Monitoring quality and safety through seafood supply chains: issues and opportunities.

Dr Janet Howieson
Outline of presentation

• Objectives of the study
• Methods
• Results and Interventions
  – Temperature monitoring
  – Quality (Shelf-life/microbiology and sensory methods)
  – Drip loss
  – Traceability
  – Waste
• Research into practice: Developing a national prawn QA program
Objectives

• Use whole of chain (harvest to retail) monitoring to identify interventions that may improve profitability
  – Increase shelf-life/improve quality
  – Minimise waste
• Implement appropriate interventions and evaluate impact.
• Develop some generic whole of chain principles and methodologies that could be applied to all seafood supply chains
1. Select target supply chains (Cooperation/willingness/interest from industry partners).
2. Test for optimal performance of target species under defined laboratory conditions.
3. To monitor pilot chains from catch through processing to retail.
   - Temperature (continuous logging)
   - Quality (Microbiology (shelf-life) and Quality Index)
   - Drip loss/weight
   - Life cycle assessment (carbon footprint)
   - Provenance /traceability
4. Identify problem areas and recommend and implement interventions.

Methods: Seafood Supply chain analyses
Map the Chain: Australian Farmed Barramundi
Examples of Trials
Quality of Seafood Changes on Storage:
How do we measure quality changes: microbiology, sensory (quality index, torry scheme).

**ROSY THREADFIN BREAM**
*(Neophron furcatus)* Whole, gut in

**Day 3**
- **Skin**: bright iridescent colour, fine moist and translucent
- **Eyes**: flat, clear, black pupils
- **Gills**: bright red, transparent mucus
- **Score**: 5-6

**Day 10**
- **Skin**: iridescent colour, fine moist and translucent
- **Eyes**: flat, cloudy, black pupils
- **Gills**: dull red, white/milky mucus
- **Score**: 5-9

Day 17
- **Skin**: paler, blue and colour, dry fins
- **Eyes**: clearer, very cloudy pupils
- **Gills**: pale red, slightly white
- **Score**: 6-8

Day 24
- **Skin**: dark, dull skin, dry fins
- **Eyes**: clear, very cloudy pupils
- **Gills**: dull red, white/milky mucus
- **Score**: 13-15
### QI score sheet for cooked King Prawns

<table>
<thead>
<tr>
<th>Quality</th>
<th>Parameter</th>
<th>Description</th>
<th>SCORE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical</td>
<td>Colour/appearance</td>
<td>high sheen / bright &amp; iridescent</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>dull</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>faded / pink sheen</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Shell feel</td>
<td>smooth</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>sandpaper</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Head</td>
<td>firmly attached</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>slightly drooped or loose</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>loose / membrane broken</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Eyes</td>
<td>dull black / charcoal / evenly bulbous</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>mottled / slightly sunken</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>dull / mottled / sunken</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Melanosis</td>
<td>no melanosis</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>melanosis present</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Gills</td>
<td>white / pink tinge</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>slight grey</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>dark grey</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Odour</td>
<td>fresh sea</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>neutral / slightly off</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>stale / musty / off / ammonia</td>
<td>2</td>
</tr>
<tr>
<td>Eating</td>
<td>Flesh texture</td>
<td>springy / firm</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Initial bite</td>
<td>slightly soft</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>soft</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Flesh texture</td>
<td>springy / firm</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>After chewing</td>
<td>soft</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>tough / chewy / fibrous</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Flesh flavour</td>
<td>fresh prawn / sweet</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>bland / minimal prawn flavour</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>no flavour</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>off flavours</td>
<td>3</td>
</tr>
</tbody>
</table>

#### Quality Index

0-19
Temperature logging: on board and processing/transport
Temperature logging: seafood retail stores

Storage of prawns at retail outlet (cooked product - 2)

Storage in retail cabinet during the day
Logger retrieved

Prawns stored on bench during set up
Logger inserted

Storage in retail cabinet during the day
Overnight storage in cool room

Length and Time of Storage

Retail- MG Kailis (raw)

Length and Time of Storage

Temperature (°C)
Quality: Finfish whole fish and fillets

Fillet shelf-life is variable (Day 5-Day 10 based on SPC of $10^6$) and is statistically correlated to initial bacterial load on whole fish.
Microbiological analysis: Finfish fillets

**Total Viable Counts**

<table>
<thead>
<tr>
<th>Period of chilled storage (days)</th>
<th>Total Viable Count (CFU/g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.E+07</td>
</tr>
<tr>
<td>3</td>
<td>1.E+08</td>
</tr>
<tr>
<td>5</td>
<td>1.E+10</td>
</tr>
</tbody>
</table>

- **Barramundi**
- **Atlantic Salmon**
- **Blue Spotted Emperor**
- **Saddletail Snapper**
- **Crimson Snapper**
Is TVC an effective indicator of fish spoilage?
Drip loss

Drip loss insignificant in whole fish.

Drip loss in fillets on retail display
Traceability: Implementing traceability from point of harvest to retail.
Waste Utilisation

![Image of fish fillets and meat slices]

![Bar chart showing percentage of meat from fish frames]

Percentage of meat from fish frames:
- Crimson snapper: 35.0%
- Blue spot emperor: 30.0%
- Saddletail: 25.0%
- Painted sweetlips bream: 20.0%
Supply Chain Analyses Outcomes

- Improved cool chain performance
- Increased shelf-life (handling, processing including sanitisers)
- Drip loss decreased
- Ability to monitor through chain (between partners) and hence improve relationships
- Alternative revenue streams (new products and/or use of waste?)
- Repositioning in the market place due to supplying a better quality product or a product that better meets end-user specs
- Confidence in traceability/provenance
- Change in end-user specifications
- INCREASED PROFITABILITY???
Research into Practice: An Australian prawn quality assurance program

- Define end-users: fishers, processors, retailers/food service, consumers
- Define agreed quality parameters
- Define agreed ways to assess parameters
- Develop best practice docs etc to meet parameters
- Pilot training programs and evaluation
Thanks

More information

Janet Howieson
Centre of Excellence for Science, Seafood and Health
Curtin University
j.howieson@curtin.edu.au.
Current Issues for the Seafood Industry

a. CoOL in food service

a. Substitution of product