moderately bright</li> <li>• Moderately moist</li> <li>• Milky 'cooked' appearance with slight yellow tints and some white spots</li> <li>• Skin slightly dull and wrinkled</li> <li>• Dense flesh with retained packaging shape</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Moderate fresh cod odour</li> </ul>
<b>Overall Quality</b>	<b>5 (Satisfactory)</b>

	<b>Cooked Assessment 400 MPa 2.5 min 12.4 °C (Run 4)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Moderately bright</li> <li>• White flesh</li> <li>• Good shape retention</li> <li>• Moist, flakes well</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Moderate fresh cod odour</li> </ul>
<b>Flavour</b>	<ul style="list-style-type: none"> <li>• Moderate cod flavour</li> <li>• Slightly sweet</li> <li>• Slightly salty</li> <li>• Slightly acidic, slightly harsh</li> </ul>
<b>Texture/Mouthfeel</b>	<ul style="list-style-type: none"> <li>• Slightly soft bite</li> <li>• Moderately moist</li> <li>• Slightly fibrous</li> </ul>
<b>Overall Quality</b>	<b>6 (Fairly Good)</b>

	<b>Raw Assessment</b> <b>400 MPa 2.5 min 11.3 °C (Run 5)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Moderate loss of brightness</li> <li>• Moderately dry</li> <li>• Milky 'cooked' appearance with slight grey/green tints</li> <li>• Skin slightly dull and wrinkled</li> <li>• Dense flesh with retained packaging shape</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Moderate fresh cod odour</li> </ul>
<b>Overall Quality</b>	<b>4 (Just Acceptable)</b>

	<b>Cooked Assessment</b> <b>400 MPa 2.5 min 11.3 °C (Run 5)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Slight loss of brightness</li> <li>• Creamy white flesh with beige and orange tints</li> <li>• Good shape retention</li> <li>• Some dry patches</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Moderate fresh cod odour</li> </ul>
<b>Flavour</b>	<ul style="list-style-type: none"> <li>• Moderate cod flavour</li> <li>• Slightly sweet</li> <li>• Slightly salty</li> <li>• Slightly savoury</li> </ul>
<b>Texture/Mouthfeel</b>	<ul style="list-style-type: none"> <li>• Moderately firm bite</li> <li>• Slightly dry</li> <li>• Moderately fibrous</li> <li>• Slightly chewy</li> </ul>
<b>Overall Quality</b>	<b>4 (Just Acceptable)</b>

	<b>Raw Assessment 400 MPa 2.5 min 11 °C (Run 6)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Moderate loss of brightness</li> <li>• Moderately dry</li> <li>• Milky 'cooked' appearance</li> <li>• Skin slightly dull and wrinkled</li> <li>• Dense flesh with retained packaging shape</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Moderate fresh cod odour</li> </ul>
<b>Overall Quality</b>	<b>4 (Just Acceptable)</b>

	<b>Cooked Assessment 400 MPa 2.5 min 11 °C (Run 6)</b>
<b>Appearance</b>	<ul style="list-style-type: none"> <li>• Slight loss of brightness</li> <li>• White flesh with grey tints</li> <li>• Slightly open structure</li> <li>• Slightly dry in patches, flakes well</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li>• Moderate fresh cod odour</li> </ul>
<b>Flavour</b>	<ul style="list-style-type: none"> <li>• Moderate cod flavour</li> <li>• Very slightly sweet</li> <li>• Slightly salty</li> <li>• Slightly acidic and slightly bitter</li> </ul>
<b>Texture/Mouthfeel</b>	<ul style="list-style-type: none"> <li>• Slightly soft bite</li> <li>• Moderately moist</li> <li>• Moderately fibrous</li> </ul>
<b>Overall Quality</b>	<b>4 (Just Acceptable)</b>