Observations on the welfare of fish released from demersal trawls

Mike Breen
Institute of Marine Research, Bergen, Norway

Presented at:
Flanders Marine Institute (VLIZ)
29th November 2019
Observations on the welfare of fish released from demersal trawls

Mike Breen
Institute of Marine Research, Bergen, Norway

Presented at: Flanders Marine Institute (VLIZ) 29th November 2019
Demersal trawl: behavioural responses of fish during capture

Zone 1 – Auditory dominated stimuli
- Orientation and optomotor response in the mouth of the net
- Increasing risk of fatigue, contact and crowding towards end of net
- Avoidance of vessel generated noise
- Avoidance of visible gear components

Zone 2 – Mostly visual stimuli

Zone 3 – Visual stimuli, physical contact, crowding & fatigue
- Increasing risk of fatigue, contact and crowding towards end of net

(Breen, 2004; after Godø, 1992)
Capture & Release Stressors

Based on Davis (2002)

- Air Temperature
- Air Exposure
- Sea Conditions
- Elevated Seawater Temperature
- Seawater Temperature
- Thermocline
- Mode of Capture
- Catch Size & Composition
- Biological Factors: Species, Size, Condition & Swimbladder
- Depth
- Delayed Mortality
- Cumulative Stress

Predation
- Seabird
- Predation

Light Conditions
- Handling

Mortality

Biological Factors
Species, Size, Condition & Swimbladder

Sea Conditions
- Air Exposure
- Sea Conditions
- Elevated Seawater Temperature
- Seawater Temperature
- Thermocline
- Mode of Capture
- Catch Size & Composition
- Biological Factors: Species, Size, Condition & Swimbladder
- Depth
- Delayed Mortality
- Cumulative Stress

Predation
- Seabird
- Predation

Light Conditions
- Handling

Mortality

Biological Factors
Species, Size, Condition & Swimbladder

Sea Conditions
- Air Exposure
- Sea Conditions
- Elevated Seawater Temperature
- Seawater Temperature
- Thermocline
- Mode of Capture
- Catch Size & Composition
- Biological Factors: Species, Size, Condition & Swimbladder
- Depth
- Delayed Mortality
- Cumulative Stress

Predation
- Seabird
- Predation

Light Conditions
- Handling

Mortality

Biological Factors
Species, Size, Condition & Swimbladder
Introduction

• From 1980’s onwards a drive for “sustainability” in trawl fisheries
  • Most recently: EU Landing Obligation
• Main objective: reduce unwanted catch (i.e. “discards”).
• Main tactic: technical measures to improve “Selectivity”.
Introduction – the “Forgotten Many”

- Majority of fish encountering a trawl => escape

Do they survive?

Area: North Sea
Mesh size: 110mm
MLS: 30cm

(Breen, 2004)
Introduction – the “Forgotten Many”

From 1987 - 2007

Methods developed for estimating escapee survival from codends

- Main & Sangster, 1987, 1991;
- Robinson et al, 1993;
- Suuronen et al, 1995, 1996;
- Sangster et al, 1996;
- Wileman et al, 1999;
- Ingolfsson et al, 2002;

Primary aim: estimate “unaccounted mortality”

Secondary: understand / mitigate causes of mortality

(Suuronen et al, 2002)
Introduction

Whiting – *Merlangius merlangus*

Haddock – *Melanogrammus aeglefinus*
Experimental Design

In each experimental period:

- Codend escapes (100mm, diamond mesh) \( \times 3 \)
- Experimental Control (No codend) \( \times 3 \)
- Captivity Control (Trap caught) \( \times 3 \)
Length Related Mortality

Haddock - Age 0

- Summer 03
- Summer 04
- Summer 03 Control
- Summer 04 Control
- Fitted
Length Related Mortality

**Escapees**
Haddock - Age 1+

<table>
<thead>
<tr>
<th>Length (cm)</th>
<th>0</th>
<th>20</th>
<th>40</th>
<th>60</th>
<th>80</th>
<th>100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mortality (%)</td>
<td>10</td>
<td>15</td>
<td>20</td>
<td>25</td>
<td>30</td>
<td>35</td>
</tr>
</tbody>
</table>

**Experimental Controls**
Haddock - Age 1+

<table>
<thead>
<tr>
<th>Length (cm)</th>
<th>0</th>
<th>20</th>
<th>40</th>
<th>60</th>
<th>80</th>
<th>100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mortality (%)</td>
<td>10</td>
<td>15</td>
<td>20</td>
<td>25</td>
<td>30</td>
<td>35</td>
</tr>
</tbody>
</table>

- Summer 03
- Spring 04
- Summer 04
Injuries

b) Injuries to Skin

- Contusions
- Lesions
- Lacerations
- Uninjured

Proportion of Specimens

Dead Fish
Survivors
Injuries
Surface Escape Mortality

Surface Escape - Age 0

Mortality (%) vs Length (cm)

- Blue squares: At Depth
- Red triangles: At Surface
Surface Escape Mortality

Surface Escape - Age 1

Mortality (%) vs Length (cm)

- Control
- At Depth
- At Surface

Length (cm): 10 15 20 25 30
Capture & Release Stressors

Based on Davis (2002)

Capture Delayed Mortality

Air Temperature
Air Exposure
Sea Conditions

Elevated Seawater Temperature

Seawater Temperature

Catch Size & Composition

Biological Factors Species, Size, Condition & Swimbladder

Mode of Capture

Depth

Predation

Cumulative Stress

Delayed Mortality
Recommendations for promoting survival of released unwanted catch (EU Landing Obligation)

- Avoid unwanted catches
- Improve gear selectivity

- Limit duration of fishing operations
- Smaller catch volumes
- Handle with urgency and care
- Avoid direct sunlight
- Avoid emersion (i.e., Removal from water)
- Avoid seabird predation
- Appropriate release location
- Assisted recompression

Breen et al, 2017. MINOUW Deliverable 2.15: Guidance on Promoting Survival of Discarded Fish
Tiaki Modular Harvesting System

• http://www.tiaki.com/#our-story
Cumulative Stress during capture in a trawl

Breen, 2004
Topless trawl
Goal: catch shrimp without herring

84 % less herring (bycatch) 2.5 x more flatfish (bycatch)

He et al. 2007. Design and Test of a Topless Shrimp Trawl to Reduce pelagic fish bycatch in the GOM pink shrimp fishery doi:10.2960/J.v38.m591
Stereoscopic imaging systems to identify and measure fish

Precise catch depth of each fish (research)  (Rosen et al, 2013; Underwood et al, 2014)

SCANTROL Deep Vision: https://www.deepvision.no/
Conclusions

Capture & release from trawls is not benign:
• Surface release / discarding => many compound stressors => mortality
• Release at depth => fewer stressors => lower mortality
  => survivors compromised – injured & fatigued
  => Smallest fish - often most vulnerable to stressors

Strategies for reducing unwanted catches should:
• Avoid / minimise capture related stressors of released animals
• Prioritise avoidance over selective release
  o Avoidance – pre- & early catch monitoring => closed areas.
  o Release at depth – as early in capture process as possible.
  o Release at surface – using modified practices.

Fishers need to want to make these strategies work!
⇒ How can we enable this?
  o Minimise loss of profit (not just marketable catch)
  o Link “Good welfare” with “Quality” & “Added-value”
Thank you!

Tusen, tusen, tusen takk!!