The Celtic Sea Trout Project
2009-2013

North Wales Fisheries Conference

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Introduction to the CSTP

**BACKGROUND**
- Historical neglect vs salmon
- Stock collapse – focused minds & funded R&D
- 2004 Cardiff Symposium review ► Gaps
- Interreg IVA funded cross-border CSTP

**AIMS**
- Marine distribution, stock identity & ecology
- Life history variation, description & causes
- Long term collaboration + awareness

**APPLICATIONS**
- Stock assessment, mixed stocks fisheries
- Responses to pressures.. past, present and future
- Managing risks from marine developments
- Bio-indicator role across FW-transitional-coastal habitats
A basic question... why do sea trout stocks vary regionally and over time?

River A: “whitling” dominated
River B: average
River C: high average size

Changes over time

- Life history theory
- Environmental variation
- Other pressures

Reduction of older/larger fish
Partial migration and anadromy: “To Sea or Not to Sea?”

Benefits (eggs) vs Risks (death)

4yr old “brown trout” (400eggs)

4yr old “sea trout” (6,000eggs)

Residency

Smolting/Migration

Photo: Ian Davidson, DSAP
Performance at sea affects age structures of sea trout stocks and fisheries

Question 1: why return from sea? (Ans: spawning, complete the life cycle)
Question 2: when to return? (Ans: maturation...survival, growth??...traits related to marine habitat)
Question 3: what determine proportions of sea ages? (Ans: ???LH tactics that maximise potential eggs)
Sampling (2009-2012)

Marine (post-smolts and adults):
• Beaches, estuaries, coastal, offshore
• Trawl, seine, rods
• 1,367 scale sets

Rivers (juveniles and adults):
• Angler samples
• Rod catch statistics
• Traps
• 5,538 adult fish scale sets
• Electro-fishing 100 rivers, (for genetics and microchemistry)

Surface trawling
Scale reading, 25cm, 3.0+
Marine habitats are highly structured

Sea temperature (NB mean and range greater in east sea board)

Bathymetry  Seascape  Prey (sand eel) habitat  Prey abundance

Currents
Results

- Trends in abundance and stock composition
- Regional variation in life histories
- Feeding
- Movements and exchange
Synchrony in catch trends, 1994-2011

- Mean catch for each country/region
- Strong temporal coherence ($V_t = 34\%$)
- Common factors acting on stock?
-努力分析在E&W表明非常低的 coherence，但高在捕获和cpld

Temporal variance = 34%

Overall smoothed, 95% CIs
Long term changes in catches and size composition in 5 Welsh rivers, 1976-2007

- 0.8kg = “whitling” (n.0+)
- Increasing abundance and % of whitling
- Reduction in N and % of larger fish in some rivers
- Evidence of life history change
- Time of 1st maturation, can’t exclude reduction in survival
Temporal variation in marine growth

Historical data (eastern sea board)
- Size of whitling increased 1923-2000
- Mixed year and latitude effects

Sea temperature increase
- Part of climate change

Temp data: MAFF/Cefas
Results

- Trends in abundance and stock composition
- Regional variation in life histories
- Feeding
- Movements and exchange
Variation in sea ages of sea trout
(from scale reading)

Multi-age

Dominated by whitling
Spatial variation in marine growth, mean length(mm) at age n.0+

Between-river variation in length of n.0+ sea trout in 23 Irish Sea rivers

- Smaller on western sea board
- Latitude effect on east coast (larger in more southerly rivers)
- Caution, smolt length and age

Sea board: E-W

LAT<53.3

Shimna(235) Bandon(273) Slaney(276) DeeWR(279) Castletown(280) Argideen(286) Boyne(322) Currane(321)
- Lower % S in popn of smaller size fish
- Lower % S in cooler waters (Irish coast & more northerly sites of eastern sea board)
Regional summary of growth and survival (selected by tree regression)
Life history responses to 1st year marine growth

- Marine survival (post 0+) increases with 2.0+ length (N=23, $R^2=0.404, p<0.01$)

- Time of first return (as % 2.0+) decreases with 2.0+ length (N=23, $R^2=0.288, p<0.01$)

- Is earlier maturation a response to maximise reproductive opportunity in the face of marine environmental influence on growth and survival?
Results

- Trends in abundance and stock composition
- Regional variation in life histories
- Feeding
- Movements and exchange
Adult sea trout prefer to eat fish

Stomach content analysis of marine caught sea trout

Regional variation

Prey (sprat) abundance
Results

- Trends in abundance and stock composition
- Regional variation in life histories
- Feeding
- Movements and exchange
Hydrodynamic Modelling (Cefas)

General Estuarine Transport Model (GETM), simulates particle (=“fish”) movements, run from April 1st

Shimna

Dyfi

Slaney

Tywi
Genetic and microchemistry/radio isotope assignment of marine-caught fish to regions

9 putative genetic regions identified by juvenile samples, 99 rivers

- Microchem origins based on 36 rivers
- δ15N suggested mainly coastal residency & some exchange

Marine samples assigned to regions by *Oncor*/GeneClass consensus

**Overall:** most fish remain “local”; evidence of some extensive exchange, can’t quantify due to small sample sizes
Conclusions

➢ **LIFE HISTORIES and MARINE ECOLOGY**
   • Evidence of synchronous variation indicates response to common marine factor/s (can’t yet rule out FW factors too)
   • Stock structure variation reflects shifts in time of 1st return, likely due to growth and survival
   • Regional growth variation linked to temperature (+ food?)......HABITAT
   • Long term temporal growth variation cause remains uncertain (probably climate)
   • Consistent with limited dispersal, reflecting marine hydro-graphic and environmental factors.
   • BUT some extensive dispersal demonstrated by genetics, microchemistry and modelling

➢ **MANAGEMENT & MONITORING**
   • Broad-scale conservation: does partial synchrony imply meta-population effects, conferring resilience and stability on individual rivers? (role of small streams?)
   • Cross-border management of marine phase is indicated by the synchrony and partial dispersal
   • Catch recording is weak and a major limitation: size data, fishing effort
   • Marine food chain is important for sea trout, but key indicators are poorly monitored
   • Marine habitat monitoring and protection are important for sea trout
Thanks to all the sponsors and many co-workers

... and many ‘00s of anglers