The search for a noble crayfish diet
• Introduction
  – Aquaculture in Belgium
  – Astaciculture: opportunities & challenges

• Feed trial
  – M&M
  – Results
  – Discussion
  – Conclusion
Aquaculture in Belgium

• No significant production
  – 2011: Belgium: 36-49 tons
    EU: 1.25 million tons

• Cultured species
  – Carp & eel (Flanders)
  – Trout (Wallonia)
  – Sturgeon (Turnhout, 1 farm)
  – Oysters (Ostend, 1 farm)

• Aquaculture potential
  – Diversification for farmers
  – RAS, Aquaponics
Aquaculture in Belgium

• Research on “new species”
  – Burbot
  – Omega perch
  – Noble crayfish
  – …
Aquaculture in Belgium

• Sustainable aquaculture species?
  – Indigenous/temperate
  – Low trophic level
  – High market value
  – Marketability
Opportunities for crayfish culture

• Sustainable aquaculture species?
  – Indigenous/temperate
    • Local product, less food miles
    • Low water temperature
  – Low trophic level
    • Polytrophic species
  – High market value
    • €25-45/kg
  – Marketability
    • Interest among top chefs
    • Culinary history
Challenges for crayfish culture

• Culture conditions/feeding
  – Majority of studies focus on juvenile culture
  – Crayfish older than 6 months?
• Reduce cannibalism
• Disease control
Feed trial

Objectives:

– find a basic diet for *A. astacus* culture
  • Practical (sinking, stability in water)
  • Existing commercial feed, readily available
  • Affordable price

– find a supplemental vegetable feed
  • Commonly available (at farms)
  • Sinking material
  • Low cost
Materials and methods

- Crayfish: 420 two-summer-old *A. astacus* (6,18±1,95g)
- System: 21 tanks (0,5m²), RAS
- Density: 40 crayfish/m²
- Shelter: Filtration bristles
- Temperature: 21°C (70°F)
- Duration: 83 days
Materials and methods

Commercial pellets
  – Shrimp feed
  – Marine fish feed
  – Carp feed
Materials and methods

Vegetable diets

– Alfalfa pellets
– Potato scrap
– Soy / rapeseed mixture
– Fodder beet tailings
## Materials and methods

### Nutritional analysis

<table>
<thead>
<tr>
<th></th>
<th>Shrimp</th>
<th>Marine</th>
<th>Carp</th>
<th>Alfalfa</th>
<th>Potato</th>
<th>Soy/rapeseed</th>
<th>Beet</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Crude protein (%)</strong></td>
<td>34,64</td>
<td>52,00</td>
<td>35,60</td>
<td>16,22</td>
<td>1,65</td>
<td>41,27</td>
<td>1,17</td>
</tr>
<tr>
<td><strong>Crude fat (%)</strong></td>
<td>8,58</td>
<td>14,20</td>
<td>10,74</td>
<td>2,62</td>
<td>0,15</td>
<td>2,97</td>
<td>0,15</td>
</tr>
<tr>
<td><strong>Carbohydrates (%)</strong></td>
<td>36,62</td>
<td>16,69</td>
<td>32,92</td>
<td>34,37</td>
<td>24,57</td>
<td>28,41</td>
<td>6,28</td>
</tr>
<tr>
<td><strong>Ash (%)</strong></td>
<td>7,92</td>
<td>7,82</td>
<td>6,87</td>
<td>12,46</td>
<td>0,53</td>
<td>7,88</td>
<td>1,58</td>
</tr>
<tr>
<td><strong>Crude fiber (%)</strong></td>
<td>3,40</td>
<td>0,88</td>
<td>3,09</td>
<td>22,75</td>
<td>1,32</td>
<td>7,41</td>
<td>1,66</td>
</tr>
<tr>
<td><strong>Moisture (%)</strong></td>
<td>8,84</td>
<td>8,41</td>
<td>10,78</td>
<td>11,58</td>
<td><strong>71,78</strong></td>
<td>12,06</td>
<td><strong>89,16</strong></td>
</tr>
</tbody>
</table>
Results

• Feed had a significant effect on:
  – Growth (p=0.005)
  – Cheliped loss (p=0.028)
  – Survival rate (p=0.006)
### Results

#### Commercial feeds

<table>
<thead>
<tr>
<th></th>
<th>Shrimp</th>
<th>Marine</th>
<th>Carp</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SGR (%.day⁻¹)</strong></td>
<td>0.20±0.04</td>
<td>0.31±0.05</td>
<td>0.34±0.03</td>
</tr>
<tr>
<td><strong>Chel. loss (%)</strong></td>
<td>20.11±10.85</td>
<td>13.70±15.17</td>
<td>6.93±8.07</td>
</tr>
<tr>
<td><strong>Survival rate (%)</strong></td>
<td>91.67±10.41</td>
<td><strong>96.67±5.77</strong></td>
<td>96.67±2.89</td>
</tr>
</tbody>
</table>

(Mean value ± st. dev.)
## Results

### Vegetable feeds

<table>
<thead>
<tr>
<th></th>
<th>Alfalfa</th>
<th>Potato</th>
<th>Soy/Rapeseed</th>
<th>Beet</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SGR (%.day(^{-1}))</strong></td>
<td>0.12±0.03</td>
<td>0.15±0.02</td>
<td><strong>0.22±0.04</strong></td>
<td>0.01±0.04</td>
</tr>
<tr>
<td><strong>Chel. Loss (%)</strong></td>
<td>27.94±13.03</td>
<td>33.43±7.67</td>
<td><strong>9.26±8.49</strong></td>
<td><strong>8.70±4.85</strong></td>
</tr>
<tr>
<td><strong>Survival rate (%)</strong></td>
<td>80.00±10.00</td>
<td>80.00±5.00</td>
<td><strong>85.00±8.66</strong></td>
<td>80.00±10.00</td>
</tr>
</tbody>
</table>

(Mean value ± st. dev.)
Results

Specific Growth Rate (% day\(^{-1}\))

- Shrimp
- Marine
- Carp
- Alfalfa
- Potato
- Soy/RS
- Beet

* significant (p < 0.05)
Results

Cheliped loss (%)

- Shrimp
- Marine
- Carp
- Alfalfa
- Potato
- Soy/RS
- Beet

* significant (p < 0.05)
. tendency (p < 0.10)
Discussion

• Carp & marine fish feed → best performance

• Vegetable feeds:
  – High mortality
  – Soy/rapeseed: acceptable growth
## Feed prices

<table>
<thead>
<tr>
<th></th>
<th>Price/kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marine</td>
<td>€ 2,18</td>
</tr>
<tr>
<td>Shrimp</td>
<td>€ 1,50</td>
</tr>
<tr>
<td>Carp</td>
<td>€ 1,20</td>
</tr>
<tr>
<td>Soy/rapeseed</td>
<td>€ 0,40</td>
</tr>
<tr>
<td>Potato</td>
<td>€ 0,05</td>
</tr>
<tr>
<td>Beet</td>
<td>€ 0,03</td>
</tr>
<tr>
<td>Alfalfa</td>
<td>€ 0,48</td>
</tr>
</tbody>
</table>
Conclusion

• Carp feed advantages:
  – Economic: relatively low price
  – Ecologic: low fishmeal content (10% vs. 60% in Marine feed)
  – Production:
    • High survival rates
    • High growth
    • Less cheliped loss/aggressive behaviour
Conclusion

• **Vegetable feeds**
  – Avoid high moisture content in fresh feeds
  – Preferable high protein content
  – Limited ash/fibre content

• **Combination comm. + veg. feed ?**
  → lower feeding costs
  → sustainability
Thank you for your attention!