A call for a paradigm shift: Assumed-to-be premature migrants actually yield good returns

Animals with complex life cycles often display plasticity in the timing of transitions across life stages. The brown trout, *Salmo trutta*, highlights such phenotypic plasticity with its alternative migratory tactics. Downstream migration of smolts exemplifies one of the many ways in which brown trout display plasticity. The timing of this migration is assumed to be in the spring, although recent evidence suggests an autumn migration is also present. While the proximate and ultimate causes for this autumn migration remain unclear, it was hypothesised that leaving in the autumn may have short-term benefits (e.g., lower competition) but that these individuals are maladapted to life at sea and yield poor adult returns. To test this hypothesis, 1370 wild juvenile brown trout from a Danish stream were tagged with PIT tags. Individuals were then divided into autumn and spring migrants depending on the timing of their outmigration to saltwater, and their return to freshwater was followed. Inconsistent with the hypothesis that autumn migrants yield poor returns, our findings suggest that autumn migrants yield similar return rates to spring migrants, with no observed differences in length, mass and condition upon tagging, nor in average time spent at sea. Our findings suggest that autumn migrants may not be maladapted to marine environments in a way that affects their survival, and call for a paradigm shift in the current description of the brown trout lifecycle.
Another paradigm lost? Autumn downstream migration of juvenile brown trout: Evidence for a presmolt migration

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology, Danish Center for Wild Salmon
Contributors: Aarestrup, K., Birnie-Gauvin, K., Larsen, M. H.
Pages: 513-516
Publication date: 2018
Peer-reviewed: Yes
Comparison of vegetable shortening and cocoa butter as vehicles for cortisol manipulation in Salmo trutta

This study demonstrates that vegetable shortening and cocoa butter are two effective vehicles for intraperitoneal cortisol implants in juvenile teleosts, specifically brown trout Salmo trutta, residing in north temperate freshwater environments. Each vehicle showed a different pattern of cortisol elevation.

Vegetable shortening was found to be a more suitable vehicle for long-term cortisol elevation [elevated at 3, 6 and 9 days post treatment (dpt)], while cocoa butter may be better suited for short-term cortisol elevation (only elevated at 3 dpt). Additionally, plasma cortisol levels were higher with cortisol–vegetable shortening than with cortisol–cocoa butter implants.
Plasma glucose levels were elevated 6 and 9 dpt for fishes injected with cortisol–vegetable shortening, but did not change relative to controls and shams in cortisol–cocoa butter fishes. In conclusion, vegetable shortening and cocoa butter are both viable techniques for cortisol manipulation in fishes in temperate climates, providing researchers with different options depending on study objectives.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology, Carleton University, University of Ottawa, Danish Center for Wild Salmon
Contributors: Birnie-Gauvin, K., Peiman, K. S., Larsen, M. H., Aarestrup, K., Gilmour, K. M., Cooke, S. J.
Pages: 229-236
Publication date: 2018
Peer-reviewed: Yes

Publication information
Journal: Journal of Fish Biology
Volume: 92
Issue number: 1
ISSN (Print): 0022-1112
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 1.71 SJR 0.822 SNIP 0.923
Web of Science (2017): Impact factor 1.702
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.57 SJR 0.748 SNIP 0.83
Web of Science (2016): Impact factor 1.519
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 1.64 SJR 0.961 SNIP 0.924
Web of Science (2015): Impact factor 1.246
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 1.76 SJR 0.956 SNIP 0.931
Web of Science (2014): Impact factor 1.658
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 1.98 SJR 1.058 SNIP 1.112
Web of Science (2013): Impact factor 1.734
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 1.88 SJR 0.94 SNIP 1.045
Web of Science (2012): Impact factor 1.834
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 1.66 SJR 0.895 SNIP 0.951
Web of Science (2011): Impact factor 1.685
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.783 SNIP 0.832
Web of Science (2010): Impact factor 1.33
Evidence of cormorant-induced mortality, disparate migration strategies and repeatable circadian rhythm in the endangered North Sea houting (Coregonus oxyrinchus): A telemetry study mapping the postspawning migration

Life history theory predicts a trade-off between migration and residency where migration is favoured when it infers elevated fitness. Although migration to more favourable environments offers higher growth rates, migrants often experience increased mortality due to predation. Here, we investigated mortality and migration behaviour of the North Sea houting (Coregonus oxyrinchus), an anadromous salmonid endemic to the Wadden Sea. We used acoustic telemetry to map the migration of the only remaining indigenous population by applying stationary hydrophones combined with manual tracking. Data suggested a total mortality of 26%, with 30% of the total mortality attributed to predation by great cormorants (Phalacrocorax carbo sinensis), highlighting that North Sea houting conservation could be jeopardised by increased cormorant predation. Risk of cormorant predation was size-dependent, with smaller fish suffering higher risk of predation. The study found North Sea houting to exhibit disparate migration strategies and identified a lentic area in the estuary as an important habitat. Two newly established artificial lakes within the river system significantly reduced the migration speeds, possibly indicating constrained navigation through the lakes. The migration into the Wadden Sea correlated with temperature perhaps indicating osmoregulatory constraints of sea entry. Unlike most salmonid species, migration occurred both day and night. Moreover, fish exhibited repeatable individual differences in diel activity patterns, suggesting that individuals differ consistently in their migratory activity throughout the 24-hr period. Our study provides novel information on salmonid migration, which is crucial for the development of science-based conservation strategies.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology, Section for Ecosystem based Marine Management, Aalborg University, Institut National des Sciences Appliquees de Lyon
Pages: 672-685
Publication date: 2018
Peer-reviewed: Yes
Moving beyond fitting fish into equations: Progressing the fish passage debate in the Anthropocene

Realization of the importance of fish passage for migratory species has led to the development of innovative and creative solutions ('fishways') to mitigate the effects of artificial barriers in freshwater systems in the last few decades. In many instances, however, the first move has been to attempt to engineer a solution to the problem, thus attempting to ‘fit fish into an equation’. These fishways are often derived from designs targeting salmonids in the Northern Hemisphere. They are rarely adequate, even for these strong-swimming fish, and certainly appear to be unsuitable for most other species, not least for those of tropical regions.

Fishway design criteria do not adequately account for natural variation among individuals, populations and species. Moreover, engineered solutions cannot reinstate the natural habitat and geomorphological properties of the river, objectives that have been largely ignored. This article discusses the most prominent issues with the current management and conservation of freshwater ecosystems as it pertains to fish passage. It is not intended as a review on fish passage, but rather a perspective on the
issues related to fishways, as seen by practitioners.

**General information**

State: Accepted/In press
Organisations: National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology, NIWA, Coventry University
Contributors: Birnie-Gauvin, K., Franklin, P., Wilkes, M., Aarestrup, K.
Publication date: 2018
Peer-reviewed: Yes

**Publication information**

Journal: Aquatic Conservation: Marine and Freshwater Ecosystems
ISSN (Print): 1052-7613
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 2.79 SJR 1.203 SNIP 1.255
Web of Science (2017): Impact factor 2.988
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.5 SJR 1.189 SNIP 1.038
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 1.98 SJR 1.087 SNIP 1.021
Web of Science (2015): Impact factor 2.415
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 1.99 SJR 1.013 SNIP 1.195
Web of Science (2014): Impact factor 2.136
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 1.95 SJR 1.139 SNIP 1.028
Web of Science (2013): Impact factor 1.756
Scopus rating (2012): CiteScore 2.15 SJR 1.069 SNIP 1.147
Web of Science (2012): Impact factor 1.917
Scopus rating (2011): CiteScore 1.97 SJR 1.178 SNIP 1.099
Web of Science (2011): Impact factor 1.929
Scopus rating (2010): SJR 0.929 SNIP 0.974
Web of Science (2010): Impact factor 1.968
Scopus rating (2009): SJR 0.834 SNIP 0.894
Scopus rating (2008): SJR 1.07 SNIP 1.224
Scopus rating (2007): SJR 0.811 SNIP 0.932
Scopus rating (2006): SJR 0.841 SNIP 0.903
Scopus rating (2005): SJR 0.82 SNIP 0.991
Scopus rating (2004): SJR 0.734 SNIP 1.32
Scopus rating (2003): SJR 0.616 SNIP 0.676
Scopus rating (2002): SJR 0.509 SNIP 0.585
Scopus rating (2001): SJR 0.586 SNIP 0.748
Scopus rating (2000): SJR 0.444 SNIP 0.752
Scopus rating (1999): SJR 0.574 SNIP 0.921
Original language: English

Electronic versions:
Postprint

DOIs:
10.1002/aqc.2946

Research output: Research - peer-review > Journal article – Annual report year: 2018
N-acetylcysteine manipulation fails to elicit an increase in glutathione in a teleost model

Levels of oxidative stress can be affected by a range of compounds including toxins and pharmaceuticals. Antioxidants are important protective compounds which counteract the damaging effects of oxidative stress. Glutathione (GSH) is one of the main antioxidants for many organisms and can be synthesized from administered N-acetylcysteine (NAC). NAC has therefore often been used in a wide range of taxa to manipulate levels of GSH. Our objective was to validate this approach in a wild temperate teleost fish model, the brown trout (Salmo trutta). We used intracoelomic injections of NAC in saline and vegetable shortening, at two different concentrations (100 and 400 mg/kg), with the appropriate controls and shams, under controlled laboratory settings. We found that NAC failed to elicit an increase in GSH over three time periods and concluded that NAC is not an effective method to enhance GSH levels in teleost fish using the concentrations and vehicles tested here. We emphasize the importance of validation studies across all new species/taxa when possible and suggest that more investigation is required with regard to NAC manipulation in fish if this approach is to be used.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology, Aarhus University
Contributors: Birnie-Gauvin, K., Larsen, M. H., Aarestrup, K., Willmore, W. G., Cooke, S.
Pages: 137-142
Publication date: 2018
Peer-reviewed: Yes

Publication information
Journal: Fish Physiology & Biochemistry
Volume: 44
Issue number: 1
ISSN (Print): 0920-1742
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 1.91 SJR 0.69 SNIP 0.891
Web of Science (2017): Impact factor 1.735
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.7 SJR 0.573 SNIP 0.825
Web of Science (2016): Impact factor 1.647
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 1.59 SJR 0.76 SNIP 0.942
Web of Science (2015): Impact factor 1.442
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 1.77 SJR 0.664 SNIP 0.889
Web of Science (2014): Impact factor 1.622
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 1.72 SJR 0.713 SNIP 0.961
Web of Science (2013): Impact factor 1.676
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 1.76 SJR 0.612 SNIP 1.194
Web of Science (2012): Impact factor 1.545
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 1.6 SJR 0.661 SNIP 1.039
Web of Science (2011): Impact factor 1.528
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.525 SNIP 0.877
Web of Science (2010): Impact factor 1.607
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.449 SNIP 0.681
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.337 SNIP 0.528
Scopus rating (2007): SJR 0.257 SNIP 0.329
Scopus rating (2006): SJR 0.31 SNIP 0.392
Scopus rating (2005): SJR 0.417 SNIP 0.425
Scopus rating (2004): SJR 0.254 SNIP 0.261
Scopus rating (2003): SJR 0.475 SNIP 0.853
Scopus rating (2002): SJR 0.451 SNIP 0.685
Scopus rating (2001): SJR 0.492 SNIP 0.654
Web of Science (2001): Indexed yes
Scopus rating (2000): SJR 0.576 SNIP 0.865
Scopus rating (1999): SJR 0.615 SNIP 0.814
Original language: English
DOIs:
10.1007/s10695-017-0419-3. Embargo ends: 05/01/2019
Research output: Research - peer-review › Journal article – Annual report year: 2018

**REKREA-Monitoring and inclusion of Danish marine recreational fisheries data in stock assessment**

**General information**
State: Published
Organisations: Section for Monitoring and Data, National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology, Section for Ecosystem based Marine Management
Publication date: 2018
Peer-reviewed: No
Research output: Research › Poster – Annual report year: 2018

**Relationship of baseline and maximum glucocorticoid concentrations to migration propensity – a field test with wild sub-adult brown trout (Salmo trutta)**
There is considerable variation in individuals’ glucocorticoid (GC) baseline status and stress responses, yet the cause and consequence of this variation remains ambiguous. Attempts to relate GC levels to fitness and life-history tradeoffs have yielded variable results. In this study, we evaluated whether baseline and post-stressor GC hormone concentrations predicted migration strategy (i.e., resident or migrant) and successful seaward migration in a partially migrating population of juvenile brown trout (&lt;i&gt;Salmo trutta&lt;/i&gt; (Linnaeus, 1758)). Baseline (N=99) or post-stressor (N=102) plasma cortisol concentrations were obtained from trout and they were tagged with passive integrated transponder (PIT) and released in a natural Danish stream. Subsequently, fish were tracked with PIT reader systems and the stream was resampled for resident individuals. GC levels were not found to be associated with recapture of resident individuals or migration propensity to our first tracking station (S1), but increased baseline (and not post-stressor) GC levels were associated with increased passage from S1 to our second tracking station, which anecdotally was an area of high predation or challenge. Our study found no evidence to suggest that cortisol regulates the migration life-history in juvenile brown trout, but intermediate increases in baseline GC (and not post-stressor GC) levels may favor migration performance.

**General information**
State: Accepted/In press
Organisations: Section for Freshwater Fisheries Ecology, National Institute of Aquatic Resources, Carleton University, Fisheries and Oceans Canada, Danish Center for Wild Salmon, University of Illinois
Contributors: Jain-Schlaepfer, S., Midwood, J. D., Larsen, M. H., Aarestrup, K., King, G., Suski, C., Cooke, S. J.
Publication date: 2018
Peer-reviewed: Yes
Today’s river systems have been extensively modified, requiring us to rethink how we approach the management of these important ecosystems. We evaluated the effects of removing 6 weirs in River Villestrup (Jutland, Denmark) on the smolt run of brown trout (Salmo trutta) over the course of 12 years. During 5 of these years, we evaluated the number, size, and timing of smolts during their downstream migration. We found an increase in smolt output following the weir removals, along with a decrease in average length and indications of an earlier peak migration. Our results suggest that barrier removal has led to an increase in spawning success by adults, fry survival, recruitment, and smolt migration success. Weir removal is therefore a viable management approach to restore connectivity in freshwater streams and rivers, which promotes the passage of smolts as they migrate to marine environment.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology
Contributors: Birnie-Gauvin, K., Candee, M. M., Baktoft, H., Larsen, M. H., Koed, A., Aarestrup, K.
Pages: 548-554
Publication date: 2018
Peer-reviewed: Yes

Publication information
Journal: River Research and Applications
Volume: 34
Issue number: 6
ISSN (Print): 1535-1459
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 2.07 SJR 0.801 SNIP 0.896
Web of Science (2017): Impact factor 2.067
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.07 SJR 0.818 SNIP 1.165
Web of Science (2016): Impact factor 2.274
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 1.99 SJR 0.949 SNIP 1.099
Web of Science (2015): Impact factor 1.98
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 2.11 SJR 0.969 SNIP 1.341
Web of Science (2014): Impact factor 2.025
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 2.08 SJR 0.924 SNIP 1.153
Web of Science (2013): Impact factor 1.971
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 2.23 SJR 1.071 SNIP 1.58
Web of Science (2012): Impact factor 2.425
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 1.92 SJR 1.088 SNIP 1.127
Web of Science (2011): Impact factor 2.028
ISI indexed (2011): ISI indexed yes
Routes and survival of anadromous brown trout Salmo trutta L. post-smolts during early marine migration through a Danish fjord system

We examined the survival and progression rates of 101 anadromous brown trout Salmo trutta L. post-smolts from two Danish river systems, Karup and Simested, with acoustic telemetry as they migrated through a large Danish fjord system (the Limfjord). No fish were documented to residualize permanently within the fjord, and the minimum survival in the fjord was low (26%) while the mortality per km of migrated linear distance (0.8% km−1) was similar to that found in adjacent and smaller Danish fjords. Survival was positively correlated with length (P=0.003) but not with condition and river of origin. The fjord has an eastern outlet into the Kattegat and a western outlet into the North Sea, but the western outlet did not exist until 1825. No fish left the fjord in the western direction in the study and all surviving fish (n=20) left the fjord in the eastern direction. The results suggest that fish from rivers Karup and Simested may have over time become adapted for leaving the Limfjord in the eastern direction and that predation rates and environmental characteristics of the fjord are more important for the fjord's ability to function as a suitable growth habitat for post-smolts than size and the availability of food within it.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology
Contributors: Kristensen, M. L., Birnie-Gauvin, K., Aarestrup, K.
Pages: 102-109
Publication date: 2018
Peer-reviewed: Yes

Publication information
Journal: Estuarine, Coastal and Shelf Science
Volume: 209
ISSN (Print): 0272-7714
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 2.61 SJR 1.059 SNIP 1.149
Web of Science (2017): Impact factor 2.413
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.43 SJR 1.034 SNIP 1.136
Web of Science (2016): Impact factor 2.176
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 2.44 SJR 1.123 SNIP 1.183
Web of Science (2015): Impact factor 2.335
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 2.28 SJR 1.074 SNIP 1.249
Web of Science (2014): Impact factor 2.057
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 2.64 SJR 1.32 SNIP 1.421
Web of Science (2013): Impact factor 2.253
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 2.52 SJR 1.251 SNIP 1.413
Web of Science (2012): Impact factor 2.324
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 2.52 SJR 1.379 SNIP 1.328
Web of Science (2011): Impact factor 2.247
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.239 SNIP 1.199
Web of Science (2010): Impact factor 1.887
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.181 SNIP 1.264
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 1.257 SNIP 1.296
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.118 SNIP 1.356
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.213 SNIP 1.363
Scopus rating (2005): SJR 0.93 SNIP 1.231
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 0.814 SNIP 1.027
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 0.937 SNIP 1.248
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 0.671 SNIP 1.253
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 1.029 SNIP 1.231
Web of Science (2001): Indexed yes
Scopus rating (2000): SJR 0.607 SNIP 1.352
Web of Science (2000): Indexed yes
Scopus rating (1999): SJR 0.659 SNIP 1.201
Telemetry observations of predation and migration behaviour of brown trout (Salmo trutta) smolts negotiating an artificial lake: Telemetry observations of smolts negotiating an artificial lake

Eutrophication of coastal areas as a consequence of the agricultural use of fertilizers is a widespread problem. The development of artificial lakes and constructed wetlands in nutrient-rich rivers is a widely used management tool in the fight to decrease eutrophication. Juvenile salmonids that have to negotiate these lakes during their downstream migration to the sea are commonly subjected to high mortality due to increased predation pressure and delayed passage. In this study, we double tagged 39 brown trout smolts with passive integrated transponder and radio tags to gain further insight into predation rates and migration patterns during their passage of an artificial lake in a Danish lowland stream in the spring of 2016. Thirty-four of the tagged smolts, caught and released upstream, entered the lake, of which 22 (65%) successfully exited the lake. Four smolts (12%) returned upstream to the river. Three smolts were predated in the lake by two northern pike (Esox lucius). Three tags were recovered from the lake bottom, and two disappeared out of the study area after a last detection in the lake. Tracking the smolts manually and by automatic listening stations showed highly erratic movement patterns during lake passage. Further, we observed long delays of up to 27 days after the smolts reached the river mouth and before they entered the sea, potentially due to low sea water temperature or due to the stocking of a large amount of hatchery-reared brown trout smolts. The results are discussed in the context of abiotic and biotic factors, which differed considerably in the year 2016 compared with previous years.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology, University of Durham
Contributors: Schwinn, M., Baktoft, H., Aarestrup, K., Lucas, M. C., Koed, A.
Pages: 898-906
Publication date: 2018
Peer-reviewed: Yes

Publication information
Journal: River Research and Applications
Volume: 34
Issue number: 8
ISSN (Print): 1535-1459
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 2.07 SJR 0.801 SNIP 0.896
Web of Science (2017): Impact factor 2.067
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.07 SJR 0.818 SNIP 1.165
Web of Science (2016): Impact factor 2.274
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 1.99 SJR 0.949 SNIP 1.099
Web of Science (2015): Impact factor 1.98
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 2.11 SJR 0.969 SNIP 1.341
Web of Science (2014): Impact factor 2.025
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 2.08 SJR 0.924 SNIP 1.153
Web of Science (2013): Impact factor 1.971
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Temperature and depth preferences of adult sea trout Salmo trutta during the marine migration phase

We tagged 125 sea trout kelts (length: 460-925 mm) in Danish rivers with positively buoyant, depth-and temperature-sensing data storage tags. Eight tags were recovered from fish that had completed a full marine cycle (exit and return to natal river). Mean duration of the postestuary marine cycle was 96.1 d (range: 47-142 d). The trout resided at depths of 0-3 m for 63.8% of the time and exhibited a characteristic diurnal behavioural pattern with repetitive dives deeper than 5.0 m during daytime and residency at the surface during night-time. The number of dives increased with day length, but dive duration was unaffected. Mean dive duration increased with water temperatures from 9.79 min at 5-7 degrees C to 79.8 min at 17-19 degrees C, and mean residence depth increased with water temperatures from 1.95 m at 5-7 degrees C to 10.1 m at 17-19 degrees C. The fish showed a marked response to temperatures above 17 degrees C by residing at greater depths and by discontinuing the characteristic dive/surface residency pattern for prolonged periods of time during warm periods. Temperature data indicated that the fish were generally close to land in the beginning of the marine period and had migrated into open sea during summer. Our results suggest that Danish sea trout kelts aim to optimize their growth at sea by exhibiting a characteristic foraging pattern similar to that of Atlantic salmon and by seeking temperatures within the range reported as optimal for growth in the species.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology, Cefas Weymouth Laboratory, University of the Highlands and Islands
Contributors: Kristensen, M. L., Righton, D., del Villar-Guerra, D., Baktoft, H., Aarestrup, K.
Pages: 209-224
Publication date: 2018
Peer-reviewed: Yes
Testing three common stocking methods: Differences in smolt size, migration rate and timing of two strains of stocked Atlantic salmon (Salmo salar)

The influence of three common stocking practices for two strains (Åtran and Burrishoole) of hatchery-reared Atlantic salmon, Salmo salar, on smolt size, migration probability and migration timing were investigated in situ. Using a common garden experiment, fish from these populations were released as fry, half-year olds and one-year olds. Our results indicate...
that fish released at the fry and half-year stage produce smaller smolts, and migrate later in the year than their counterparts released at one-year of age, for both the Átran and the Burrishoole populations. While fry had the lowest probability of migration, half-year old releases had greater migration rates than one-year olds of the same strain. Additionally, Átran fish tended to migrate earlier in the year than Burrishoole fish of the same age. Our findings highlight the variability that exists among individuals and populations due to inherited factors, and emphasize the importance of considering age of fish and time spent in the hatchery when stocking populations in the wild to maximize smolt output.
The future of fish passage science, engineering, and practice

Much effort has been devoted to developing, constructing and refining fish passage facilities to enable target species to pass barriers on fluvial systems, and yet, fishway science, engineering and practice remain imperfect. In this review, 17 experts from different fish passage research fields (i.e., biology, ecology, physiology, ecohydraulics, engineering) and from different continents (i.e., North and South America, Europe, Africa, Australia) identified knowledge gaps and provided a roadmap for research priorities and technical developments. Once dominated by an engineering-focused approach, fishway science today involves a wide range of disciplines from fish behaviour to socioeconomics to complex modelling of passage prioritization options in river networks. River barrier impacts on fish migration and dispersal are currently better understood than historically, but basic ecological knowledge underpinning the need for effective fish passage in many regions of the world, including in biodiversity hotspots (e.g., equatorial Africa, South-East Asia), remains largely unknown. Designing efficient fishways, with minimal passage delay and post-passage impacts, requires adaptive management and continued innovation. While the use of fishways in river restoration demands a transition towards fish passage at the community scale, advances in selective fishways are also needed to manage invasive fish colonization. Because of the erroneous view in some literature and communities of practice that fish passage is largely a proven technology, improved international collaboration, information sharing, method standardization and multidisciplinary training are needed. Further development of regional expertise is needed in South America, Asia and Africa where hydropower dams are currently being planned and constructed.

General information

State: Published
Organisations: National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology, SINTEF, Norwegian Institute for Nature Research, University of Durham, United States Geological Survey, Katopodis Ecohydraulics Ltd., Charles Sturt University, Department of Primary Industries, Federal University of Lavras, University of KwaZulu-Natal, InStream Fisheries Research Inc., University of Alberta, University of Washington, Carleton University
The influence of sex, parasitism, and ontogeny on the physiological response of European eel (Anguilla anguilla) to an abiotic stressor

Migration of adult European eels (Anguilla anguilla) from freshwater feeding grounds to oceanic spawning grounds is an energetically demanding process and is accompanied by dramatic physiological and behavioral changes. Humans have altered the aquatic environment (e.g., dams) and made an inherently challenging migration even more difficult; human activity is regarded as the primary driver of the collapse in eel populations. The neuroendocrine stress response is central in coping with these challenging conditions, yet little is known about how various biotic factors such as sex, parasites, and ontogeny influence (singly and via interactions) the stress response of eels. In this study, mixed-effects and linear models were used to quantify the influence of sex, parasitism (Anguillicola crassus), life stage (yellow and silver eels), and silvering stage on the stress response of eels when exposed to a standardized handling stressor. The physiological response of eels to a standardized abiotic stressor (netting confinement in air) was quantified through measurements of blood glucose and plasma cortisol. The relationships between biotic factors and the activity of gill Na+/K+-ATPase was also examined. Analyses revealed that in some instances a biotic factor acted alone while in other cases several factors interacted to influence the stress response. Blood glucose concentrations increased after exposure to the standardized stressor and remained elevated after 4 h. Variation in plasma cortisol concentrations after exposure to the stressor were found to be time dependent, which was exacerbated by life stage and parasitism condition. Males and nonparasitized silver eels had the highest Na+/K+-ATPase activity. Silvering stage was strongly positively correlated with Na+/K+-ATPase activity in female eels. Collectively, these findings confirm that the factors mediating stress responsiveness in fish are complicated and that aspects of inherent biotic variation cannot be ignored.
Tracking anguillid eels: five decades of telemetry-based research

Advances in telemetry technologies have provided new opportunities to reveal the often-cryptic spatial ecology of anguillid eels. Herein we review 105 studies published between 1972 and 2016 that used a variety of telemetry technologies to study the movements of eels in a variety of habitats. Eight anguillid species have been tracked in three main geographical locations: Western Europe, the north-eastern part of North America and Australasia. Telemetry has proven to be an effective method for determining patterns of yellow eel movements in continental waters. It has also been used extensively to investigate the migratory behaviour of maturing eels as they leave fresh water to reach the sea. Among recent findings is the observation that downstream migration in continental waters is quite discontinuous, characterised by extended stopovers. Reconstructed migration routes in the open ocean obtained from satellite tags have provided indications of spawning areas, extensive vertical migrations and initial clues about the orientation mechanisms at sea. Telemetry studies have also revealed apparent evidence of predation by marine mammals and fish at sea, suggesting a significant natural source of mortality during the eel spawning migration. Finally, we discuss some limitations of telemetry technology and future directions, as well as associated challenges, to the developing field of eel spatial ecology.

General information
A comparison of the survival and migration of wild and F1-hatchery-reared brown trout (Salmo trutta) smolts traversing an artificial lake

Supplementing salmonid populations by stocking is a widely-used method to improve catch or to rehabilitate populations. Though, most studies found that survival and fitness of hatchery-reared salmonids is inferior to wild fish. We compared survival, emigration patterns, migration speed and return rates from the sea of wild and 1-year old F1-hatchery-reared brown trout smolts in a Danish lowland stream that contains an artificial lake using passive integrated transponder telemetry in the years 2011–2013 and 2016. The majority of hatchery-reared smolts descended within 72 h after their release, whereas wild fish migration was mainly triggered by increased water discharge. Increased probability of a successful lake passage was found at higher discharge. Within years, the groups differed in lake passage time, but without a significant overall difference. Overall, there was no difference in lake survival (wild: 30%, hatchery-reared: 32%) between the two groups, but survival differed between years. Only a single fish (0.9%) of the hatchery-reared smolts
tagged in 2011–2013 returned from the sea compared to 11 (6.4%) wild smolts tagged in that period, which questions the value of supplementary stocking of smolts for conservation purposes.
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 0.946 SNIP 1.136
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.031 SNIP 1.079
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.028 SNIP 1.274
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 0.924 SNIP 1.139
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 0.964 SNIP 1.032
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 1.078 SNIP 1.29
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 1.19 SNIP 1.246
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 0.933 SNIP 0.902
Web of Science (2001): Indexed yes
Scopus rating (2000): SJR 0.541 SNIP 0.816
Web of Science (2000): Indexed yes
Scopus rating (1999): SJR 0.565 SNIP 0.838
Editorial information
Original language: English
Keywords: Artificial lake, Hatchery fish, Migration, Passive integrated transponder, Survival
DoIs:
10.1016/j.fishres.2017.08.011
URLs:
http://www.scopus.com/inward/record.url?scp=85028327777&partnerID=8YFLogxK (Link to publication in Scopus)
Source: Scopus
Source-ID: 8502832777
Research output: Research - peer-review › Journal article – Annual report year: 2017

30 years of data reveal dramatic increase in abundance of brown trout following the removal of a small hydrodam
Humans and freshwater ecosystems have a long history of cohabitation. Today, nearly all major rivers of the world have an in-stream structure which changes water flow, substrate composition, vegetation, and fish assemblage composition. The realization of these effects and their subsequent impacts on population sustainability and conservation has led to a collective effort aimed to find ways to mitigate these impacts. Barrier removal has recently received greater interest as a potential solution to restore river connectivity, and reestablish high quality habitats, suitable for feeding, refuge and spawning of fish. In the present study, we present thirty years of data from electrofishing surveys obtained at two sites, both prior to and following the removal of a small-scale hydropower dam in Central Jutland, Denmark. We demonstrate that the dam removal has led to a dramatic increase in trout density, especially in young of the year. Surprisingly, we found that this increase was not just upstream of the barrier, where the ponded zone previously was, but also downstream of the barrier, despite little changes in habitat in that area. These findings suggest that barrier removal may be the soundest conservation option to reinstate fish population productivity.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology, Danish Center for Wild Salmon
Contributors: Birnie-Gauvin, K., Larsen, M. H., Nielsen, J., Aarestrup, K.
Pages: 467-471
Publication date: 2017
Peer-reviewed: Yes

Publication information
Journal: Journal of Environmental Management
Volume: 204
ISSN (Print): 0301-4797
Ratings:
BFI (2018): BFI-level 2
<table>
<thead>
<tr>
<th>Year</th>
<th>Scopus rating</th>
<th>Web of Science</th>
<th>BFI</th>
</tr>
</thead>
<tbody>
<tr>
<td>2018</td>
<td>Indexed yes</td>
<td></td>
<td>BFI-level 2</td>
</tr>
<tr>
<td>2017</td>
<td>CiteScore 4.54 SJR 1.161 SNIP 1.705</td>
<td>Impact factor 4.005</td>
<td>BFI-level 2</td>
</tr>
<tr>
<td>2016</td>
<td>CiteScore 4.28 SJR 1.161 SNIP 1.809</td>
<td>Impact factor 4.01</td>
<td>BFI-level 2</td>
</tr>
<tr>
<td>2015</td>
<td>CiteScore 3.86 SJR 1.189 SNIP 1.712</td>
<td>Impact factor 3.131</td>
<td>BFI-level 2</td>
</tr>
<tr>
<td>2014</td>
<td>CiteScore 3.62 SJR 1.228 SNIP 1.913</td>
<td>Impact factor 2.723</td>
<td>BFI-level 2</td>
</tr>
<tr>
<td>2013</td>
<td>CiteScore 3.84 SJR 1.203 SNIP 1.988</td>
<td>Impact factor 3.188</td>
<td>BFI-level 2</td>
</tr>
<tr>
<td>2012</td>
<td>CiteScore 4.01 SJR 1.354 SNIP 2.51</td>
<td>Impact factor 3.057</td>
<td>BFI-level 2</td>
</tr>
<tr>
<td>2011</td>
<td>CiteScore 3.66 SJR 1.212 SNIP 2.182</td>
<td>Impact factor 3.245</td>
<td>BFI-level 2</td>
</tr>
<tr>
<td>2010</td>
<td>SJR 1.143 SNIP 1.741</td>
<td>Impact factor 2.597</td>
<td>BFI-level 2</td>
</tr>
<tr>
<td>2009</td>
<td>SJR 0.962 SNIP 1.735</td>
<td>Indexed yes</td>
<td>BFI-level 2</td>
</tr>
<tr>
<td>2008</td>
<td>SJR 0.759 SNIP 1.344</td>
<td>Indexed yes</td>
<td>BFI-level 2</td>
</tr>
<tr>
<td>2007</td>
<td>SJR 0.899 SNIP 1.505</td>
<td>Indexed yes</td>
<td>BFI-level 2</td>
</tr>
<tr>
<td>2006</td>
<td>SJR 0.823 SNIP 1.423</td>
<td>Indexed yes</td>
<td>BFI-level 2</td>
</tr>
<tr>
<td>2005</td>
<td>SJR 0.677 SNIP 1.098</td>
<td>Indexed yes</td>
<td>BFI-level 2</td>
</tr>
<tr>
<td>2004</td>
<td>SJR 0.536 SNIP 1.056</td>
<td>Indexed yes</td>
<td>BFI-level 2</td>
</tr>
<tr>
<td>2003</td>
<td>SJR 0.64 SNIP 0.915</td>
<td>Indexed yes</td>
<td>BFI-level 2</td>
</tr>
<tr>
<td>2002</td>
<td>SJR 0.392 SNIP 0.817</td>
<td>Indexed yes</td>
<td>BFI-level 2</td>
</tr>
<tr>
<td>2001</td>
<td>SJR 0.473 SNIP 0.92</td>
<td>Indexed yes</td>
<td>BFI-level 2</td>
</tr>
<tr>
<td>2000</td>
<td>SJR 0.447 SNIP 0.956</td>
<td>Indexed yes</td>
<td>BFI-level 2</td>
</tr>
<tr>
<td>1999</td>
<td>SJR 0.41 SNIP 0.629</td>
<td>Indexed yes</td>
<td>BFI-level 2</td>
</tr>
</tbody>
</table>
Adaptive management in the context of barriers in European freshwater ecosystems

Many natural habitats have been modified to accommodate for the presence of humans and their needs. Infrastructures such as hydroelectric dams, weirs, culverts and bridges are now a common occurrence in streams and rivers across the world. As a result, freshwater ecosystems have been altered extensively, affecting both biological and geomorphological components of the habitats. Many fish species rely on these freshwater ecosystems to complete their lifecycles, and the presence of barriers has been shown to reduce their ability to migrate and sustain healthy populations. In the long run, barriers may have severe repercussions on population densities and dynamics of aquatic animal species. There is currently an urgent need to address these issues with adequate conservation approaches. Adaptive management provides a relevant approach to managing barriers in freshwater ecosystems as it addresses the uncertainties of dealing with natural systems, and accommodates for future unexpected events, though this approach may not be suitable in all instances. A literature search on this subject yielded virtually no output. Hence, we propose a step-by-step guide for implementing adaptive management, which could be used to manage freshwater barriers.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology, University of Durham
Contributors: Birnie-Gauvin, K., Tummers, J. S., Lucas, M. C., Aarestrup, K.
Pages: 436-441
Publication date: 2017
Peer-reviewed: Yes

Publication information
Journal: Journal of Environmental Management
Volume: 204
ISSN (Print): 0301-4797
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 4.54 SJR 1.161 SNIP 1.705
Web of Science (2017): Impact factor 4.005
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 4.28 SJR 1.161 SNIP 1.809
Web of Science (2016): Impact factor 4.01
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 3.86 SJR 1.189 SNIP 1.712
Web of Science (2015): Impact factor 3.131
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 3.62 SJR 1.228 SNIP 1.913
Web of Science (2014): Impact factor 2.723
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): CiteScore 3.84 SJR 1.203 SNIP 1.988
Web of Science (2013): Impact factor 3.188
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): CiteScore 4.01 SJR 1.354 SNIP 2.51
Research output: Research - peer-review › Journal article – Annual report year: 2017

Blåfinnet tuns færden skal undersøges i danske farvande

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Oceans and Arctic, Section for Freshwater Fisheries Ecology, Section for Ecosystem based Marine Management
Contributors: MacKenzie, B., Aarestrup, K., Christoffersen, M.
Pages: 11
Publication date: 2017
Peer-reviewed: Unknown

Publication information
Journal: Fritidsfiskeren
Volume: 24
Issue number: 26
ISSN (Print): 0906-7752
Ratings:
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
ISI indexed (2011): ISI indexed no
Original language: Danish

Research output: Communication › Contribution to newspaper - Newspaper article – Annual report year: 2017
Effects of Cortisol on Short and Long Term Diet and Morphology

Glucocorticoids such as cortisol are released during stressful events. However, many of the effects of cortisol on animals in the wild are still poorly documented. We evaluated the effects of artificially elevated cortisol on diet and morphology over the short term (2 weeks) and long term (4 months) using a wild population of juvenile semi-anadromous brown trout (Salmo trutta) in Denmark. We caught, tagged and manipulated juvenile fish while in their natal freshwater streams in the fall. Manipulations consisted of an exogenous intracoelomic injection of cortisol suspended in vegetable shortening (designed to mimic an extreme physiological challenge), a sham group (injection of vegetable shortening) and a control group (tagged only). We then recaptured fish 2 weeks later and again after 4 months. We assessed diet using stable isotopes from plasma (short term) and scales (long term), and morphology using geometric morphometrics. Cortisol affected carbon stable isotope signatures but had minimal effects on nitrogen isotopes and morphology. Irrespective of treatment, carbon and nitrogen stable isotope values increased over time. This study shows that cortisol can have both short and long term effects on individuals in the wild.
Environment-dependent plasticity and ontogenetic changes in the brain of hatchery-reared Atlantic salmon

Lowered rearing density has repeatedly been shown to increase the performance of hatchery-reared salmonids stocked into natural environments. One possible mechanism for this pattern could be that lower densities enhance brain
development, which has been shown to be the case in other hatchery enhancement strategies, like environmental enrichment. Here, we investigated the size of the brain in hatchery-reared Atlantic salmon Salmo salar kept at standard (high) and reduced (low) tank densities. In contrast to our predictions, we found that fish reared at high density had larger dry mass of cerebellum and telencephalon, correcting for body size. No differences were detected for total brain mass. Furthermore, we found that the relative size of both telencephalon and cerebellum, in relation to total brain mass, changed with body size. Cerebellum increased in relative size with increased body size, while the opposite pattern was observed for telencephalon. Overall, these results reveal substantial brain plasticity depending on the surrounding environment as well as ontogenetic adaptive changes in the brain of the Atlantic salmon
Envisioning the future of aquatic animal tracking: Technology, science, and application

Electronic tags are significantly improving our understanding of aquatic animal behavior and are emerging as key sources of information for conservation and management practices. Future aquatic integrative biology and ecology studies will increasingly rely on data from electronic tagging. Continued advances in tracking hardware and software are needed to provide the knowledge required by managers and policymakers to address the challenges posed by the world’s changing aquatic ecosystems. We foresee multiplatform tracking systems for simultaneously monitoring the position, activity, and physiology of animals and the environment through which they are moving. Improved data collection will be accompanied by greater data accessibility and analytical tools for processing data, enabled by new infrastructure and cyberinfrastructure. To operationalize advances and facilitate integration into policy, there must be parallel developments in the accessibility of education and training, as well as solutions to key governance and legal issues.

General information
Følg den daglige smoltvandring i europæiske vandløb

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology
Contributors: Aarestrup, K., Baktoft, H., Sivebæk, F.
Publication date: 2017

Publication information
Media of output: Fiskepleje.dk
Year: 2017
Original language: Danish
URLs:
http://www.fiskepleje.dk/nyheder/2017/05/smolt-udvandring-2017?id=54e0230c-aa41-47c8-8a7a-
ef1ddf00bce&utm_source=newsletter&utm_media=mail&utm_campaign=2017_05_10_Nyhedsbrev
Research output: Communication › Net publication - Internet publication – Annual report year: 2017

Følg den naturlige udvandring af ørred- og laksesmolt fra danske vandløb

General information
State: Published
Organisations: National Institute of Aquatic Resources, Institute Management, Section for Freshwater Fisheries Ecology
Contributors: Koed, A., Aarestrup, K., Baktoft, H., Sivebæk, F., Geertz-Hansen, P.
Publication date: 2017

Publication information
Media of output: Fiskepleje.dk
Year: 2017
Original language: Danish
URLs:
Research output: Communication › Net publication - Internet publication – Annual report year: 2017

Havørredsmoltenes migration i Limfjorden

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology
Contributors: Kristensen, M. L., Aarestrup, K.
Number of pages: 26
Publication date: 2017

Publication information
Publisher: DTU Aqua. Institut for Akvatiske Ressourcer
If and when: Intrinsic differences and environmental stressors influence migration in brown trout (Salmo trutta)

Partial migration is a common phenomenon, yet the causes of individual differences in migratory propensity are not well understood. We examined factors that potentially influence timing of migration and migratory propensity in a wild population of juvenile brown trout (Salmo trutta) by combining experimental manipulations with passive integrated transponder telemetry. Individuals were subjected to one of six manipulations: three designed to mimic natural stressors (temperature increase, food deprivation, and chase by a simulated predator), an injection of exogenous cortisol designed to mimic an extreme physiological challenge, a sham injection, and a control group. By measuring length and mass of 923 individuals prior to manipulation and by monitoring tagged individuals as they left the stream months later, we assessed whether pre-existing differences influenced migratory tendency and timing of migration, and whether our manipulations affected growth, condition, and timing of migration. We found that pre-existing differences predicted migration, with smaller individuals and individuals in poor condition having a higher propensity to migrate. Exogenous cortisol manipulation had the largest negative effect on growth and condition, and resulted in an earlier migration date. Additionally, low-growth individuals within the temperature and food deprivation treatments migrated earlier. By demonstrating that both pre-existing differences in organism state and additional stressors can affect whether and when individuals migrate, we highlight the importance of understanding individual differences in partial migration. These effects may carry over to influence migration success and affect the evolutionary dynamics of sub-populations experiencing different levels of stress, which is particularly relevant in a changing world.
The vertical behaviour of 44 veteran sea trout Salmo trutta (275-580 mm) in different marine fjord habitats (estuary, pelagic, near shore with and without steep cliffs) was documented during May-February by acoustic telemetry. The swimming depth of S. trutta was influenced by habitat, time of day (day v. night), season, seawater temperature and the body length at the time of tagging. Mean swimming depth during May-September was 1.7 m (individual means ranged from 0.4 to 6.4 m). Hence, S. trutta were generally surface oriented, but performed dives down to 24 m. Mean swimming depth in May-September was deeper in the near-shore habitats with or without steep cliffs (2.0 m and 2.5 m, respectively) than in the pelagic areas (1.2 m). May-September mean swimming depth in all habitats was slightly deeper during day (1.9 m) than at night (1.2 m), confirming that S. trutta conducted small-scale diel vertical movements. During summer, S. trutta residing in near-shore habitat progressively moved deeper over the period May (mean 1.1 m) to August (mean 4.0 m) and then reoccupied shallower areas (mean 2.3 m) during September. In winter (November and February), individuals residing in the innermost part of the fjords were found at similar average depths as they occupied during the summer (mean 1.3 m). The swimming depths of S. trutta coincide with the previously known surface orientation of salmon lice Lepeophtheirus salmonis. Combined with previous studies on horizontal use of S. trutta, this study illustrates how S. trutta utilize marine water bodies commonly influenced by anthropogenic factors such as aquaculture, harbours and marine constructions, marine renewable energy production or other human activity. This suggests that the marine behaviour of S. trutta and its susceptibility to coastal anthropogenic factors should be considered in marine planning processes.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology, Norwegian University of Science and Technology, Norwegian Institute for Nature Research, Dalhousie University, UiT The Arctic University of Norway

DOI: 10.1007/s00442-017-3873-9
Research output: Research - peer-review > Journal article – Annual report year: 2017
Møde om havørreder i Roskilde Fjord 18. november 2017

Morphological, physiological and dietary covariation in migratory and resident adult brown trout (Salmo trutta)
The causes and consequences of trait relationships within and among the categories of physiology, morphology, and life-history remain poorly studied. Few studies cross the boundaries of these categories, and recent reviews have pointed out not only the dearth of evidence for among-category correlations but that trait relationships may change depending on the ecological conditions a population faces. We examined changes in mean values and correlations between traits in a partially migrant population of brown trout when migrant sea-run and resident stream forms were breeding sympatrically. Within each sex and life-history strategy group, we used carbon and nitrogen stable isotopes to assess trophic level and habitat use; assessed morphology which reflects swimming and foraging ability; measured circulating cortisol as it is released in response to stressors and is involved in the transition from salt to freshwater; and determined oxidative status by measuring oxidative stress and antioxidants. We found that sea-run trout were larger and had higher values of stable isotopes, cortisol and oxidative stress compared to residents. Most groups showed some correlations between morphology and diet, indicating individual resource specialization was occurring, and we found consistent correlations between morphology and cortisol. Additionally, relationships differed between the sexes (cortisol and oxidative status were related in females but not males) and between life-history strategies (habitat use was related to oxidative status in male sea-run trout but not in either sex of residents). The differing patterns of covariation between the two life-history strategies and between the sexes suggest that the relationships among phenotypic traits are subjected to different selection pressures, illustrating the importance of integrating multiple phenotypic measures across different trait categories and contrasting life-history strategies.
Oxidative stress and partial migration in brown trout (Salmo trutta)

During migration, animals are typically limited by their endogenous energetic resources which must be allocated to the physiological costs associated with locomotion, as well as avoiding and/or compensating for oxidative stress. To date, there have been few attempts to understand the role of oxidative status in migration biology, particularly in fish. Semi-anadromous brown trout (Salmo trutta, Linnaeus 1758) exhibit partial migration, where some individuals smoltify and migrate to sea, and others become stream residents, providing us with an excellent model to investigate the link between oxidative stress and migration. Using the brown trout, we obtained blood samples from juveniles from a coastal stream in Denmark in the fall prior to peak seaward migration which occurs in the spring, and assayed for antioxidant capacity (oxygen radical absorbance capacity) and oxidative stress levels (ratio of oxidized to reduced glutathione). We found that individuals that migrated had higher antioxidant capacity than residents and that future migration date was negatively correlated with both antioxidant capacity and body length in the fall. This study provides the first evidence that oxidative status is associated with migration strategy and timing, months in advance of the actual migration, and provides insight into the role of oxidative status in animal migration.
Telemetry has become a standard tool in fish research, but tagging methods still need refinement to achieve better results and to improve animal welfare. One of the problems reported from evaluations of surgical implants is unsatisfactory wound closure. Thus, researchers struggle to find better ways to close incisions, typically for implants of tags under field conditions. Problems are regularly encountered when closing incisions with traditional absorbable or non-absorbable suture, including decreased growth, slow wound healing, erythema and necrosis at sutures. In this study, survival, growth, tag expulsion rate and incision healing was compared among three groups of dummy transmitter-tagged wild brown trout Salmo trutta where incisions were closed with two types of suture material (absorbable vs. fast absorbable) and Histo-glue. The tagged fish were kept in semi-natural ponds for 20 days. Survival did not differ between groups, but growth of the tagged fish was lower than that of the control group. Histo-glue gave the best healing, but resulted in high tag loss rate (33%). The fast absorbable suture did not disappear faster than normal absorbable suture, healing and tag loss was similar. The use of fast absorbable suture may hold potential for improving the procedure and should be further tested.
Pighværrers vandring i Roskilde Fjord

General information
State: Published
Pike (Esox lucius L.) on the edge: consistent individual movement patterns in transitional waters of the western Baltic

Pike in the western Baltic Sea live on the edge of their salinity tolerance. Under physiologically challenging conditions, organism may respond by moving to environmentally more benign areas during critical periods, such as during spawning. We hypothesised that pike in a brackish lagoon (8–10 ppt salinity) would perform spawning- and feeding-related movements between areas with different salinity regimes. Twenty-two pike were caught prior to spawning, tagged with acoustic transmitters, and their movements were tracked for 18 months. Pike showed two main patterns of movements that were consistent within individuals across two years. Whereas some individuals stayed in the lagoon year-round, most pike left the lagoon for longer periods after spawning and returned to the lagoon prior to following year’s spawning season. We found no evidence that probability of moving out of the lagoon co-varied with either length or condition factor. Despite the fact that the lagoon’s salinity is close to the reported upper limit for pike egg development, results indicated that all pike spawned in the lagoon. Correspondingly, genetic data showed that all fish belonged to the same reproductive population unit. Movement patterns thus appear to reflect individual variation in home-range and/or resource optimisation following ideal free principles.
Shining a light on the loss of rheophilic fish habitat in lowland rivers as a forgotten consequence of barriers and its implications for management

Abstract
1. The majority of rivers around Europe have been modified in one way or another, and no longer have an original, continuous flow from source to outlet. The presence of weirs and dams has altered habitats, thus affecting the wildlife that lives within them. This is especially true for migrating rheophilic fish species, which, in addition to safe passage, depend on gradient and fast-flowing waters for reproductive success and early development.
2. Thus far, research has focused on investigating the impacts of weirs and dams on fish passage, with less attention paid to the loss of habitat entrained by such infrastructure. The loss of rheophilic habitat is particularly important in lowland streams, where gradient is limited, and dams and weirs can be constructed with less effort.
3. Denmark is considered a typical lowland country, where the landscape around streams and rivers has been modified by agriculture and other human activities for centuries, leaving management practitioners wondering how much change is acceptable to maintain sustainable fish populations and fisheries practices.
4. With examples from Denmark, this paper attempts to conceptualize the loss in habitat as a result of barriers in lowland streams and rivers, and the repercussions that such alterations may have on rheophilic fish populations. Furthermore, the need for management to address habitat loss and its related consequences concurrently with the improvement of fish passage is emphasized.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology, Institute Management, Limfjord Council
Contributors: Birnie-Gauvin, K., Aarestrup, K., Riis, T. M. O., Jepsen, N., Koed, A.
Pages: 1345-1349
Publication date: 2017
Peer-reviewed: Yes

Publication information
Journal: Aquatic Conservation: Marine and Freshwater Ecosystems
Volume: 27
Issue number: 6
ISSN (Print): 1052-7613
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 2.79 SJR 1.203 SNIP 1.255
Web of Science (2017): Impact factor 2.988
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.5 SJR 1.189 SNIP 1.038
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 1.98 SJR 1.087 SNIP 1.021
Web of Science (2015): Impact factor 2.415
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 1.99 SJR 1.013 SNIP 1.195
Web of Science (2014): Impact factor 2.136
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 1.95 SJR 1.139 SNIP 1.028
Web of Science (2013): Impact factor 1.756
Scopus rating (2012): CiteScore 2.15 SJR 1.069 SNIP 1.147
Web of Science (2012): Impact factor 1.917
Scopus rating (2011): CiteScore 1.97 SJR 1.178 SNIP 1.099
Web of Science (2011): Impact factor 1.929
Short-term and long-term effects of transient exogenous cortisol manipulation on oxidative stress in juvenile brown trout

In the wild, animals are exposed to a growing number of stressors with increasing frequency and intensity, as a result of human activities and human-induced environmental change. To fully understand how wild organisms are affected by stressors, it is crucial to understand the physiology that underlies an organism's response to a stressor. Prolonged levels of elevated glucocorticoids are associated with a state of chronic stress and decreased fitness. Exogenous glucocorticoid manipulation reduces an individual's ability to forage, avoid predators and grow, thereby limiting the resources available for physiological functions like defence against oxidative stress. Using brown trout (Salmo trutta), we evaluated the short-term (2 weeks) and long-term (4 months over winter) effects of exogenous cortisol manipulations (versus relevant shams and controls) on the oxidative status of wild juveniles. Cortisol caused an increase in glutathione over a 2 week period and appeared to reduce glutathione over winter. Cortisol treatment did not affect oxidative stress levels or low molecular weight antioxidants. Cortisol caused a significant decrease in growth rates but did not affect predation risk. Over-winter survival in the stream was associated with low levels of oxidative stress and glutathione. Thus, oxidative stress may be a mechanism by which elevated cortisol causes negative physiological effects.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology, Carleton University
Contributors: Birnie-Gauvin, K., Peiman, K. S., Larsen, M. H., Aarestrup, K., Willmore, W. G., Cooke, S. J.
Pages: 1693-1700
Publication date: 2017
Peer-reviewed: Yes

Publication information
Journal: Journal of Experimental Biology
Volume: 220
Issue number: 9
ISSN (Print): 0022-0949
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 2.6 SJR 1.611 SNIP 1.306
Web of Science (2017): Impact factor 3.179
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.62 SJR 1.824 SNIP 1.27
Web of Science (2016): Impact factor 3.32
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 2.4 SJR 1.821 SNIP 1.211
Web of Science (2015): Impact factor 2.914
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 2.51 SJR 1.742 SNIP 1.315
Web of Science (2014): Impact factor 2.897
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): CiteScore 2.75 SJR 1.733 SNIP 1.314
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): CiteScore 2.91 SJR 1.627 SNIP 1.372
Web of Science (2012): Impact factor 3.236
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): CiteScore 2.77 SJR 1.553 SNIP 1.321
Web of Science (2011): Impact factor 2.996
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 1.491 SNIP 1.332
Web of Science (2010): Impact factor 3.04
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 1.775 SNIP 1.356
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 1.915 SNIP 1.384
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.599 SNIP 1.397
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.449 SNIP 1.358
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 1.619 SNIP 1.299
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 1.527 SNIP 1.329
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 1.271 SNIP 1.194
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 1.452 SNIP 1.221
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 1.484 SNIP 1.313
Scopus rating (2000): SJR 1.491 SNIP 1.196
Web of Science (2000): Indexed yes
Scopus rating (1999): SJR 1.592 SNIP 1.318
Original language: English
Keywords: Antioxidants, Glucocorticoids, Glutathione, Oxidative ecology, Reactive oxygen species, Salmo trutta
Electronic versions:
Publishers version
DOIs:
10.1242/jeb.155465
URLs:
http://jeb.biologists.org/content/early/2017/02/15/jeb.155465
Survival of migrating sea trout (Salmo trutta) smolts during their passage of an artificial lake in a Danish lowland stream

Artificial lake development is often used as a management tool to reduce nutrient runoff to coastal waters. Denmark has restored more than 10,000 ha of wetlands and lakes in the last 14 years as a consequence of 'Action Plans for the Aquatic Environment', which aim to meet the demands of the European Union's Water Framework Directive. Juvenile, seaward migrating salmonids are highly affected by impounded waterbodies, as they are subjected to extraordinary high mortalities due to predation and altered habitat. From 2005 to 2015, survival and migration patterns of wild brown trout (Salmo trutta) smolts were investigated by using radio, acoustic and Passive Integrated Transponder telemetry both before and after the development of an artificial lake in a small Danish lowland stream. In 2005 and 2006, before the lake developed, survival was estimated to be 100% in the river stretch where the lake later developed. In 2007 and in the period between 2009 and 2015, mean yearly survival decreased to 26%. Mean time for passing the area increased significantly after the development of the lake from 0.42 to 5.95 days. Generalized additive models were used to model the probability of a successful passage. Water temperature and discharge were key environmental factors affecting survival of the smolts during the passage of the lake. Furthermore, smolt survival was negatively correlated with condition factor. This elevated level of smolt mortality may seriously compromise self-sustaining anadromous salmonid populations when artificial lakes are developed in connection with rivers.
Udsatte pighvarrer lader til at blive i Roskilde Fjord

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, Section for Freshwater Fisheries Ecology
Publication date: 2017

Publication information
Media of output: Fiskepleje.dk
Year: 2017
Original language: Danish
URLs: http://www.fiskepleje.dk/nyheder/2017/12/pighvarrer-i-roskilde-fjord?id=ce1c2f6f-2b03-4961-8f77-55ee732b8e6&utm_source=newsletter&utm_media=mail&utm_campaign=2017_12_07_Nyhedsbrev
Research output: Communication › Net publication - Internet publication – Annual report year: 2017

Vildt, vildere – Villestrup Å

General information
State: Published
Aborrer og gedder i brakvand - betydningen af ferskvandsområder for gydning

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology, Section for Marine Ecology and Oceanography, University of Copenhagen
Contributors: Jacobsen, L., Berg, S., Skov, C., Nielsen, J., Aarestrup, K., Jepsen, N., Christensen, E. A. F., Skovrind, M., Højrup, L. B.
Publication date: 2016
Peer-reviewed: No
Event: Poster session presented at Dansk Ferskvandssymposium 2016, Copenhagen, Denmark.
Research output: Research › Poster – Annual report year: 2016

Accounting for potential physiological, behavioral, and community-level responses to reintroduction

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology
Contributors: Jachowski, D. S., Bremner-Harrison, S., Steen, D. A., Aarestrup, K.
Number of pages: 408
Pages: 185-215
Publication date: 2016

Host publication information
Title of host publication: Reintroduction of Fish and Wildlife Populations
Publisher: University of California Press
Editors: Jachowski, D. S., Millspaugh, J. J., Angermeier, P. L., Slotow, R.
ISBN (Print): 9780520284616
ISBN (Electronic): 9780520960381
Research output: Research - peer-review › Book chapter – Annual report year: 2016

Cormorant predation of the highly endangered North Sea houting in river Vidaa, Denmark

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology, Section for Ecosystem based Marine Management, Institut National des Sciences Appliquees de Lyon, Aalborg University, Fisheries and Maritime Museum
Contributors: Jensen, L. F., Rognon, P. C. B., Aarestrup, K., Thomsen, S. N., Hertz, M., Svendsen, J. C.
Publication date: 2016
Peer-reviewed: No
Electronic versions: Snæbel poster
Research output: Research › Poster – Annual report year: 2016

Deltag i en undersøgelse af ørredfiskeri i Isefjorden

General information
Empirical observations of the spawning migration of European eels: The long and dangerous road to the Sargasso Sea

Fresh data on the timing and speed of the oceanic spawning migration of European eels suggest a new paradigm for spawning ecology.

First evidence of European eels exiting the Mediterranean Sea during their spawning migration

The migration route and the spawning site of the European eel Anguilla anguilla are still uncertain. It has been suggested that the Mediterranean eel stock does not contribute to spawning because there is no evidence of eels leaving the Mediterranean Sea. To test this hypothesis, we equipped eight female silver eels from the south of France with pop-up satellite tags during escapement from coastal waters. Once in deeper water, the eels quickly established diel vertical migration (DVM) between the upper and lower mesopelagic zone. Five tagged eels were taken by predators within the Mediterranean, but two eels reached the Atlantic Ocean after six months and at distances greater than 2000 km from release. These eels ceased their DVM while they negotiated the Gibraltar Strait, and remained in deep water until they reached the Atlantic Ocean, when they recommenced DVM. Our results are the first to show that eels from Mediterranean can cross the Strait of Gibraltar and continue their migration into the Atlantic Ocean. This finding suggests that Mediterranean countries, as for other EU states, have an important role to play in contributing to conservation efforts for the recovery of the European eel stock.
Hvilke ørreder fanger lystfiskere i Isefjorden?

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology
Contributors: Geertz-Hansen, P., Aarestrup, K., Sivebæk, F.
Publication date: 2016

Hvilke ørreder fanger lystfiskere i Isefjorden?

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology
Contributors: Amilhat, E., Aarestrup, K., Faliex, E., Simon, G., Westerberg, H., Righton, D.
Publication date: 2016

Publication information
Journal: Scientific Reports
Volume: 6
Article number: 21817
ISSN (Print): 2045-2322
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 4.36 SJR 1.533 SNIP 1.245
Web of Science (2017): Impact factor 4.122
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 4.63 SJR 1.692 SNIP 1.354
Web of Science (2016): Impact factor 4.259
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 5.3 SJR 2.034 SNIP 1.597
Web of Science (2015): Impact factor 5.228
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 4.75 SJR 2.163 SNIP 1.554
Web of Science (2014): Impact factor 5.578
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 4.06 SJR 1.998 SNIP 1.57
Web of Science (2013): Impact factor 5.078
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 2.44 SJR 1.531 SNIP 0.962
Web of Science (2012): Impact factor 2.927
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
Web of Science (2011): Impact factor
ISI indexed (2011): ISI indexed no
Original language: English
Electronic versions:
Publishers versions
DOIs:
10.1038/srep21817
Research output: Research - peer-review › Journal article – Annual report year: 2016
Hydrographic features of anguillid spawning areas: Potential signposts for migrating eels

Catadromous anguillid eels (genus Anguilla) migrate from their freshwater or estuarine habitats to marine spawning areas. Evidence from satellite tagging studies indicates that tropical and temperate eel species exhibit pronounced diel vertical migrations, from between 150-300 m nighttime depths to 600-800 m during the day. Collections of eggs and larvae of Japanese eels A. japonica suggest they may spawn at these upper nighttime migration depths. How anguillid eels navigate through the ocean and find their spawning areas remains unknown; thus, this study describes the salinity, temperature and geostrophic currents between 0 and 800 m depths within 2 confirmed and 3 hypothetical anguillid spawning areas during likely spawning seasons. Within the 4 ocean gyres in which these spawning areas are located, many eels would encounter subducted 'Subtropical Underwater' water masses during their nighttime ascents that could provide odor plumes as signposts. Four of the spawning areas are located near the western margins of where subducted water masses form cores of elevated salinities (~35.0 to 36.8) around 150 m depths, and one is located near the center of subduction. Low salinity surface waters and fronts are present in some of the areas above the high-salinity cores. Spawning may occur at temperatures between 16 and 24°C where the thermocline locally deepens. At spawning depths, weak westward currents (~0 to 0.1 m s^-1) prevail, and eastward surface countercurrents are present. Anguillid eels possess acute sensory capabilities to detect these hydrographic features as potential signposts, guiding them to their spawning areas.
Investigating the phenology of seaward migration of juvenile brown trout (Salmo trutta) in two European populations

Recent evidence supports the existence of a downstream autumn-migratory phenotype in juvenile anadromous brown trout (Salmo trutta), however the precise timing, extent and ecological significance of such behaviour remains ambiguous. We investigated the phenology of downstream migration of wild juvenile trout using passive integrated transponder (PIT) telemetry over an eight-month period in two European rivers; the River Deerness, north-east England, and the River Villestrup, Denmark. The incidence of autumn–winter seaward migration was greater in the Deerness than the Villestrup, with at least 46% of migrating juveniles detected prior to spring smoltification in the Deerness. Timing of migration was strongly regulated by factors associated with river discharge in both systems. While autumn and spring downstream migrants did not differ in size at the time of tagging in either system, evidence that spring migrants were of better condition, travelled faster (autumn: 11.0 km day⁻¹; spring: 24.3 km day⁻¹) and were more likely to leave the Deerness suggests that autumn and spring migrant conspecifics respond to different behavioural motivations. Further investigation into the sex of autumn migrant juveniles, as well as the temporal and geographical variability in the incidence and fitness consequences of autumn emigration by juvenile trout would be beneficial.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology, University of Durham
Knowledge exchange for efficient passage of fish in the southern hemisphere (KEEPFISH)
The decline of freshwater fish biodiversity is proceeding at an alarming and persistent rate. Given that most fish must undertake some form of migration in order to complete their life-cycle, of particular concern is the proliferation of hydropower schemes that block migration routes, as well as a variety of other barriers such as weirs and culverts. Several locations in the southern hemisphere are among the major global hotspots of hydropower development. Mitigation measures for fish passage have traditionally relied on designs developed for strong swimming, generally salmonid species of the northern hemisphere. These designs are ineffective for smaller, relatively weak swimming 'non-sport' fish, such as those found in temperate regions of the southern hemisphere, but there is no detailed understanding of the mechanisms involved. This paper introduces an innovative EU-funded project, KEEPFISH, that aims to address gaps in the knowledge of passage requirements for non-sport fish of the temperate south. The project, beginning in 2016, represents the first systematic attempt to bring together world-leading practitioners in an effort to exchange knowledge and construct a shared vision for fish passage science and policy. This will be achieved through systematic review, expert consultation, ecological modelling, postgraduate training programmes, networking and stakeholder engagement using a novel combination of approaches.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology, Coventry University, Magdeburg-Stendal University of Applied Sciences, NIWA, Universidad de Concepcion, University of Southampton, Federal University of Lavras, Universidade Federal de Sao Joao del-Rei, University of Melbourne
Publication date: 2016
Peer-reviewed: No
Keywords: ENVIRONMENTAL, WATER, ADULT SOCKEYE-SALMON, BIODIVERSITY, TELEMETRY, PATAGONIA, UPSTREAM, CHILE
Source: FindIt
Source-ID: 2371978645
Research output: Research › Conference abstract for conference – Annual report year: 2017

Konflikt mellem skarv og den udrydelsesstruede snæbel

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, Section for Freshwater Fisheries Ecology, Aalborg University, Institut National des Sciences Appliquees de Lyon, Fisheries and Maritime Museum
Contributors: Svendsen, J. C., Aarestrup, K., Hertz, M., Thomsen, S. N., Rognon, P. C., Jensen, L. F.
Publication date: 2016

Publication Information
Media of output: Fiskepleje.dk
Year: 2016
Original language: Danish
URLs:
http://www.fiskepleje.dk/Nyheder/Nyhed?id=8eef00f1-f20b-442c-90a4-c5b9c575d7d3
Research output: Communication › Net publication - Internet publication – Annual report year: 2016

Laksebestanden i Ribe Å 2014

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology, Institute Management
Contributors: Pedersen, S., Koed, A., Aarestrup, K., Jepsen, N., Sivebæk, F.
Number of pages: 88
Publication date: 2016
Laksen i Storå skal fremover klare sig uden udsætninger

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology, Institute Management, Section for Marine Living Resources
Contributors: Sivebæk, F., Koed, A., Eg Nielsen, E., Jepsen, N., Aarestrup, K.
Publication date: 2016

Naturlig smoltudvandring fra danske vandløb

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology
Contributors: Aarestrup, K., Baktoft, H., Sivebæk, F.
Publication date: 2016

Partitioning the metabolic scope: the importance of anaerobic metabolism and implications for the oxygen- and capacity-limited thermal tolerance (OCLTT) hypothesis
Ongoing climate change is predicted to affect the distribution and abundance of aquatic ectotherms owing to increasing constraints on organismal physiology, in particular involving the metabolic scope (MS) available for performance and fitness. The oxygen- and capacity-limited thermal tolerance (OCLTT) hypothesis prescribes MS as an overarching benchmark for fitness-related performance and assumes that any anaerobic contribution within the MS is insignificant. The MS is typically derived from respirometry by subtracting standard metabolic rate from the maximal metabolic rate; however, the methodology rarely accounts for anaerobic metabolism within the MS. Using gilthead sea bream (Sparus aurata) and Trinidadian guppy (Poecilia reticulata), this study tested for trade-offs (i) between aerobic and anaerobic components of locomotor performance; and (ii) between the corresponding components of the MS. Data collection involved measuring oxygen consumption rate at increasing swimming speeds, using the gait transition from steady to unsteady (burst-assisted) swimming to detect the onset of anaerobic metabolism. Results provided evidence of the locomotor performance trade-off, but only in S. aurata. In contrast, both species revealed significant negative correlations between aerobic and anaerobic components of the MS, indicating a trade-off where both components of the MS cannot be optimized simultaneously. Importantly, the fraction of the MS influenced by anaerobic metabolism was on average 24.3 and 26.1% in S. aurata and P. reticulata, respectively. These data highlight the importance of taking anaerobic metabolism into account when assessing effects of environmental variation on the MS, because the fraction where anaerobic
metabolism occurs is a poor indicator of sustainable aerobic performance. Our results suggest that without accounting for anaerobic metabolism within the MS, studies involving the OCLTT hypothesis could overestimate the metabolic scope available for sustainable activities and the ability of individuals and species to cope with climate change.
Reduced rearing density increases postrelease migration success of Atlantic salmon (Salmo salar) smolts

The overall aim of this study was to investigate the effect of rearing density on the post-release survival of Atlantic salmon (Salmo salar) smolts during seaward migration. Fish were either reared at conventional hatchery density or at one-third of conventional density. Three hundred one-year old smolts from each density treatment were individually tagged with passive integrated transponder (PIT) tags and released 3.2 km upstream of a stationary antenna array in a natural stream. There were no significant differences in length, body mass, or condition between fish from the two density treatments during rearing in the hatchery. However, individuals reared at reduced density had less eroded dorsal fins and opercula relative to those from the high-density treatment. In the stream, the downstream migration success was 16% higher for fish reared at reduced density than for conspecifics kept at high-density, but the timing of migration was similar for both groups. These novel results suggest that conventionally high rearing densities may reduce welfare and the post-release migration success of hatchery-reared Atlantic salmon.
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 2.44 SJR 1.329 SNIP 1.036
Web of Science (2017): Impact factor 2.631
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.56 SJR 1.388 SNIP 1.185
Web of Science (2016): Impact factor 2.466
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 2.22 SJR 1.267 SNIP 1.025
Web of Science (2015): Impact factor 2.437
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 2.6 SJR 1.476 SNIP 1.379
Web of Science (2014): Impact factor 2.287
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): CiteScore 2.25 SJR 1.439 SNIP 1.086
Web of Science (2013): Impact factor 2.276
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): CiteScore 2.29 SJR 1.359 SNIP 1.232
Web of Science (2012): Impact factor 2.323
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): CiteScore 2.13 SJR 1.452 SNIP 1.136
Web of Science (2011): Impact factor 2.213
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 1.466 SNIP 1.154
Web of Science (2010): Impact factor 2.166
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 1.488 SNIP 1.226
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 1.609 SNIP 1.367
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.64 SNIP 1.237
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.37 SNIP 1.258
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 1.583 SNIP 1.539
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 1.767 SNIP 1.538
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 2.112 SNIP 1.616
Scopus rating (2002): SJR 1.777 SNIP 1.495
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 1.774 SNIP 1.455
Spatial ecology of blue shark and shortfin mako in southern Peru: local abundance, habitat preferences and implications for conservation

While global declines of pelagic shark populations have been recognized for several years, conservation efforts remain hampered by a poor understanding of the spatial distribution and ecology. Two species of conservation concern are the blue shark Prionace glauca and the shortfin mako shark Isurus oxyrinchus. To improve management of the species, this study examined their local abundance patterns, habitat preferences, and distribution in the Southeast Pacific. Catch per unit effort (CPUE) data from an artisanal fishery in Peru were used to identify geographic hotspots and model abundance estimates as a function of environmental variables including the El Niño Southern Oscillation (ENSO). A 10-year data series revealed declining annual landings since 2011, despite no changes in management structures. Significant aggregations of both species were found in the southwestern part of Peruvian waters (74–76°W; 17–19°S) with both locations targeted by major fishing efforts. P. glauca CPUE increased during La Niña conditions, and CPUE of both species declined when water depths exceeded 1000 m. Correlations with lunar illumination and chlorophyll-a were revealed in P. glauca and I. oxyrinchus, respectively. Modeling explained 57 to 61% of the deviance, indicating that other factors not included in the present study might account for unexplained variance in CPUE (e.g. thermocline, location of marine fronts, dissolved oxygen, and gear characteristics). Given the importance of the examined area to shark fisheries and the exploitation of multiple species of conservation concern, the information presented here can be used to inform management strategies designed to limit the depletion of pelagic sharks.
Stress and food deprivation: linking physiological state to migration success in a teleost fish

Food deprivation (FD) is a naturally occurring stressor that is thought to influence the ultimate life-history strategy of individuals. Little is known about how FD interacts with other stressors to influence migration success. European populations of brown trout (Salmo trutta) exhibit partial migration, whereby a portion of the population smoltifies and migrates to the ocean, and the rest remain in their natal stream. This distinct, natural dichotomy of life-history strategies provides an excellent opportunity to explore the roles of energetic state (as affected by FD) and activation of the glucocorticoid stress response in determining life-history strategy and survival of a migratory species. Using an experimental approach, the relative influences of short-term FD and experimental cortisol elevation (i.e., intra-coelomic injection of cortisol suspended in cocoa butter) on migratory status, survival, and growth of juvenile brown trout relative to a control were evaluated. Fewer fish migrated in both the FD and cortisol treatments; however, migration of cortisol and control treatments occurred at the same time while the FD treatment was delayed for approximately one week. A significantly greater proportion of trout in the FD treatment remained in their natal stream, but unlike the cortisol treatment, there were no long-term negative effects of FD on growth, relative to the control. Overall survival rates were comparable between the FD and control treatments, but significantly lower for the cortisol treatment. Food availability and individual energetic state appear to dictate the future life-history strategy (migrate or remain resident) of juvenile salmonids while experimental elevation of the stress hormone cortisol caused impaired growth and reduced survival of both resident and migratory individuals.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology, Aarhus University
Contributors: Midwood, J., Larsen, M. H., Aarestrup, K., Cooke, S.
Pages: 3712-3718
Publication date: 2016
Peer-reviewed: Yes

Publication information
Journal: Journal of Experimental Biology
Volume: 219
Issue number: 23
ISSN (Print): 0022-0949
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 2.6 SJR 1.611 SNIP 1.306
Web of Science (2017): Impact factor 3.179
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.62 SJR 1.824 SNIP 1.27
Web of Science (2016): Impact factor 3.32
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 2.4 SJR 1.821 SNIP 1.211
Web of Science (2015): Impact factor 2.914
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Udbytte af udsatte ½- og 1-års laks (Salmo salar) i Skjern Å

General information
An experimental field evaluation of winter carryover effects in semi-anadromous Brown trout (Salmo trutta)

For semi-anadromous brown trout, the decision whether or not to smoltify and migrate to the sea is believed to be made at the end of the preceding summer in response to both local environmental conditions and individual physiological status. Stressors experienced during the fall may therefore influence their propensity to migrate as well as carry over into the winter resulting in mortality when fish face challenging environmental conditions. To evaluate this possibility, we artificially elevated cortisol levels in juvenile trout (via intracoelomic injection of cortisol in the fall) and used passive integrated transponder tags to compare their overwinter and spring survival, growth, and migration success relative to a control group. Results suggest that overwinter mortality is high for individuals in this population regardless of treatment. However, survival rates were 2.5 times lower for cortisol-treated fish and they experienced significantly greater loss in mass. In addition, less than half as many cortisol-treated individuals made it downstream to a stationary antenna over the winter and also during the spring migration compared to the control treatment. These results suggest that a fall stressor can reduce overwinter survival of juvenile brown trout, negatively impact growth of individuals that survive, and ultimately result in a reduction in the number of migratory trout. Carryover effects such as those documented here reveal the cryptic manner in which natural and anthropogenic stressors can influence fish populations.
Aquatic animal telemetry: A panoramic window into the underwater world

The distribution and interactions of aquatic organisms across space and time structure our marine, freshwater, and estuarine ecosystems. Over the past decade, technological advances in telemetry have transformed our ability to observe aquatic animal behavior and movement. These advances are now providing unprecedented ecological insights by connecting animal movements with measures of their physiology and environment. These developments are revolutionizing the scope and scale of questions that can be asked about the causes and consequences of movement and are redefining how we view and manage individuals, populations, and entire ecosystems. The next advance in aquatic telemetry will be the development of a global collaborative effort to facilitate infrastructure and data sharing and management over scales not previously possible.
Effects of emergence time and early social rearing environment on behaviour of Atlantic salmon: Consequences for juvenile fitness and smolt migration

Consistent individual differences in behaviour have been well documented in a variety of animal taxa, but surprisingly little is known about the fitness and life-history consequences of such individual variation. In wild salmonids, the timing of fry emergence from gravel spawning nests has been suggested to be coupled with individual behavioural traits. Here, we further investigate the link between timing of spawning nest emergence and behaviour of Atlantic salmon (Salmo salar), test effects of social rearing environment on behavioural traits in fish with different emergence times, and assess whether behavioural traits measured in the laboratory predict growth, survival, and migration status in the wild. Atlantic salmon fry were sorted with respect to emergence time from artificial spawning nest into three groups: early, intermediate, and late. These emergence groups were hatchery-reared separately or in co-culture for four months to test effects of social rearing environment on behavioural traits. Twenty fish from each of the six treatment groups were then subjected to three individual-based behavioural tests: basal locomotor activity, boldness, and escape response. Following behavioural characterization, the fish were released into a near-natural experimental stream. Results showed differences in escape behaviour between emergence groups in a net restraining test, but the social rearing environment did not affect individual behavioural expression. Emergence time and social environment had no significant effects on survival, growth, and migration status in the stream, although migration propensity was 1.4 to 1.9 times higher for early emerging individuals that were reared separately. In addition, despite individuals showing considerable variation in behaviour across treatment groups, this was not translated into differences in growth, survival, and migration status. Hence, our study adds to the view that fitness (i.e., growth and survival) and life-history predictions from laboratory measures of behaviour should be made with caution and ideally tested in nature.
Effects of hatchery rearing practices and cortisol manipulation on growth, survival and seaward migration success of stocked and wild Atlantic salmon and brown trout smolts

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology
Contributors: Larsen, M. H., Aarestrup, K., Skov, C.
Number of pages: 166
Publication date: 2015

Publication information
Place of publication: Charlottenlund
Publisher: Technical University of Denmark. National Institute of Aquatic Resources
Original language: English
Research output: Research › Ph.D. thesis – Annual report year: 2015

Følg ørrederne, når de vandrer fra Geels Å og ud i Odense Fjord

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology
Contributors: Geertz-Hansen, P., Aarestrup, K., Sivebæk, F.
Publication date: 2015

Publication information
Media of output: Fiskepleje.dk
Year: 2015
Original language: Danish
URLs:
Følg ørrederne, når de vandrer fra vandløb og ud i havet

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology
Contributors: Aarestrup, K., Sivebæk, F., Baktoft, H.
Publication date: 2015

Publication information
Media of output: Fiskepleje.dk
Year: 2015
Original language: Danish
URLs:
http://www.fiskepleje.dk/Nyheder/2015/03/Smoltudvandring-fra-vandloeb-2015

Genetic and migratory evidence for sympatric spawning of tropical Pacific eels from Vanuatu
The spawning areas of tropical anguillid eels in the South Pacific are poorly known, and more information about their life histories is needed to facilitate conservation. We genetically characterized 83 out of 84 eels caught on Gaua Island (Vanuatu) and tagged 8 eels with pop-up satellite transmitters. Based on morphological evidence, 32 eels were identified as Anguilla marmorata, 45 as A. megastoma and 7 as A. obscura. Thirteen of these eels possessed a mitochondrial DNA sequence (control region, 527 bp) or nuclear haplotype (GTH2b, 268 bp) conflicting with their species designation. These individuals also had multi-locus genotypes (6 microsatellite loci) intermediate between the species, and 9 of these eels further possessed heterozygote genotypes at species-diagnostic nuclear single nucleotide polymorphisms (SNPs). We classified these individuals as possibly admixed between A. marmorata and A. megastoma. One A. marmorata and one A. megastoma migrated 634 and 874 km, respectively, towards the border between the South Equatorial Current and the South Equatorial Counter Current. Both species descended from around 200 m depth at night to 750 m during the day. Lunar cycle affected the upper limit of migration depths of both species. The tags remained attached for 3 and 5 mo and surfaced

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology, University of Salzburg, Norwegian Institute for Nature Research, Department of Environmental Protection and Conservation, University of Innsbruck, University of Tartu, University of Salford, Plymouth Marine Laboratory, Nihon University
Pages: 171-187
Publication date: 2015
Peer-reviewed: Yes
Publication information
Journal: Marine Ecology Progress Series
Volume: 521
ISSN (Print): 0171-8630
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 2.53
Web of Science (2017): Impact factor 2.276
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.4
Web of Science (2016): Impact factor 2.292
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 2.56
Web of Science (2015): Impact factor 2.361
Marine migration and habitat use of anadromous brown trout Salmo trutta

The biology and ecology of anadromous brown trout (Salmo trutta) at sea is poorly understood. This study provided information on spatial and temporal distribution of sea trout in the ocean. The behaviour of 115 individuals (veteran migrants, 270–700 mm) was tracked by using acoustic telemetry in a fjord system during April–September in 2012–2013. Overall, fish spent 68% of their marine residence time close to river mouths (<4 km). Most fish registrations (75%) were in nearshore habitats, but pelagic areas were also used. The maximum migration distance of tagged fish was categorized as short (<4 km from river mouth, 40% of fish), medium (4 – 13 km, 18% of fish), or long (>13 km, 42% of fish). Long-distance migrants had poorer body condition in spring prior to migration, used pelagic areas more often, and returned earlier to fresh water than short- and medium-distance migrants. Marine residence time was 7–183 days and was positively correlated to body length and smolt age, but negatively correlated to the date of sea entry.
Scopus rating (2007): SJR 1.64 SNIP 1.237
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.37 SNIP 1.258
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 1.583 SNIP 1.539
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 1.767 SNIP 1.538
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 2.112 SNIP 1.616
Scopus rating (2002): SJR 1.777 SNIP 1.495
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 1.774 SNIP 1.455
Web of Science (2001): Indexed yes
Scopus rating (2000): SJR 2.125 SNIP 1.462
Web of Science (2000): Indexed yes
Scopus rating (1999): SJR 1.973 SNIP 1.431
Original language: English
Electronic versions:
Publishers_version
DOIs:
10.1139/cjfas-2014-0560
Research output: Research - peer-review › Journal article – Annual report year: 2015

Ørredfangster i Isefjorden bliver undersøgt

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology
Contributors: Geertz-Hansen, P., Aarestrup, K., Sivebæk, F.
Publication date: 2015

Publication information
Media of output: Fiskeplej.dk
Year: 2015
Original language: Danish
URLs:
http://www.fiskepleje.dk/Nyheder/2015/05/Oerredsmolt-udaetsning-i-isefjorden-sjaelland-2015?id=e5b32e1f-cc95-40ab-b914-a266c9422f&utm_source=newsletter&utm_media=mail&utm_campaign=
Research output: Communication › Net publication - Internet publication – Annual report year: 2015

Phenotypic variation in metabolism and morphology correlating with fish movements in the wild: a study combining respirometry and telemetry

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology, Institute Management, University of Porto
Publication date: 2015
Peer-reviewed: No
Research output: Research › Conference abstract for conference – Annual report year: 2015

Præcis 3D-overvågning af ørred- og laksesmolt

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology
Contributors: Baktoft, H., Aarestrup, K.
Revfisk – et projekt som kvantificerer stenrevs betydning for fisk

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, Section for Freshwater Fisheries Ecology, Section for Marine Living Resources, Section for Marine Ecology and Oceanography, Centre for Ocean Life, Aarhus University, DHI Denmark
Publication date: 2015
Peer-reviewed: No
Event: Poster session presented at 18. Danske Havforskermøde, Copenhagen, Denmark.
Electronic versions:
Publishers version
Research output: Research › Poster – Annual report year: 2015

Spatial segregation of ocean migrating Atlantic salmon

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology, Norwegian University of Science and Technology, UiT The Arctic University of Norway, Inland Fisheries Ireland, University of British Columbia, Norwegian Institute for Nature Research, Cefas Weymouth Laboratory
Number of pages: 2
Publication date: 2015
Peer-reviewed: No
Event: Abstract from ICES Annual Science Conference 2015, Copenhagen, Denmark.
Electronic versions:
Publishers version
Bibliographical note
ICES CM 2015/T:12
Research output: Research › Conference abstract for conference – Annual report year: 2015
Survival and progression rates of anadromous brown trout kelts Salmo trutta during downstream migration in freshwater and at sea

The marine migration of post-spawning anadromous fish remains poorly understood. The present study examined survival and progression rates of anadromous brown trout Salmo trutta L. after spawning (kelts) during downriver, fjord, and sea migration. Kelts (n = 49) were captured in the Danish River Gudenaa, tagged with acoustic transmitters and subsequently recorded by automatic receivers. Kelts spent on average 25 d moving down the 45 km river and through the brackish fjord. The fish entered the Kattegat Sea between 14 April and 30 May. Eighteen of the 49 kelts disappeared in the river and fjord during outward migration, likely due to mortality. Survival was not significantly related to gill Na+/K+-ATPase activity, suggesting that physiological adaptation to saltwater may be less critical for adults compared to juveniles (smolts). Of the 31 fish that entered the Kattegat Sea, 45% survived and returned to the fjord. The duration of the entire marine migration, from leaving to entering the river, was on average 163 d. The fish returned from the Kattegat Sea to the fjord between 22 July and 21 October. Upon return, the fish spent 1−90 d passing through Randers Fjord, with most individuals completing the reach within 4 d, suggesting that the kelts spent limited time foraging after returning to the fjord. The total survival during the entire marine migration, including the fjord, was a minimum of 29%. Our study provides data that are important for management of anadromous brown trout, and the high survival highlights that kelts may represent a valuable resource for both population reproduction and recreational fisheries.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology, Institute Management
Contributors: Aarestrup, K., Baktoft, H., Thorstad, E., Svendsen, J. C., Höjesjö, J., Koed, A.
Pages: 185-195
Publication date: 2015
Peer-reviewed: Yes

Publication information
Journal: Marine Ecology Progress Series
Volume: 535
ISSN (Print): 1616-1599
Ratings:
Web of Science (2018): Indexed yes
Scopus rating (2017): CiteScore 2.53
Web of Science (2017): Impact factor 2.276
Web of Science (2017): Indexed yes
Scopus rating (2016): CiteScore 2.4
Web of Science (2016): Impact factor 2.292
Web of Science (2016): Indexed yes
Scopus rating (2015): CiteScore 2.56
Web of Science (2015): Impact factor 2.361
Web of Science (2015): Indexed yes
Scopus rating (2014): CiteScore 2.75
Web of Science (2014): Impact factor 2.619
Web of Science (2014): Indexed yes
Scopus rating (2013): CiteScore 2.79
Web of Science (2013): Impact factor 2.64
ISI indexed (2013): ISI indexed no
Web of Science (2013): Indexed yes
Scopus rating (2012): CiteScore 2.9
Web of Science (2012): Impact factor 2.546
ISI indexed (2012): ISI indexed no
Web of Science (2012): Indexed yes
Scopus rating (2011): CiteScore 2.85
Web of Science (2011): Impact factor 2.711
ISI indexed (2011): ISI indexed no
Web of Science (2011): Indexed yes
Web of Science (2010): Impact factor 2.483
The marine life of sea trout (Salmo trutta): Aspects of their migratory behaviour and survival
During my PhD. research project I have studied the marine migratory behaviour and survival of wild sea trout (Salmo trutta L.) juveniles when moving from freshwater to saltwater (i.e. smolts/post-smolts) in two different fjord systems. These studies are focused on the initial marine stage of post-smolts as well as on the fish returning to freshwater after the marine stage. The results of my experiments increase the current knowledge of specific behavioural traits that sea trout displays during their marine life. Additionally, it provides new information on the early and late marine survival which is needed for comprehensive management of sea trout populations in the area. The principal method used was telemetry (acoustic and PIT-telemetry) which enable studying migratory patterns of fish in the fjord (i.e. acoustic telemetry) and detecting the transitions from the marine to the riverine environments and vice versa (PIT-telemetry). On basis of the results, it is suggested that partial migration in sea trout not only occurs in freshwater but also in saltwater. Further, this research project shows that different developmental stages of trout juveniles can display different behaviours and also have differential survival in saltwater and that straying into other streams can be high in sea trout. Overall, this research expands the knowledge of sea trout ecology at sea where information is very limited and underlines the high polymorphic and ecologically variable nature of the species.

The migration behaviour of European silver eels (Anguilla anguilla) released in open ocean conditions
Despite some recent progress, there are still large gaps of knowledge about migration routes and behaviour of European eels, Anguilla anguilla, during their long-distance oceanic migration. To achieve a better understanding of the migration behaviour, 28 large female silver eels were equipped with pop-up satellite transmitters and released at three different locations in the north-eastern Atlantic Ocean and in the Sargasso Sea. The study covers tracking periods between 7 and 92 days. The distance between release point and estimated pop-up position ranged from 40 to 1000 km, the mean minimum migration speeds from 1.5 to 17.0 km day\(^{-1}\). The eels consistently conducted distinct diel vertical movements (DVM) with daily amplitudes of more than 300m and maximum diving depths of more than 1000 m. Eels released in the Sargasso Sea used greater depths and a broader temperature range than individuals released in the Atlantic Ocean closer to the European continent. At least two eels were clearly preyed upon. The transmitters ascended in a considerable range of directions from the release points. Hence, the results of the study did not allow clear conclusions about the detailed location of the spawning site and on the routes of the eels to the spawning grounds.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology, Institute Management
Contributors: Del Villar, D., Aarestrup, K., Koed, A.
Number of pages: 126
Publication date: 2015

Publication information
Place of publication: Charlottenlund
Publisher: Technical University of Denmark. National Institute of Aquatic Resources
Original language: English
Research output: Research › Ph.D. thesis – Annual report year: 2015
Behaviour of stocked and naturally recruited European eels during migration

An objection to the stocking of translocated eels as a management measure for the European eel (Anguilla anguilla L.) is that these eels may lack the ability to find their way back to the spawning area in the Sargasso Sea because the translocation will confuse their imprinted navigation. We undertook a series of tagging experiments using satellite tags, data storage tags and acoustic tags to test the hypothesis that eels translocated 1200 km from the UK to Sweden differed in their ability to migrate compared to naturally recruited eels. Eels to be tagged were caught in two locations: one with a record of eel stocking for more than 20 years and with a series of barriers to upstream migration, and another in a river with only natural immigration and without barriers to upstream migration. In the first year, the natural and stocked eels were released in a fjord where the initial escapement behaviour could be monitored by acoustic tagging, in addition to using archival and satellite tags to track the subsequent marine migration. In the second year, the eels were released on the open coast and only their marine migration was investigated. Eels were tracked more than 2000 km along a route that, after leaving the Skagerrak, followed the Norwegian Trench to the Norwegian Sea, turned south and west along the Faroe-Shetland channel before emerging into the Atlantic Ocean and then continued west. There were no statistically significant differences in estuarine or oceanic behaviour regarding route, swimming speed and preferred swimming depth between stocked and naturally recruited eels. These results provide the first empirical evidence of a Nordic migration route, and do not support the hypothesis that a sequential imprinting of the route during the immigration is necessary for adequate orientation or behaviour during the adult spawning migration.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology
Contributors: Westerberg, H., Sjöberg, N., Lagenfelt, I., Aarestrup, K., Righton, D.
Pages: 145-157
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: Marine Ecology Progress Series
Volume: 496
ISSN (Print): 0171-8630
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 2.53
Web of Science (2017): Impact factor 2.276
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.4
Web of Science (2016): Impact factor 2.292
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 2.56
Web of Science (2015): Impact factor 2.361
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 2.75
Web of Science (2014): Impact factor 2.619
Using rainbow trout Oncorhynchus mykiss, the present study demonstrated that: (1) calcium (Ca) increased the range of copper (Cu) concentrations that O. mykiss avoided; (2) Ca conserved the maintenance of pre-exposure swimming activity during inescapable acute (10 min) Cu exposure. Data showed that when presented with a choice of Cu-contaminated water (ranging from 0 to 454 µg Cu l(-1)) and uncontaminated water in a choice tank, O. mykiss acclimated and tested at low Ca concentration (3 mg Ca l(-1)) avoided the 10 µg Cu l(-1) only. By contrast, O. mykiss acclimated and tested at high Ca concentration (158 mg Ca l(-1)) avoided all the Cu concentrations ≥37 µg l(-1). The Cu avoidance was connected with increased spontaneous swimming speed in the Cu-contaminated water. When subjected to inescapable Cu exposure (35 µg Cu l(-1)), O. mykiss acclimated and tested at low Ca concentration reduced their spontaneous swimming speed, whereas no response was observed in O. mykiss acclimated and tested at high Ca concentration. Collectively, the data support the conclusion that in O. mykiss the behavioural responses to acute Cu exposure are Ca-dependent.

**Calcium-dependent behavioural responses to acute copper exposure in Oncorhynchus mykiss**

Using rainbow trout Oncorhynchus mykiss, the present study demonstrated that: (1) calcium (Ca) increased the range of copper (Cu) concentrations that O. mykiss avoided; (2) Ca conserved the maintenance of pre-exposure swimming activity during inescapable acute (10 min) Cu exposure. Data showed that when presented with a choice of Cu-contaminated water (ranging from 0 to 454 µg Cu l(-1)) and uncontaminated water in a choice tank, O. mykiss acclimated and tested at low Ca concentration (3 mg Ca l(-1)) avoided the 10 µg Cu l(-1) only. By contrast, O. mykiss acclimated and tested at high Ca concentration (158 mg Ca l(-1)) avoided all the Cu concentrations ≥37 µg l(-1). The Cu avoidance was connected with increased spontaneous swimming speed in the Cu-contaminated water. When subjected to inescapable Cu exposure (35 µg Cu l(-1)), O. mykiss acclimated and tested at low Ca concentration reduced their spontaneous swimming speed, whereas no response was observed in O. mykiss acclimated and tested at high Ca concentration. Collectively, the data support the conclusion that in O. mykiss the behavioural responses to acute Cu exposure are Ca-dependent.

**General information**

State: Published
Organisations: National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology, Aarhus University
Contributors: Poulsen, S., Svendsen, J. C., Aarestrup, K., Malte, H.
Pages: 1326-1339
Publication date: 2014
Peer-reviewed: Yes
The seaward migration of wild (n = 61) and hatchery-reared (n = 46) sea trout smolts was investigated in the Danish River Gudenaa and Randers Fjord (17.3 and 28.6 km stretch, respectively) using acoustic telemetry. Their riverine and early marine migration was monitored by deploying automatic listening stations (ALS) at four locations in the river and fjord. Migration speeds were approximately three to eleven times faster in the river than in the early marine environment. Hatchery-reared smolts migrated faster than wild smolts, but the difference was small, especially compared to the large differences in migration speeds among habitats. There was no difference in the diurnal activity pattern between wild and hatchery-reared smolts. Both the riverine and early marine migration activity was primarily nocturnal, although some individuals were also recorded by the ALSs during daytime. The survival of the wild smolts was 1.8 and 2.9 times higher than that of the hatchery-reared smolts in the two study years, respectively, from release in the river to the outermost marine ALS site, 46 km from the release site. Overall, survival from release to the outermost ALS site was 79% for wild and 39% for hatchery-reared smolts. Since the lower survival of the hatchery-reared compared to the wild smolts could not be explained by differences in migration speeds or diurnal migration patterns, behavioural differences on a smaller scale than those recorded in the present study may explain the difference in survival.
Den lokaløkonomiske værdi af laksefiskeriet i Skjern Å

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology, Institute Management, COWI AS
Contributors: Jordal-Jørgensen, J., Rønnest, A. K., Ladenburg, J., Aarestrup, K., Skov, C., Koed, A.
Number of pages: 51
Publication date: 2014

Publication information
Place of publication: Charlottenlund
Publisher: Institut for Akvatiske Ressourcer, Danmarks Tekniske Universitet
ISBN (Print): 978-87-7481-198-5
Does cortisol manipulation influence outmigration behaviour, survival and growth of sea trout? A field test of carryover effects in wild fish

For anadromous brown trout (Salmo trutta), the transition from life in freshwater to the marine environment is an inherently challenging and dangerous period characterized by high levels of mortality. As such, smoltification is a relevant life-history phase to examine how physiological state, in particular glucocorticoids, influences fitness-oriented endpoints such as migration timing and survival. We experimentally assessed the effect of cortisol by combining passive integrated transponder (PIT) telemetry with a physiologically relevant exogenous cortisol manipulation (i.e., intracoelomic injection) in juvenile sea trout in the Gudsø Stream in Denmark. Individual survival, migration behaviour (timing and speed), and growth were assessed for four treatment categories: control (CO), sham (SH), and low- (LW; 25 mg/kg) and high-dose (HI; 100 mg/kg) cortisol. There was no difference in the timing of migration among treatments, but trout in the HI treatment had lower survival rates to the lower station (41.6%) when compared to the CO (53.9%) and SH (52.3%) groups. After migration, the system was electroshocked again to contrast growth of trout that remained in the system. HI, LW and SH individuals recaptured in the stream had lower growth rates for length than the CO treatments; HI and LW also had significantly lower growth rates for mass than CO trout. Future monitoring of this population may demonstrate the long-term repercussions of chronic stress as trout return from the ocean and further contribute to our understanding of the relationship between organismal condition and fitness while elucidating the potential for carry-over effects (lasting effects that influence future success)
Eels in culture, fisheries and science in Denmark

General information
State: Published
Organisations: National Institute of Aquatic Resources, Secretariat for Management and Communication, Section for Marine Ecology and Oceanography, Centre for Ocean Life, Section for Freshwater Fisheries Ecology, Section for Marine Living Resources, Section for Administration and Service, Danish Eel Farmers Association
Pages: 41-61
Publication date: 2014

Host publication information
Title of host publication: Eels and humans
Place of publication: Tokyo
Publisher: Springer
Editors: Tsukamoto, K., Kuroki, M.
ISBN (Print): 978-4-431-54528-6 (Humanity and the Sea).
DOIs: 10.1007/978-4-431-54529-3_3

Research output: Research - peer-review › Journal article – Annual report year: 2014

Electronic versions:
Publishers version. Embargo ended: 26/02/2018
DOIs:
10.3354/meps10524

Research output: Research - peer-review › Book chapter – Annual report year: 2013
Effect of boat noise and angling on lake fish behaviour
The effects of disturbances from recreational activities on the swimming speed and habitat use of roach Rutilius rutilus, perch Perca fluviatilis and pike Esox lucius were explored. Disturbances were applied for 4h as (1) boating in short intervals with a small outboard internal combustion engine or (2) boating in short intervals combined with angling with artificial lures between engine runs. The response of the fish species was evaluated by high-resolution tracking using an automatic acoustic telemetry system and transmitters with sub-minute burst rates. Rutilius rutilus swimming speed was significantly higher during disturbances [both (1) and (2)] with an immediate reaction shortly after the engine started. Perca fluviatilis displayed increased swimming activity during the first hour of disturbance but not during the following hours. Swimming activity of E. lucius was not significantly different between disturbance periods and the same periods on days without disturbance (control). Rutilius rutilus increased their use of the central part of the lake during disturbances, whereas no habitat change was observed in P. fluviatilis and E. lucius. No difference in fish response was detected between the two types of disturbances (boating with and without angling), indicating that boating was the primary source of disturbance. This study highlights species-specific responses to recreational boating and may have implications for management of human recreational activities in lakes.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology
Contributors: Jacobsen, L., Baktoft, H., Jepsen, N., Aarestrup, K., Berg, S., Skov, C.
Pages: 1768-1780
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: Journal of Fish Biology
Volume: 84
Issue number: 6
ISSN (Print): 0022-1112
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 1.71 SJR 0.822 SNIP 0.923
Web of Science (2017): Impact factor 1.702
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.57 SJR 0.748 SNIP 0.83
Web of Science (2016): Impact factor 1.519
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 1.64 SJR 0.961 SNIP 0.924
Web of Science (2015): Impact factor 1.246
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 1.76 SJR 0.956 SNIP 0.931
Web of Science (2014): Impact factor 1.658
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 1.98 SJR 1.058 SNIP 1.112
Web of Science (2013): Impact factor 1.734
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 1.88 SJR 0.94 SNIP 1.045
Web of Science (2012): Impact factor 1.834
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 1.66 SJR 0.895 SNIP 0.951
Evidence of marine mammal predation of the European eel (Anguilla anguilla L.) on its marine migration

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology, Lund University, University of Southern Denmark
Contributors: Wahlberg, M., Westerberg, H., Aarestrup, K., Feunteun, E., Gargan, P., Righton, D.
Pages: 32-38
Publication date: 2014
Peer-reviewed: Yes

Publication information
Volume: 86
ISSN (Print): 0967-0637
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 2.66 SJR 1.342 SNIP 1.161
Web of Science (2017): Impact factor 2.384
Marine migrations in anadromous brown trout (Salmo trutta). Fjord residency as a possible alternative in the continuum of migration to the open sea

Partial migration is a common phenomenon in many fish species. Trout (Salmo trutta) is a partially migratory species where some part of the population migrate to the marine environment, while another remains in freshwater. In the years 2008 and 2009, a total of 159 wild sea trout smolts were tagged with acoustic and PIT-tags in the river Villestrup (Denmark) to study the initial postsmolt marine behaviour within a fjord system. We found that the strategies of the sea migrants vary: some stay in the fjord, while others migrate to the sea, suggesting that partial migration occurs even in the marine environments. Overall, a total of 53% of the tagged smolts migrated from the fjord to the sea, and 47% stayed (or potentially died) in the fjord. The ratios of fjord-resident versus seamigrating postsmolts were consistent at the study times, and no differences between the early and late migration periods of the smolts were observed. The individual’s size or body condition at the time of tagging did not affect survival or the migratory decisions in the fjord. High overall initial survival (74%) was found 30 days after the fjord entry. We suggest that within a continuum of migration to sea, there is a migratory decision point when sea trout postsmolts encounter a fjord system. At this point, postsmolts will assess the possibility of migration versus the alternative of fjord residency.
Scanning for PIT-tagged flatfish in a coastal area using a sledge equipped with an RFID antenna

A radio frequency identification (RFID) antenna system, built into a sledge that can be towed behind a vessel like a trawl and thereby has the potential to detect the position of a passive inductor technology (PIT)-tagged fish in a wide variety of habitats, is presented. By scanning for hatchery-reared PIT-tagged turbot Psetta maxima released into a natural habitat, the performance of the system was compared to a standard juvenile trawl and results suggested that the efficiency of the sledge was five times that of the trawl, which in absolute values corresponds to 75% of P. maxima lying in the pathway of the sledge.
Tagging fish in the field: Ethical and procedural considerations: A Comment to the Recent Paper of D. Mulcahy; Legal, Ethical and Procedural Bases for the Use of Aseptic Techniques to Implant Electronic Devices, (Journal of Fish and Wildlife Management 4:211-219)

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology, Carleton University
Contributors: Jepsen, N., Aarestrup, K., Cooke, S. J.
Pages: 441-444
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: Journal of Fish and Wildlife Management
Volume: 5
Issue number: 2
ISSN (Print): 1944-687X
Ratings:
Web of Science (2018): Indexed yes
Scopus rating (2017): CiteScore 0.7 SJR 0.398 SNIP 0.567
Web of Science (2017): Impact factor 0.598
Web of Science (2017): Indexed yes
Scopus rating (2016): CiteScore 0.79 SJR 0.434 SNIP 0.698
Web of Science (2016): Impact factor 0.633
Scopus rating (2015): CiteScore 0.82 SJR 0.521 SNIP 0.606
Web of Science (2015): Impact factor 0.795
Scopus rating (2014): CiteScore 1.14 SJR 0.536 SNIP 0.622
Web of Science (2014): Impact factor 0.757
Web of Science (2014): Indexed yes
Scopus rating (2013): CiteScore 0.86 SJR 0.574 SNIP 0.488
Web of Science (2013): Impact factor 0.949
The physiological basis of the migration continuum in brown trout (Salmo trutta)

Partial migration is common in many animal taxa; however, the physiological variation underpinning migration strategies remains poorly understood. Among salmonid fishes, brown trout (Salmo trutta) is one of the species that exhibits the most complex variation in sympatric migration strategies, expressed as a migration continuum, ranging from residency to anadromy. In looking at brown trout, our objective with this study was to test the hypothesis that variation in migration strategies is underpinned by physiological variation. Prior to migration, physiological samples were taken from fish in the stream and then released at the capture site. Using telemetry, we subsequently classified fish as resident, short-distance migrants (potamodromous), or long-distance migrants (potentially anadromous). Our results revealed that fish belonging to the resident strategy differed from those exhibiting any of the two migratory strategies. Gill Na,K-ATPase activity, condition factor, and indicators of nutritional status suggested that trout from the two migratory strategies were smoltified and energetically depleted before leaving the stream, compared to those in the resident strategy. The trout belonging to the two migratory strategies were generally similar; however, lower triacylglycerides levels in the short-distance migrants indicated that they were more lipid depleted prior to migration compared with the long-distance migrants. In the context of migration cost, we suggest that additional lipid depletion makes migrants more inclined to terminate migration at the first given feeding opportunity, whereas individuals that are less lipid depleted will migrate farther. Collectively, our data suggest that the energetic state of individual fish provides a possible mechanism underpinning the migration continuum in brown trout.
Development and testing of attachment methods for pop-up satellite archival transmitters in European eel

Background
Four methods for attaching pop-up satellite transmitters to European eel were tested in the laboratory by recording long-term tag retention, growth and survival; short-term behavioral responses; and physical damage from attachments.

Results
All eels survived until they lost their tag, or until end of the six-month study. Specific growth rate did not differ between tagged fish and controls. Tag retention varied from 0% to 100% among attachment methods. A tagging method that uses the strength of the eel skin by attaching the tag to the skin at three points is recommended for ocean migration studies based on a long tag retention time, minimal behavioral reactions, negligible damage to the swimming muscle, and minimal physical damage both for fish retaining and losing the tag. Although tag retention was 50% over six months, those losing their tags still retained them for 114 to 134 days. Another method had higher tag retention (100%), but required the use of steel wires that moved upwards through the muscle over time. This method was regarded as less suitable because of a strong behavioral reaction in the first two days after tagging and damage to the swimming muscle. Results from 275 silver eels released on European coasts equipped with pop-up satellite transmitters or similarly sized pop-up data storage tags to study the ocean spawning migration indicated a large premature tag release. This was partly related to mechanical tag loss, but probably mainly to a high predation rate (>20% confirmed predations of eels with pop-up satellite transmitters). Mean time to premature tag release was 14 to 21 days (maximum nine months).

Conclusions
Laboratory and field data showed that pop-up satellite transmitters attached to eels can remain attached for six to nine months, but that tag retention is a challenge. Hiding behavior in a structured habitat increased the risk of entanglement and tag loss. In ocean migration studies, consideration should be given to transportation and release off shore instead of in shallower areas where they are more likely to seek the seabed and hide in structured habitats. Behavioral reactions indicate that data recorded during the first two to three days after tagging may not reflect natural behavior.
Divergent stress responses and behaviour in early and late emerging Atlantic salmon (Salmo salar)

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology, Section for Aquaculture
Publication date: 2013
Peer-reviewed: No
Event: Abstract from Society for Experimental Biology, Annual Main Meeting, Valencia, Spain.
Research output: Research › Conference abstract for conference – Annual report year: 2013

Effects of angling and manual handling on pike behaviour investigated by high-resolution positional telemetry

Human disturbances such as angling and manual handling may have long-term effects on the behaviour of pike, Esox lucius L., an ecologically important species. Using continuous high-resolution positional telemetry, this study compared the swimming activity of handled and unhandled pike in a small lake. Pike pre-equipped with acoustic transmitters were angled and exposed to a handling protocol including measurements of length and mass. Pike not recaptured constituted an unhandled control group. Results demonstrated that the handling protocol caused temperature-dependent changes in pike activity, with higher temperatures leading to lower activity of the recaptured pike. The effects, however, were transitory and not detectable after 48-h post-release. These findings indicate that pike are relatively resilient to handling and quickly resume pre-handling activity

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology, Department of Applied Mathematics and Computer Science, Centre for Ocean Life, Fisheries and Oceans Canada
Contributors: Baktoft, H., Aarestrup, K., Berg, S., Boel, M., Jacobsen, L., Koed, A., Pedersen, M. W., Svendsen, J. C., Skov, C.
Pages: 518-525
Publication date: 2013
Peer-reviewed: Yes

Publication information
Journal: Fisheries Management and Ecology
Volume: 20
Issue number: 6
ISSN (Print): 0969-997X
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 1.59 SJR 0.746 SNIP 0.823
Web of Science (2017): Impact factor 1.624
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.85 SJR 0.858 SNIP 0.846
Web of Science (2016): Impact factor 1.327
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 1.91 SJR 1.017 SNIP 1.109
Web of Science (2015): Impact factor 1.51
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 1.85 SJR 0.939 SNIP 0.962
Web of Science (2014): Impact factor 1.76
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 1.36 SJR 0.757 SNIP 0.774
Web of Science (2013): Impact factor 1.136
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 1.32 SJR 0.665 SNIP 0.875
Web of Science (2012): Impact factor 1.028
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 1.29 SJR 0.828 SNIP 0.948
Web of Science (2011): Impact factor 1.294
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.864 SNIP 0.819
Web of Science (2010): Impact factor 0.798
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.807 SNIP 0.957
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.844 SNIP 0.854
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 0.823 SNIP 1.232
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 0.868 SNIP 1.006
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 0.777 SNIP 0.918
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 0.423 SNIP 0.669
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 0.405 SNIP 0.58
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 0.484 SNIP 0.663
Scopus rating (2001): SJR 0.508 SNIP 0.643
Web of Science (2001): Indexed yes
Scopus rating (2000): SJR 0.466 SNIP 0.677
Effects of intraspecific variation in reproductive traits, pectoral fin use and burst swimming on metabolic rates and swimming performance in the Trinidadian guppy (Poecilia reticulata)

There is considerable intraspecific variation in metabolic rates and locomotor performance in aquatic ectothermic vertebrates; however, the mechanistic basis remains poorly understood. Using pregnant Trinidadian guppies (Poecilia reticulata), a livebearing teleost, we examined the effects of reproductive traits, pectoral fin use and burst-assisted swimming on swimming metabolic rate, standard metabolic rate (MO2std) and prolonged swimming performance (Ucrit). Reproductive traits included reproductive allocation and pregnancy stage, the former defined as the mass of the reproductive tissues divided by the total body mass. Results showed that the metabolic rate increased curvilinearly with swimming speed. The slope of the relationship was used as an index of swimming cost. There was no evidence that reproductive traits correlated with swimming cost, MO2std or Ucrit. In contrast, data revealed strong effects of pectoral fin use on swimming cost and Ucrit. Poecilia reticulata employed body-caudal fin (BCF) swimming at all tested swimming speeds; however, fish with a high simultaneous use of the pectoral fins exhibited increased swimming cost and decreased Ucrit. These data indicated that combining BCF swimming and pectoral fin movement over a wide speed range, presumably to support swimming stability and control, is an inefficient swimming behaviour. Finally, transition to burst-assisted swimming was associated with an increase in aerobic metabolic rate. Our study highlights factors other than swimming speed that affect swimming cost and suggests that intraspecific diversity in biomechanical performance, such as pectoral fin use, is an important source of variation in both locomotor cost and maximal performance.
Effects of passive integrated transponder tags on survival and growth of juvenile Atlantic salmon Salmo salar

Background: A laboratory experiment was conducted to assess the potential impacts of surgically implanted 23 and 32 mm passive integrated transponder (PIT) tags on survival, growth, and body condition of juvenile Atlantic salmon Salmo salar. Rate of tag retention and healing of the tagging incision were also evaluated. Atlantic salmon of three different size classes (I: 80 to 99 mm fork length (FL), II: 100 to 119 mm FL, III: 120 to 135 mm FL) were allocated to each of five experimental treatment groups: control, sham-operated (surgery without PIT-tag implantation), 23 mm PIT-tag implantation with and without suture closure of the incision, and 32 mm PIT-tag implantation without suture closure.

Results: Over the 35-day experiment, mortality occurred only among fish tagged with 32 mm PIT tags (14%) and all fish larger than 103 mm FL survived. Non-sutured Atlantic salmon between 80 and 99 mm FL implanted with 23 mm PIT tags had a significantly lower mean specific growth rate of mass compared with untagged (control and sham-operated) and sutured conspecifics. However, no significant difference in growth was found between untagged fish and 23 mm PIT-tagged fish with suture closure of the incision.
PIT-tagged fish 100 to 135 mm FL. Implantation of 32 mm PIT tags decreased growth in all size classes. Regardless of size class, body condition of the fish was not affected by PIT tagging. Retention rates of 23 mm PIT tags with and without suture closure were 100% and 97%, respectively; retention of 32 mm PIT tags without suture closure was 69%. At the end of the experiment, tagging incisions without suture closure were generally well-healed. Fungal infection and inflammation around the incision site occurred only when suture was used, in 46% of size class I, 21% of size class II and 38% of size class III.

Conclusions: Although suture closure of the incision following 23 mm PIT-tag implantation had a positive impact on growth of fish smaller than 100 mm FL, we advise against the use of sutures due to high rates of fungal infection around the incision site. Hence, results suggest that surgical implantation of 23 mm PIT tags without suture closure of the incision is a feasible method for marking juvenile Atlantic salmon 100 to 135 mm FL. Further, we caution researchers about the use of 32 mm PIT tags in juvenile Atlantic salmon 80 to 135 mm FL due to high rate of tag rejection and reduced survival and growth.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology
Contributors: Larsen, M. H., Thorn, A. N., Skov, C., Aarestrup, K.
Publication date: 2013
Peer-reviewed: Yes

Publication information
Journal: Animal Biotelemetry
Volume: 1
Issue number: 19
ISSN (Print): 2050-3385
Ratings:
BFI (2018): BFI-level 1
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 2.26 SJR 1.067 SNIP 0.851
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): SJR 1.221 SNIP 0.783
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.198 SNIP 1.408
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.002 SNIP 0.739
BFI (2013): BFI-level 1
ISI indexed (2013): ISI indexed no
Original language: English
Electronic versions:
Larsen et al 2013
DOIs: 10.1186/2050-3385-1-19
URLs: http://www.animalbiotelemetry.com/content/1/1/19/abstract#
Research output: Research - peer-review ; Journal article – Annual report year: 2013

Evaluation of surgical implantation of electronic tags in European eel and effects of different suture materials
Effects of implanting data-storage tags in European eel, Anguilla anguilla, and the suitability of different suture materials (braided permanent silk, permanent monofilament, absorbable and absorbable antibacterial) were examined. The tags consisted of an electronic unit and three floats on a wire, making them flexible and able to follow the swimming movements of the eel. No mortality occurred, and tagged fish did not differ from the control fish in growth.
Sutures were shed or dissolved slowly. After 4 weeks, there was no difference among the groups in the proportion of sutures left. After 6 months, fish with braided silk had largely shed their sutures, fish with monofilament sutures had the majority of sutures left, whereas the fish with absorbable sutures were intermediate in between. Fish with monofilament sutures showed the least-extensive inflammation reactions and fastest wound healing. Antibacterial treatment had no effect on inflammation or healing rates. After 6 months, the tag started to become expelled through the incision in five fish (12%). The internal reaction appeared stronger around the floats, suggesting that the coating material of the floats created a tissue reaction, which should be further investigated. Intraperitoneal implantation appears to be a suitable tagging method for European silver eel, and it is recommended to close incisions using permanent monofilament sutures.
Extreme swimming: The oceanic migrations of anguillids

Anguillids evolved between 20 and 40 million years ago and, as catadromous fish, migrate between marine and freshwater environments. The migration occurs only twice in the lifetime of most eels: when they migrate as larvae to coastal and river habitats, and again as adult, when they return to their natal habitat to spawn. In temperate species, the migrations are extreme, requiring larvae and adults to swim thousands of km before reaching their destination, but the migrations of tropical species (hundreds of km) are still remarkable in comparison with many other fish species. To achieve these migratory feats, eel larvae and adults are uniquely adapted to oceanic environments. We describe and discuss these adaptations, and identify the challenges and opportunities ahead for aquaculture and eel conservation.

Impact of a short-term exposure to tributyl phosphate on morphology, physiology and migratory behaviour of European eels during the transition from freshwater to the marine environment

Migrating silver European eels were exposed for 5 days in a laboratory to an environmental level of tributyl phosphate (TBP), tagged with acoustic transmitters and released below the Tange hydropower station, on the River Gudenaa, Denmark. The subsequent movements of the eels were monitored as they migrated through Randers Fjord and into the Kattegat Sea using an array of acoustic receivers. In laboratory-based studies, exposure of eels for 5 days to a nominal concentration of 0.5 μg·l−1 TBP significantly affected plasma glucose concentration and reduced plasma levels of sodium and chloride both in freshwater and 3 days after transfer to saltwater. However, there were no mortalities when the eels were transferred to full strength sea water. Exposure to TBP did not appear to have a significant effect on the subsequent movements of the eels in the river or fjord. The eels moved rapidly through the fjord predominantly at night. The results of the study are discussed in relation to the impact of diffuse pollution on the behaviour and physiology of European eels.
Influence of experimental cortisol manipulation on outmigration behaviour, survival and growth of sea trout smolts

**General information**

**State:** Published

**Organisations:** National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology, Unknown

**Contributors:** Midwood, J., Larsen, M. H., Jepsen, N., Aarestrup, K., Cooke, S.

**Publication date:** 2013

**Peer-reviewed:** No

**Event:** Abstract from Canadian Conference for Freshwater Fisheries Research, Windsor, Canada.

**Research output:** Research › Conference abstract for conference – Annual report year: 2013

Marine survival in wild sea trout (Salmo trutta) post-smolts. Why little fish matter!

**General information**

**State:** Published

**Organisations:** National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology

**Contributors:** Del Villar, D., Aarestrup, K., Baktoft, H., Larsen, M. H., Koed, A.

**Publication date:** 2013

**Peer-reviewed:** No

**Event:** Abstract from International Conference on Fish Telemetry (ICFT), Grahamstown, South Africa.

**Research output:** Research › Conference abstract for conference – Annual report year: 2013

Oceanic migration behaviour of tropical Pacific eels from Vanuatu

Information on oceanic migrations and spawning areas of tropical Pacific freshwater eels (genus Anguilla) is very limited. Lake Letas and its single outflowing river, Mbe Solomul on Gaua Island, Vanuatu, were surveyed for large migrating individuals. Twenty-four Anguilla marmorata (87 to 142 cm), 39 A. megastoma (50 to 131 cm), and 3 A. obscura (119 to 126 cm) were caught. Seven individuals were tagged with pop-up satellite transmitters and released offshore. One A. marmorata migrated 843 km towards the South Equatorial Current. The tag surfaced only 330 km from the point where the smallest leptocephalus has been captured so far. Tags on A. megastoma and A. obscura popped up within the archipelago. All 3 species exhibited pronounced diel vertical migrations. Eels descended from around 200 m nighttime depth, to 320 (A. obscura), 650 (A. marmorata), and 750 m (A. megastoma) during the day. A clear impact of the lunar cycle on the upper limit of migration depths was found in A. marmorata (full moon: 230 m, new moon: 170 m). These behaviours may be explained as a trade-off between predator avoidance and the necessity to maintain a sufficiently high metabolism for migration.

**General information**

**State:** Published

**Organisations:** National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology, Plymouth Marine Laboratory

**Contributors:** Schabetsberger, R., Økland, F., Aarestrup, K., Kalfatak, D., Sichrowsky, U., Tambets, M., Dall’Olmo, G., Kaiser, R., Miller, P.

**Pages:** 177-190

**Publication date:** 2013

**Peer-reviewed:** Yes

**Publication information**

**Journal:** Marine Ecology - Progress Series

**Volume:** 475

**ISSN (Print):** 0171-8630

**Ratings:**

**BFI (2018):** BFI-level 2
Reliability of non-lethal assessment methods of body composition and energetic status exemplified by applications to eel (Anguilla anguilla) and carp (Cyprinus carpio)

Non-lethal assessments of proximate body composition of fish can help unravelling the physiological and condition-dependent mechanisms of individual responses to ecological challenges. Common non-lethal methods designed to index nutrient composition in fish include the relative condition factor (Kn), bioelectric impedance-based assessments of body composition (BIA), and microwave-based “fat” meters (FM). Previous studies have revealed mixed findings as to the reliability of each of these. We compared the performance of Kn, BIA and FM at different temperatures to predict energetic status of the whole bodies of live eel (Anguilla anguilla) and carp (Cyprinus carpio) and the dorsal white muscle of carp. Homogenized fish flesh was used for calibration. Relative dry mass was strongly correlated with relative fat content (R² up to 96.7%) and energy density (R² up to 99.1%). Thus, calibrations were only conducted for relative dry mass as an index of energetic status of a fish. FM readings were found to predict relative dry mass of whole body in eel (R² = 0.707) and carp (R² = 0.676), and dorsal white muscle of carp (R² = 0.814) well. By contrast, BIA measurements and Kn were much less suited to identify variation in relative dry mass. BIA-based models were also temperature-dependent. As a result, a regression model calibrated at 10°C and applied to BIA measurements at 20°C was found to underestimate energetic status of a fish. By contrast, no effects of temperature on FM calibration results were found. Based on our study, the FM approach is the most suitable method to non-lethally estimate energetic status in both, carp and eel, whereas BIA is of limited use for energetic measurements in the same species, in contrast to other reports in the literature.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology, Humboldt University of Berlin
Contributors: Klefoth, T., Skov, C., Aarestrup, K., Arlinghaus, R.
Pages: 18-26
Publication date: 2013
Peer-reviewed: Yes

Publication information
Journal: Fisheries Research
Volume: 146
ISSN (Print): 0165-7836
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 1.94 SJR 0.941 SNIP 0.959
Web of Science (2017): Impact factor 1.874
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.21 SJR 1.183 SNIP 1.153
Web of Science (2016): Impact factor 2.185
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 2.01 SJR 1.092 SNIP 1.131
Web of Science (2015): Impact factor 2.23
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 2.17 SJR 1.122 SNIP 1.305
Web of Science (2014): Impact factor 1.903
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 1.85 SJR 1.049 SNIP 1.167
Web of Science (2013): Impact factor 1.843
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 1.78 SJR 0.948 SNIP 1.189
Aspects of lentic fish behaviour studied with high resolution positional telemetry

General information
State: Published
Organisations: National Institute of Aquatic Resources
Contributors: Baktoft, H., Skov, C., Svendsen, J. C., Berg, S., Aarestrup, K., Koed, A., Jacobsen, L.
Number of pages: 118
Publication date: 2012

Publication information
Place of publication: Kgs. Lyngby
Publisher: Technical University of Denmark (DTU)
Original language: English
Electronic versions:
120529_PhD_dissertation_Baktoft..PDF
Research output: Research › Ph.D. thesis – Annual report year: 2012
Early enrichment effects on brain development in hatchery-reared Atlantic salmon (Salmo salar): no evidence for a critical period

In hatcheries, fish are normally reared in barren environments, which have been reported to affect their phenotypic development compared with wild conspecifics. In this study, Atlantic salmon (Salmo salar) alevins were reared in conventional barren hatchery trays or in either of two types of structurally enriched trays. We show that increased structural complexity during early rearing increased brain size in all investigated brain substructures. However, these effects disappeared over time after transfer to barren tanks for external feeding. Parallel to the hatchery study, a group of salmon parr was released into nature and recaptured at smoltification. These stream-reared smolts developed smaller brains than the hatchery reared smolts, irrespective of initial enrichment treatment. These novel findings do not support the hypothesis that there is a critical early period determining the brain growth trajectory. In contrast, our results indicate that brain growth is plastic in relation to environment. In addition, we show allometric growth in brain substructures over juvenile development, which suggests that comparisons between groups of different body size should be made with caution. These results can aid the development of ecologically sound rearing methods for conservational fish-stocking programs.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology, University of Gothenburg, Danish Center for Wild Salmon
Contributors: Näslund, J., Aarestrup, K., Thomassen, S. T., Johnsson, J. I.
Pages: 1481-1490
Publication date: 2012
Peer-reviewed: Yes

Publication information
Journal: Canadian Journal of Fisheries and Aquatic Sciences
Volume: 69
Issue number: 9
ISSN (Print): 0706-652X
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 2.44 SJR 1.329 SNIP 1.036
Web of Science (2017): Impact factor 2.631
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.56 SJR 1.388 SNIP 1.185
Web of Science (2016): Impact factor 2.466
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 2.22 SJR 1.267 SNIP 1.025
Web of Science (2015): Impact factor 2.437
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 2.6 SJR 1.476 SNIP 1.379
Web of Science (2014): Impact factor 2.287
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): CiteScore 2.25 SJR 1.439 SNIP 1.086
Web of Science (2013): Impact factor 2.276
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): CiteScore 2.29 SJR 1.359 SNIP 1.232
Web of Science (2012): Impact factor 2.323
ISI indexed (2012): ISI indexed yes
Effect of anthropogenic disturbances on lake fish individual behaviour

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology
Contributors: Jacobsen, L., Baktoft, H., Berg, S., Jepsen, N., Skov, C., Aarestrup, K.
Publication date: 2012
Peer-reviewed: No

Effekten af rekreative aktiviteter på fiskenes adfærd i en lille sø

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology
Contributors: Jacobsen, L., Baktoft, H., Berg, S., Jepsen, N., Skov, C., Aarestrup, K.
Publication date: 2012
Peer-reviewed: No
Excess posthypoxic oxygen consumption in rainbow trout (Oncorhynchus mykiss): recovery in normoxia and hypoxia

General information
State: Published
Organisations: Section for Freshwater Fisheries Ecology, National Institute of Aquatic Resources, University of Copenhagen
Contributors: Svendsen, J. C., Steffensen, J. F., Aarestrup, K., Frisk, M., Etzerodt, A. P., Jyde, M.
Pages: 1-11
Publication date: 2012
Peer-reviewed: Yes

Publication information
Journal: Canadian Journal of Zoology
Volume: 90
ISSN (Print): 0008-4301
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 1.62 SJR 0.889 SNIP 0.873
Web of Science (2017): Impact factor 1.184
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.27 SJR 0.708 SNIP 0.66
Web of Science (2016): Impact factor 1.347
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 1.38 SJR 0.889 SNIP 0.739
Web of Science (2015): Impact factor 1.52
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 1.48 SJR 0.863 SNIP 0.767
Web of Science (2014): Impact factor 1.303
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 1.66 SJR 0.883 SNIP 0.875
Web of Science (2013): Impact factor 1.346
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 1.53 SJR 0.734 SNIP 0.8
Web of Science (2012): Impact factor 1.498
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 1.37 SJR 0.809 SNIP 0.729
Web of Science (2011): Impact factor 1.205
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.814 SNIP 0.761
Web of Science (2010): Impact factor 1.196
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.802 SNIP 0.737
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.963 SNIP 0.828
Loss of European silver eel passing a hydropower station

The aim of this study was to assess escapement success of silver eels, Anguilla anguilla (L.), in a lowland river while passing a reservoir and a hydropower station. It was hypothesized that passage success would be lowest at the hydropower station and that survival and migration speed would be highest in the free-flowing river section upstream the reservoir. Forty-five female silver eels 56–86 cm in length were tagged with acoustic transmitters and released in November 2006. Their migration was monitored via automatic listening stations (ALS) in various sections of the river, covering a total migration distance of 64 km. Survival and progression rate of downstream migration was highest in the upstream river section and significantly lower in the reservoir. The eels apparently had trouble finding their way past the turbines and spent between 1.5 and 35 h in the forebay. The results show that within the study period, only 23% of the tagged eels reached the tidal limit, mainly due to difficulties in passing the hydropower dam. With such high loss-rates, the escapement goals set in the management plan cannot be achieved.
Seasonal and diel effects on the activity of northern pike studied by high-resolution positional telemetry

Temperate lakes can be ice covered for several months each year, yet little is known about the behaviour and activity of the fish during the cold season. As northern pike represents the top of the food web in many northern temperate lakes and may structure the ecosystem both directly and indirectly, a detailed understanding of the behaviour of this species during winter is important. We continuously monitored the activity of adult northern pike (Esox lucius) in a small temperate lake from late summer to winter for two consecutive years using an automatic acoustic positional telemetry system. Four subsample periods representing different temperature regimes from each year were chosen for further investigation. The results revealed that pike activity was similar between seasons. In all periods, a distinct diel pattern, showing increased activity during day as compared to night, was evident. Our findings indicate that the fish component of temperate lentic ecosystems can be more active during the cold season than previously assumed. This may have implications for the structuring effect of pike on the lower trophic levels.

General information
State: Published
Organisations: Section for Freshwater Fisheries Ecology, National Institute of Aquatic Resources, Fisheries and Oceans Canada
Contributors: Baktoft, H., Aarestrup, K., Berg, S., Boel, M., Jacobsen, L., Jepsen, N., Koed, A., Svendsen, J. C., Skov, C.
Pages: 386-394
Publication date: 2012
Peer-reviewed: Yes

Publication information
Journal: Ecology of Freshwater Fish
Volume: 21
Issue number: 3
ISSN (Print): 0906-6691
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 1.65 SJR 0.83 SNIP 1.046
Web of Science (2017): Impact factor 1.832
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.66 SJR 0.8 SNIP 0.852
Web of Science (2016): Impact factor 2.054
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 1.92 SJR 1.041 SNIP 1.186
Web of Science (2015): Impact factor 2.052
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 1.58 SJR 0.874 SNIP 0.979
Web of Science (2014): Impact factor 1.701
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 1.77 SJR 0.98 SNIP 1.049
Web of Science (2013): Impact factor 1.59
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 2.05 SJR 1.075 SNIP 1.279
Web of Science (2012): Impact factor 1.935
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
Shark predation on migrating adult American eels (Anguilla rostrata) in the Gulf of St. Lawrence.

In an attempt to document the migratory pathways and the environmental conditions encountered by American eels during their oceanic migration to the Sargasso Sea, we tagged eight silver eels with miniature satellite pop-up tags during their migration from the St. Lawrence River in Quebec, Canada. Surprisingly, of the seven tags that successfully transmitted archived data, six were ingested by warm-gutted predators, as observed by a sudden increase in water temperature. Gut temperatures were in the range of 20 to 25°C too cold for marine mammals but within the range of endothermic fish. In order to identify the eel predators, we compared their vertical migratory behavior with those of satellite-tagged porbeagle shark and bluefin tuna, the only endothermic fishes occurring non-marginally in the Gulf of St. Lawrence. We accurately distinguished between tuna and shark by using the behavioral criteria generated by comparing the diving behavior of these two species with those of our unknown predators. Depth profile characteristics of most eel predators more closely resembled those of sharks than those of tuna. During the first days following tagging, all eels remained in surface waters and did not exhibit diel vertical migrations. Three eels were eaten at this time. Two eels exhibited inverse diel vertical migrations (at surface during the day) during several days prior to predation. Four eels were eaten during daytime, whereas the two night-predation events occurred at full moon. Although tagging itself may contribute to increasing the eel's susceptibility to predation, we discuss evidence suggesting that predation of silver-stage American eels by porbeagle sharks may represent a significant source of mortality inside the Gulf of St. Lawrence and raises the possibility that eels may represent a reliable, predictable food resource for porbeagle sharks.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology, Bedford Institute of Oceanography, Acadia University, Universite Laval
Contributors: Béguel-Pon, M., Benchetrit, J., Castonguay, M., Aarestrup, K., Campana, S. E., Stokesbury, M. J. W., Dodson, J. J.
The Anguilla spp. migration problem: 40 million years of evolution and two millennia of speculation

Anguillid eels Anguilla spp. evolved between 20 and 40 million years ago and possess a number of remarkable migratory traits that have fascinated scientists for millennia. Despite centuries of effort, the spawning areas and migrations are known only for a few species. Even for these species, information on migratory behaviour is remarkably sketchy. The latest knowledge on the requirements for successful migration and field data on the migrations of adults and larvae are presented, how experiments on swimming efficiency have progressed the understanding of migration are highlighted and the challenges of swimming at depth considered. The decline of Anguilla spp. across the world is an ongoing concern for fisheries and environmental managers. New developments in the knowledge of eel migration will, in addition to solving a centuries old mystery, probably help to identify how this decline might be halted or even reversed.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology
Contributors: Righton, D., Aarestrup, K., Jellyman, D., Sébert, P., van den Thillart, G., Tsukamoto, K.
Number of pages: 386
Pages: 365
Publication date: 2012
Peer-reviewed: Yes

Publication information
Journal: Journal of Fish Biology
Volume: 81
Issue number: 2
ISSN (Print): 0022-1112
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 1.71 SJR 0.822 SNIP 0.923
Web of Science (2017): Impact factor 1.702
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.57 SJR 0.746 SNIP 0.83
Web of Science (2016): Impact factor 1.519
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 1.64 SJR 0.961 SNIP 0.924
Web of Science (2015): Impact factor 1.246
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 1.76 SJR 0.956 SNIP 0.931
Web of Science (2014): Impact factor 1.658
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 1.98 SJR 1.058 SNIP 1.112
Web of Science (2013): Impact factor 1.734
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 1.88 SJR 0.94 SNIP 1.045
Web of Science (2012): Impact factor 1.834
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
All roads lead to home: panmixia of European eel in the Sargasso Sea

General information
State: Published
Organisations: Section for Freshwater Fisheries Ecology, National Institute of Aquatic Resources, Section for Ocean Ecology and Climate
Pages: 1333-1346
Publication date: 2011
Peer-reviewed: Yes

Publication information
Journal: Molecular Ecology
Volume: 20
Issue number: 7
ISSN (Print): 0962-1083
Ratings:
BFI (2018): BFI-level 2
Behaviour of rainbow trout Oncorhynchus mykiss presented with a choice of normoxia and stepwise progressive hypoxia

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology
Pages: 969-979
Publication date: 2011
Peer-reviewed: Yes

Publication information
Journal: Journal of Fish Biology
Volume: 79
Issue number: 4
ISSN (Print): 0022-1112
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 1.71 SJR 0.822 SNIP 0.923
Web of Science (2017): Impact factor 1.702
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.57 SJR 0.748 SNIP 0.83
Web of Science (2016): Impact factor 1.519
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 1.64 SJR 0.961 SNIP 0.924
Web of Science (2015): Impact factor 1.246
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 1.76 SJR 0.956 SNIP 0.931
Web of Science (2014): Impact factor 1.658
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 1.98 SJR 1.058 SNIP 1.112
Web of Science (2013): Impact factor 1.734
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 1.88 SJR 0.94 SNIP 1.045
Web of Science (2012): Impact factor 1.834
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Can metabolic properties explain variation in individual behaviour?

General information
State: Published
Organisations: Section for Freshwater Fisheries Ecology, National Institute of Aquatic Resources, Section for Ocean Ecology and Climate
Publication date: 2011
Peer-reviewed: No
Event: Abstract from 1st International Conference on Fish Telemetry, Sapporo, Japan.
Source: orbit
Source-ID: 278070
Research output: Research › Conference abstract for conference – Annual report year: 2011

Can metabolic properties explain variation in individual behaviour? Attempting to link physiology and morphology with field behavior

General information
Disturbance by human activities on fish individual behaviour in a small lake

General information
State: Published
Organisations: Section for Freshwater Fisheries Ecology, National Institute of Aquatic Resources
Contributors: Jacobsen, L., Baktoft, H., Berg, S., Jepsen, N., Skov, C., Aarestrup, K.
Publication date: 2011
Peer-reviewed: No
Event: Abstract from World Recreational Fisheries Congress, Berlin, Germany.
Source: orbit
Source-ID: 281696
Research output: Research › Conference abstract for conference – Annual report year: 2011

Freshwater eels – Marvelous and mysterious

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology
Contributors: Aarestrup, K.
Publication date: 2011
Peer-reviewed: No
Event: Abstract from 1st International Conference on Fish Telemetry, Sapporo, Japan.
Electronic versions:
Kim Aarestrup.pdf

Bibliographical note
Keynote Speach
Source: orbit
Source-ID: 281833
Research output: Research › Conference abstract for conference – Annual report year: 2011

Linking individual behaviour and migration success in Salmo salar smolts approaching a water withdrawal site: implications for management

General information
State: Published
Organisations: Section for Freshwater Fisheries Ecology, National Institute of Aquatic Resources, Section for Population Ecology and Genetics
Contributors: Svendsen, J. C., Aarestrup, K., Malte, H., Thygesen, U. H., Baktoft, H., Koed, A., Deacon, M. G., Cubitt, K. F., McKinley, R. S.
Pages: 201-209
Publication date: 2011
Peer-reviewed: Yes
Publication information
Journal: Aquatic Living Resources
Volume: 24
Issue number: 2
ISSN (Print): 0990-7440
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 0.66 SJR 0.296 SNIP 0.299
Web of Science (2017): Impact factor 0.525
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.41 SJR 0.606 SNIP 0.728
Web of Science (2016): Impact factor 0.448
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 1.39 SJR 0.755 SNIP 0.843
Web of Science (2015): Impact factor 1.327
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 1.25 SJR 0.649 SNIP 0.892
Web of Science (2014): Impact factor 1.014
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 1.15 SJR 0.556 SNIP 0.695
Web of Science (2013): Impact factor 0.919
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 1.19 SJR 0.553 SNIP 0.586
Web of Science (2012): Impact factor 1.071
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 1.17 SJR 0.633 SNIP 0.687
Web of Science (2011): Impact factor 1.152
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.612 SNIP 0.564
Web of Science (2010): Impact factor 1.062
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.486 SNIP 0.589
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.741 SNIP 0.664
Scopus rating (2007): SJR 0.66 SNIP 0.811
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 0.652 SNIP 0.997
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 0.547 SNIP 0.725
Scopus rating (2004): SJR 0.605 SNIP 0.75
Scopus rating (2003): SJR 0.698 SNIP 0.855
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 0.555 SNIP 0.808
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 0.651 SNIP 0.878
Web of Science (2001): Indexed yes
Scopus rating (2000): SJR 0.861 SNIP 0.902
Scopus rating (1999): SJR 0.787 SNIP 0.928
Original language: English
Electronic versions:
download.pdf
Non-indigenous signal crayfish Pacifastacus leniusculus is now common in Danish streams: Preliminary status for national distribution and protective actions

General information
State: Published
Organisations: Section for Freshwater Fisheries Ecology, National Institute of Aquatic Resources
Contributors: Skov, C., Aarestrup, K., Sivebæk, F., Pedersen, S., Vrålstad, T., Berg, S.
Pages: 1269-1274
Publication date: 2011
Peer-reviewed: Yes

Publication information
Journal: Biological Invasions
Volume: 13
Issue number: 6
ISSN (Print): 1387-3547
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 3.19 SJR 1.514 SNIP 1.317
Web of Science (2017): Impact factor 3.054
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.71 SJR 1.349 SNIP 1.199
Web of Science (2016): Impact factor 2.473
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 2.58 SJR 1.462 SNIP 1.213
Web of Science (2015): Impact factor 2.855
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 2.78 SJR 1.435 SNIP 1.405
Web of Science (2014): Impact factor 2.586
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 2.9 SJR 1.567 SNIP 1.304
Web of Science (2013): Impact factor 2.716
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 2.79 SJR 1.532 SNIP 1.332
Web of Science (2012): Impact factor 2.509
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 3 SJR 1.674 SNIP 1.353
Web of Science (2011): Impact factor 2.896
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.687 SNIP 1.524
Web of Science (2010): Impact factor 3.474
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.882 SNIP 1.614
Progression rates and survival of Sea trout smolts in the early stage of their marine migration

General information
State: Published
Organisations: Section for Freshwater Fisheries Ecology, National Institute of Aquatic Resources
Contributors: Del Villar, D., Aarestrup, K., Baktoft, H.
Publication date: 2011
Peer-reviewed: No
Event: Abstract from 1st International Conference on Fish Telemetry, Sapporo, Japan.
Source: orbit
Source-ID: 279160
Research output: Research › Conference abstract for conference – Annual report year: 2011

Ål og konsekvenser av vannkraftutbygging – en kunnskapsoppsummering

General information
State: Published
Organisations: Section for Freshwater Fisheries Ecology, National Institute of Aquatic Resources
Contributors: Thorstad, E. B., Larsen, B. M., Hesthagen, T., Næsje, T. F., Poole, R., Aarestrup, K., Pedersen, M. I., Hanssen, F., Østborg, G., Økland, F., Aasestad, I., Sandlund, O. T.
Number of pages: 137
Publication date: 2010

Publication information
Place of publication: Oslo
Publisher: Norges vassdrags- og energidirektorat
ISBN (Print): 978-82-410-0708-8
Original language: English
URLs:
http://www.nina.no/archive/nina/PpBasePdfRapporter%20%20ekstern%20rapportserie/2010/Thorstad%20%20C3%85l%20Mili%20C3%88basert%20Vannf%20%20ring%20%201%20%202010.pdf
Source: orbit
Source-ID: 271519
Research output: Research › Report – Annual report year: 2010

Aquatic nomads: The life and migrations of the Atlantic salmon

General information
State: Published
Organisations: Section for Freshwater Fisheries Ecology, National Institute of Aquatic Resources
Contributors: Thorstad, E. B., Whoriskey, F., Rikardsen, A. H., Aarestrup, K.
Number of pages: 467
Pages: 1-32
Effects of a surface oriented travelling screen and water abstraction practices on downstream migrating Salmonidae smolts in a lowland stream

Downstream migration of immature salmonids (smolts) may be associated with severe mortalities in anthropogenically altered channels. In Pacific salmon, several investigations have suggested the use of the dominating surface orientation of smolts to improve fish by-pass structures in large and deep hydroelectric reservoirs. The present study tested the use of a surface orientated travelling screen to guide Atlantic salmon (Salmo salar L.) and brown trout (Salmo trutta L.) smolts past a water abstraction site in a shallow lowland stream. The percentage of total discharge abstracted from the stream was included in the analyses. Indigenous migrating smolts were trapped, PIT tagged and subsequently released upstream of the water abstraction site. Releases shifted between a present or absent travelling screen. The migration success of the released smolts was evaluated using a trap situated downstream of the water abstraction site. There was no evidence that the surface oriented travelling screen had any influence on the probability of fish passing the water abstraction site. However, for both species, the probability of successful migration past the water abstraction site correlated negatively with the abstracted percentage of the total daily stream discharge. These findings may have important management implications because they suggest that short term changes in the percentage of total stream discharge abstracted may have consequences for the downstream migration success of smolts. Copyright (C) 2009 John Wiley & Sons, Ltd.

General information
State: Published
Organisations: Section for Freshwater Fisheries Ecology, National Institute of Aquatic Resources, Mathematical Statistics, Department of Informatics and Mathematical Modeling
Contributors: Svendsen, J. C., Aarestrup, K., Deacon, M. G., Christensen, R. H. B.
Pages: 353-361
Publication date: 2010
Peer-reviewed: Yes

Publication information
Journal: River Research and Applications
Volume: 26
Issue number: 3
ISSN (Print): 1535-1459
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 2.07 SJR 0.801 SNIP 0.896
Web of Science (2017): Impact factor 2.067
European eel and aquaculture

General information
Influences of environmental cues, migration history and habitat familiarity on partial migration

The factors that drive partial migration in organisms are not fully understood. Roach (Rutilus rutilus), a freshwater fish, engage in partial migration where parts of populations switch between summer habitats in lakes and winter habitats in connected streams. To test if the partial migration trait is phenotypically plastic or has genetic components, we translocated roach from 2 populations with different opportunities for migration to a lake with migration opportunity, containing a local roach population. This enabled monitoring of partial migration of fish in 3 different situations: 1) previous opportunity for migration, migrating in a familiar environment (the local population); 2) previous opportunity for migration, migrating in an unfamiliar environment; and 3) no previous opportunity for seasonal migration, migrating in an unfamiliar environment. In addition, we evaluated the migration patterns of roach in the lake with migration opportunity where from group 2 fish were translocated. Directional migration in and out of the lakes was monitored using Passive Integrated Transponder technology. Translocated fish with previous migration opportunity showed migration patterns more similar to local fish than to their home lake population, and individuals translocated from the lake without migration opportunity migrated when given the opportunity, suggesting that partial migration is phenotypically plastic and triggered by lake-specific environmental cues. We found temperature to be a proximate cue for migration decisions. Individuals without previous migration opportunity migrated at a lower proportion and with different small-scale migration patterns, suggesting that also genetic components are involved in the expression of the partial migration trait.
Life in the big blue box: studying the marine life of European eels

General information
State: Published
Organisations: Section for Freshwater Fisheries Ecology, National Institute of Aquatic Resources
Publication date: 2010
Peer-reviewed: No
URLs:
http://www.ices.dk/products/cmdocsindex.asp
Source: orbit
Source-ID: 256647
Research output: Research › Poster – Annual report year: 2010

Oceanic fronts in the Sargasso Sea control the early life and drift of Atlantic eels
Anguillid freshwater eels show remarkable life histories. In the Atlantic, the European eel (Anguilla anguilla) and American eel (Anguilla rostrata) undertake extensive migrations to spawn in the oceanic Sargasso Sea, and subsequently the offspring drift to foraging areas in Europe and North America, first as leaf-like leptoccephali larvae that later metamorphose into glass eels. Since recruitment of European and American glass eels has declined drastically during past decades, there is a strong demand for further understanding of the early, oceanic phase of their life cycle. Consequently, during a field expedition to the eel spawning sites in the Sargasso Sea, we carried out a wide range of dedicated bio-physical studies across areas of eel larval distribution. Our findings suggest a key role of oceanic frontal processes, retaining eel larvae within a zone of enhanced feeding conditions and steering their drift. The majority of the more westerly distributed American eel larvae are likely to follow a westerly/northerly drift route entrained in the Antilles/Florida Currents. European eel larvae are generally believed to initially follow the same route, but their more easterly distribution close to the eastward flowing Subtropical Counter Current indicates that these larvae could follow a shorter, eastward route towards the Azores and Europe. The findings emphasize the significance of oceanic physical–biological linkages in the life-cycle completion of Atlantic eels.

General information
State: Published
Organisations: Section for Ocean Ecology and Climate, National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology
Pages: 3593-3599
Publication date: 2010
Peer-reviewed: Yes

Publication information
Journal: Royal Society of London. Proceedings. Biological Sciences
Volume: 277
Issue number: 1700
ISSN (Print): 1471-2954
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 4.75 SJR 2.826 SNIP 1.677
Web of Science (2017): Impact factor 4.847
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 3.89 SJR 3.414 SNIP 1.723
Web of Science (2016): Impact factor 4.94
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 4.08 SJR 3.693 SNIP 1.8
Web of Science (2015): Impact factor 4.823
Partition of aerobic and anaerobic swimming costs related to gait transitions in a labriform swimmer

Members of the family Embiotocidae exhibit a distinct gait transition from exclusively pectoral fin oscillation to combined pectoral and caudal fin propulsion with increasing swimming speed. The pectoral–caudal gait transition occurs at a threshold speed termed $U_{p-c}$. The objective of this study was to partition aerobic and anaerobic swimming costs at speeds below and above the $U_{p-c}$ in the striped surfperch Embiotoca lateralis using swimming respirometry and video analysis to test the hypothesis that the gait transition marks the switch from aerobic to anaerobic power output. Exercise oxygen consumption rate was measured at 1.4, 1.9 and 2.3 L s$^{-1}$. The presence and magnitude of excess post-exercise...
oxygen consumption (EPOC) were evaluated after each swimming speed. The data demonstrated that 1.4 L s\(^{-1}\) was below the Up–c, whereas 1.9 and 2.3 L s\(^{-1}\) were above the Up–c. These last two swimming speeds included caudal fin propulsion in a mostly steady and unsteady (burst-assisted) mode, respectively. There was no evidence of EPOC after swimming at 1.4 and 1.9 L s\(^{-1}\), indicating that the pectoral–caudal gait transition was not a threshold for anaerobic metabolism. At 2.3 L s\(^{-1}\), E. lateralis switched to an unsteady burst and flap gait. This swimming speed resulted in EPOC, suggesting that anaerobic metabolism constituted 25% of the total costs. Burst activity correlated positively with the magnitude of the EPOC. Collectively, these data indicate that steady axial propulsion does not lead to EPOC whereas transition to burst-assisted swimming above Up–c is associated with anaerobic metabolism in this labriform swimmer.

**General information**

State: Published  
Organisations: Section for Freshwater Fisheries Ecology, National Institute of Aquatic Resources  
Contributors: Svendsen, J. C., Tudorache, C., Jordan, A. D., Steffensen, J. F., Aarestrup, K., Domenici, P.  
Pages: 2177-2183  
Publication date: 2010  
Peer-reviewed: Yes

**Publication information**

Journal: Journal of Experimental Biology  
Volume: 213  
Issue number: 13  
ISSN (Print): 0022-0949  
Ratings:  
BFI (2018): BFI-level 2  
Web of Science (2018): Indexed yes  
BFI (2017): BFI-level 2  
Scopus rating (2017): CiteScore 2.6 SJR 1.611 SNIP 1.306  
Web of Science (2017): Impact factor 3.179  
Web of Science (2017): Indexed yes  
BFI (2016): BFI-level 2  
Scopus rating (2016): CiteScore 2.62 SJR 1.824 SNIP 1.27  
Web of Science (2016): Impact factor 3.32  
Web of Science (2016): Indexed yes  
BFI (2015): BFI-level 2  
Scopus rating (2015): CiteScore 2.4 SJR 1.821 SNIP 1.211  
Web of Science (2015): Impact factor 2.914  
Web of Science (2015): Indexed yes  
BFI (2014): BFI-level 2  
Scopus rating (2014): CiteScore 2.51 SJR 1.742 SNIP 1.315  
Web of Science (2014): Impact factor 2.897  
Web of Science (2014): Indexed yes  
BFI (2013): BFI-level 2  
Scopus rating (2013): CiteScore 2.75 SJR 1.733 SNIP 1.314  
ISI indexed (2013): ISI indexed yes  
Web of Science (2013): Indexed yes  
BFI (2012): BFI-level 2  
Scopus rating (2012): CiteScore 2.91 SJR 1.627 SNIP 1.372  
Web of Science (2012): Impact factor 3.236  
ISI indexed (2012): ISI indexed yes  
BFI (2011): BFI-level 2  
Scopus rating (2011): CiteScore 2.77 SJR 1.553 SNIP 1.321  
Web of Science (2011): Impact factor 2.996  
ISI indexed (2011): ISI indexed yes  
Web of Science (2011): Indexed yes  
BFI (2010): BFI-level 2  
Scopus rating (2010): SJR 1.491 SNIP 1.332  
Web of Science (2010): Impact factor 3.04
Qualitative assessment of the diet of European eel larvae in the Sargasso Sea resolved by DNA barcoding

European eels (Anguilla anguilla) undertake spawning migrations of more than 5000 km from continental Europe and North Africa to frontal zones in the Sargasso Sea. Subsequently, the larval offspring are advected by large-scale eastward ocean currents towards continental waters. However, the Sargasso Sea is oligotrophic, with generally low plankton biomass, and the feeding biology of eel larvae has so far remained a mystery, hampering understanding of this peculiar life history. DNA barcoding of gut contents of 61 genetically identified A. anguilla larvae caught in the Sargasso Sea showed that even the smallest larvae feed on a striking variety of plankton organisms, and that gelatinous zooplankton is of fundamental dietary importance. Hence, the specific plankton composition seems essential for eel larval feeding and growth, suggesting a linkage between eel survival and regional plankton productivity. These novel insights into the prey of Atlantic eels may furthermore facilitate eel larval rearing in aquaculture, which ultimately may replace the unsustainable use of wild-caught glass eels.

General information
State: Published
Organisations: Section for Freshwater Fisheries Ecology, National Institute of Aquatic Resources, Section for Ocean Ecology and Climate
Pages: 819-822
Publication date: 2010
Peer-reviewed: Yes

Publication information
Journal: Biology Letters
Volume: 6
Issue number: 6
ISSN (Print): 1744-9561
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
Survival and progression rates of large European silver eel Anguilla anguilla in late freshwater and early marine phases

The population of European silver eel Anguilla anguilla has declined tremendously in the last decades. The cause of this decline is unknown, and it is necessary to investigate the migratory behaviour and survival rates of silver eels during the reproductive migration in order to understand if the decline is related to factors acting during that migration. We estimated survival and progression rates of European silver eel migrating in the lower part of the River Gudenaa and during the first phase of the marine migration in the Randers Fjord in Denmark. Fifty migrating silver eel (total body length: 56 to 84 cm) were captured, and each was equipped with an acoustic transmitter. Their migration was subsequently monitored using an
array of automatic listening stations, and progression rate and mortality in the river, inner part of the fjord and outer part of
the fjord were estimated. Survival was high in fresh water. However, 60% of eels were lost in the inner and outer fjord,
supporting the hypothesis that mortality is large in the early phase of the marine migration and that fishing may be a major
cause of mortality of silver eels. There was no indication that the slowest-migrating individuals were more prone to fishing
mortality than the faster-migrating individuals. Progression rate increased as the eels proceeded downriver and out of the
fjord. The migration was predominantly nocturnal, both in the river and fjord. Based on the available evidence, a
considerable increase in eel survival in the river–fjord system will be needed in order to fulfil the goals in the European
Union recovery plan for eels.

General information
State: Published
Organisations: Section for Freshwater Fisheries Ecology, National Institute of Aquatic Resources
Contributors: Aarestrup, K., Thorstad, E. B., Koed, A., Svendsen, J. C., Jepsen, N., Pedersen, M. I., Økland, F.
Pages: 263-270
Publication date: 2010
Peer-reviewed: Yes

Publication information
Journal: Aquatic Biology
Volume: 9
Issue number: 3
ISSN (Print): 1864-7782
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 2.23 SJR 0.949 SNIP 0.99
Web of Science (2017): Impact factor 1.932
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.82 SJR 0.898 SNIP 0.892
Web of Science (2016): Impact factor 1.6
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 1.41 SJR 0.767 SNIP 0.689
Web of Science (2015): Impact factor 1.265
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 1.44 SJR 0.688 SNIP 0.681
Web of Science (2014): Impact factor 1.258
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 1.34 SJR 0.652 SNIP 0.627
Web of Science (2013): Impact factor 1.118
ISI indexed (2013): ISI indexed no
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 1.7 SJR 0.819 SNIP 0.829
Web of Science (2012): Impact factor 1.453
ISI indexed (2012): ISI indexed no
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 1.79 SJR 0.859 SNIP 0.84
Web of Science (2011): Impact factor 1.474
ISI indexed (2011): ISI indexed no
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.907 SNIP 0.693
Web of Science (2010): Impact factor 1.611
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Álens afaerd i havet

General information
State: Published
Organisations: Section for Freshwater Fisheries Ecology, National Institute of Aquatic Resources
Contributors: Sivebæk, F., Aarestrup, K.
Pages: 12
Publication date: 2009
Peer-reviewed: No

Publication information
Journal: Sportsfiskeren
Volume: 84
Issue number: 10
ISSN (Print): 0038-8211
Ratings:
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
ISI indexed (2011): ISI indexed no
Original language: Danish
Source: orbit
Source-ID: 253224
Research output: Research - Journal article – Annual report year: 2009

Behavioural alarm and avoidance responses to copper in rainbow trout (Oncorhynchus mykiss): The effect of calcium

General information
State: Published
Organisations: Section for Freshwater Fisheries Ecology, National Institute of Aquatic Resources, Aarhus University
Contributors: Poulsen, S., Aarestrup, K., Svendsen, J. C., Malte, H.
Pages: S103-S103
Publication date: 2009
Peer-reviewed: Yes

Publication information
Journal: Comparative Biochemistry and Physiology - Part A: Molecular & Integrative Physiology
Volume: 153A
Issue number: 2
ISSN (Print): 1095-6433
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 2.23 SJR 0.836 SNIP 0.932
Web of Science (2017): Impact factor 2.258
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.16 SJR 0.84 SNIP 0.891
Web of Science (2016): Impact factor 1.812
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 2.01 SJR 0.943 SNIP 0.944
Web of Science (2015): Impact factor 2.039
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 2.18 SJR 0.999 SNIP 0.951
Web of Science (2014): Impact factor 1.966
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 2.36 SJR 0.974 SNIP 1.043
Web of Science (2013): Impact factor 2.371
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 2.18 SJR 0.797 SNIP 1.048
Web of Science (2012): Impact factor 2.167
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 2.2 SJR 0.885 SNIP 1.059
Web of Science (2011): Impact factor 2.235
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.851 SNIP 1.057
Web of Science (2010): Impact factor 2.134
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.82 SNIP 0.95
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.744 SNIP 0.819
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 0.649 SNIP 0.891
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 0.629 SNIP 0.89
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 0.666 SNIP 0.921
Scopus rating (2004): SJR 0.777 SNIP 1.043
Scopus rating (2003): SJR 0.606 SNIP 0.974
Scopus rating (2002): SJR 0.512 SNIP 0.741
Scopus rating (2001): SJR 0.444 SNIP 0.695
Scopus rating (2000): SJR 0.49 SNIP 0.663
Scopus rating (1999): SJR 0.498 SNIP 0.645
Original language: English
DOIs: 10.1016/j.cbpa.2009.04.134

Bibliographical note
Annual Meeting of the Society-for-Experimental-Biology Glasgow, SCOTLAND
Source: orbit
Source-ID: 263674
Research output: Research - peer-review › Conference abstract in journal – Annual report year: 2009
Følg antallet af ørreder som naturligt trækker fra et dansk vandløb

General information
State: Published
Organisations: Section for Freshwater Fisheries Ecology, National Institute of Aquatic Resources
Contributors: Aarestrup, K.
Publication date: 2009
Peer-reviewed: Unknown

Publication information
Journal: www.fiskepleje.dk
Original language: Danish
URLs:
http://www.dtu.dk/Subsites/fiskepleje/nyheder.aspx?guid=%7bC981CE82-A68B-441B-9CBB-5D3D4F55CD6E%7d
Source: orbit
Source-ID: 241604
Research output: Communication › Journal article – Annual report year: 2009

New insights in pike behaviour

General information
State: Published
Organisations: Section for Freshwater Fisheries Ecology, National Institute of Aquatic Resources
Contributors: Baktoft, H., Jacobsen, L., Berg, S., Aarestrup, K., Skov, C., Svendsen, J. C.
Publication date: 2009
Peer-reviewed: No
Event: Abstract from PhD Student Seminar, Søminestationen, Holbæk, Danmark, .
Source: orbit
Source-ID: 252607
Research output: Research › Conference abstract for conference – Annual report year: 2009

New insights in pike behaviour using 2D/3D telemetry

General information
State: Published
Organisations: Section for Freshwater Fisheries Ecology, National Institute of Aquatic Resources, Mathematical Statistics, Department of Informatics and Mathematical Modeling
Publication date: 2009
Peer-reviewed: No
Event: Abstract from 8th Conference on Fish Telemetry held in Europe; Umeå, Sweden; September 14-18, .
Source: orbit
Source-ID: 252533
Research output: Research › Conference abstract for conference – Annual report year: 2009

Oceanic spawning migration of the European eel (Anguilla anguilla)

General information
State: Published
Organisations: Section for Freshwater Fisheries Ecology, National Institute of Aquatic Resources, Section for Population Ecology and Genetics
Contributors: Aarestrup, K., Økland, F., Hansen, M. M., Righton, D., Gargan, P., Castonguay, M., Bernatchez, L., Howey, P., Sparholt, H., Pedersen, M. I., McKinley, R. S.
Pages: 1660
Publication date: 2009
Peer-reviewed: Yes

Publication information
Journal: Science
Volume: 325
Issue number: 5948
ISSN (Print): 0036-8075
Scopus rating (2016): CiteScore 14.39 SJR 13.745 SNIP 7.547
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 13.12 SJR 12.872 SNIP 7.606
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 12.68 SJR 12.052 SNIP 8.129
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): CiteScore 12.43 SJR 12.41 SNIP 7.809
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): CiteScore 12.39 SJR 13.318 SNIP 8.087
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): CiteScore 11.97 SJR 14.238 SNIP 8.277
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 13.481 SNIP 7.773
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 11.897 SNIP 7.056
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 11.277 SNIP 6.075
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 10.072 SNIP 6.017
Web of Science (2007): Indexed yes
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 11.09 SNIP 6.563
Web of Science (2005): Indexed yes
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 11.428 SNIP 7.488
Web of Science (2003): Indexed yes
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 10.987 SNIP 6.94
Web of Science (2001): Indexed yes
Scopus rating (2000): SJR 15.245 SNIP 7.042
Web of Science (2000): Indexed yes
Scopus rating (1999): SJR 16.615 SNIP 7.018
Organochlorine fingerprinting to determine foraging areas of sea-ranched Atlantic salmon: A case study from Denmark

General information
State: Published
Organisations: Section for Freshwater Fisheries Ecology, National Institute of Aquatic Resources
Contributors: Svendsen, T. C., Vorkamp, K., Svendsen, J. C., Aarestrup, K., Frier, J.
Pages: 598-603
Publication date: 2009
Peer-reviewed: Yes

Publication information
Journal: North American Journal of Fisheries Management
Volume: 29
Issue number: 3
ISSN (Print): 0275-5947
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 1.13 SJR 0.761 SNIP 0.751
Web of Science (2017): Impact factor 1.519
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.12 SJR 0.661 SNIP 0.814
Web of Science (2016): Impact factor 1.201
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 1.04 SJR 0.624 SNIP 0.786
Web of Science (2015): Impact factor 1.013
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 0.89 SJR 0.583 SNIP 0.745
Web of Science (2014): Impact factor 0.954
Sea lamprey (Petromyzon marinus L.) in Danish streams 1869-2009

General information
State: Published
Organisations: Section for Freshwater Fisheries Ecology, National Institute of Aquatic Resources
Contributors: Olesen, T., Carl, H., Aarestrup, K.
Pages: 46-59
Publication date: 2009
Peer-reviewed: Yes

Publication information
Journal: Flora og Fauna
Issue number: 115
ISSN (Print): 0015-3818
Ratings:
Web of Science (2018): Indexed yes
Web of Science (2017): Indexed yes
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
The volitional travel speed varies with reproductive state in mature female brown trout Salmo trutta

This study tested the effect of reproduction on the volitional travel speed of mature female brown trout Salmo trutta L. The downstream travel speed in the pre-spawning state was 0.25 m s⁻¹ (95% CI: 0.19, 0.34) while it increased significantly to 0.65 m s⁻¹ (95% CI: 0.49, 0.87) in the post-spawning state. The results suggest state-dependent travel speed in S. trutta.

General Information
State: Published
Organisations: Section for Freshwater Fisheries Ecology, National Institute of Aquatic Resources, Mathematical Statistics, Department of Informatics and Mathematical Modeling
Contributors: Svendsen, J. C., Aarestrup, K., Dolby, J., Svendsen, T., Christensen, R. H. B.
Pages: 901-907
Publication date: 2009
Peer-reviewed: Yes

Publication Information
Journal: Journal of Fish Biology
Volume: 75
Issue number: 4
ISSN (Print): 0022-1112
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 1.71 SJR 0.822 SNIP 0.923
Web of Science (2017): Impact factor 1.702
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.57 SJR 0.748 SNIP 0.83
Web of Science (2016): Impact factor 1.519
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 1.64 SJR 0.961 SNIP 0.924
Web of Science (2015): Impact factor 1.246
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 1.76 SJR 0.956 SNIP 0.931
Web of Science (2014): Impact factor 1.658
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 1.98 SJR 1.058 SNIP 1.112
Web of Science (2013): Impact factor 1.734
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 1.88 SJR 0.94 SNIP 1.045
Web of Science (2012): Impact factor 1.834
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 1.66 SJR 0.895 SNIP 0.951
Web of Science (2011): Impact factor 1.685
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.783 SNIP 0.832
Web of Science (2010): Impact factor 1.33
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.782 SNIP 0.888
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 0.896 SNIP 0.968
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.013 SNIP 1.067
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 0.907 SNIP 1.049
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 0.833 SNIP 0.886
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 0.96 SNIP 1.145
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 0.942 SNIP 1.092
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 0.991 SNIP 1.093
Web of Science (2002): Indexed yes
Factors affecting the within-river spawning migration of Atlantic salmon, with emphasis on human impacts

We review factors affecting the within-river spawning migration of Atlantic salmon. With populations declining across the entire distribution range, it is important that spawners survive in the last phase of the spawning migration. Knowledge on the factors affecting migration is essential for the protection of populations, and to increase the success of reintroduction programmes. A number of studies have documented that the upstream migration may be delayed for many weeks at man-made obstacles such as power station outlets, residual flow stretches, dams, weirs and fishways. The fish may also be delayed at natural migration barriers. Often, the magnitude of delay is not predictable; fish may be considerably delayed at barriers that appear to humans to be easily passable, or they may quickly pass barriers that appear difficult. Stressful events like catch-and-release angling may affect upstream migration. Impacts of human activities may also cause altered migration patterns, affect the within-river distribution of the spawning population, and severe barriers may result in displacement of the spawning population to other rivers. Factors documented to affect within-river migration include previous experience, water discharge, water temperature, water velocity, required jump heights, fish size, fish acclimatisation, light, water quality/pollution, time of the season, and catch and handling stress. How each of these factors affects the upstream migration is to a varying extent understood; however, the effects may differ among different river sections and sites. There are likely a number of additional important factors, and the relationship between different factors is complex. The understanding of general mechanisms stimulating fish within-river migration are still lacking, and it cannot be reliably predicted under which conditions a fish will pass a given migration barrier or which conditions are needed to stimulate migration at different sites. The strong focus on the effects of water discharge in past work may have hampered consideration of other factors. Exploration of the influence of these other factors in future studies could improve our understanding of what controls the upstream migration.
Følg antallet af ørreder som naturligt trækker fra Villestrup Å og ud i Mariager Fjord

General information
State: Published
Organisations: Section for Freshwater Fisheries Ecology, National Institute of Aquatic Resources
Contributors: Aarestrup, K.
Publication date: 2008
Peer-reviewed: No

Publication information
Journal: Fiskepleje.dk
Original language: Danish
URLs:
http://www.fiskepleje.dk/default.asp?getreq=%2Fvillestrup%2Ehtm
Source: orbit
Source-ID: 224659
Research output: Research › Journal article – Annual report year: 2008

Lampretter - vandløbets sugekop...

General information
State: Published
Organisations: Section for Freshwater Fisheries Ecology, National Institute of Aquatic Resources
Contributors: Sivebæk, F., Aarestrup, K.
Publication date: 2008
Peer-reviewed: No

Publication information
Journal: www.fiskepleje.dk
Original language: Danish
URLs:
http://www.fiskepleje.dk/default.asp?getreq=%2Flampret%2Ehtm
Source: orbit
Source-ID: 227387
Research output: Research › Journal article – Annual report year: 2008

Proceedings of the Seventh Conference on Fish Telemetry held in Europe

General information
State: Published
Organisations: Section for Freshwater Fisheries Ecology, National Institute of Aquatic Resources
Contributors: Jacobsen, L., Berg, S., Skov, C., Aarestrup, K., Pedersen, M. I.
Pages: 331-331
Publication date: 2008
Peer-reviewed: No

Publication information
Journal: Fisheries Management and Ecology
Volume: 15
Issue number: 5-6
ISSN (Print): 0969-997X
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 1.59 SJR 0.746 SNIP 0.823
Web of Science (2017): Impact factor 1.624
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.85 SJR 0.858 SNIP 0.846
Red bækkerreden

General information
State: Published
Organisations: Section for Freshwater Fisheries Ecology, National Institute of Aquatic Resources
Contributors: Aarestrup, K., Sivebæk, F.
Pages: 80-83
Publication date: 2008
Peer-reviewed: No

Publication information
Journal: Sportsfiskeren
Volume: 83
Issue number: 2
ISSN (Print): 0038-8211
Ratings:
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
ISI indexed (2011): ISI indexed no
Original language: Danish
Source: orbit
Source-ID: 224669
Research output: Research › Journal article – Annual report year: 2008

Survival and behaviour of European silver eel in late freshwater and early marine phase during spring migration

General information
State: Published
Organisations: Section for Freshwater Fisheries Ecology, National Institute of Aquatic Resources
Contributors: Aarestrup, K., Thorstad, E., Koed, A., Jepsen, N., Svendsen, J. C., Pedersen, M. I., Skov, C., Okland, F.
Pages: 435-440
Publication date: 2008
Peer-reviewed: Yes

Publication information
Journal: Fisheries Management and Ecology
Volume: 15
Issue number: 5-6
ISSN (Print): 0969-997X
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 1.59 SJR 0.746 SNIP 0.823
Web of Science (2017): Impact factor 1.624
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.85 SJR 0.858 SNIP 0.846
Web of Science (2016): Impact factor 1.327
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 1.91 SJR 1.017 SNIP 1.109
Web of Science (2015): Impact factor 1.51
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 1.85 SJR 0.939 SNIP 0.962
Web of Science (2014): Impact factor 1.76
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 1.36 SJR 0.757 SNIP 0.774
Web of Science (2013): Impact factor 1.136
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
Evidence for non-random spatial positioning of migrating smolts (Salmonidae) in a small lowland stream

General information
State: Published
Organisations: Section for Freshwater Fisheries Ecology, National Institute of Aquatic Resources
Contributors: Svendsen, J. C., Eskesen, A., Aarestrup, K., Koed, A., Jordan, A.
Pages: 1147-1158
Publication date: 2007
Peer-reviewed: Yes

Publication information
Journal: Freshwater Biology
Volume: 52
Issue number: 6
ISSN (Print): 0046-5070
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 3.67 SJR 1.603 SNIP 1.418
Web of Science (2017): Impact factor 3.767
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 3.36 SJR 1.584 SNIP 1.417
Web of Science (2016): Impact factor 3.255
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 2.95 SJR 1.532 SNIP 1.364
Web of Science (2015): Impact factor 2.933
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 3.03 SJR 1.502 SNIP 1.469
Web of Science (2014): Impact factor 2.738
BFI (2013): BFI-level 2
Scopus rating (2013): CiteScore 4.02 SJR 2.049 SNIP 1.86
Web of Science (2013): Impact factor 2.905
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): CiteScore 3.76 SJR 2.076 SNIP 1.754
Web of Science (2012): Impact factor 3.933
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): CiteScore 3.33 SJR 1.945 SNIP 1.629
Web of Science (2011): Impact factor 3.29
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 1.754 SNIP 1.517
Web of Science (2010): Impact factor 3.082
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 1.739 SNIP 1.513
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 1.661 SNIP 1.492
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.754 SNIP 1.723
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.962 SNIP 1.855
Scopus rating (2005): SJR 2.017 SNIP 1.877
Scopus rating (2004): SJR 1.613 SNIP 1.555
Scopus rating (2003): SJR 1.78 SNIP 1.597
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 1.369 SNIP 1.455
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 1.514 SNIP 1.437
Scopus rating (2000): SJR 1.623 SNIP 1.536
Scopus rating (1999): SJR 1.691 SNIP 1.346
Original language: English
DOIs:
10.1111/j.1365-2427.2007.01743.x
Source: orbit
Source-ID: 227590
Annual movement of adult pike (Esox lucius L.) in a lowland river

General information
State: Published
Organisations: Section for Freshwater Fisheries Ecology, National Institute of Aquatic Resources
Contributors: Koed, A., Balleby, K., Mejhede, P., Aarestrup, K.
Pages: 191-199
Publication date: 2006
Peer-reviewed: Yes

Publication information
Journal: Ecology of Freshwater Fish
Volume: 15
Issue number: 2
ISSN (Print): 0906-6691
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 1.65 SJR 0.83 SNIP 1.046
Web of Science (2017): Impact factor 1.832
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.66 SJR 0.8 SNIP 0.852
Web of Science (2016): Impact factor 2.054
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 1.92 SJR 1.041 SNIP 1.186
Web of Science (2015): Impact factor 2.052
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 1.58 SJR 0.874 SNIP 0.979
Web of Science (2014): Impact factor 1.701
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 1.77 SJR 0.98 SNIP 1.049
Web of Science (2013): Impact factor 1.59
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 2.05 SJR 1.075 SNIP 1.279
Web of Science (2012): Impact factor 1.935
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 1.65 SJR 0.969 SNIP 0.907
Web of Science (2011): Impact factor 1.573
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.819 SNIP 0.979
Web of Science (2010): Impact factor 1.432
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.831 SNIP 1.051
BFI (2008): BFI-level 2
Comparison of physiological smolt status in descending and nondescending wild brown trout (Salmo trutta) in a Danish stream

General information
State: Published
Organisations: Section for Freshwater Fisheries Ecology, National Institute of Aquatic Resources
Contributors: Nielsen, C., Aarestrup, K., Madsen, S.
Pages: 229-236
Publication date: 2006
Peer-reviewed: Yes

Publication information
Journal: Ecology of Freshwater Fish
Volume: 15
Issue number: 2
ISSN (Print): 0906-6691
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 1.65 SJR 0.83 SNIP 1.046
Web of Science (2017): Impact factor 1.832
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.66 SJR 0.8 SNIP 0.852
Web of Science (2016): Impact factor 2.054
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 1.92 SJR 1.041 SNIP 1.186
Web of Science (2015): Impact factor 2.052
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 1.58 SJR 0.874 SNIP 0.979
Declines in juvenile American eel (Anguilla rostrata Lesueur) abundance have led to concern about the impacts of anthropogenic structures on eel migration patterns. Telemetry provides an insightful tool for examining the movements of eels around these structures. Although there have been a number of studies investigating movements of Anguillid eels, using a variety of transmitter attachment techniques, there are few published evaluations of the effects of various tag attachment procedures. Hence, the effects of three telemetry attachment procedures were evaluated for female silver phase American eels. Short-term effects were examined by comparing the swimming performance of control eels and
surgical shams with the swimming capacity of eels tagged externally, internally, and gastrically 24-hours following surgeries. Adaptive effects were investigated using a second swim trial 8 to 10 weeks following surgical procedures. Additionally, 12-week transmitter retention rates were calculated for each attachment method. Critical swimming velocity was not significantly different between treatments (P > 0.05), but did decrease significantly between trials (P = 0.012), suggesting that the swimming capacity of silver-phase American eels is not affected by the presence of telemetry transmitters or the method of transmitter attachment, even though swim performance decreases. However, transmitter retention rates varied considerably after the 12-week experimental period. Three gastric tags were regurgitated for a 12-week retention rate of 72.7%. No surgically implanted transmitters were shed, while 11 out of 12 externally affixed transmitters were lost, resulting in a retention rate of only 9.1%. These results suggest that surgically implanting transmitters is the preferred method of affixing telemetry transmitters to American eels especially for long-term telemetry studies.

General information
State: Published
Organisations: Section for Freshwater Fisheries Ecology, National Institute of Aquatic Resources
Contributors: Cottrill, R., Økland, F., Aarestrup, K., Jepsen, N., Koed, A., Hunter, K., Butterworth, K., McKinley, R.
Pages: 502-511
Publication date: 2006
Peer-reviewed: Yes

Publication information
Journal: Journal of Great Lakes Research
Volume: 32
Issue number: 3
ISSN (Print): 0380-1330
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 2.27 SJR 1.222 SNIP 1.057
Web of Science (2017): Impact factor 2.354
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.02 SJR 0.884 SNIP 0.913
Web of Science (2016): Impact factor 1.958
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 2.01 SJR 0.961 SNIP 0.931
Web of Science (2015): Impact factor 1.91
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 1.7 SJR 0.867 SNIP 0.928
Web of Science (2014): Impact factor 1.748
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 1.91 SJR 0.995 SNIP 0.933
Web of Science (2013): Impact factor 1.771
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 2.23 SJR 1.06 SNIP 1.199
Web of Science (2012): Impact factor 2.309
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 1.45 SJR 0.89 SNIP 0.836
Web of Science (2011): Impact factor 1.521
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.897 SNIP 0.997
Web of Science (2010): Impact factor 1.305
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.789 SNIP 0.806
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.821 SNIP 0.817
Scopus rating (2007): SJR 0.643 SNIP 0.778
Scopus rating (2006): SJR 0.614 SNIP 0.68
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 0.562 SNIP 0.705
Scopus rating (2004): SJR 0.89 SNIP 1.026
Scopus rating (2003): SJR 0.812 SNIP 1.161
Scopus rating (2002): SJR 0.966 SNIP 0.988
Scopus rating (2001): SJR 0.813 SNIP 0.695
Scopus rating (2000): SJR 0.695 SNIP 0.71
Scopus rating (1999): SJR 0.689 SNIP 0.492
Original language: English
DOIs:
Source: orbit
Source-ID: 225153
Research output: Research - peer-review › Journal article – Annual report year: 2006

Fisks vandring forbi opstemninger i vandløb

General information
State: Published
Organisations: Section for Freshwater Fisheries Ecology, National Institute of Aquatic Resources
Contributors: Olesen, T., Aarestrup, K.
Pages: 142-146
Publication date: 2006
Peer-reviewed: No

Publication information
Journal: Vand og jord
Volume: 13
Issue number: 4
ISSN (Print): 0908-7761
Ratings:
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
ISI indexed (2011): ISI indexed no
Original language: Danish
Source: orbit
Source-ID: 226970
Research output: Research › Journal article – Annual report year: 2006

Nedstrøms vandring og opstemninger

General information
State: Published
Organisations: Section for Freshwater Fisheries Ecology, National Institute of Aquatic Resources
Contributors: Aarestrup, K., Koed, A., Møller Olesen, T.
Pages: 54-62
Publication date: 2006
Peer-reviewed: No

Publication information
Journal: Fisk og Hav
Issue number: 60
ISSN (Print): 0105-9211
Ratings:
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
Opstemninger - forarmelse af vandløbene

General information
State: Published
Organisations: Section for Freshwater Fisheries Ecology, National Institute of Aquatic Resources
Contributors: Aarestrup, K., Koed, A., Møller Olesen, T.
Pages: 38-44
Publication date: 2006
Peer-reviewed: No

Publication information
Journal: Fisk og Hav
Issue number: 60
ISSN (Print): 0105-9211
Ratings:
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
ISI indexed (2011): ISI indexed no
Original language: Danish
URLs:
http://www.aqua.dtu.dk/Publikationer/Fisk-og-hav.aspx
Source: orbit
Source-ID: 224664
Research output: Research › Journal article – Annual report year: 2006

Opstrøms vandring og opstemninger

General information
State: Published
Organisations: Section for Freshwater Fisheries Ecology, National Institute of Aquatic Resources
Contributors: Aarestrup, K., Koed, A., Møller Olesen, T.
Pages: 44-54
Publication date: 2006
Peer-reviewed: No

Publication information
Journal: Fisk og Hav
Issue number: 60
ISSN (Print): 0105-9211
Ratings:
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
ISI indexed (2011): ISI indexed no
Original language: Danish
URLs:
http://www.aqua.dtu.dk/Publikationer/Fisk-og-hav.aspx
Source: orbit
Source-ID: 224667
Research output: Research › Journal article – Annual report year: 2006
Preface to the Silkeborg conference issue

General information
State: Published
Organisations: Section for Freshwater Fisheries Ecology, National Institute of Aquatic Resources
Contributors: Jacobsen, L., Koed, A., Aarestrup, K., Skov, C., Jepsen, N., Berg, S.
Publication date: 2006
Peer-reviewed: No

Publication information
Journal: Ecology of Freshwater Fish
Volume: 15
Issue number: 2
ISSN (Print): 0906-6691
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 1.65 SJR 0.83 SNIP 1.046
Web of Science (2017): Impact factor 1.832
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.66 SJR 0.8 SNIP 0.852
Web of Science (2016): Impact factor 2.054
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 1.92 SJR 1.041 SNIP 1.186
Web of Science (2015): Impact factor 2.052
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 1.58 SJR 0.874 SNIP 0.979
Web of Science (2014): Impact factor 1.701
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 1.77 SJR 0.98 SNIP 1.049
Web of Science (2013): Impact factor 1.59
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 2.05 SJR 1.075 SNIP 1.279
Web of Science (2012): Impact factor 1.935
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 1.65 SJR 0.969 SNIP 0.907
Web of Science (2011): Impact factor 1.573
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.819 SNIP 0.979
Web of Science (2010): Impact factor 1.432
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.831 SNIP 1.051
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 0.956 SNIP 0.985
Use of a novel acoustic dissolved oxygen transmitter for fish telemetry

The multiple responses of fishes to changes in dissolved oxygen saturations have been studied widely in the laboratory. In contrast only few studies have included field observations. The objective of the present study was to evaluate the performance of a novel acoustic dissolved oxygen transmitter for field biotelemetry. The results demonstrated that the output of the transmitter was unaffected by three different temperatures (10 to 30 degrees C) and described the dissolved oxygen saturation with high accuracy ($r^2 > 0.99$) over the entire range of 0 to 191% saturation. The response time ($\geq 90\%$ of end value) of the transmitter was 12 s both in terms of decreasing (100 to 0%) and increasing (0 to 100%) oxygen saturations. When externally attached to fishes the present findings support the use of the transmitter for reliable dissolved oxygen measurements on individuals living in environments that may change both temporally and spatially with regard to ambient temperature and dissolved oxygen saturation.
Movement and mortality of stocked brown trout in a stream

The movement and mortality of stocked brown trout Salmo trutta were investigated using radio telemetry. Four brown trout left the study area whereas the remaining fish were stationary. After 5 weeks, 13 out of 50 tagged brown trout were still alive in the stream. Surviving fish had a significantly lower mean movement per day than fish, which later either died or disappeared. This difference in behaviour was most pronounced 2 to 8 days after release. Predation by the otter Lutra lutra was probably the main cause of the observed mortality. (c) 2005 The Fisheries Society of the British Isles
Overlevelsen af laksesmolt i Karlsårde Sø i foråret 2004

General information
State: Published
Organisations: Section for Freshwater Fisheries Ecology, National Institute of Aquatic Resources, Institute Management
Contributors: Koed, A., Deacon, M., Aarestrup, K., Rasmussen, G.
Number of pages: 20
Publication date: 2005

Publication information
Place of publication: Silkeborg
Publisher: Danmarks Fiskeriundersøgelser
ISBN (Print): 87-90968-74-3
Original language: Danish
(DFU-rapport; No. 145-05).
Electronic versions:
145-05 Overlevelsen af laksesmolt i Karlsårde sø 2004.pdf
URLs:
Source: orbit
Source-ID: 226261
Research output: Research › Report – Annual report year: 2005

Upstream migration of Atlantic salmon in three regulated rivers

General information
Factors influencing the spawning migration of female anadromous brown trout

Radio telemetry was employed to study movements of adult female anadromous brown trout Salmo trutta (sea trout) during upstream spawning migration and following spawning in a stream with tributaries. Sea trout were monitored by manual tracking and by automatic listening stations. The latter suggested that initiation of upstream migration was positively correlated with stream discharge. Individual sea trout performed repeated upstream migration 'initiations' (visits) to areas where they were detected by the automatic listening stations. The first and subsequent upstream migration 'initiations' occurred under conditions of similar water temperature and stream discharge. Manual tracking indicated that in the pre-spawning state, the distance migrated over 3 days was positively correlated with stream discharge and water temperature, whereas in the post-spawning state, the total distance migrated was not correlated with any of these two environmental variables. (C) 2004 The Fisheries Society of the British Isles.
Future migratory behaviour predicted from premigratory levels of gill Na⁺/K⁺-ATPase activity in individual wild brown trout (Salmo trutta)

General information
State: Published
Organisations: Section for Freshwater Fisheries Ecology, National Institute of Aquatic Resources
Contributors: Nielsen, C., Aarestrup, K., Norum, U., Madsen, S.
Pages: 527-533
Migration of landlocked brown trout in two Scandinavian streams as revealed from trap data

General information
State: Published
Organisations: Section for Freshwater Fisheries Ecology, National Institute of Aquatic Resources
Contributors: Carlsson, J., Aarestrup, K., Nordwall, F., Naslund, I., Eriksson, T., Carlsson, J.
Pages: 161-167
Publication date: 2004
Peer-reviewed: Yes

Publication information
Journal: Ecology of Freshwater Fish
Volume: 13
Issue number: 3
ISSN (Print): 0906-6691
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 1.65 SJR 0.83 SNIP 1.046
Web of Science (2017): Impact factor 1.832
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.66 SJR 0.8 SNIP 0.852
Web of Science (2016): Impact factor 2.054
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 1.92 SJR 1.041 SNIP 1.186
Web of Science (2015): Impact factor 2.052
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 1.58 SJR 0.874 SNIP 0.979
Web of Science (2014): Impact factor 1.701
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 1.77 SJR 0.98 SNIP 1.049
Web of Science (2013): Impact factor 1.59
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 2.05 SJR 1.075 SNIP 1.279
Udsætning af ørredsmolt

General information
State: Published
Organisations: Section for Freshwater Fisheries Ecology, National Institute of Aquatic Resources
Contributors: Madsen, S., Nielsen, C., Aarestrup, K.
Publication date: 2004
Peer-reviewed: No

Publication information
Journal: http://www.fiskepleje.dk
Original language: Danish
URLs:
http://dmz-web04/fiskepleje/smolt2.htm
Source: orbit
Source-ID: 226583
Research output: Research › Journal article – Annual report year: 2004
Efficiency of a nature-like bypass channel for sea trout (Salmo trutta) ascending a small Danish stream studied by PIT telemetry

General information
State: Published
Organisations: Section for Freshwater Fisheries Ecology, National Institute of Aquatic Resources
Contributors: Aarestrup, K., Lucas, M., Hansen, J.
Pages: 160-168
Publication date: 2003
Peer-reviewed: Yes

Publication information
Journal: Ecology of Freshwater Fish
Volume: 12
Issue number: 3
ISSN (Print): 0906-6691
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 1.65 SJR 0.83 SNIP 1.046
Web of Science (2017): Impact factor 1.832
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.66 SJR 0.8 SNIP 0.852
Web of Science (2016): Impact factor 2.054
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 1.92 SJR 1.041 SNIP 1.186
Web of Science (2015): Impact factor 2.052
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 1.58 SJR 0.874 SNIP 0.979
Web of Science (2014): Impact factor 1.701
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 1.77 SJR 0.98 SNIP 1.049
Web of Science (2013): Impact factor 1.59
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 2.05 SJR 1.075 SNIP 1.279
Web of Science (2012): Impact factor 1.935
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 1.65 SJR 0.969 SNIP 0.907
Web of Science (2011): Impact factor 1.573
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.819 SNIP 0.979
Web of Science (2010): Impact factor 1.432
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.831 SNIP 1.051
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 0.956 SNIP 0.985
Pre-migratory differentiation of wild brown trout into migrant and resident individuals

General information
State: Published
Organisations: Section for Freshwater Fisheries Ecology, National Institute of Aquatic Resources
Contributors: Nielsen, C., Aarestrup, K., Norum, U., Madsen, S.
Pages: 1184-1196
Publication date: 2003
Peer-reviewed: Yes

Publication information
Journal: Journal of Fish Biology
Volume: 63
Issue number: 5
ISSN (Print): 0022-1112
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 1.71 SJR 0.822 SNIP 0.923
Web of Science (2017): Impact factor 1.702
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.57 SJR 0.748 SNIP 0.83
Web of Science (2016): Impact factor 1.519
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 1.64 SJR 0.961 SNIP 0.924
Web of Science (2015): Impact factor 1.246
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 1.76 SJR 0.956 SNIP 0.931
Web of Science (2014): Impact factor 1.658
Web of Science (2014): Indexed yes
Survival of migrating sea trout (Salmo trutta) and Atlantic salmon (Salmo salar) smolts negotiating weirs in small Danish rivers

General information
State: Published
Organisations: Section for Freshwater Fisheries Ecology, National Institute of Aquatic Resources
Contributors: Aarestrup, K., Koed, A.
Pages: 169-176
Udsætning og fysiologi hos ørredsmolt

General information
State: Published
Organisations: Section for Freshwater Fisheries Ecology, National Institute of Aquatic Resources
Contributors: Nielsen, C., Aarestrup, K., Madsen, S.
Pages: 12-21
Publication date: 2003
Peer-reviewed: No

Publication information
Journal: Fisk og Hav
Issue number: 56
ISSN (Print): 0105-9211
Ratings:
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
ISI indexed (2011): ISI indexed no
Original language: Danish
URLs:
http://www.difres.dk/dk/publication/files/22122003$FH56.PDF
Source: orbit
Source-ID: 226789
Research output: Research › Journal article – Annual report year: 2003

Initial mortality of radio-tagged Atlantic salmon (Salmo salar L.) smolts following release downstream of a hydropower station

General information
State: Published
Organisations: Section for Freshwater Fisheries Ecology, National Institute of Aquatic Resources
Contributors: Koed, A., Jepsen, N., Aarestrup, K., Nielsen, C.
Pages: 31-37
Publication date: 2002
Peer-reviewed: Yes

Publication information
Journal: Hydrobiologia
Volume: 483
Issue number: 1-3
ISSN (Print): 0018-8158
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Net ground speed of downstream migrating radio-tagged Atlantic salmon (Salmo salar L.) and brown trout (Salmo trutta L.) smolts in relation to environmental factors

The downstream migration of Atlantic salmon (Salmo salar L.) and sea trout smolt (S. trutta L.) was investigated using radio telemetry in the spring of 1999 and 2000. Forty wild sea trout smolts, 20 F1 sea trout smolts, 20 hatchery salmon smolts and 20 salmon smolts from river stockings were radio tagged and released in the Danish River Lilleaa. The downstream migration of radio tagged smolts of both species occurred concurrently with their untagged counterparts. The diel migration pattern of the radio tagged smolts was predominantly nocturnal in both species. Wild sea trout smolt migrated significantly faster than both the F1 trout and the introduced salmon. There was no correlation between net ground speed, gill Na+, K+-ATPase activity or fish length in any of the different groups. The migration speed of wild sea trout smolts was positively correlated with water discharge in both years. In F1 sea trout smolts, migration speed was positively correlated with temperature in 1999. The migration speed of salmon smolts did not correlate to any
of the investigated parameters

**General information**

State: Published
Organisations: Section for Freshwater Fisheries Ecology, National Institute of Aquatic Resources
Contributors: Aarestrup, K., Nielsen, C., Koed, A.
Pages: 95-102
Publication date: 2002
Peer-reviewed: Yes

**Publication information**

Journal: Hydrobiologia
Volume: 483
Issue number: 1-3
ISSN (Print): 0018-8158

Ratings:
- BFI (2018): BFI-level 1
- Web of Science (2018): Indexed yes
- BFI (2017): BFI-level 1
- Scopus rating (2017): CiteScore 2.15
- Web of Science (2017): Impact factor 2.401
- Web of Science (2017): Indexed yes
- BFI (2016): BFI-level 1
- Scopus rating (2016): CiteScore 2.27
- Web of Science (2016): Impact factor 2.616
- Web of Science (2016): Indexed yes
- BFI (2015): BFI-level 1
- Scopus rating (2015): CiteScore 2.16
- Web of Science (2015): Impact factor 2.372
- Web of Science (2015): Indexed yes
- BFI (2014): BFI-level 1
- Scopus rating (2014): CiteScore 2.22
- Web of Science (2014): Impact factor 2.559
- Web of Science (2014): Indexed yes
- BFI (2013): BFI-level 1
- Scopus rating (2013): CiteScore 2.02
- Web of Science (2013): Impact factor 2.492
- ISI indexed (2013): ISI indexed yes
- Web of Science (2013): Indexed yes
- BFI (2012): BFI-level 1
- Scopus rating (2012): CiteScore 2.13
- Web of Science (2012): Impact factor 2.326
- ISI indexed (2012): ISI indexed yes
- Web of Science (2012): Indexed yes
- BFI (2011): BFI-level 1
- Scopus rating (2011): CiteScore 1.98
- Web of Science (2011): Impact factor 2.411
- ISI indexed (2011): ISI indexed yes
- Web of Science (2011): Indexed yes
- BFI (2010): BFI-level 1
- Web of Science (2010): Impact factor 1.792
- Web of Science (2010): Indexed yes
- BFI (2009): BFI-level 1
- BFI (2008): BFI-level 1
- Web of Science (2008): Indexed yes
- Web of Science (2007): Indexed yes
Vandpleje øger fiskebestandene

General information
State: Published
Organisations: Section for Freshwater Fisheries Ecology, National Institute of Aquatic Resources
Contributors: Sivebæk, F., Jepsen, N., Aarestrup, K.
Publication date: 2002
Peer-reviewed: No

Publication information
Journal: www.fiskepleje.dk
Original language: Danish
URLs:
http://www.dfu.min.dk/fiskepleje/vandpleje.htm
Source: orbit
Source-ID: 227417
Research output: Research › Journal article – Annual report year: 2002

Factors affecting the migration of anadromous Atlantic salmon (Salmo salar L) and sea trout (Salmo trutta L)

General information
State: Published
Organisations: Section for Freshwater Fisheries Ecology, National Institute of Aquatic Resources
Contributors: Aarestrup, K.
Publication date: 2001

Publication information
Publisher: Aalborg University
Original language: English
Source: orbit
Source-ID: 224658
Research output: Research › Ph.D. thesis – Annual report year: 2001

Annual movement and migration of adult pikeperch in a lowland river

General information
State: Published
Organisations: Section for Freshwater Fisheries Ecology, National Institute of Aquatic Resources
Contributors: Koed, A., Mejlhede, P., Balleby, K., Aarestrup, K.
Pages: 1266-1279
Publication date: 2000
Peer-reviewed: Yes

Publication information
Journal: Journal of Fish Biology
Volume: 57
ISSN (Print): 0022-1112
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 1.71 SJR 0.822 SNIP 0.923
Web of Science (2017): Impact factor 1.702
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.57 SJR 0.748 SNIP 0.83
Web of Science (2016): Impact factor 1.519
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 1.64 SJR 0.961 SNIP 0.924
Web of Science (2015): Impact factor 1.246
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 1.76 SJR 0.956 SNIP 0.931
Web of Science (2014): Impact factor 1.658
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 1.98 SJR 1.058 SNIP 1.112
Web of Science (2013): Impact factor 1.734
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 1.88 SJR 0.94 SNIP 1.045
Web of Science (2012): Impact factor 1.834
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 1.66 SJR 0.895 SNIP 0.951
Web of Science (2011): Impact factor 1.685
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.783 SNIP 0.832
Web of Science (2010): Impact factor 1.33
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.782 SNIP 0.888
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 0.896 SNIP 0.968
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.013 SNIP 1.067
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 0.907 SNIP 1.049
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 0.833 SNIP 0.886
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 0.96 SNIP 1.145
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 0.942 SNIP 1.092
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 0.991 SNIP 1.093
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 0.877 SNIP 1.12
Web of Science (2001): Indexed yes
Scopus rating (2000): SJR 1.088 SNIP 0.978
Prespawning migratory behaviour and spawning success of sea-ranched Atlantic salmon, Salmo salar L., in the River Gudenaa, Denmark

The migratory behaviour of sea-ranched Atlantic salmon, Salmo salar L., was analysed by radio-telemetry in the River Gudenaa, Denmark. The main objectives were to: (1) estimate mortality of returning adults through the fjord; (2) observe rate of progression and migratory pattern in the fjord and river; and (3) record whether spawning occurs in the river. Forty-two returning salmon (19 males and 23 females of total body length from 60-97 cm) reared and released as smolts, were caught and equipped with external radio transmitters in the outer estuary of the River Gudenaa in 1994 and 1995. Of the tagged salmon, 18 (43%) were caught in the estuary, four (10%) were not recorded after release and 20 (47%) entered the river. The mean rate of progression through the fjord was 7.6 km d\(^{-1}\) (range 1.4-18.2) in 1994 and 5.4 km d\(^{-1}\) (range 1.6-17.1) in 1995. Eleven salmon were alive at the onset of the spawning period. Eight were retrieved dead from the river during or after the spawning period; four with empty gonads assumed to be successful spawners, and four with intact gonads. In 1994, unsuccessful spawners (found dead with intact gonads) entered the river earlier and had a longer total migration distance in the river compared to successful spawners. This suggests that spawning success of sea-ranched salmon is associated with time of river entry and river migration length.
Relationship between gill Na+,K+-ATPase activity and downstream movement in domesticated and first-generation offspring of wild anadromous brown trout (Salmo trutta)

The relationship between smolt status and downstream movement following release was investigated in two stocks of hatchery-reared anadromous brown trout (Salmo trutta). Yearlings from a domesticated stock (DS) and first-generation offspring (F1) of wild anadromous trout were held under identical conditions from August 1997 until the following spring, where they developed smolt characteristics as judged from increasing gill Na+,K+-ATPase activity. Presmolts (low Na+,K+-ATPase activity), smolts (high Na+,K+-ATPase activity), and desmolts (regressed Na+,K+-ATPase activity) were released on three occasions into the River Salten. Using both dye-marked and radiotagged fish, downstream movement was monitored by either trapping 3 km downstream (dye-marked fish) or radiotracking on a daily basis. The experiments showed a positive correlation between smolt status (gill Na+,K+-ATPase activity) and downstream movement. Gill Na+,K+-ATPase activity may therefore be used as an indicator of migratory readiness in brown trout. F1 and DS trout had the highest migration frequency when released as presmolts and smolts, respectively. Despite smaller size, F1 trout had similar or better survival than DS trout after release. Our data suggest that initiation of downstream movement is influenced by an interaction between the previous physiological development of the fish and a discrete level of water discharge or water temperature.

General information
State: Published
Organisations: Section for Freshwater Fisheries Ecology, National Institute of Aquatic Resources
Contributors: Aarestrup, K., Nielsen, C., Madsen, S.
Pages: 2086-2095
Publication date: 2000
Peer-reviewed: Yes

Publication information
Journal: Canadian Journal of Fisheries and Aquatic Sciences
Volume: 57
Issue number: 10
ISSN (Print): 0706-652X
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 2.44 SJR 1.329 SNIP 1.036
Web of Science (2017): Impact factor 2.631
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.56 SJR 1.388 SNIP 1.185
Web of Science (2016): Impact factor 2.466
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 2.22 SJR 1.267 SNIP 1.025
A comparison of the growth of radio-tagged and dye-marked pike

Radio-tagged and dye-marked adult pike Esox lucius L. were recaptured in a reservoir 1 year after tagging. There was no significant difference in length or weight growth rate between the two groups of fish and no change in their condition factor. (C) 1999 The Fisheries Society of the British Isles
Movements of two strains of radio tagged Atlantic salmon, Salmo salar L., smolts through a reservoir

Smolt migration through a shallow and turbid hydro-reservoir in a major Danish river system was investigated using radiotelemetry. Hatchery-reared 1+-year-old Atlantic salmon, Salmo salar L., smolts of equal size from two different non-native strains were radio-tagged and followed during their downstream migration through the 12-km-long reservoir. A total of 50 salmon smolts, 25 of Swedish (Atran River) and 25 of Irish (Burrishoole River) origin, were surgically implanted with miniature radiotransmitters. The tagged smolts were tracked daily over a 3-week period in May 1996. The Atran smolts initiated migration first (P <0.001), moved faster (P <0.01), were delayed less when passing a culvert (P <0.001) and were more successful in moving through the reservoir than the Burrishoole smolts. The observed differences in migratory behaviour are interpreted as evidence of a genetic component influencing smolt migration.

General information
State: Published
Organisations: Section for Freshwater Fisheries Ecology, National Institute of Aquatic Resources, Institute Management
Contributors: Aarestrup, K., Jepsen, N., Rasmussen, G., Økland, F.
Pages: 97-107
Publication date: 1999
Peer-reviewed: Yes

Publication information
Journal: Fisheries Management and Ecology
Volume: 6
Issue number: 2
ISSN (Print): 0969-997X
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 1.59 SJR 0.746 SNIP 0.823
Web of Science (2017): Impact factor 1.624
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.85 SJR 0.858 SNIP 0.846
Web of Science (2016): Impact factor 1.327
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 1.91 SJR 1.017 SNIP 1.109
Web of Science (2015): Impact factor 1.51
Status for laksehandlingsplan

General information
State: Published
Organisations: Section for Freshwater Fisheries Ecology, National Institute of Aquatic Resources, Section for Population Ecology and Genetics
Contributors: Koed, A., Aarestrup, K., Eg Nielsen, E., Glüsing, H.
Number of pages: 46
Spawning migration of sea trout (Salmo trutta (L)) in a Danish river

From September to November in 1995, a total of 49 mature sea trout were caught and radio tagged in the estuary (Randers fjord) or at the river mouth of the River Gudena in Eastern Jutland. The tagged trout were between 2 and 6 yr old with total body length of 56-85 cm. Twenty-five of the tagged trout ascended the river. They were tracked every third day, for up to six months, until death or descent. Great variation was found in migration pattern and duration of river residence. Some fish spawned and left the river, some died after spawning, while others died unspent. The sea trout preferred to stay on the southern side of the main river, and Males spent significantly more time of the freshwater stay in spawning tributaries than females. Most of the trout ascended the main spawning tributary, the River Lillea, where none passed a weir, 2 km upstream the confluence, despite the presence of a fish ladder.

General information
State: Published
Organisations: Section for Freshwater Fisheries Ecology, National Institute of Aquatic Resources
Contributors: Aarestrup, K., Jepsen, N.
Pages: 275-281
Publication date: 1998
Peer-reviewed: Yes

Publication information
Journal: Hydrobiologia
Volume: 371-372
ISSN (Print): 0018-8158
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Survival of radio-tagged Atlantic salmon (Salmo salar L.) and trout (Salmo trutta L.) smolts passing a reservoir during seaward migration

High mortality-rates of seaward migrating salmonid smelts when passing reservoirs and lakes have earlier been found in the Danish River Gudena watershed. To reveal the causes of mortality of migrating smelts in Lake Tange, a 12 km long, shallow reservoir, 50 salmon smelts and 24 trout smelts were tagged with internal miniature radio-transmitters, and released in the river just upstream the reservoir on May 1, 1996. The salmon smelts were hatchery-reared, while the trout smelts were wild fish, caught in a smelt trap. The tagged smelts were tracked daily for 3 weeks, and when possible the cause of death was determined. During the 3-week period, 90% of the tagged smelts died. The main cause of death for both trout and salmon was predation from fish and birds. The most important predator was pike (Esox lucius L.), being responsible for 56% of the observed mortality. Avian predators were assumed to be responsible for 31% of the observed mortality. No trout smelts left the reservoir, but 5 salmon-smelts got out through the turbines. Others did traverse the reservoir, but were unable to enter the river downstream, and were later eaten. The present results suggest that
mortalities for migrating smolts through Lake Tange are of such a magnitude, that stocking of juveniles in the river upstream is futile, and further, that the establishment of a natural population of salmon or sea-trout in river Gudena, upstream Tange, is unrealistic under present conditions.
Smoltdødeligheder i Tange sø, undersøgt i foråret 1996

General information
State: Published
Organisations: Section for Freshwater Fisheries Ecology, National Institute of Aquatic Resources, Institute Management
Contributors: Jepsen, N., Aarestrup, K., Rasmussen, G.
Number of pages: 30
Publication date: 1997

Publication information
Place of publication: Silkeborg
Publisher: Danmarks Fiskerundersøgelser
ISBN (Print): 87-88047-16-4
Original language: Danish
(DFU-rapport; No. 32-97).
Electronic versions:
32_97_smoltd_deligheder_i_tange_s_.pdf
Source: orbit
Source-ID: 226027
Research output: Research › Report – Annual report year: 1997

Mortality of sea trout (Salmo trutta L.) and Atlantic salmon (S. salar L.) smolts during seaward migration through rivers and lakes in Denmark

General information
State: Published
Organisations: Institute Management, National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology
Contributors: Rasmussen, G., Aarestrup, K., Jepsen, N.
Publication date: 1996
Peer-reviewed: No

Publication information
Journal: ICES CM 1996/
Volume: M:9
Original language: English
Source: orbit
Source-ID: 227194
Research output: Research › Conference article – Annual report year: 1996

Projects:

Citizen science as a method to collect recreational fisheries data; Strengths and limitations
Jørgensen, C. G., PhD Student, National Institute of Aquatic Resources
Skov, C., Main Supervisor, National Institute of Aquatic Resources
Aarestrup, K., Supervisor, National Institute of Aquatic Resources
Baktoft, H., Supervisor, National Institute of Aquatic Resources
Samfinansieret - Andet
15/04/2018 – 14/04/2021
Award relations: Citizen science as a method to collect recreational fisheries data; Strengths and limitations
Project: PhD
Ecology of Atlantic Salmon
Flávio, H. D. M., PhD Student, National Institute of Aquatic Resources
Aarestrup, K., Main Supervisor, National Institute of Aquatic Resources
Jepsen, N., Supervisor, National Institute of Aquatic Resources
Koed, A., Supervisor, National Institute of Aquatic Resources
Samfinansieret - Andet
01/08/2017 → 31/07/2020
Award relations: Ecology of Atlantic Salmon
Project: PhD

Investigating the effects of barriers on fish in European streams and rivers
Birnie-Gauvin, K., PhD Student, National Institute of Aquatic Resources
Aarestrup, K., Main Supervisor, National Institute of Aquatic Resources
Jepsen, N., Supervisor, National Institute of Aquatic Resources
Koed, A., Supervisor, National Institute of Aquatic Resources
Anden EU-finansiering
15/12/2016 → 14/12/2019
Award relations: Investigating the effects of barriers on fish in European streams and rivers
Project: PhD

REKREA: Forbedring af forvaltningsgrundlaget for bestande i det rekreative fiskeri (39370)
Olesen, H. J., Project Participant, National Institute of Aquatic Resources, Section for Monitoring and Data
Storr-Paulsen, M., Project Participant, National Institute of Aquatic Resources, Section for Monitoring and Data
Støttrup, J. G., Project Participant, National Institute of Aquatic Resources, Section for Ecosystem based Marine Management
Skov, C., Project Participant, National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology
Christoffersen, M., Project Participant, National Institute of Aquatic Resources, Section for Ecosystem based Marine Management
Reeh, L., Project Participant, National Institute of Aquatic Resources, Institute Management
Stubgaard, K., Project Participant, National Institute of Aquatic Resources, Institute Management
Svendsen, J. C., Project Participant, National Institute of Aquatic Resources, Section for Ecosystem based Marine Management
Pedersen, S., Project Participant, National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology
Pedersen, M. I., Project Participant, National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology
Jepsen, N., Project Participant, National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology
Aarestrup, K., Project Participant, National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology
Hansen, F. I., Project Participant, National Institute of Aquatic Resources, Section for Monitoring and Data
Pinna, L. G. B., Project Participant, National Institute of Aquatic Resources, Section for Monitoring and Data
Azour, F., Project Participant, National Institute of Aquatic Resources, Section for Monitoring and Data
Larsen, P. V., Project Participant, National Institute of Aquatic Resources, Section for Monitoring and Data
14/07/2016 → 31/12/2018
Project: Research

Strengthening the Danish populations of Atlantic salmon – Increasing populations, genetic resources and recreational fishing (39340)
In the beginning of the 1980’ies indigenous Danish salmon populations were close to extinction due to habitat degradation and stocking with non-native strains. Conservation efforts, led to a resurge of the populations in western Jutland. However, following the initial increases, Danish salmon populations have stagnated in recent years. Whether this is a response to limiting local factors or a correlated response across population (e.g. to climate change), is unknown. A profitable recreational fishery has developed on the Danish salmon. If the productivity of Danish salmon populations can be improved, this fishery and the related economical gain have the potential to increase correspondingly. Atlantic salmon has a highly complex and specialized life cycle where the weakest link(s) determines the productivity of the salmon population. Accordingly, there is a need for a multifaceted research project The main objectives of this project will be reached through six work packages aiming to: 1. Identify key local and global bottlenecks production of salmon across four life-stages, 2.
Determine genetic characteristics ('quality') of local populations and identify how measures of 'quality' should be implemented into stocking programmes and 3. Communicate and implement insights on optimal management and exploitation to stakeholders. The overarching aim of the project is to provide research based knowledge that can be directly implemented into a self-sustainable management framework that maximizes salmon population sizes, and hereby vastly increases local income from a recreational fishery with a high economic potential. This project is coordinated by Danish Center for Wild Salmon. The project is funded by Innovation Fund Denmark.

Koed, A., Project Manager, Section for Freshwater Fisheries Ecology, National Institute of Aquatic Resources
Eg Nielsen, E., Project Manager, National Institute of Aquatic Resources
Bekkevold, D., Project Manager, National Institute of Aquatic Resources
Mena, B. J., Project Participant, National Institute of Aquatic Resources
Aarestrup, K., Project Manager, National Institute of Aquatic Resources

01/01/2016 → 31/12/2019

Keywords: Research areas: Freshwater Fisheries and Ecology & Population Genetics
Collaborators: Danish Center for Wild Salmon
Project: Research

**Expertise in marine and aquatic ecology and genomics for sustainable management of fish and shellfish in Skagerrak-Kattegat-Øresund (MarGen) (39301)**

The marine and freshwater regions encompassing Skagerrak, Kattegat, Øresund and the North Sea are biologically highly productive and contain plentiful living aquatic resources that are important for the region. At the same time the coastal areas are densely populated and industrialized, fish and shellfish resources are heavily harvested, and waters are subject to pollution and eutrophication. The region is also markedly affected by the ongoing global warming, with sea temperature rising nearly 2 degrees C during the last 40 years. These environmental pressures call for investigations into the consequences for aquatic organisms, their potential for adapting to environmental changes, and for identifying management strategies that could mitigate deteriorating environmental conditions, using state-of-the-art methodology. Here, we will capitalize on the revolutionizing developments in genomics, electronic tagging and computer modelling to obtain insights on the ecology, evolution and management of aquatic biodiversity in the region. The ØKS region harbours leading scientific environments within the aquatic, marine and genomic sciences that are complementary with respect to research and education and that would strongly benefit from better integration and networking. This proposal also aims to establish a research cluster and expand the number of active PhDs, postdocs and senior researchers within the region, thereby fostering an innovative research and educational network in the ØKS region. This project is coordinated by DTU Aqua. The project is funded by EU, InterReg (regional collaboration).

Hansen, J. H., Project Manager, National Institute of Aquatic Resources, Section for Marine Living Resources
Bekkevold, D., Project Participant, National Institute of Aquatic Resources
Aarestrup, K., Project Participant, National Institute of Aquatic Resources
Kristensen, M. L., PhD Student, National Institute of Aquatic Resources
Mensberg, K. D., Project Participant, National Institute of Aquatic Resources
Meldrup, D., Project Participant, National Institute of Aquatic Resources
Mikkelsen, J. S., Project Participant, National Institute of Aquatic Resources
Le Moan, A., PhD Student, National Institute of Aquatic Resources

01/07/2015 → 30/06/2018

Keywords: Research areas: Population Genetics & Freshwater Fisheries and Ecology
Collaborators: Aarhus University, University of Oslo, Institute of Marine Research, University of Gothenburg, University of Agder, Norwegian Institute for Water Research
Project: Research

**Marine migration behaviour of salmonids and gadoids assessed using biotelemetry and genetic stock identification**

Kristensen, M. L., PhD Student, National Institute of Aquatic Resources
Aarestrup, K., Main Supervisor, National Institute of Aquatic Resources
Bekkevold, D., Supervisor, National Institute of Aquatic Resources

Anden EU-finansiering
15/12/2015 → 29/03/2019

Award relations: Marine migration behaviour of salmonids and gadoids assessed using biotelemetry and genetic stock identification
Project: PhD

**Effects of the newly established lake on migrating juvenile salmonids (smolts)**

Schwinn, M., PhD Student, National Institute of Aquatic Resources
Aarestrup, K., Main Supervisor, National Institute of Aquatic Resources
Koed, A., Main Supervisor, National Institute of Aquatic Resources
Baktoft, H., Supervisor, National Institute of Aquatic Resources
Jepsen, N., Examiner, National Institute of Aquatic Resources
Moore, A., Examiner
Thorstad, E. B., Examiner
Samfinansieret - Andet  
01/03/2015 → 16/05/2018  
Award relations: Effects of the newly established lake on migrating juvenile salmonids (smolts)  
Project: PhD  

**Marine Survival of Sea Trout**  
Del Villar, D., PhD Student, National Institute of Aquatic Resources  
Aarestrup, K., Main Supervisor, National Institute of Aquatic Resources  
Koed, A., Supervisor, National Institute of Aquatic Resources  
Jepsen, N., Examiner, National Institute of Aquatic Resources  
Höjesjö, J., Examiner  
Lucas, M., Examiner  
Institut, samfinansiering  
15/12/2010 → 27/08/2014  
Award relations: Marine Survival of Sea Trout  
Project: PhD  

**Stresses coping Styles’ effect on fitness and life history choice in wild salmonids**  
Larsen, M. H., PhD Student, National Institute of Aquatic Resources  
Aarestrup, K., Main Supervisor, National Institute of Aquatic Resources  
Högland, E., Supervisor, National Institute of Aquatic Resources  
Skov, C., Supervisor, National Institute of Aquatic Resources  
Koed, A., Examiner, National Institute of Aquatic Resources  
Lucas, M., Examiner  
Thorstad, E., Examiner  
Institut stipendie (DTU) Samf.  
01/12/2011 → 02/09/2015  
Award relations: Stresses coping Styles’ effect on fitness and life history choice in wild salmonids  
Project: PhD  

**Behaviour of lake-dwelling fish**  
Baktoft, H., PhD Student, National Institute of Aquatic Resources  
Jacobsen, L., Main Supervisor, National Institute of Aquatic Resources  
Aarestrup, K., Supervisor, National Institute of Aquatic Resources  
Berg, S., Supervisor, National Institute of Aquatic Resources  
Koed, A., Supervisor, National Institute of Aquatic Resources  
Skov, C., Supervisor, National Institute of Aquatic Resources  
Svendsen, J. C., Supervisor, National Institute of Aquatic Resources  
Rasmussen, G., Examiner, National Institute of Aquatic Resources  
Cooke, S. J., Examiner  
Lucas, M. C., Examiner  
1/3 FUU, 1/3 inst 1/3 Andet  
01/12/2008 → 19/09/2012  
Award relations: Behaviour of lake-dwelling fish  
Project: PhD  

**Scaling of individual trout behaviour and life history to population dynamics**  
Boel, M., PhD Student, National Institute of Aquatic Resources  
Koed, A., Main Supervisor, National Institute of Aquatic Resources  
Aarestrup, K., Supervisor, National Institute of Aquatic Resources  
Skov, C., Supervisor, National Institute of Aquatic Resources  
Jacobsen, L., Examiner, National Institute of Aquatic Resources  
Moore, A., Examiner  
Thorstad, E. B., Examiner  
Institut stipendie (DTU) Samf.  
01/01/2009 → 25/04/2012  
Award relations: Scaling of individual trout behaviour and life history to population dynamics  
Project: PhD  

**Sustainable smolt production – an integrated approach (SMOLTPRO) (38876)**  
Salmonid fish is an important natural resource in Scandinavia. Anadromous salmon and brown trout are important natural resources for recreation and fishing and are a part of our cultural heritage. Human activities however, have impaired the natural production of salmonids considerably. Large numbers of hatchery salmonids are therefore released, to
compensate losses in natural production caused by hydroelectric power exploitation and other environmental impact. However, conventionally reared hatchery fish have difficulties adapting to natural conditions and therefore perform poorly after release. New research shows that modifications of the conventional hatchery environment can have positive effects on the development of hatchery reared fish, but their long-term effects on performance in nature are poorly known. Previous research in this area has been too scattered and limited by insufficient infrastructure to conduct large scale experiments over the full life cycle. SMOLTPRO integrated the competence and resources in this field of research using a multidisciplinary approach. We evaluated the effects of modified rearing methods on smolt migration and survival, and its socioeconomic value. Experiments were conducted in a series of full-scale model systems to evaluate the generality of effects across the climate zones in the Baltic Sea, Kattegat and the North Sea. Following a dialogue with relevant stakeholders, the results will have been used to produce new guidelines for sustainable smolt production. The project was coordinated by University of Gothenburg, Sweden. The project was funded by the Swedish Research Council FORMAS.

Aarestrup, K., Project Manager, National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology

01/01/2010 → 31/12/2014

Keywords: Research area: Freshwater Fisheries and Ecology

Collaborators: Norwegian Institute for Nature Research, University of Gothenburg

Project: Research

Marine behaviour of Atlantic salmon (38825)
The last years of development of the salmon stocks in western Jutland has been a success. This is achieved through specific management focus on removing the constraints identified in freshwater and coastal areas, as well as a modified release practices. One of the major challenges for the continued successful management is knowledge of the salmon's marine life. This is the project's overall objective, to obtain more knowledge about this part of the salmon's life, so as to describe the salmon's marine life. So far it has not been possible to make more specific behavioural studies of Danish salmon marine life for two reasons. First: there were very few salmon, and second: there has simply not been technology available to get behavioural data from the fish, apart for the very expensive marine expeditions. Especially with the development of electronic tags, such as data storage tags (DST) and pop-up satellite tags (PSAT) it is now possible. DST tags are passive tags that records information about the fish's environment and store them. Upon retrieval the data can be offloaded to a computer. The tag is labelled providing an address and information about the reward by for return of the tag. A PSAT tag is essentially the same type of tag, but also contains a satellite device that can send the recorded information to the ARGOS satellite system and a release mechanism. At a predetermined time, the tag detaches from the animal and rises to the surface sending stored information to the satellites. These new types of tags allow you to record information about the fish's environment with an unprecedented accuracy and both types of labels have large application possibilities (Neuenfeldt et al. 2009). Aarestrup et al. 2009). Currently, the limitation is the size of the transmitters and attachment method. Both types of tags are (still) too big for smolt, so kelts will be the most obvious group of salmon to tag. Another way to examine the salmon's movements in the sea is to investigate the chemical fingerprints of fish's scales (Svendsen et al. 2009). The method is a consequence of the fact that a number of stable compounds from the fish food items are incorporated in the fish scales and otoliths. By analysing the fish's scales or otoliths a "chemical fingerprint" depending on where the fish were and what they have eaten can be obtained. Scale samples will be taken from the tagged salmon and the "chemical fingerprint" from these Danish salmon will be compared with "chemical fingerprint" of scales from other population where salmon has been tagged with PSAT tags. The project is coordinated by DTU Aqua.

Aarestrup, K., Project Manager, National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology

01/01/2011 → 31/12/2015

Keywords: Research area: Freshwater Fisheries and Ecology

Collaborators: Norwegian Institute for Nature Research, Aalborg University

Project: Research

Living North Sea: Fish migration from sea to source (LNS) (38872)
The Living North Sea project aims to promote free fish migration from sea to source to keep our waters alive. It addresses three essential aspects about the management of migratory fish: 1) Migration routes 2) Threats such as man-made barriers and fish migration measures 3) Influencing future policy at a regional, national and international level and informing the general public. The work on migratory routes will focus on sea trout, eel and salmon, but will be applicable to many other species. The partnership will carry out analysis and visualization of migratory routes, populations and consequences of management actions. New communication and mapping tools for working and sharing data between partners will be explored. The second part involves the innovation of fish migration measures. In the North Sea Region some deltas and estuaries are closed to fish and many more have barriers such as dams and sluices throughout their system. This means that many fish species like the eel, salmon and sea trout cannot reach their spawning and breeding grounds. The partnership focuses on the development of better and innovative migration measures, such as passages or sluice management and the implementation of these in demonstration projects. Last but not least, communication and the dissemination of our findings to policy-makers, local decision-makers and the public. The Living North Sea Project will place emphasis on promotion and publicity because the effect of barriers on fish populations is often not considered when dealing with flooding, drainage, or renewable power generation. Yet healthy fisheries are critical to sustainable development and good ecological status. Intensive communication actions intended to influence regional, national and European policies will be carried out. Creating new partnerships, sharing knowledge and achieving greater awareness and involvement are key elements in this project. The project is coordinated by Association of River Trust, UK.

Aarestrup, K., Project Participant, National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology
Survival and growth of eel in coastal habitats (38830)

Very little is known about settling, habitat utilization and survival of European eel (Anguilla anguilla) in coastal areas (fjords and estuaries). We don’t know what proportion of elvers take residence in the coastal zone. For eels stocked in fjords and estuaries, only little is known about survival and growth. In Denmark it has been suggested that the main production of eel takes place in the coastal areas and not in freshwater. Thus, it is very important to obtain some information about this to enhance our management of this threatened species. The overall objective is to investigate the importance of various marine habitats for settlement, density, survival and growth of eel. In relation to survival, the importance of fishing and cormorant predation will be sought estimated. In the first stage (pilot) new sampling methods are being tested in order to be able to generate data about the juvenile eel in the coastal habitats. This is not trivial as no methods have proved effective in sampling small (Jepsen, N., Project Manager, National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology Pedersen, M. I., Project Manager, National Institute of Aquatic Resources Aarestrup, K., Project Manager, National Institute of Aquatic Resources Mikkelsen, J. S., Project Participant, National Institute of Aquatic Resources 01/01/2011 → 31/12/2016 Keywords: Research area: Freshwater Fisheries and Ecology Project: Research

Silver eel biomass and non-fishing mortality (38845)

The EU-plan for restoring the European eel population, requires for each MS to issue a national Management Plan and report status of the eel population to the EU Commission in 2012 (and 2015, 2018). Among other things, the report must include estimates of the total production of silver eels (from freshwater), the magnitude of non-fisheries mortality and the reduction of this due to management measures. This project aimed at providing solid estimates of mortality and biomass. This was be done by trapping silver eels in a number of representative river-systems and extrapolate the results to a national level. The mortality in association with hydropower passage has already been measured (and published), but the mortality of silver eels migrating pass fish farms (with weirs) was measured using radio-telemetry. Sixty migrating silver eels will be radio tagged (surgical implants) and followed on their way downstream in the river Kongeå, where they had to pass 3 fish farms to reach the sea. The results revealed massive loss and delay of silver eels at fish farms. This project was coordinated by DTU Aqua. The project was funded by the Danish Ministry of Food, Agriculture and Fisheries. Jepsen, N., Project Manager, National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology Pedersen, M. I., Project Manager, National Institute of Aquatic Resources Aarestrup, K., Project Participant, National Institute of Aquatic Resources Mikkelsen, J. S., Project Participant, National Institute of Aquatic Resources 01/01/2011 → 31/12/2016 Keywords: Research area: Freshwater Fisheries and Ecology Project: Research

Genetic mapping of Danish trout populations (38828)

The objective of this project is to map the genetic structure of Danish trout populations and to develop genetic tools for use in management of Danish trout populations. This tool will be used for identifying indigenous populations of trout, and to identify causes for maintenance of genetic differentiation between populations. In the longer term we aim to map the geographical distribution of genetic diversity of most Danish trout populations. The genetic database will also be used to establish a molecular testing system allowing the determination of the river origin of individual sea trout, thereby describing migration patterns. This is done by developing genetic stock identification methods specifically targeting sea trout in Danish waters. A genetic map with more detail (both geographically and genomic) compared to previous genetic studies will become an important tool for conservation and restoration of natural trout. It will be applied for identifying trout populations that are locally adapted or differs genetically from other populations and therefore are particularly important for maintaining genetic diversity. This tool will be used to define management units and assessment of evolutionary potential. A genetic map provides an overview of indigenous populations and conservation units, and will thus have important implications in counselling practical restoration efforts. The identification of local adaptations of specific populations, and knowledge of whether individual stocks are adapted to life in their particular environment can be applied in identifying causes for maintenance of genetic differentiation between populations, e.g. whether certain populations are genetically adapted to spawn under certain environmental conditions or at certain times. Individuals from approx. 50 rivers are selected in a manner that ensures a good coverage of Danish trout populations. These are genotyped for 6000 candidate SNPs (Single Nucleotide Polymorphisms) on an Illumina iSelect bead array. The SNP chip is developed in another DTU Aqua project (Living North Sea Project). Results from the 6000 SNPs will be used to identify a subset of SNPs that are particularly well suited to distinguish between Danish trout populations. These SNPs will be used as a genetic tool in the future and it is therefore extremely important to get proper coverage of Danish trout populations in the mapping of the genetic diversity. The projects was coordinated by DTU Aqua. The project is funded by the Danish Rod and Net Fishing License Funds.
spawning areas constructed with tubes will be carried out by measuring the content of fine sediment in the gravel on sediment transported by the stream to be transported past the area with spawning gravel. Investigations on artificial excessive amounts of fine sediment in spawning gravel, has been placing tubes below the gravel in order to allow the in many Danish streams, several methods to mitigate this have been tested. One attempt to prevent the embedment of sediments and sand transport in streams. Realizing that erosion and transport of fine sediment (sand) is a major problem restoration (removal/sanitation of barriers and restoration of spawning areas), implementation of EU Water plans, fine procurements of knowledge in this project aims at improving the basic available knowledge for advising on restoration and stream maintenance activities. Realizing that the question of stream restoration is huge, focus is on selected issues often in cooperation with external partners whenever relevant. Regular cooperation has been done with other Danish universities (Roskilde University, Aalborg University, Aarhus University), local authorities, Environmental centers and anglers associations. In the coming years it is expected that several issues will be particularly relevant, such as stream restoration (removal/sanitation of barriers and restoration of spawning areas), implementation of EU Water plans, fine sediments and sand transport in streams. Realizing that erosion and transport of fine sediment (sand) is a major problem in many Danish streams, several methods to mitigate this have been tested. One attempt to prevent the embedment of excessive amounts of fine sediment in spawning gravel, has been placing tubes below the gravel in order to allow the sediment transported by the stream to be transported past the area with spawning gravel. Investigations on artificial spawning areas constructed with tubes will be carried out by measuring the content of fine sediment in the gravel on
European eel: Investigation and assessment of their decline (EELIAD) (38410)

The EELIAD project was a research initiative to investigate the ecology and biology of European eels during their marine migrations, and how these relate to eel condition and population of origin. The information has been integrated into models to determine the most important factors that influence silver eel production and migration success. The fulfillment of this objective will provide a means to evaluate the likely success of the EU eel recovery plan, to enable management actions to be most effectively directed to enhance and conserve eel stocks across Europe, and to determine the dynamics of eel population structure and reproductive success. To achieve this aim we undertook a large-scale field program to determine the migration routes and behavior of silver eels during their spawning migration, and to determine ecological factors that influence the number and quality of silver eels leaving river catchments. These field studies were supported by the use of cutting edge biotechnological analyses to determine population structure and innovative modeling approaches aiming to incorporate these data into fishery management models. In addition, these different studies were linked to studies and observations undertaken in other cooperative projects such as INDICANG which is a network of monitoring programs that report on the status and the development of eel populations over a large area (e.g. Atlantic Area). The knowledge gained from the EELIAD research, aside from its scientific significance, have been of direct use to the conservation of eel stocks because it helps to clarify the reasons for the recent decline in the stock. This information will then be used to change and improve the way that eel fisheries and habitats are managed across Europe, and to help ensure that enough silver eels migrate to their spawning grounds to reproduce and sustain the species. The project was coordinated by Centre for Environment, Fisheries and Aquaculture Sciences (CEFAS), UK. The project was funded by EU, Framework Programme 7.

Keywords: Research areas: Freshwater Fisheries and Ecology & Observation Technology
Collaborators: Norwegian Institute for Nature Research, Consejo Superior de Investigaciones Cientificas, Marine Institute, Centre for Agricultural and Environmental Engineering Research, Swedish National Board of Fisheries, Universite de Pau et des Pays de l'Adour, Cefas Weymouth Laboratory, IFREMER, Museum National d'Histoire Naturelle, Laboratoire de Biologie et d'Ecologie Tropicale et Méditerranéenne
Project: Research

Predation from birds and mammals and the significance for populations of freshwater fish (38829)

It is a well-known fact that predation can be a key factor for many fish populations and in some areas predation may even be the most important regulating factor for fish stocks of major recreational importance. Several species of predators were earlier persecuted, but are now protected and have experienced high population growths recently. This includes species like: cormorant, grey heron, seals and otter. Thus, the protection of these species has been a conservation success, but has also caused severe conflicts between various user-groups. To handle and mitigate these conflicts, scientific documentation is severely needed. During a long period, DTU Aqua has carried out number of projects that directly or as side-results have assessed the magnitude of predation and its impact on various fish stocks. This has provided some insights in when, where and by whom the important recreational fish species are being eaten. This project gathered and synthesized this knowledge to provide an overview of the significance of predation. Outputs: - Synthesis and analyses of existing knowledge/results. - Method evaluation for scanning for PIT tags in cormorant/heron colonies. - Investigations of possible causes for the recent drastic decline in grayling (Thymallus thymallus) populations. The project was funded by the Danish Rod and Net Fishing License Funds.

Keywords: Research
Collaborators: Aalborg University
Project: Research

Pedersen, S., Project Participant, National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology
Aarestrup, K., Project Participant, National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology
Jepsen, N., Project Manager, National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology

01/01/2008 → 31/12/2012

Project: Research

Pedersen, S., Project Participant, National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology
Aarestrup, K., Project Participant, National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology
Jepsen, N., Project Manager, National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology

01/01/2008 → 31/12/2012

Project: Research
Migration and spawning behaviors of brackish water perch and pike (38413)

Brackish water populations of pike and perch have decreased severely along the coasts of the Baltic Sea. In Denmark a drastic decline in catches of brackish water pikes has been recorded during the last 30-40 years. Both brackish water pikes and perch are well estimated in angling and commercial fisheries on the brackish coastlines around the southern part of Zealand and the southern islands. Very little is known about their behaviour and life history, for instance the possible dependence of access to freshwaters to spawn. Obstacles in rivers and hereby blocking of migratory routes can therefore be crucial to reproductive success and survival of brackish fish populations along with deterioration of spawning areas in freshwater. In some areas perch is known to migrate into rivers to spawn in freshwater, but perch are also observed to spawn in brackish waters. In the Gulf of Bothnia perch have different spawning and migration strategies and some perch spawn in the bays with salinities of 6 ppt. whereas the upper limit of salinity tolerance during spawning is not known in Danish areas, where salinity is often 8-10 ppt. The present project aims to initiate investigations of the dependence of perch for access to freshwater lakes and bogs for spawning. In particular it will be explored if it is possible to enhance brackish water perch recruitment by creating or reopening of access to lakes and bogs along a river system and this way to be able to re-establish or increase the brackish water perch fishery. This is highly relevant to local authorities that manage restoration of rivers and lakes. For this purpose the perch population of a large number of lakes and bogs along river systems with present or historical migration of brackish water perch will be monitored. Some of the lakes have connection to the river, some not, and in the latter a connection will be created afterwards. The fish population and recruitment of perch will be studied before and after the intervention. Scale chemistry will be explored and possibly this will be able to define whether large perch caught in the lakes and bogs during spawning actually had a brackish water life history. The project also aims to elucidate the salinity tolerance of perch under Danish condition to establish whether it is possible that some perch spawn along the coast and bays of southern Denmark. The project is done in close cooperation with municipalities around southern Zealand. The project is coordinated by DTU Aqua.

Jacobsen, L., Project Manager, National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology

Berg, S., Project Participant, National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology

Skov, C., Project Participant, National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology

Aarestrup, K.; Project Participant, National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology

01/01/2010 → 31/12/2016

Keywords: Research area: Freshwater Fisheries and Ecology

Collaborators: Municipality of Vordingborg, University of Copenhagen, Municipality of Naestved, Municipality of Guldborgsund, Aalborg University

Project: Research

Flatfish nursery grounds (38176)

The aim of the project is to determine what constitutes a good nursery area for specific flatfish in coastal soft bottom areas in the inner Danish waters using a combination of empirical and theoretical approaches. Field studies on juvenile flatfish feeding, growth and condition use both wild and released fish. One approach is to explore different statistical methods to determine potential nursery grounds for different flatfish based on physical parameters such as wave exposure, sediment type and abiotic variables such as temperature, salinity and depth. This research coupled with the development of tools to map different coastal habitats will provide the basis for advice on management of coastal fish nursery areas. Implementation of PIT-tag technology in coastal marine waters will be developed in order to build up expertise to sample released individuals in different habitats. The project was coordinated by DTU Aqua. The project is funded by the Danish Rod and Net Fishing License Funds.

Støttrup, J. G., Project Manager, National Institute of Aquatic Resources, Section for Ecosystem based Marine Management

Kristensen, L. D., Project Participant, National Institute of Aquatic Resources

Kristensen, K., Project Participant, National Institute of Aquatic Resources

Aarestrup, K., Project Participant, National Institute of Aquatic Resources

Brown, E. J., PhD Student, National Institute of Aquatic Resources

01/01/2011 → 31/12/2013

Keywords: Research areas: Coastal Ecology & Freshwater Fisheries and Ecology & Marine Living Resources

Collaborators: Aarhus University, Danish Organization for Amateur Fishermen

Project: Research

Population development of sea trout after removal of migration obstacles (38259)

Generally, the size of a sea trout population is under the influence of a number of bottlenecks in the life cycle. Reduced spawning- and nursery habitat, as a consequence of sand walk and adjustments of streams, is one of the major obstacles. Another important factor is obstacles in connection with migration. A very important obstacle during migration is the passage of weirs which deny the fish access to important habitats, both when it comes to downstream and upstream migration. The weirs’ negative effect on the population of migrating fish is well-documented (Aarestrup et al. 2003; Aarestrup et al. 2006a, b, c; Baktoft et al. 2007). It has lead to a number of model reflections on the impact on the fish stock
if the weirs are removed (Olesen & Aarestrup 2006). However this model has not been validated. The possibility of such a validation now exists in the River Villestrup, where the original model was developed. In this comprehensive restoration project, the plan is to remove all weirs in the main stream. This gives a unique chance to test the size in the stock of migrating fish before and after the removal of the weirs. The study aims at estimating the spring run of smolt and kelts in a number of defined years before and after the removal of the dams. The restoration project was in 2011. The run has been estimated in 2008 and 2009 before the removals were removed and again in 2015-2017 after the completion of the restoration project and allowing for juvenile cohorts to develop. The estimated smolt run before the removals was around 5000 smolt migrating into Mariager Fjord. In 2015 the smolt run was estimated to app. 20000 smolts. The project provides us with valuable information on the potential for optimizing the fish stocks without releases. The project is running concurrently with project 38258 "The marine life and survival of sea trout” and with the EU funded project 39301: “Expertise in marine and aquatic ecology and genomics for sustainable management of fish and shellfish in Skagerrak-Kattegat-Øresund (MarGen)”. MarGen is an interregional management project with a specific aim to increase scientific and management competencies of marine resources in Kattegat/Skagerrak including understanding of fish migration. This project is funded by the Danish Rod and Net Fishing License Funds.

Aarestrup, K., Project Manager, National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology
01/01/2008 → …

Keywords: Research area: Freshwater Fisheries and Ecology
Project: Research

The marine life and survival of sea trout (38258)
Considering the importance of the species and the fact that it is spending most of its time in the sea, it is striking that the knowledge on the survival and whereabouts of the sea trout in the marine areas is so limited. This is mainly due to technical barriers. The development within telemetry has made it possible to study the behavior of the sea trout by means of electronic tags. By using the so-called PIT tags and acoustic tags it is possible to monitor the fish when it passes a given place - typically at the outlet of the stream, the river or similar. At the same time new types of marks, the so-called DST-marks and the acoustic oxygen transmitter, make it possible to register information about the surrounding environment of the fish with a so far unprecedented accuracy. In the last few years, DTU Aqua has investigated the behavior and survival of postsmolts and kelts in the initial estuarine phase after exit from the river. The results show that wild fish have a relatively high degree of survival after emigration (Aarestrup et al. 2014; 2015). Meanwhile, further studies of survival and behavior in other systems are necessary in order to make any conclusions - as well as the rest of the survival and behavior of the sea trout in the sea that is not yet clarified. This project aims at obtaining information on the behavior of the marine phase of the sea trout. Besides valuable information on the marine life of the sea trout, the project will also give detailed information on the survival in salt water, survival of spawning, survival of repeat spawners as well as a lot of other information such as the time of entering fresh water to spawn and the time of returning to the sea. In some rivers part of the population are said to have an alternative life history strategy and these fish are called “fjord trout”. Rumor has it that sea trout with this particular life history only wander into the fjord and not to the sea. Furthermore it has a number of morphological differences compared to the sea trout. The project will try to determine if there actually exist two life history strategies in the form of fjord- and sea wandering trout. The project is running concurrently with project 38259: “Population development of sea trout after removal of migration obstacles” and both collaborates with the EU funded project 39301: “Expertise in marine and aquatic ecology and genomics for sustainable management of fish and shellfish in Skagerrak-Kattegat-Øresund (MarGen)”. MarGen is an interregional management project with a specific aim to increase scientific and management competencies of marine resources in Kattegat/Skagerrak including understanding of fish migration. The project is coordinated by DTU Aqua. The project is funded by the Danish Rod and Net Fishing License Funds.

Aarestrup, K., Project Manager, National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology
01/01/2008 → 01/01/9999
Keywords: Research areas: Freshwater Fisheries and Ecology & Coastal Ecology
Collaborators: Aalborg University
Project: Research

Activities:

2nd International Workshop on the Swimming Physiology of Fish
Period: 9 Oct 2014
Kim Aarestrup (Invited speaker)
National Institute of Aquatic Resources
Section for Freshwater Fisheries Ecology

Description
Track’n field…the challenge of following migrating fishes

Invited Keynote in FITFISH Workshop
Links:
Related event

2nd International Workshop on the Swimming Physiology of Fish
09/10/2014 → 10/10/2014
Barcelona, Spain
Activity: Talks and presentations › Conference presentations