Dehydration in New Zealand fishing vessel crews
Water, water, everywhere,  
And all the boards did shrink;  
Water, water, everywhere,  
Nor any drop to drink.

From ‘Rime of the Ancient Mariner’ by Samuel Taylor Coleridge
Background

• Part of ergonomics scoping assessment considering opportunities to address high rates of musculoskeletal injuries in fishers

• New Zealand an island nation, commercial fishing one of our top five largest export earners

• Fishing one of 5 industry sectors in NZ targeting a reduction in work injuries (with agriculture, forestry, construction, manufacturing)

• 2012 – highest injury rate all sectors; fishing work related injury rate 7.29% (quarrying 4.47%, construction 3.29%); highest ACC injury claim rate per sector; 1 in 4 fishery workers with ACC claim

• Literature Review (Edwin, 2013; ACC funded) suggested focus on manual handling/ergonomics on larger (over 24m) vessels – as linked with more than half vessel injuries
Fisher dehydration testing

• Ergonomics scoping assessment included urine specific gravity testing as:
  – anecdotal reports* suggested high frequency of urinary tract and kidney infections among crew (*not backed up by health centre reports, suggesting that we either ‘heard wrong’ or under-reporting via formal channels)
  – and because of our interest in musculoskeletal injury prevention and work performance

• 49 urine samples were tested (using a refractometer) in the first days of the vessel trip, at varied times during day, shift
Why investigate hydration?

• Dehydration and performance links are well understood (from popular and scientific literature) and include:
  – Cognitive function
  – Fatigue
  – Muscle function and muscle recovery
  – Long term health eg kidney stones, bladder cancer
  – Work capacity:

    1-2% deficit in body weight from sweating etc = 6-7% reduction in physical work capacity

    3-4% deficit in body weight = 22% reduction of physical work capacity. Bates and Schneider (2008 citing Sawka and Pandolf, 1990)
# Initial Hydration Findings

<table>
<thead>
<tr>
<th>Hydration status</th>
<th>Urine Specific Gravity</th>
<th>Percentage of crew</th>
</tr>
</thead>
<tbody>
<tr>
<td>Euhydrated</td>
<td>USG 1.0003 – 1.015</td>
<td>8.2%</td>
</tr>
<tr>
<td>Hypo-hydrated</td>
<td>USG &gt;1.015 – 1.020</td>
<td>8.2%</td>
</tr>
<tr>
<td>Dehydrated</td>
<td>USG &gt;1.020</td>
<td>83.6%</td>
</tr>
<tr>
<td>Clinically dehydrated (as a subset of those that were dehydrated)</td>
<td>USG &gt;1.030</td>
<td>16.3%</td>
</tr>
</tbody>
</table>
Follow-up on-vessel hydration testing

- N = 10
- 8 improved their hydration status (were more conscious of it following discussions)
- But 2 became more dehydrated
Follow-up hydration testing four weeks later - at end of trip

• N = 23
• 12 (52%) improved their hydration status
• 1 (4%) hydration stayed the same
• But 10 (43%) were more dehydrated
Factors impacting on hydration

- Access to clean toilet near factory for female crew
- ‘Hot and dry’ environment on vessel
- Limited access to water near (food hygiene) work areas
- 6, 8, 12 hour shift schedules, fatigue and impact on self-care time
- Some work tasks are very physical and result in increased sweat rates - difficult to manage in chiller/freezer environment
- Historical factors – water stored on boats tasted bad (design factors re: water/fuel tanks)
- Poor knowledge/education re: hydration
- Desalinated water supply (is corrosive, requires remineralisation, attention to adequate electrolytes)
## From the literature

<table>
<thead>
<tr>
<th>Industry group studied</th>
<th>Dehydration with USG/colour measure</th>
<th>Mean hydration with USG measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>NZ fishers (Edwin, 2015)</td>
<td>83.6% dehydrated (USG &gt;1.020),</td>
<td>USG 1.025</td>
</tr>
<tr>
<td>NZ loggers (Parker et al, 2001)</td>
<td>30% dehydrated (USG &gt;1.020)</td>
<td></td>
</tr>
<tr>
<td>South African forest workers (Biggs et al, 2011)</td>
<td>Post shift dehydration (USG &gt;1.020) 64% autumn, 63% winter</td>
<td></td>
</tr>
<tr>
<td>Australian surface/underground miners (Hunt et al, 2013)</td>
<td>71% minimally or significantly dehydrated per urine colour</td>
<td></td>
</tr>
<tr>
<td>Australian underground miners (Polkinghorne et al, 2013)</td>
<td>58% dehydrated (USG &gt;1.020)</td>
<td></td>
</tr>
<tr>
<td>Australian miners/processers (Peiffer and Abbiss, 2013)</td>
<td></td>
<td>USG 1.029 for miners, USG 1.021 for processers.</td>
</tr>
<tr>
<td>Australian fly-in/fly-out minerals workers (Carter and Muller, 2007)</td>
<td></td>
<td>USG 1.022</td>
</tr>
</tbody>
</table>
Hydration!

- Your body is around 60% water
- 1-2% loss of body weight from dehydration = 6-7% reduction in physical work capacity
- 3-4% loss of body weight from dehydration = 22% reduction in physical work capacity (in a hot environment up to 50% reduction)
- Being dehydrated impacts on your work capacity:
  - aerobic performance
  - muscle function, injury risks increase, cramps
  - judgement, memory, concentration, slower reaction times
  - fatigue, recovery after exertion, fainting risks
Still More Hydration!

- Can lose around 1 litre an hour if you are sweating
- Need to replace this with water, electrolytes (sodium/potassium), carbs
- Electrolytes needed to keep muscles and nerves firing, carbs = energy
- Alcohol intake makes you dehydrated – avoid it before getting on vessel or you will start off in a bad way
- Drinking too much water is also dangerous (hyponatraemia) – washes the electrolytes out of your system
- Your urine should be ‘light straw coloured’
<table>
<thead>
<tr>
<th>Hydration Status</th>
<th>Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>Well hydrated</td>
<td>1, 2, 3</td>
</tr>
<tr>
<td>Hydrated but not well</td>
<td>4, 5</td>
</tr>
<tr>
<td>Dehydrated - You need to drink more</td>
<td>6, 7, 8</td>
</tr>
</tbody>
</table>

Check Your Urine
... Even More Hydration!

Sweaty work:

- up to 1.5 hours at a time = plain water ok
- 1.5 - 4 hours = carbs (sugar) and water beverage ok for rehydration (2 tablespoons sugar/litre of water)
- 4+ hours = add a teaspoon of salt per litre to this mix (½ teaspoon salt per cup of liquid)

For USG: (from Joubert and Bates, 2008)

- 1.000 - 1.021 – ok, but keep drinking (low risk)
- 1.022 - 1.026 – under-hydrated, drink 1 litre H2O (moderate risk)
- 1.027 - 1.029 – dehydrated, drink at least 1.5 litre (high risk)
- 1.030+ – clinically dehydrated, stop work and drink water until properly hydrated (several hours) (very high risk)
Summary

• We now understand that dehydration (and musculoskeletal discomfort/injury) among fishers is common and significant
• And we have indications that creating change is both possible and rewarding – via fisher education and healthy work practices
• Further study on the topic could include analysis of intervention effectiveness across wellbeing, performance and productivity measures
• Need to consider the links of dehydration with fatigue and poor decision making in terms of vessel control etc
Water, water, everywhere,
And all the fishers did shrink;
Water, water, everywhere,
Despite enough to drink.

Modified from ‘Rime of the Ancient Mariner’ by Samuel Taylor Coleridge
Acknowledgements:
- The companies of the NZ Fishing Industry Safety Forum
- NZ fishers
- ACC
- AUT University