Limited impact of big fish mothers for population replenishment
A recent meta-analysis by Barneche et al. (Science 360(6389): 642) show that fish reproductive output scales hypergeometrically with female weight. This result challenges the common assumption that reproductive output is proportional to weight. The implication made is that current theory and practice severely underestimates the importance of larger females for population replenishment. Their example for cod shows that current practice makes an error of 149%. By properly accounting for fish demography we show that the error is maximally on the order of 10%, and in most other fish stocks likely much less.
The cost of toxin production in phytoplankton: the case of PST producing dinoflagellates

Many species of phytoplankton produce toxins that may provide protection from grazing. In that case one would expect toxin production to be costly; else all species would evolve toxicity. However, experiments have consistently failed to show any costs. Here, we show that costs of toxin production are environment dependent but can be high. We develop a fitness optimization model to estimate rate, costs, and benefits of toxin production, using PST (paralytic shellfish toxin) producing dinoflagellates as an example. Costs include energy and material (nitrogen) costs estimated from well-established biochemistry of PSTs, and benefits are estimated from relationship between toxin content and grazing mortality. The model reproduces all known features of PST production: inducibility in the presence of grazer cues, low toxicity of nitrogen-starved cells, but high toxicity of P-limited and light-limited cells. The model predicts negligible reduction in cell division rate in nitrogen replete cells, consistent with observations, but >20% reduction when nitrogen is limiting and abundance of grazers high. Such situation is characteristic of coastal and oceanic waters during summer when blooms of toxic algae typically develop. The investment in defense is warranted, since the net growth rate is always higher in defended than in undefended cells.

General information

State: Published
Organisations: National Institute of Aquatic Resources, Centre for Ocean Life
Contributors: Chakraborty, S., Pančić, M., Andersen, K. H., Kiørboe, T.
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BFI (2019): BFI-level 2
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 9.5 SJR 4.813 SNIP 2.284
Web of Science (2017): Impact factor 9.52
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 8.91 SJR 4.938 SNIP 2.248
Web of Science (2016): Impact factor 9.664
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Adaptive feeding behavior and functional responses in pelagic copepods

Zooplankton may modify their feeding behavior in response to prey availability and presence of predators with implications to populations of both predators and prey. Optimal foraging theory predicts that such responses result in a type II functional response for passive foragers and a type III response for active foragers, with the latter response having a stabilizing effect on prey populations. Here, we test the theoretical predictions and the underlying mechanisms in pelagic copepods that are actively feeding (feeding-current feeders), passively feeding (ambushers), or that can switch between the two feeding modes. In all cases, individual behaviors are consistent with the resulting functional response. Passive ambushing copepods have invariant foraging behavior and a type II functional response, as predicted. When foraging actively, the species with switching capability change its functional response from type II to III and modify its foraging effort in response to prey density and predation risk, also as predicted by theory. The obligate active feeders, however, follow a type II response inconsistent with the theoretical prediction. A survey of the literature similarly finds consistent type II response in ambush feeding copepods, but variable (II or III) responses in active feeders. We examine reasons for why observed behaviors at times deviate from predictions, and discuss the population dynamics and food web implications of the two types of functional responses and their underlying mechanisms.
A trait-based approach to ocean ecology

Trait-based ecology merges evolutionary with classical population and community ecology and is a rapidly developing branch of ecology. It describes ecosystems as consisting of individuals rather than species, and characterizes individuals by few key traits that are interrelated through trade-offs. The fundamental rationale is that the spatio-temporal distribution of organisms and their functional role in ecosystems depend on their traits rather than on their taxonomical affiliation. The approach respects that interactions are between individuals, not between species or populations, and in trait-based models ecosystem structure emerges as a result of interactions between individuals and with the environments, rather than being prescribed. It offers an alternative to classical species-centric approaches and has the potential to describe complex ecosystems in simple ways and to assess the effects of environmental change on ecosystem structure and function. Here, we describe the components of the trait-based approach and apply it to describe and model marine ecosystems. Our description is illustrated with multiple examples of life in the ocean from unicellular plankton to fish.
Biogeography of zooplankton feeding strategy
Cannibalism as a selective force on offspring size in fish

Cannibalism may cause considerable mortality on juvenile fish and it has been hypothesised that it may exercise selection on offspring size in that larger offspring may enjoy a size refuge. For this to be evolutionarily advantageous the survival of individual offspring must compensate for the reduced fecundity implied by larger offspring size. We develop a model which combines standard assumptions of size-dependent mortality with adult cannibalism to investigate the potential for cannibalism to act as selective force on offspring size. We find that for this potential to be realised, the mortality due to cannibalism must exceed a threshold value that is a decreasing function of non-cannibalistic predation intensity, cannibalized size range width and the average cannibalized size. If cannibalism exceeds this threshold, the model predicts evolution of offspring size towards refuges above or below cannibalized size range depending on initial offspring size. Cannibalistic mortality cannot be so great that the population is non-viable, however, the range of parameter values describing cannibalistic intensity allowed within these boundaries is wide. On this basis, we suggest that cannibalism is a potential mechanism for offspring size selection.
Challenges to fisheries advice and management due to stock recovery

During the 20th century, many large-bodied fish stocks suffered from unsustainable fishing pressure. Now, signs of recovery are appearing among previously overfished large-bodied fish stocks. This new situation raises the question of whether current fisheries advice and management procedures, which were devised and optimized for depleted stocks, are well-suited for the management of recovered stocks. We highlight two challenges for fisheries advice and management: First, recovered stocks are more likely to show density-dependent growth. We show how the appearance of density-dependent growth will make reference points calculated with current procedures inaccurate. Optimal exploitation of recovered large-bodied piscivorous fish will therefore require accounting for density-dependent growth. Second, we show how a biomass increase of large-bodied piscivorous fish will lead to a reverse trophic cascade, where their increased predation mortality on forage fish reduces forage fish productivity and abundance. The resulting decrease in maximum sustainable yield of forage fish stocks could lead to conflicts between forage and large-piscivore fisheries. Avoiding such conflicts

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requires that choices are made between the exploitation of interacting fish stocks. Failure to account for the changed ecological state of recovered stocks risks creating new obstacles to sustainable fisheries management.

**General information**

State: Published
Organisations: National Institute of Aquatic Resources, Centre for Ocean Life
Contributors: van Gemert, R., Andersen, K. H.
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Peer-reviewed: Yes

**Publication Information**

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BFI (2019): BFI-level 1
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 2.98
Web of Science (2017): Impact factor 2.906
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.63
Web of Science (2016): Impact factor 2.76
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 2.18
Web of Science (2015): Impact factor 2.626
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 2.62
Web of Science (2014): Impact factor 2.377
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 2.46
Web of Science (2013): Impact factor 2.525
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 2.35
Web of Science (2012): Impact factor 2.277
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 2.32
Web of Science (2011): Impact factor 2.007
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Web of Science (2010): Impact factor 1.808
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Evolution of boldness and life-history in response to selective harvesting

Whether intensive harvesting alters the behavioral repertoire of exploited fishes is currently unknown, but plausible. We extend a fish life-history model to account for boldness as a personality trait that affects foraging intensity, which affects energy intake and risk from predation and fishing gear. We systematically investigate life-history and behavioral trait evolution along the boldness–timidity axis in response to the full range of common selectivity and exploitation patterns in fisheries. In agreement with previous studies, we find that any type of harvesting selects for fast life histories and that merely elevated, yet unselective, fishing mortality favors boldness. We also find that timid-selective fishing (which can be expected in species targeted by active gear types) selects for increased boldness. By contrast, increased timidity is predicted when fishing targets bolder individuals common to passive gears, whether in combination with selection on size or not. Altered behavior caused by intensive harvesting should be commonplace in nature, which can have far-reaching ecological, evolutionary, and managerial impacts. Evolution of timidity is expected to strongly erode catchability, which will negatively affect human well-being and influence the reliability of stock assessments that rely on fishery-dependent data.

General information

State: Published
Organisations: National Institute of Aquatic Resources, Centre for Ocean Life, Institut Pierre Louis d’Epidémiologie et de Santé Publique, Leibniz-Institute of Freshwater Ecology and Inland Fisheries (IGB), Berlin
Contributors: Andersen, K. H., Marty, L., Arlinghaus, R.
Pages: 271-281
Publication date: 2018
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Publication information

Journal: Canadian Journal of Fisheries and Aquatic Sciences
Volume: 75
Issue number: 2
ISSN (Print): 0706-652X
Ratings:
BFI (2019): BFI-level 2
Web of Science (2019): Indexed yes
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
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
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:
Postprint
DOIs:
10.1139/cjfas-2016-0350
Fish community structure from productive shelf systems to open ocean environments

General information
State: Published
Organisations: Centre for Ocean Life, National Institute of Aquatic Resources
Contributors: van Denderen, P. D., Petrik, C. M., Stock, C., Andersen, K. H.
Publication date: 2018
Peer-reviewed: No
Event: Abstract from ICES Annual Science Conference 2018, Hamburg, Germany.

Bibliographical note
CM Code: A:370
Research output: Research › Conference abstract for conference – Annual report year: 2018

Growth of teleost fish across marine regions and ecological lifestyles

General information
State: Published
Organisations: Centre for Ocean Life, National Institute of Aquatic Resources, Section for Ecosystem based Marine Management
Contributors: van Denderen, P. D., Gislason, H., Andersen, K. H.
Publication date: 2018
Peer-reviewed: No
Research output: Research › Conference abstract for conference – Annual report year: 2018

Identifying salmon lice transmission characteristics between Faroese salmon farms
Sea lice infestations are an increasing challenge in the ever-growing salmon aquaculture sector and cause large economic losses. The high salmon production in a small area creates a perfect habitat for parasites. Knowledge of how salmon lice planktonic larvae disperse and spread the infection between farms is of vital importance in developing treatment management plans to combat salmon lice infestations. Using a particle tracking model forced by tidal currents, we show that Faroese aquaculture farms form a complex network. In some cases as high as 10% of infectious salmon lice released at one farm site enter a neighboring fjord containing another farm site. Farms were characterized as emitters, receivers or isolated, and we could identify two clusters of farms that were largely isolated from each other. The farm characteristics are a valuable input for the development of management plans for the entire Faroese salmon industry.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Centre for Ocean Life, Section for Oceans and Arctic, Aquaculture Research Station of the Faroes
Contributors: Kragesteen, T. J., Simonsen, K., Visser, A., Andersen, K. H.
Pages: 49-60
Publication date: 2018
Peer-reviewed: Yes

Publication information
Journal: Aquaculture Environment Interactions
Volume: 10
ISSN (Print): 1869-215X
Ratings:
BFI (2019): BFI-level 1
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Implications of late-in-life density-dependent growth for fishery size-at-entry leading to maximum sustainable yield

Currently applied fisheries models and stock assessments rely on the assumption that density-dependent regulation only affects processes early in life, as described by stock-recruitment relationships. However, many fish stocks also experience density-dependent processes late in life, such as density-dependent adult growth. Theoretical studies have found that, for stocks which experience strong late-in-life density dependence, maximum sustainable yield (MSY) is obtained with a small fishery size-at-entry that also targets juveniles. This goes against common fisheries advice, which dictates that primarily adults should be fished. This study aims to examine whether the strength of density-dependent growth in actual fish stocks is sufficiently strong to reduce optimal fishery size-at-entry to below size-at-maturity. A size-structured model is fitted to three stocks that have shown indications of late-in-life density-dependent growth: North Sea plaice (Pleuronectes platessa), Northeast Atlantic (NEA) mackerel (Scomber scombrus), and Baltic sprat (Sprattus sprattus balticus). For all stocks, the model predicts exploitation at MSY with a large size-at-entry into the fishery, indicating that late-in-life density dependence in fish stocks is generally not strong enough to warrant the targeting of juveniles. This result lends credibility to the practise of predominantly targeting adults in spite of the presence of late-in-life density-dependent growth.
Response to comment: "What drives plankton seasonality in a stratifying shelf sea? Some competing and complementary theories": Response to comment: Seasonality

General information
State: Published
Organisations: National Institute of Aquatic Resources, Centre for Ocean Life, Section for Oceans and Arctic, Scripps Institution of Oceanography
Contributors: Kenitz, K. M., Visser, A. W., Andersen, K. H.
Pages: 2885-2886
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Journal: Limnology and Oceanography
Volume: 63
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ISSN (Print): 0024-3590
Ratings:
BFI (2019): BFI-level 2
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 3.81 SJR 1.871 SNIP 1.329
Web of Science (2017): Impact factor 3.595
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 3.5 SJR 1.806 SNIP 1.253
Web of Science (2016): Impact factor 3.383
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 3.93 SJR 2.423 SNIP 1.408
Web of Science (2015): Impact factor 3.66
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 3.73 SJR 2.118 SNIP 1.581
Web of Science (2014): Impact factor 3.794
BFI (2013): BFI-level 2
Scopus rating (2013): CiteScore 3.98 SJR 2.244 SNIP 1.564
Web of Science (2013): Impact factor 3.615
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): CiteScore 3.81 SJR 2.474 SNIP 1.499
The ability of a surplus production model to capture density dependence in growth and mortality

General information
State: Published
Organisations: Centre for Ocean Life, National Institute of Aquatic Resources
Contributors: van Gemert, R., Andersen, K. H.
Publication date: 2018
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Event: Abstract from ICES Annual Science Conference 2018, Hamburg, Germany.

Bibliographical note
CM Code: Q:374
Research output: Research › Conference abstract for conference – Annual report year: 2018
Challenges to fisheries management due to stock recovery

General information
State: Published
Organisations: National Institute of Aquatic Resources, Centre for Ocean Life
Contributors: van Gemert, R., Andersen, K. H.
Publication date: 2017
Peer-reviewed: No
Event: Abstract from ICES Annual Science Conference 2017, Fort Lauderdale, United States.

Bibliographical note
ICES CM 2017/G:266
Research output: Research › Conference abstract for conference – Annual report year: 2017

Connectivity and Dispersal of Salmon Lice in a Tidal Energetic Island System: Faroe Islands

General information
State: Published
Organisations: National Institute of Aquatic Resources, Centre for Ocean Life, Section for Marine Ecology and Oceanography, Aquaculture Research Station of the Faroes
Contributors: Kragesteen, T. J., Simonsen, K., Visser, A., Andersen, K. H.
Publication date: 2017
Peer-reviewed: No
Event: Abstract from Dansk Havforskmøde, Helsingør, Denmark.
Research output: Research › Conference abstract for conference – Annual report year: 2017

Efficiency of fisheries is increasing at the ecosystem level
Managing fisheries presents trade-offs between objectives, for example yields, profits, minimizing ecosystem impact, that have to be weighed against one another. These trade-offs are compounded by interacting species and fisheries at the ecosystem level. Weighing objectives becomes increasingly challenging when managers have to consider opposing objectives from different stakeholders. An alternative to weighing incomparable and conflicting objectives is to focus on win-wins until Pareto efficiency is achieved: a state from which it is impossible to improve with respect to any objective without regressing at least one other. We investigate the ecosystem-level efficiency of fisheries in five large marine ecosystems (LMEs) with respect to yield and an aggregate measure of ecosystem impact using a novel calibration of size-based ecosystem models. We estimate that fishing patterns in three LMEs (North Sea, Barents Sea and Benguela Current) are nearly efficient with respect to long-term yield and ecosystem impact and that efficiency has improved over the last 30 years. In two LMEs (Baltic Sea and North East US Continental Shelf), fishing is inefficient and win-wins remain available. We additionally examine the efficiency of North Sea and Baltic Sea fisheries with respect to economic rent and ecosystem impact, finding both to be inefficient but steadily improving. Our results suggest the following: (i) a broad and encouraging trend towards ecosystem-level efficiency of fisheries; (ii) that ecosystem-scale win-wins, especially with respect to conservation and profits, may still be common; and (iii) single-species assessment approaches may overestimate the availability of win-wins by failing to account for trade-offs across interacting species.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Centre for Ocean Life, University of Washington, University of California at Santa Barbara
Contributors: Jacobsen, N. S., Burgess, M. G., Andersen, K. H.
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Peer-reviewed: Yes

Publication information
Journal: Fish and Fisheries
Volume: 18
Issue number: 2
ISSN (Print): 1467-2960
Ratings:
BFI (2019): BFI-level 2
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
Estimating uncertainty of data limited stock assessments

Many methods exist to assess the fishing status of data-limited stocks; however, little is known about the accuracy or the uncertainty of such
assessments. Here we evaluate a new size-based data-limited stock assessment method by applying it to well-assessed, data-rich fish stocks treated as data-limited. Particular emphasis is put on providing uncertainty estimates of the data-limited assessment. We assess four cod stocks in the North-East Atlantic and compare our estimates of stock status (F/Fmsy) with the official assessments. The estimated stock status of all four cod stocks followed the established stock assessments remarkably well and the official assessments fell well within the uncertainty bounds. The estimation of spawning stock biomass followed the same trends as the official assessment, but not the same levels. We conclude that the data-limited assessment method can be used for stock assessment and that the uncertainty estimates are reliable. Further work is needed to quantify the spawning biomass of the stock.

General information
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Organisations: Centre for Ocean Life, National Institute of Aquatic Resources, Section for Marine Living Resources, Centre for Ecological and Evolutionary Synthesis, Faroe Marine Research Institute
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BFI (2019): BFI-level 1
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 2.98
Web of Science (2017): Impact factor 2.906
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.63
Web of Science (2016): Impact factor 2.76
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 2.18
Web of Science (2015): Impact factor 2.626
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 2.62
Web of Science (2014): Impact factor 2.377
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 2.46
Web of Science (2013): Impact factor 2.525
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 2.35
Web of Science (2012): Impact factor 2.277
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 2.32
Web of Science (2011): Impact factor 2.007
Food-web dynamics under climate change

Climate change affects ecological communities through its impact on the physiological performance of individuals. However, the population dynamic of species well inside their thermal niche is also determined by competitors, prey and predators, in addition to being influenced by temperature changes. We use a trait-based food-web model to examine how the interplay between the direct physiological effects from temperature and the indirect effects due to changing interactions between populations shapes the ecological consequences of climate change for populations and for entire communities. Our simulations illustrate how isolated communities deteriorate as populations go extinct when the environment moves outside the species’ thermal niches. High-trophic-level species are most vulnerable, while the ecosystem function of lower trophic levels is less impacted. Open communities can compensate for the loss of ecosystem function by invasions of new species. Individual populations show complex responses largely uncorrelated with the direct
impact of temperature change on physiology. Such complex responses are particularly evident during extinction and invasion events of other species, where climatically well-adapted species may be brought to extinction by the changed food-web topology. Our results highlight that the impact of climate change on specific populations is largely unpredictable, and apparently well-adapted species may be severely impacted.

General information
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Organisations: National Institute of Aquatic Resources, Centre for Ocean Life
Contributors: Zhang, L., Takahashi, M., Hartvig, M., Andersen, K. H.
Publication date: 2017
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Publication information
Journal: Proceedings of the Royal Society B: Biological Sciences
Volume: 284
Issue number: 1867
Article number: 1772
ISSN (Print): 0962-8452
Ratings:
BFI (2019): BFI-level 2
Web of Science (2019): Indexed yes
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
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 4.18 SJR 3.422 SNIP 1.895
Web of Science (2014): Impact factor 5.051
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): CiteScore 5.08 SJR 3.441 SNIP 1.9
Web of Science (2013): Impact factor 5.292
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): CiteScore 4.99 SJR 3.258 SNIP 1.972
Web of Science (2012): Impact factor 5.683
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): CiteScore 5.02 SJR 3.555 SNIP 1.88
Web of Science (2011): Impact factor 5.415
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 3.288 SNIP 1.753
Web of Science (2010): Impact factor 5.064
Web of Science (2010): Indexed yes
Global patterns in marine predatory fish

Large teleost (bony) fish are a dominant group of predators in the oceans and constitute a major source of food and livelihood for humans. These species differ markedly in morphology and feeding habits across oceanic regions; large pelagic species such as tunas and billfish typically occur in the tropics, whereas demersal species of gadoids and flatfish dominate boreal and temperate regions. Despite their importance for fisheries and the structuring of marine ecosystems, the underlying factors determining the global distribution and productivity of these two groups of teleost predators are poorly known. Here, we show how latitudinal differences in predatory fish can essentially be explained by the inflow of energy at the base of the pelagic and benthic food chain. A low productive benthic energy pathway favours large pelagic species, whereas equal productivities support large demersal generalists that outcompete the pelagic specialists. Our findings demonstrate the vulnerability of large teleost predators to ecosystem-wide changes in energy flows and hence provide key insight to predict the responses of these important marine resources under global change.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Centre for Ocean Life, Section for Oceans and Arctic, University of Tasmania
Contributors: van Denderen, P. D., Lindegren, M., MacKenzie, B., Watson, R., Andersen, K. H.
Pages: 65-70
Publication date: 2017
Peer-reviewed: Yes

Publication information
Journal: Nature Ecology & Evolution
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Web of Science (2017): Impact factor
Original language: English
Global patterns in the productivity of marine fish along parallel pathways of energy

Modeling succession of key resource-harvesting traits of mixotrophic plankton

Unicellular eukaryotes make up the base of the ocean food web and exist as a continuum in trophic strategy from pure heterotrophy (phagotrophic zooplankton) to pure photoautotrophy (‘phytoplankton’), with a dominance of mixotrophic organisms combining both strategies. Here we formulate a trait-based model for mixotrophy with three key resource-harvesting traits: photosynthesis, phagotrophy and inorganic nutrient uptake, which predicts the trophic strategy of species throughout the seasonal cycle. Assuming that simple carbohydrates from photosynthesis fuel respiration, and feeding primarily provides building blocks for growth, the model reproduces the observed light-dependent ingestion rates and species-specific growth rates with and without prey from the laboratory. The combination of traits yielding the highest growth rate suggests high investments in photosynthesis, and inorganic nutrient uptake in the spring and increased phagotrophy during the summer, reflecting general seasonal succession patterns of temperate waters. Our trait-based model presents a simple and general approach for the inclusion of mixotrophy, succession and evolution in ecosystem models. The ISME Journal advance online publication, 2 August 2016; doi:10.1038/ismej.2016.92.
Seasonal succession in zooplankton feeding traits reveals trophic trait coupling
The seasonal forcing of pelagic communities invokes a succession of the dominant phytoplankton and zooplankton species. Here, we characterize the seasonal succession of the plankton traits and their interactions using observations and model simulations of the plankton community in the western English Channel. We focus on activity traits that characterize the defensive and feeding abilities of zooplankton and distinguish between low risk, low return ambush feeders and high risk, high return feeding-current feeders. While the phytoplankton succession depends on traits related to nutrient acquisition and photosynthesis, it also depends on grazing which couples feeding and motility traits across trophic guilds. Despite interannual variations in the species dominating the protist plankton community, the seasonal trait distribution reveals robust and repeatable seasonal patterns, changing between non-motile cells flourishing in spring and motile community dominating during summer. The zooplankton community is dominated by active feeding-current feeders with peak biomass in the late spring declining during summer. The model reveals how zooplankton grazing reinforces protist plankton seasonal succession and shows how the physical environment controls the vertical structure of plankton communities, where ambush feeders exhibit a preference for greater depths during summer. We characterize the seasonal succession as trophic trait coupling and conjecture that this coupling leads to a trophic trait cascade where successive trophic levels alternate in their expression of activity traits further up in the food chain.

General information
Seasonal succession in zooplankton feeding traits reveals trophic trait coupling

General information
State: Published
Organisations: National Institute of Aquatic Resources, Centre for Ocean Life, Section for Marine Ecology and Oceanography
Contributors: Kenitz, K., Visser, A., Mariani, P., Andersen, K. H.
Publication date: 2017
Peer-reviewed: No
Event: Abstract from Dansk Havforskermøde, Helsingør, Denmark.
Research output: Research › Conference abstract for conference – Annual report year: 2017

Trait-based model of mixotrophy in plankton

General information
State: Published
Organisations: National Institute of Aquatic Resources, Centre for Ocean Life, University of Copenhagen
Contributors: Andersen, K. H., Berge, T., Chakraborty, S., Hansen, P. J.
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Event: Abstract from Dansk Havforskermøde, Helsingør, Denmark.
Research output: Research › Conference abstract for conference – Annual report year: 2017

Trophic impact of Atlantic bluefin tuna migrations in the North Sea

Large highly migratory predators can have major impacts on local marine ecosystems by reducing prey populations and leading to trophic cascades that affect the entire fish community. These trophic interactions are typically non-linear and can alter both the migratory behaviour of the predator and the stability of the fish community. The impact of a migrating top-predator is investigated here for Atlantic bluefin tuna in the North Sea. Bluefin tuna has been absent from the region for half-century, but recent years have seen recovery of migrations and a return of bluefin tuna in the area. We use a size spectrum model to analyse the trophic impact of the returning tuna on the entire fish community, under scenarios with varying levels of tuna consumption and fishing mortality on the prey. We show that with high level of prey fishing mortality in the North Sea, the effect of a tuna re-colonization results in only limited trophic cascades. However, high tuna consumption or changes in fishing mortality may result in a sudden recruitment failure of small-pelagic fish due to cascading effects on the fish community. In present-day conditions, the level of tuna consumption that triggers recruitment
failure is lower at increasing fishing mortalities on their prey, providing indications for the future sustainable management of both small-pelagics and bluefin tuna in the area.
Unicellular plankton employ trophic strategies ranging from pure photoautotrophs over mixotrophy to obligate heterotrophs (phagotrophs), with cell sizes from 10^{-8} to 1 \mu g C. A full understanding of how trophic strategy and cell size depend on resource environment and predation is lacking. To this end, we develop and calibrate a trait-based model for unicellular planktonic organisms characterized by four traits: cell size and investments in phototrophy, nutrient uptake, and phagotrophy. We use the model to predict how optimal trophic strategies depend on cell size under various environmental conditions, including seasonal succession. We identify two mixotrophic strategies: generalist mixotrophs investing in all three investment traits and obligate mixotrophs investing only in phototrophy and phagotrophy. We formulate two conjectures: (1) most cells are limited by organic carbon; however, small unicellulars are colimited by organic carbon and nutrients, and only large photoautotrophs and smaller mixotrophs are nutrient limited; (2) trophic strategy is bottom-up selected by the environment, while optimal size is top-down selected by predation. The focus on cell size and trophic strategies facilitates general insights into the strategies of a broad class of organisms in the size range from micrometers to millimeters that dominate the primary and secondary production of the world's oceans.
Unplanned ecological engineering

Fisheries can double the production of protein and revenue by abandoning current single-species management. This provocative prediction is the implication of the work in PNAS by Szuwalski et al. (1). Using the East China Sea as a case, they show how an indiscriminate fishery can support unexpectedly large catches by removing predators from the ecosystem. Such ecosystem engineering stands in stark contrast to reigning management paradigms that do not allow fishing down predators to increase the productivity of their prey.

The theoretical support for such a feat of ecosystem engineering is well developed (2, 3). Trusting the Chinese catch statistics, Szuwalski et al. (1) provide empirical evidence that theory may be turned into practice. But their work is more
than “just another fisheries paper;” it underscores highly controversial issues about the unavoidable trade-offs in managing fisheries and ecosystems. If we narrowly consider food security, maximizing fisheries catch from the ecosystem is a “no-brainer,” but from a conservation point of view, the loss of biodiversity in the East China Sea may seem like Aquacalypse come true (4). Can we really double fisheries’ production by turning the oceans into mega-scale mariculture operations? Is it what we want?

**General information**

State: Published
Organisations: National Institute of Aquatic Resources, Centre for Ocean Life, Section for Ecosystem based Marine Management
Contributors: Andersen, K. H., Gislason, H.
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Volume: 114
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BFI (2019): BFI-level 2
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 8.59 SJR 6.092 SNIP 2.626
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 8.56 SJR 6.576 SNIP 2.642
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 8.84 SJR 6.814 SNIP 2.691
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 8.86 SJR 6.898 SNIP 2.734
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): CiteScore 9.5 SJR 7.073 SNIP 2.738
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): CiteScore 9.49 SJR 6.868 SNIP 2.697
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): CiteScore 9.31 SJR 6.864 SNIP 2.646
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 6.898 SNIP 2.545
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 7.025 SNIP 2.556
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 7.034 SNIP 2.449
When in life does density dependence occur in fish populations?

**General information**
State: Published
Organisations: National Institute of Aquatic Resources, Centre for Ocean Life, Section for Marine Living Resources, Section for Marine Ecology and Oceanography
Contributors: Andersen, K. H., Jacobsen, N. S., Jansen, T., Beyer, J. E.
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Journal: Fish and Fisheries
Volume: 18
Issue number: 4
ISSN (Print): 1467-2960
Ratings:
BFI (2019): BFI-level 2
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 7.94 SJR 3.615 SNIP 3.156
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 7.7 SJR 3.703 SNIP 3.156
Adult and offspring size in the ocean: a database of size metrics and conversion factors

General information
State: Published
Organisations: National Institute of Aquatic Resources, Centre for Ocean Life, University of Copenhagen, University of Hawaii, University of Göttingen, Linnaeus University

Research output: Research - peer-review › Journal article – Annual report year: 2017
An indicator for ecosystem externalities in fishing

Ecosystem externalities arise when one use of an ecosystem affects its other uses through the production functions of the ecosystem. We use simulations with a size-spectrum ecosystem model to investigate the ecosystem externality created by fishing of multiple species. The model is based upon general ecological principles and is calibrated to the North Sea. Two fleets are considered: a "forage fish" fleet targeting species that mature at small sizes and a "large fish" fleet targeting large piscivorous species. Based on the marginal analysis of the present value of the rent, we develop a benefit indicator that explicitly divides the consequences of fishing into internal and external benefits. This analysis demonstrates that the forage fish fleet has a notable economic impact on the large fish fleet, but the reverse is not true. The impact can be either negative or positive, which entails that for optimal economic exploitation, the forage fishery has to be adjusted according to the large fish fishery. With the present large fish fishery in the North Sea, the two fisheries are well adjusted; however, the present combined exploitation level is too high to achieve optimal economic rents.
Assumptions behind size-based ecosystem models are realistic: Comment

A recent publication about balanced harvesting (Froese et al., ICES Journal of Marine Science; doi:10.1093/icesjms/fsv122) contains several erroneous statements about size-spectrum models. We refute the statements by showing that the assumptions pertaining to size-spectrum models discussed by Froese et al. are realistic and consistent. We further show that the assumption about density-dependence being described by a stock recruitment relationship is responsible for determining whether a peak in the cohort biomass of a population occurs late or early in life. Finally, we argue that there is indeed a constructive role for a wide suite of ecosystem models to evaluate fishing strategies in an ecosystem context.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Centre for Ocean Life, Section for Ecosystem based Marine Management, University of Tasmania, Commonwealth Scientific and Industrial Research Organisation, Wageningen IMARES
Pages: 1651-1655
Publication date: 2016
Peer-reviewed: Yes

Publication information
Journal: ICES Journal of Marine Science
Volume: 73
Issue number: 6
ISSN (Print): 1054-3139
Comparing model predictions for ecosystem-based management

Ecosystem modeling is becoming an integral part of fisheries management, but there is a need to identify differences between predictions derived from models employed for scientific and management purposes. Here, we compared two models: a biomass-based food-web model (Ecopath with Ecosim (EwE)) and a size-structured fish community model. The models were compared with respect to predicted ecological consequences of fishing to identify commonalities and differences in model predictions for the California Current fish community. We compared the models regarding direct and indirect responses to fishing on one or more species. The size-based model predicted a higher fishing mortality needed to reach maximum sustainable yield than EwE for most species. The size-based model also predicted stronger top-down effects of predator removals than EwE.

In contrast, EwE predicted stronger bottom-up effects of forage fisheries removal. In both cases, the differences are due to
the presumed degree of trophic overlap between juveniles of large-bodied fish and adult stages of forage fish. These differences highlight how each model’s emphasis on distinct details of ecological processes affects its predictions, underscoring the importance of incorporating knowledge of model assumptions and limitation, possibly through using model ensembles, when providing model-based scientific advice to policy makers.

**General information**

State: Published
Organisations: National Institute of Aquatic Resources, Centre for Ocean Life, University of Washington
Contributors: Jacobsen, N. S., Essington, T. E., Andersen, K. H.
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Peer-reviewed: Yes

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Journal: Canadian Journal of Fisheries and Aquatic Sciences
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BFI (2019): BFI-level 2
Web of Science (2019): Indexed yes
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
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
Differences in density-dependence drive dual offspring size strategies in fish

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, Centre for Ocean Life
Contributors: Olsson, K. H., Gislason, H., Andersen, K. H.
Pages: 118-127
Publication date: 2016
Peer-reviewed: Yes

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Journal: Journal of Theoretical Biology
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Ratings:
BFI (2019): BFI-level 1
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 1.93 SJR 0.746 SNIP 0.83
Web of Science (2017): Impact factor 1.833
Web of Science (2017): Indexed yes

Original language: English
DOIs:
10.1139/cfjas-2014-0561
Source: FindIt
Source-ID: 2280306859
Research output: Research - peer-review : Journal article – Annual report year: 2015
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.16 SJR 0.934 SNIP 0.915
Web of Science (2016): Impact factor 2.113
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 2.21 SJR 1.072 SNIP 0.989
Web of Science (2015): Impact factor 2.049
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 2.25 SJR 1.076 SNIP 1.035
Web of Science (2014): Impact factor 2.116
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 2.44 SJR 1.044 SNIP 1.039
Web of Science (2013): Impact factor 2.303
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 2.5 SJR 0.947 SNIP 1.032
Web of Science (2012): Impact factor 2.351
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 2.44 SJR 0.81 SNIP 1.019
Web of Science (2011): Impact factor 2.208
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.081 SNIP 0.972
Web of Science (2010): Impact factor 2.371
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.139 SNIP 1.067
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 0.885 SNIP 1.07
Scopus rating (2007): SJR 1.277 SNIP 1.096
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.132 SNIP 1.071
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 1.111 SNIP 0.913
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 1.05 SNIP 0.928
Scopus rating (2003): SJR 1.04 SNIP 0.991
Scopus rating (2002): SJR 0.898 SNIP 0.835
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 0.839 SNIP 0.825
Scopus rating (2000): SJR 0.877 SNIP 0.869
Web of Science (2000): Indexed yes
Scopus rating (1999): SJR 0.839 SNIP 0.911

Original language: English
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Dynamics of a physiologically structured population in a time-varying environment

Physiologically structured population models have become a valuable tool to model the dynamics of populations. In a stationary environment such models can exhibit equilibrium solutions as well as periodic solutions. However, for many organisms the environment is not stationary, but varies more or less regularly. In order to understand the interaction between an external environmental forcing and the internal dynamics in a population, we examine the response of a physiologically structured population model to a periodic variation in the food resource. We explore the addition of forcing in two cases: (A) where the population dynamics is in equilibrium in a stationary environment, and (B) where the population dynamics exhibits a periodic solution in a stationary environment. When forcing is applied in case A, the solutions are mainly periodic. In case B the forcing signal interacts with the oscillations of the unforced system, and both periodic and irregular (quasi-periodic or chaotic) solutions occur. In both cases the periodic solutions include one and multiple period cycles, and each cycle can have several reproduction pulses.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Dynamical Systems, National Institute of Aquatic Resources, Centre for Ocean Life, Section for Marine Living Resources
Contributors: Heilmann, I. L. T., Starke, J., Andersen, K. H., Thygesen, U. H., Sørensen, M. P.
Pages: 54-61
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Web of Science (2019): Indexed yes
BFI (2018): BFI-level 1
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BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 1.7 SJR 0.753 SNIP 0.856
Web of Science (2017): Impact factor 1.634
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.11 SJR 0.824 SNIP 1.017
Web of Science (2016): Impact factor 1.784
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 2.01 SJR 0.914 SNIP 1.071
Web of Science (2015): Impact factor 1.797
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 2.53 SJR 0.898 SNIP 1.48
Web of Science (2014): Impact factor 1.931
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 3.29 SJR 1.085 SNIP 1.635
Web of Science (2013): Impact factor 2
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 2.64 SJR 1.009 SNIP 1.319
Web of Science (2012): Impact factor 2.34
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 1.91 SJR 1 SNIP 0.978
Web of Science (2011): Impact factor 1.926
Fish stock assessment under data limitations developing a new method based on a size-structured theoretical ecology framework

Fish stock assessment is an integral part of every fisheries management system. Modern assessment methods require data about the fishery and the stock, such as catches, survey estimates, aging information and life history parameters, all of which is difficult and expensive to gather. However, the majority of global fish catches comes from species that lack an official assessment due to lack of data. That is true especially for small scale fisheries and fisheries in developing countries. New methods are in need that require little amount of easily attainable data and provide scientific advice for fish stocks that are not assessed. The goal of the thesis is to develop a new data-limited stock assessment method that is: rooted in theoretical ecology, requires only information about the size composition of the catch or surveys (i.e. aging is not required), and does not require time-series. The method provides estimates of fishing mortality and the FMSY reference point, it is tested and validated, and is implemented as software package making it easy to use by stakeholders of different levels. The basis of the method is a size-based theoretical ecology framework that describes exploited fish stocks. The model parameters correspond to Beverton-Holt life history invariants, which reduces the number of parameters and allows data-limited assessments to borrow information from data-rich stocks. The mathematical formulation of the single species population dynamics is used in a maximum-likelihood optimisation framework to estimate model parameters. The data-limited method estimates at the same time the fishing mortality rate and the biological reference point FMSY. Minimum data requirements consist of a single size frequency distribution from the commercial catch or a scientific survey. If the total catch is known, important quantities about the stock (e.g. biomass of spawners, recruitment) can be quantified. The method is tested using simulated data and validated using a subset of available data from data-rich fish stocks. The implementation of the method as a software package in the R programming language is publicly available.
Maximizing fisheries yields while maintaining community structure

General information
State: Published
Organisations: National Institute of Aquatic Resources, Centre for Ocean Life, Wageningen IMARES, University of Bergen
Contributors: Kolding, J., Jacobsen, N. S., Andersen, K. H., van Zwieten, P. A.
Pages: 644–655
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Web of Science (2018): Indexed yes
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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
Remaining questions in the case for balanced harvesting

Balanced harvesting – harvesting all species and sizes in an ecosystem in proportion to their productivity – is a fisheries management strategy that has been suggested recently to increase yields, while reducing overall ecosystem impact. However, some aspects of balanced harvesting are controversial, including its call for extensive harvesting of juveniles and forage fish. Balanced harvesting also calls for targeting species and size-classes that are not currently marketable, possibly at a significant economic cost. Some have argued that this cost is outweighed by the ecological benefits of maintaining the ecosystem size and trophic structures and by the benefits of extra yield for food security. There is broad consensus that balanced harvesting would require major changes to fishery management institutions and consumer behaviour, and it is unclear to what extent it is physically possible with current technologies. For this reason, we argue that steps to implement balanced harvesting are difficult to justify until the case for it is more clearly resolved. We outline some of the pivotal questions that must be answered to make a convincing case for or against balanced harvesting, many of which can be answered.
Scaling laws in phytoplankton nutrient uptake affinity
Nutrient uptake affinity affects the competitive ability of microbial organisms at low nutrient concentrations. From the theory of diffusion limitation it follows that uptake affinity scales linearly with the cell radius. This is in conflict with some observations suggesting that uptake affinity scales to a quantity that is closer to the square of the radius, i.e. to cell surface area. We show that this apparent conflict can be resolved by nutrient uptake theory. Pure diffusion limitation assumes that the cell is a perfect sink which means that it is able to absorb all encountered nutrients instantaneously. Here we provide empirical evidence that the perfect sink strategy is not common in phytoplankton. Although small cells are indeed favored by a large surface to volume ratio, we show that they are punished by higher relative investment cost in order to fully benefit from the larger surface to volume ratio. We show that there are two reasons for this. First, because the small cells need a higher transporter density in order to maximize their affinity, and second because the relative cost of a transporter is higher for a small than for a large cell. We suggest that this might explain why observed uptake affinities do not scale linearly with the cell radius.

The theoretical foundations for size spectrum models of fish communities
Size spectrum models have emerged from 40 years of basic research on how body size determines individual physiology and structures marine communities. They are based on commonly accepted assumptions and have a low parameter set, which make them easy to deploy for strategic ecosystem oriented impact assessment of fisheries. We describe the fundamental concepts in size-based models about food encounter and the bioenergetics budget of individuals. Within the general framework three model types have emerged that differs in their degree of complexity: the food-web, the trait-based and the community model. We demonstrate the differences between the models through examples of their...
response to fishing and their dynamic behavior. We review implementations of size spectrum models and describe important variations concerning the functional response, whether growth is food-dependent or fixed, and the density-dependence imposed on the system. Finally we discuss challenges and promising directions.

General information
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Organisations: National Institute of Aquatic Resources, Centre for Ocean Life, Queen's University Belfast
Contributors: Andersen, K. H., Jacobsen, N. S., Farnsworth, K.
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Web of Science (2018): Indexed yes
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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
Adult and offspring size in the ocean over 17 orders of magnitude follows two life history strategies

Explaining variability in offspring vs. adult size among groups is a necessary step to determine the evolutionary and environmental constraints shaping variability in life history strategies. This is of particular interest for life in the ocean where a diversity of offspring development strategies is observed along with variability in physical and biological forcing factors in space and time. We compiled adult and offspring size for 407 pelagic marine species covering more than 17 orders of magnitude in body mass including Cephalopoda, Cnidaria, Crustaceans, Ctenophora, Elasmobranchii, Mammalia, Sagittoidea, and Teleost. We find marine life following one of two distinct strategies, with offspring size being either proportional to adult size (e.g., Crustaceans, Elasmobranchii, and Mammalia) or invariant with adult size (e.g., Cephalopoda, Cnidaria, Sagittoidea, Teleosts, and possibly Ctenophora). We discuss where these two strategies occur and how these patterns (along with the relative size of the offspring) may be shaped by physical and biological constraints in the organism’s environment. This adaptive environment along with the evolutionary history of the different groups shape observed life history strategies and possible group-specific responses to changing environmental conditions (e.g., production and distribution).

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An effective algorithm for approximating adaptive behavior in seasonal environments

Behavior affects most aspects of ecological processes and rates, and yet modeling frameworks which efficiently predict and incorporate behavioral responses into ecosystem models remain elusive. Behavioral algorithms based on life-time optimization, adaptive dynamics or game theory are unsuited for large global models because of their high computational demand. We compare an easily integrated, computationally efficient behavioral algorithm known as Gilliam's rule against the solution from a life-history optimization. The approximation takes into account only the current conditions to optimize behavior; the so-called "myopic approximation", "short sighted", or "static optimization". We explore the performance of the myopic approximation with diel vertical migration (DVM) as an example of a daily routine, a behavior with seasonal dependence that trades off predation risk with foraging opportunities in aquatic environments. The myopic approximation proves to be a robust replacement for the life-history optimization, deviating only up to 25% in regions of strong seasonality. The myopic approximation has additional advantages in that it can readily accommodate density dependence and inter-annual variations, aspects that can only be accessed in dynamic programming approaches with escalating computational costs. Furthermore, the explanatory power of the myopic approximation is notably higher than when behavior is not implemented, highlighting the importance for adaptive DVM behavior in ecological models where techniques such as dynamic programming are simply too computational demanding to be implemented.
An Indicator for ecosystem externalities in fishing

Ecosystem externalities arise when one use of an ecosystem affects its other uses through the production functions of the ecosystem. We use simulations from a size-spectrum ecosystem model to investigate the ecosystem externality created by fishing of multiple species. The model is based upon general ecologcal principles and is calibrated to the North Sea. Two fleets are considered: a “forage fish” fleet targeting species that mature at small sizes and a “large fish” fleet targeting large piscivorous species. Based on the marginal analysis of the present value of the rent, we develop a benefit indicator that explicitly divides the consequences of fishing into internal and external benefits. This analysis demonstrates that the forage...
fish fleet has a notable economic impact on the large fish fleet, but the reverse is not true. The impact can be either negative or positive, which entails that for optimal economic exploitation, the forage fishery has to be adjusted according to the large fish fishery. With the present large fish fishery in the North Sea, the two fisheries are well adjusted; however, the present combined exploration level is too high to achieve optimal economic rents.
Four types of interference competition and their impacts on the ecology and evolution of size-structured populations and communities

We investigate how four types of interference competition - which alternatively affect foraging, metabolism, survival, and reproduction - impact the ecology and evolution of size-structured populations. Even though all four types of interference competition reduce population biomass, interference competition at intermediate intensity sometimes significantly increases the abundance of adult individuals and the population's reproduction rate. We find that foraging and metabolic interference evolutionarily favor smaller maturation size when interference is weak and larger maturation size when interference is strong. The evolutionary response to survival interference and reproductive interference is always larger maturation size. We also investigate how the four types of interference competition impact the evolutionary dynamics and resultant diversity and trophic structure of size-structured communities. Like other types of trait-mediated competition, all four types of interference competition can induce disruptive selection and thus promote initial diversification. Even though foraging interference and reproductive interference are more potent in promoting initial diversification, they catalyze the formation of diverse communities with complex trophic structure only at high levels of interference intensity. By contrast, survival interference does so already at intermediate levels, while reproductive interference can only support relatively smaller communities with simpler trophic structure. Taken together, our results show how the type and intensity of interference competition jointly affect coexistence patterns in structured population models.

General information

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Organisations: Department of Applied Mathematics and Computer Science, National Institute of Aquatic Resources, Centre for Ocean Life, Umeå University, International Institute for Applied Systems Analysis
Contributors: Zhang, L., Andersen, K. H., Dieckmann, U., Brännström, Å. K.
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BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 1.93 SJR 0.746 SNIP 0.83
Web of Science (2017): Impact factor 1.833
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.16 SJR 0.934 SNIP 0.915
Web of Science (2016): Impact factor 2.113
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 2.21 SJR 1.072 SNIP 0.989
Web of Science (2015): Impact factor 2.049
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 2.25 SJR 1.076 SNIP 1.035
Web of Science (2014): Impact factor 2.116
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 2.44 SJR 1.044 SNIP 1.039
Web of Science (2013): Impact factor 2.303
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 2.5 SJR 0.947 SNIP 1.032
Web of Science (2012): Impact factor 2.351
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 2.44 SJR 0.81 SNIP 1.028
Web of Science (2011): Impact factor 2.008
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.081 SNIP 0.972
Web of Science (2010): Impact factor 2.371
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.139 SNIP 1.067
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 0.885 SNIP 1.07
Scopus rating (2007): SJR 1.277 SNIP 1.096
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.132 SNIP 1.071
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 1.111 SNIP 0.913
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 1.05 SNIP 0.928
Scopus rating (2003): SJR 1.04 SNIP 0.991
Scopus rating (2002): SJR 0.898 SNIP 0.835
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 0.839 SNIP 0.825
Scopus rating (2000): SJR 0.877 SNIP 0.869
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Scopus rating (1999): SJR 0.839 SNIP 0.911
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Limits to the reliability of size-based fishing status estimation for data-poor stocks

For stocks which are considered "data-poor" no knowledge exist about growth, mortality or recruitment. The only available information is from catches. Here we examine the ability to assess the level of exploitation of a data-poor stock based only on information of the size of individuals in catches. The model is a formulation of the classic Beverton–Holt theory in terms of size where stock parameters describing growth, natural mortality, recruitment, etc. are determined from life-history invariants. A simulation study was used to compare the reliability of assessments performed under different information availability scenarios, from data-limited, where none of the parameters are known beforehand, to different degrees of information availability cases where one or more parameters are known. If no parameters are known it is possible to correctly assess whether the fishing mortality is below Fmsy in more than 60% of the cases, and almost always correctly assess whether a stock is subject to overfishing. Adding information about age, i.e., assuming that growth rate and asymptotic size are known, does not improve the estimation. Only knowledge of the ratio between mortality and growth led to a considerable improvement in the assessment. Overall, the simulation study demonstrates that it may be possible to classify a data-poor stock as undergoing over- or under-fishing, while the exact status, i.e., how much the fishing mortality is above or below Fmsy, can only be assessed with a substantial uncertainty. Limitations of the approach are discussed.
Maximum sustainable yield from fisheries: food production, resource rent and conservation

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Contributors: Andersen, K. H., Brander, K., Ravn-Jonsen, L.
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F10_DTU_Sustain_2015.pdf

Research output: Research - peer-review › Conference abstract in proceedings – Annual report year: 2015
Modelling emergent trophic strategies in plankton

Plankton are typically divided into phytoplanckton and zooplankton in marine ecosystem models. Yet, most protists in the photic zone engage in some degree of phagotrophy, and it has been suggested that trophic strategy is really a continuum between pure phototrophs (phytoplankton) and pure phagotrophs (unicellular zooplankton). Such a continuum of trophic strategies is well represented by trait-based modelling techniques. A key model ingredient is the size of individual cells, as size constrains affinities for nutrient uptake, photosynthesis and active encounter with other cells. We outline a general trait-based model of a unicellular planktonic organism where size is a central trait and where nutrient uptake, photosynthesis and phagotrophy are determined by investments into these functions and by the physical constraints imposed by organism size. This framework provides simple predictions of how trophic strategy correlates with size.

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Organisations: National Institute of Aquatic Resources, Centre for Ocean Life, Section for Marine Ecology and Oceanography, University of Copenhagen, University of Bergen
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BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.92 SJR 1.123 SNIP 0.856
Web of Science (2016): Impact factor 1.983
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 1.77 SJR 1.029 SNIP 0.802
Web of Science (2015): Impact factor 2.15
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 2.24 SJR 1.098 SNIP 1.234
Web of Science (2014): Impact factor 2.407
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 2.39 SJR 1.292 SNIP 1.101
Web of Science (2013): Impact factor 2.263
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 2.43 SJR 1.594 SNIP 1.109
Web of Science (2012): Impact factor 2.435
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Size structure, not metabolic scaling rules, determines fisheries reference points

Impact assessments of fishing on a stock require parameterization of vital rates: growth, mortality and recruitment. For ‘data-poor’ stocks, vital rates may be estimated from empirical size-based relationships or from life-history invariants. However, a theoretical framework to synthesize these empirical relations is lacking. Here, we combine life-history invariants, metabolic scaling and size-spectrum theory to develop a general size- and trait-based theory for demography and recruitment of exploited fish stocks. Important concepts are physiological or metabolic scaled mortalities and flux of individuals or their biomass to size. The theory is based on classic metabolic relations at the individual level and uses asymptotic size $W_\infty$ as a trait. The theory predicts fundamental similarities and differences between small and large species in vital rates and response to fishing. The central result is that larger species have a higher egg production per recruit than small species. This means that density dependence is stronger for large than for small species and has the consequence that fisheries reference points that incorporate recruitment do not obey metabolic scaling rules. This result implies that even though small species have a higher productivity than large species their resilience towards fishing is lower than expected from metabolic scaling rules. Further, we show that the fishing mortality leading to maximum yield per recruit is an ill-suited reference point. The theory can be used to generalize the impact of fishing across species and for making demographic and evolutionary impact assessments of fishing, particularly in data-poor situations

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Contributors: Andersen, K. H., Beyer, J.
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Life in the ocean is shaped by the trade-off between a need to encounter other organisms for feeding or mating, and to avoid encounters with predators. Avoiding or achieving encounters necessitates an efficient means of collecting the maximum possible information from the surroundings through the use of remote sensing. In this study, we explore how sensing mode and range depend on body size. We reveal a hierarchy of sensing modes (chemosensing, mechanosensing, vision, hearing, and echolocation) where body size determines the available battery of sensing modes and where larger body size means a longer sensing range. The size-dependent hierarchy and the transitions between primary sensory modes are explained on the grounds of limiting factors set by physiology and the physical laws governing signal generation, transmission and reception. We characterize the governing mechanisms and theoretically predict the body size limits for various sensory modes, which align very well with size ranges found in literature. The treatise of all ocean life, from unicellular organisms to whales, demonstrates how body size determines available sensing modes, and thereby acts as a major structuring factor of aquatic life.
Trade-offs between objectives for ecosystem management of fisheries

The strategic objectives for fisheries, enshrined in international conventions, is to maintain or restore stocks to produce maximum sustainable yield (MSY) and implement the ecosystem approach requiring that interactions between species be taken into account and conservation constraints be respected. While the yield and conservation aims are to some extent compatible when a fishery for a single species is considered, species interactions entail that MSY for a species depends on the species with which it interacts and the yield and conservation objectives therefore conflict when an ecosystem approach to fisheries management is required. We apply a conceptual size- and trait-based model to clarify and resolve these issues, by determining the fishing pattern that maximizes the total yield of an entire fish community in terms of catch weight or economic rent under acceptable conservation constraints. Our results indicate that the eradication of large, predatory fish species results in a potential maximum catch at least twice as high as if conservation constraints are imposed. However, such a large catch could only be achieved at a cost of foregone rent; maximum rent extracts less than half of the potential maximum catch weight. When a conservation constraint is applied, catch can be maximized at negligible cost in foregone rent, compared with maximizing rent. Maximization of rent is the objective that comes closest to respecting conservation concerns.
A life-history evaluation of the impact of maternal effects on recruitment and fisheries reference points

Fishing causes dramatic changes in the age and size structure of fish stocks. In particular, the targeting of the largest and oldest individuals in a stock changes the age and size distribution of that stock. A large female produces a higher quantity of eggs than a young female because of its larger size, but recent laboratory evidence further indicates that large females also produce eggs of higher quality, a phenomenon known as maternal effects. However, most traditional management models assume that all female fish contribute equally per unit biomass to future recruitment. Here we investigate whether this assumption is valid by calculating the impact of maternal effects both before and after accounting for density-dependent effects. We find that the contribution of large individuals to reproduction is much more pronounced for unfished than for fished stocks. Fisheries reference points are largely unaffected by maternal effects. Our results indicate that the incorporation of maternal effects into impact assessments of fisheries is not expected to change advice substantially. Important exceptions are stocks whose demography is very vulnerable to fishing (and which therefore have low fishing reference points) for which maternal effects are relevant and necessary to consider.

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A metacommunity perspective on source-sink dynamics and management: the Baltic Sea as a case study

The degree to which metapopulation processes influence fish stock dynamics is a largely unresolved issue in marine science and management, especially for highly mobile species such as Atlantic cod (Gadus morhua) and herring (Clupea harengus). The Baltic Sea comprises a heterogeneous oceanographic environment that structures the spatial and temporal distribution of the dominant species cod, herring, and sprat (Sprattus sprattus). Despite local differences, the stocks are traditionally managed as homogeneous units. Here, we present a metacommunity-perspective on source–sink dynamics of Baltic Sea fish stocks by using a spatially disaggregated statistical food web model. The model is fitted to area-specific time series of multiple abiotic and biotic variables using state-space methods. Our analysis reveals pronounced net fluxes between areas, indicative of source–sink dynamics, as well as area-specific differences in species interactions (i.e., density dependence, competition, and predator–prey) and the degree of fishing and climate impact on survival and recruitment. Furthermore, model simulations show that decreasing exploitation pressure in the source area for cod (without reallocating fishing effort) produces an increase in neighboring sink habitats, but a decline of prey species in response to increased predation. Our approach provides valuable insight concerning metacommunity-structuring of marine fish and may serve as an important tool for implementing sustainable management strategies under the ecosystem approach to marine and fisheries management.

Read More: http://www.esajournals.org/doi/abs/10.1890/13-0566.1
Capital versus income breeding in a seasonal environment

The allocation of resources between growth, storage, and reproduction is a key trade-off in the life-history strategies of organisms. A central dichotomy is between capital breeders and income breeders. Capital breeders build reserves that allow them to spawn at a later time independently of food availability, while income breeders allocate ingested food directly to reproduction. Motivated by copepod studies, we use an analytical model to compare the fitness of income with capital...
breeding in a deterministic seasonal environment. We analyze how the fitness of breeding strategies depend on feeding season duration and size at maturity. Small capital breeders perform better in short feeding seasons but fall behind larger individuals when the length of the feeding season increases. Income breeding favors smaller individuals as their short generation time allows for multiple generations within a year and thereby achieve a high annual growth rate, outcompeting capital breeders in long feeding seasons. Therefore, we expect to find a dominance of small income breeders in temperate waters, while large capital breeders should dominate high latitudes where the spring is short and intense. This pattern is evident in nature, particularly in organisms with a generation time of a year or less.

**General information**

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Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Centre for Ocean Life, Akvaplan-niva AS
Contributors: Sainmont, J., Andersen, K. H., Varpe, O., Visser, A. W.
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Scopus rating (2017): CiteScore 3.81 SJR 2.661 SNIP 1.321
Web of Science (2017): Impact factor 4.265
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BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 3.52 SJR 2.841 SNIP 1.356
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 4.22 SJR 3.283 SNIP 1.6
Web of Science (2014): Impact factor 3.832
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): CiteScore 4.52 SJR 3.206 SNIP 1.638
Web of Science (2013): Impact factor 4.454
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): CiteScore 4.68 SJR 3.446 SNIP 1.666
Web of Science (2012): Impact factor 4.552
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): CiteScore 4.72 SJR 3.911 SNIP 1.703
Web of Science (2011): Impact factor 4.725
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 4.26 SNIP 1.751
Web of Science (2010): Impact factor 4.736
BFI (2009): BFI-level 2
Ecosystem-based management objectives for the North Sea: riding the forage fish rollercoaster
The North Sea provides a useful model for considering forage fish (FF) within ecosystem-based management as it has a complex assemblage of FF species. This paper is designed to encourage further debate and dialogue between stakeholders about management objectives. Changing the management of fisheries on FF will have economic consequences for all fleets in the North Sea. The predators that are vulnerable to the depletion of FF are Sandwich terns, great skua and common guillemots, and to a lesser extent, marine mammals. Comparative evaluations of management strategies are required to consider whether maintaining the reserves of prey biomass or a more integral approach of monitoring mortality rates across the trophic system is more robust under the ecosystem approach. In terms of trophic energy transfer, stability, and resilience of the ecosystem, FF should be considered as both a sized-based pool of biomass and as species components of the system by managers and modellers. Policy developers should not consider the knowledge base robust enough to embark on major projects of ecosystem engineering. Management plans appear able to maintain sustainable exploitation in the short term. Changes in the productivity of FF populations are inevitable so management should remain responsive and adaptive.
Estimating spatio-temporal dynamics of size-structured populations

Spatial distributions of structured populations are usually estimated by fitting abundance surfaces for each stage and at each point of time separately, ignoring correlations that emerge from growth of individuals. Here, we present a statistical model that combines spatio-temporal correlations with simple stock dynamics, to estimate simultaneously how size distributions and spatial distributions develop in time. We demonstrate the method for a cod population sampled by trawl surveys. Particular attention is paid to correlation between size classes within each trawl haul due to clustering of individuals with similar size. The model estimates growth, mortality and reproduction, after which any aspect of size-structure, spatio-temporal population dynamics, as well as the sampling process can be probed. This is illustrated by two applications: 1) tracking the spatial movements of a single cohort through time, 2) predicting the risk of by-catch of undersize individuals. The method demonstrates that it is possible to combine
stock assessment and spatio-temporal dynamics, however at a high computational cost. The model can be extended by increasing its ecological fidelity, although computational feasibility eventually becomes limiting.

**General information**

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Contributors: Kristensen, K., Thygesen, U. H., Andersen, K. H., Beyer, J. E.

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Web of Science (2016): Impact factor 2.466  
Web of Science (2016): Indexed yes  
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Scopus rating (2015): CiteScore 2.22 SJR 1.267 SNIP 1.025  
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BFI (2014): BFI-level 2  
Scopus rating (2014): CiteScore 2.6 SJR 1.476 SNIP 1.379  
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Web of Science (2014): Indexed yes  
BFI (2013): BFI-level 2  
Scopus rating (2013): CiteScore 2.25 SJR 1.439 SNIP 1.086  
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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  
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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
Evaluating targets and trade-offs among fisheries and conservation objectives using a multispecies size spectrum model

Marine environmental management policies seek to ensure that fishing impacts on fished populations and other components of the ecosystem are sustainable, to simultaneously meet objectives for fisheries and conservation. For example, in Europe, targets for (i) biodiversity, (ii) food web structure as indicated by the proportion of large fish and (iii) fishing mortality rates for exploited species that lead to maximum sustainable yield, FMSY, are being proposed to support implementation of the Marine Strategy Framework Directive. Efforts to reconcile any trade-offs among objectives need to be informed by knowledge on the consequences of alternate management actions. We develop, calibrate and apply a multispecies size spectrum model of the North Sea fish community to assess the response of populations and the community to fishing. The model predicts species’ size distributions, abundance, productivity and interactions and therefore provides a single framework for evaluating trade-offs between population status, community and food web structure, biodiversity and fisheries yield. We show that the model can replicate realistic fish population and community structure and past responses to fishing. We assess whether meeting management targets for exploited North Sea populations (fishing species at FMSY) will be sufficient to meet proposed targets for biodiversity and food web indicators under two management scenarios (status quo and FMSY). The recovery in biodiversity indicators is 60% greater when fishing populations at FMSY than if status quo (2010) fishing rates are maintained. The probability of achieving a food web target was 60% under both scenarios in spite of major community restructuring revealed by other indicators of community size structure. Synthesis and applications. Our model can be applied to evaluate indicator targets and trade-offs among fisheries and conservation objectives. There is a significant probability that reductions in fishing mortality below FMSY would be needed in Europe if managers make a binding commitment to a proposed large fish indicator target, with concomitant reductions in fisheries yield.
Forage fish interactions: A symposium on creating the tools for ecosystem-based management of marine resources

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Scopus rating (2017): CiteScore 2.98
Web of Science (2017): Impact factor 2.906
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.63
Web of Science (2016): Impact factor 2.76
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 2.18
Web of Science (2015): Impact factor 2.626
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 2.62
Web of Science (2014): Impact factor 2.377
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 2.46
Web of Science (2013): Impact factor 2.525
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 2.35
Web of Science (2012): Impact factor 2.277
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 2.32
Web of Science (2011): Impact factor 2.007
Forage fish, their fisheries, and their predators: who drives whom?
The North Sea has a diverse forage fish assemblage, including herring, targeted for human consumption; sandeel, sprat, and Norway pout, exploited by industrial fisheries; and some sardine and anchovy, supporting small-scale fisheries. All show large abundance fluctuations, impacting on fisheries and predators. We review field, laboratory, and modelling studies to investigate the drivers of this complex system of forage fish. Climate clearly influences forage fish productivity; however, any single-species considerations of the influence of climate might fail if strong interactions between forage fish exist, as in the North Sea. Sandeel appears to be the most important prey forage fish. Seabirds are most dependent on forage fish, due to specialized diet and distributional constraints (breeding colonies). Other than fisheries, key predators of forage fish are a few piscivorous fish species including salthe, whiting, mackerel, and horse-mackerel, exploited in turn by fisheries; seabirds and seals have a more modest impact. Size-based foodwebmodelling suggests that reducing fishing mortality may not necessarily lead to larger stocks of piscivorous fish, especially if their early life stages compete with forage fish for zooplankton resources. In complex systems, changes in the impact of fisheries on forage fish may have potentially complex (and perhaps unanticipated) consequences on other commercially and/or ecologically important species.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, Section for Marine Living Resources, Section for Marine Ecology and Oceanography, Cefas Weymouth Laboratory, University of Hamburg, University of St Andrews, Wageningen IMARES, Kiel University
Pages: 90-104
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Peer-reviewed: Yes

Publication information
Journal: ICES Journal of Marine Science
Volume: 71
Issue number: 1
ISSN (Print): 1054-3139
Ratings:
BFI (2019): BFI-level 1
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
mizer: an R package for multispecies, trait-based and community size spectrum ecological modelling

1. Size spectrum ecological models are representations of a community of individuals which grow and change trophic level. A key emergent feature of these models is the size spectrum; the total abundance of all individuals that scales negatively with size. The models we focus on are designed to capture fish community dynamics useful for
assessing the community impacts of fishing.

2. We present mizer, an R package for implementing dynamic size spectrum ecological models of an entire aquatic community subject to fishing. Multiple fishing gears can be defined and fishing mortality can change through time making it possible to simulate a range of exploitation strategies and management options.

3. mizer implements three versions of the size spectrum modelling framework: the community model, where individuals are only characterized by their size; the trait-based model, where individuals are further characterized by their asymptotic size; and the multispecies model where additional trait differences are resolved.

4. A range of plot, community indicator and summary methods are available to inspect the results of the simulations.
Size-based predictions of food web patterns

We employ size-based theoretical arguments to derive simple analytic predictions of ecological patterns and properties of natural communities: size-spectrum exponent, maximum trophic level, and susceptibility to invasive species. The predictions are brought about by assuming that an infinite number of species are continuously distributed on a size-trait axis. It is, however, an open question whether such predictions are valid for a food web with a finite number of species embedded in a network structure. We address this question by comparing the size-based predictions to results from dynamic food web simulations with varying species richness. To this end, we develop a new size- and trait-based food web model that can be simplified into an analytically solvable size-based model. We confirm existing solutions for the size distribution and derive novel predictions for maximum trophic level and invasion resistance. Our results show that the predicted size-spectrum exponent is borne out in the simulated food webs even with few species, albeit with a systematic bias. The predicted maximum trophic level turns out to be an upper limit since simulated food webs may have a lower number of trophic levels, especially for low species richness, due to structural constraints. The size-based model possesses an evolutionary stable state and is therefore un-invadable. In contrast, the food web simulations show that all communities, irrespective of number of species, are equally open to invasions. We use these results to discuss the validity of size-based predictions in the light of the structural constraints imposed by food webs

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, National Institute of Aquatic Resources, Centre for Ocean Life, Scientific Computing, Section for Marine Ecology and Oceanography
Contributors: Zhang, L., Hartvig, M., Knudsen, K., Andersen, K. H.
Pages: 23-33
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: Theoretical Ecology
Volume: 7
ISSN (Print): 1874-1738
Ratings:
BFI (2019): BFI-level 1
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 1.48 SJR 0.873 SNIP 0.727
Web of Science (2017): Impact factor 1.453
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.81 SJR 1.149 SNIP 0.861
Web of Science (2016): Impact factor 1.221
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 1.71 SJR 1.29 SNIP 0.762
Web of Science (2015): Impact factor 2.085
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 1.86 SJR 1.42 SNIP 0.976
Web of Science (2014): Impact factor 1.553
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 2.2 SJR 1.472 SNIP 0.913
Web of Science (2013): Impact factor 1.732
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
The consequences of balanced harvesting of fish communities

Balanced harvesting, where species or individuals are exploited in accordance with their productivity, has been proposed as a way to minimize the effects of fishing on marine fish communities and ecosystems. This calls for a thorough examination of the consequences balanced harvesting has on fish community structure and yield. We use a size- and trait-based model that resolves individual interactions through competition and predation to compare balanced harvesting with traditional selective harvesting, which protects juvenile fish from fishing. Four different exploitation patterns, generated by combining selective or unselective harvesting with balanced or unbalanced fishing, are compared. We find that unselective balanced fishing, where individuals are exploited in proportion to their productivity, produces a slightly larger total maximum sustainable yield than the other exploitation patterns and, for a given yield, the least change in the relative biomass composition of the fish community. Because fishing reduces competition, predation and cannibalism within the community, the total maximum sustainable yield is achieved at high exploitation rates. The yield from unselective balanced fishing is dominated by small individuals, whereas selective fishing produces a much higher proportion of large individuals in the yield. Although unselective balanced fishing is predicted to produce the highest total maximum sustainable yield and the lowest impact on trophic structure, it is effectively a fishery predominantly targeting small forage fish.
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
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 4.18 SJR 3.422 SNIP 1.895
Web of Science (2014): Impact factor 5.051
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): CiteScore 5.08 SJR 3.441 SNIP 1.9
Web of Science (2013): Impact factor 5.292
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): CiteScore 4.99 SJR 3.258 SNIP 1.972
Web of Science (2012): Impact factor 5.683
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): CiteScore 5.02 SJR 3.555 SNIP 1.88
Web of Science (2011): Impact factor 5.415
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 3.288 SNIP 1.753
Web of Science (2010): Impact factor 5.064
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 3.345 SNIP 1.775
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 2.943 SNIP 1.563
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 2.98 SNIP 1.619
Scopus rating (2006): SJR 3.028 SNIP 1.762
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 2.767 SNIP 1.569
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 2.956 SNIP 1.724
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 2.955 SNIP 1.585
Scopus rating (2002): SJR 3.034 SNIP 1.513
Scopus rating (2001): SJR 2.721 SNIP 1.332
Web of Science (2001): Indexed yes
Scopus rating (2000): SJR 2.303 SNIP 1.408
Scopus rating (1999): SJR 2.552 SNIP 1.865

Original language: English
Electronic versions:
Analysing migrations of Atlantic cod Gadus morhua in the north-east Atlantic Ocean: Then, now and the future

The application of data storage tags bears the potential for a quantum leap in the research on fish migrations, because not only first-capture and recapture positions are known, but at least theoretically, the migration path during the period at large can be reconstructed. Position, however, cannot be measured directly but has to be estimated using the available data on light, temperature, pressure and salinity. The reconstructed locations based on advanced estimation techniques have been termed geolocations. Examples are discussed which illustrate the applicability of geolocations in individual path descriptions, separation of reproductively isolated populations, timing and areas of spawning, tidal transport and use of protected areas. The examples are based on archival tag data from the North Sea, the Baltic Sea, the Barents Sea and Faroese and Icelandic Waters. Besides presenting the state-of-the-art geolocations for cod Gadus morhua in the north-east Atlantic Ocean, the major aim of this review is to raise awareness of gaps in knowledge and to identify ideas for new research.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Department of Applied Mathematics and Computer Science, Centre for Ocean Life, Cefas Weymouth Laboratory, Marine Scotland, Swedish Institute for the Marine Environment, Institute of Marine Research, Faroe Marine Research Institute, Marine Research Institute Reykjavik
Pages: 741-763
Publication date: 2013
Peer-reviewed: Yes

Publication information
Journal: Journal of Fish Biology
Volume: 82
Issue number: 3
ISSN (Print): 0022-1112
Ratings:
BFI (2019): BFI-level 1
Web of Science (2019): Indexed yes
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
Characteristic sizes of life in the oceans - from bacteria to whales

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Centre for Ocean Life, Section for Ecosystem based Marine Management
Coexistence of structured populations with size-based prey selection

General information
State: Published
Organisations: National Institute of Aquatic Resources, Centre for Ocean Life, Section for Marine Ecology and Oceanography
Contributors: Hartvig, M., Andersen, K. H.
Pages: 24-33
Publication date: 2013
Peer-reviewed: Yes

Publication information
Journal: Theoretical Population Biology
Volume: 89
ISSN (Print): 0040-5809
Ratings:
BFI (2019): BFI-level 1
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 1.23 SJR 0.969 SNIP 0.668
Web of Science (2017): Impact factor 1.259
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.53 SJR 1.12 SNIP 0.717
Web of Science (2016): Impact factor 1.613
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 1.42 SJR 1.019 SNIP 0.71
Web of Science (2015): Impact factor 1.452
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 1.66 SJR 1.046 SNIP 0.728
Web of Science (2014): Impact factor 1.702
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 1.54 SJR 0.989 SNIP 0.828
Web of Science (2013): Impact factor 1.531
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 1.58 SJR 0.935 SNIP 0.987
Web of Science (2012): Impact factor 1.241
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 2 SJR 1.607 SNIP 1.106
Web of Science (2011): Impact factor 1.65
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.568 SNIP 0.935
Web of Science (2010): Impact factor 1.8
Web of Science (2010): Indexed yes
Comparing ecosystem models as fisheries management tools: a case study in the California current

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography
Contributors: Jacobsen, N. S., Koehn, L., Hodgson, E., Andersen, K. H., Essington, T.
Publication date: 2013
Peer-reviewed: No
Event: Abstract from International Workshop on Trait-based approaches to Ocean Life, Copenhagen, Denmark.
URLs:

Control of plankton seasonal succession by adaptive grazing
The ecological succession of phytoplankton communities in temperate seas is characterized by the dominance of nonmotile diatoms during spring and motile flagellates during summer, a pattern often linked to the seasonal variation in the physical environment and nutrient availability. We focus on the effects of adaptive zooplankton grazing behavior on the seasonal succession of temperate plankton communities in an idealized community model consisting of a zooplankton grazer and two phytoplankton species, one motile and the other nonmotile. The grazer can switch between ambush feeding on motile cells or feeding-current feeding on nonmotile cells. The feeding-current behavior imposes an additional mortality risk on the grazer, whereas ambush feeding benefits from small-scale fluid turbulence. Grazer–phytoplankton feeding interactions are forced by light and turbulence and the grazer adopts the feeding behavior that optimizes its fitness. The adaptive grazing model predicts essential features of the seasonal plankton succession reported from temperate seas, including the vertical distribution and seasonal variation in the relative abundance of motile and nonmotile phytoplankton and the seasonal variation in grazer abundance. Adaptive grazing behavior, in addition to nutrient and mixing regimes, can promote characteristic changes in the seasonal structure of phytoplankton community observed in nature.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Ocean Ecology and Climate, Section for Population Ecology and Genetics
Contributors: Mariani, P., Andersen, K. H., Visser, A., Barton, A., Kjærboe, T.
Pages: 173-184
Publication date: 2013
Peer-reviewed: Yes
Emerging asymmetric interactions between forage and predator fisheries impose management trade-offs

A size and trait-based marine community model was used to investigate interactions, with potential implications for yields, when a fishery targeting forage fish species (whose main adult diet is zooplankton) co-occurs with a fishery targeting larger-sized predator species. Predicted effects on the size structure of the fish community, growth and recruitment of fishes, and yield from the fisheries were used to identify management trade-offs among the different fisheries. Results showed that moderate fishing on forage fishes imposed only small effects on predator fisheries, whereas predator fisheries could enhance yield from forage fisheries under some circumstances.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Marine Institute, Queen's University Belfast
Contributors: Houle, J., Andersen, K. H., Farnsworth, K., Reid, D.
Pages: 890-904
Publication date: 2013
Peer-reviewed: Yes

Publication information
Journal: Journal of Fish Biology
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ISSN (Print): 0022-1112
Ratings:
BFI (2019): BFI-level 1
Web of Science (2019): Indexed yes
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
En revision af traditionelle koncepter i fiskeriet. Er balanceret fiskeri en mulig forvaltningsstrategi?

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Section for Ecosystem based Marine Management
Feeding season duration and the relative success of capital and income spawning copepods

In high latitude environments, two closely related Calanus copepods have developed opposite reproduction strategies to cope with the strongly seasonal fluctuation. Calanus finmarchicus copepods breeds relying on the available food (income breeder), while Calanus hyperboreus copepods spawn prior to the spring bloom, using only its reserves accumulated the previous year (capital breeder). The success of these two strategies is related to the length of the spring bloom, the only source of nutrients for these copepods. We use an individual based model to approach the question of income versus capital breeders in a highly seasonal environment, and find that the capital breeders have a higher fitness during short spring bloom while the income breeder has an improved performance over long productive seasons.

Food for thought: Overconfidence in model projections

There is considerable public and political interest in the state of marine ecosystems and fisheries, but the reliability of some recent projections has been called into question. New information about declining fish stocks, loss of biodiversity, climate impacts, and management failure is frequently reported in the major news media, based on publications in prominent scientific journals. Public and political awareness of the generally negative changes taking place in marine ecosystems is welcome, especially if it results in effective remedial action, but the scientific basis for such action must be reliable and uncertainties arising from models and data shortcomings must be presented fully and transparently. Scientific journals play an important role and should require more detailed analysis and presentation of uncertainties.
Individual behaviour of Baltic cod (Gadus morhua) in relation to sex and reproductive state

Information from data storage tags (DSTs) is conventionally used to infer movement patterns or reveal characteristics (e.g. temperature or salinity) of the environment surrounding tagged fish. Here we link data derived from DSTs with the reproductive physiology of tagged fish. Individual vertical activity of adult male and female Atlantic cod Gadus morhua L. in the Bornholm Basin was derived from DST measures and related to the individual histologically determined reproductive phase. Spawning migrations were identified by movements towards deeper and more saline waters. No difference was observed between sexes in the timing of the onset of migration and the duration of migration from feeding grounds to the spawning area. While there was no significant difference in duration of the spawning period between females and males, the histological indices suggest that females finish spawning before males. Irrespective of gender, vertical swimming activity was most pronounced during spawning, with descents towards the bottom dominating the movements. During spawning, males stayed significantly deeper than females. In conclusion, the present results suggest that initiation of spawning migration and duration of the spawning period differs between sexes, as does the level of activity during...
spawning events. Not all individuals followed the general pattern; a considerable number of individuals were found to spawn in shallow water in the Arkona Basin, and juvenile fish undertook the migration without spawning.
Optimal foraging and diel vertical migration in a life history model

Zooplankton such as copepods are known to perform diel vertical migration, avoiding the food rich surface during bright hours to avoid visual predator when they are most dangerous, and returning to the surface to feed at night. The resolution of this foraging behaviour requires fine time scale in the model, unsuited for life history modeling. We propose a method based on optimal foraging theory to take into account the emergent feeding rates as a function of the copepod metabolic cost, latitude, time and predation. We predict that copepods will balance their growth rate and mortality, playing a safe strategy when food is plentiful, but taking greater risks at low food concentrations. We apply these concepts to high latitude ecosystems where there is a strong seasonal variation in both food availability and day length. Specifically, during the summer, the midnight sun will force the animals to take more risk and maintain some feeding at the surface to cover their nutritional needs, compensate for predation mortality and sustain their growth.

Size-based estimation of the status of fish stocks: simulation analysis and comparison with age-based estimations

Estimation of the status of fish stocks is important for sustainable management. Data limitations and data quality hinder this task. The commonly used age-based approaches require information about individual age, which is costly and relatively inaccurate. In contrast, the size of organisms is linked to physiology more directly than is age, and can be measured easier with less cost. In this work we used a single-species size-based model to estimate the fishing mortality (F) and the status of the stock, quantified by the ratio F/Fmsy between actual fishing mortality and the fishing mortality which leads to the maximum sustainable yield. A simulation analysis was done to investigate the sensitivity of the estimation and its improvement when stock specific life history information is available. To evaluate our approach with real observations, data-rich fish stocks, like the North Sea cod, were investigated and our estimations were compared to the ICES advice. Only size-specific catch data were used, in order to emulate data limited situations. The simulation analysis reveals that the status of the stock, i.e. F/Fmsy, is estimated more accurately than the fishing mortality F itself. Specific knowledge of the natural mortality improves the estimation more than having information about all other life history parameters. Our approach gives, at least qualitatively, an estimated stock status which is similar to the results of an age-based assessment. Since our approach only uses size-based catch data, it is a suitable tool for data-limited situations.

Spawning migration and behavior of Baltic cod (Gadus morhua) based on DST-derived individual information

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography
Contributors: Behrens, J., Nielsen, B., Hussey, K., Neuenfeldt, S., Andersen, K. H., Tomkiewicz, J.
Publication date: 2013
Peer-reviewed: No
Trait-based plankton trophic interactions and community composition in a global ocean ecosystem model

**General information**

State: Published
Organisations: National Institute of Aquatic Resources, Centre for Ocean Life, Section for Marine Ecology and Oceanography
Contributors: Prowe, F., Andersen, K. H., Kiørboe, T., Visser, A.
Publication date: 2013
Peer-reviewed: No
Event: Abstract from Annual Meeting of the German Limnological society, Potsdam, Germany.
Research output: Research › Conference abstract for conference – Annual report year: 2013

Trait diversity promotes stability of community dynamics

The theoretical exploration of how diversity influences stability has traditionally been approached by species-centric methods. Here we offer an alternative approach to the diversity–stability problem by examining the stability and dynamics of size and trait distributions of individuals. The analysis is performed by comparing the properties of two size spectrum models. The first model considers all individuals as belonging to the same “average” species, i.e., without a description of diversity. The second model introduces diversity by further considering individuals by a trait, here asymptotic body size.

The dynamic properties of the models are described by a stability analysis of equilibrium solutions and by the non-equilibrium dynamics. We find that the introduction of trait diversity expands the set of parameters for which the equilibrium is stable and, if the community is unstable, makes the oscillations smaller, slower, and more regular. The stabilizing mechanism is the variation in growth rate between individuals with the same body size but different trait values.

**General information**

State: Published
Organisations: Applied functional analysis, National Institute of Aquatic Resources, Department of Mathematics, Section for Population Ecology and Genetics
Contributors: Zhang, L., Thygesen, U. H., Knudsen, K., Andersen, K. H.
Pages: 57-69
Publication date: 2013
Peer-reviewed: Yes

**Publication information**

Journal: Theoretical Ecology
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ISSN (Print): 1874-1738
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BFI (2019): BFI-level 1
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 1.48 SJR 0.873 SNIP 0.727
Web of Science (2017): Impact factor 1.453
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.81 SJR 1.149 SNIP 0.861
Web of Science (2016): Impact factor 1.221
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 1.71 SJR 1.29 SNIP 0.762
Web of Science (2015): Impact factor 2.085
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 1.86 SJR 1.42 SNIP 0.976
Web of Science (2014): Impact factor 1.553
Zooplankton feeding traits and community composition in a global ecosystem model

General information
State: Published
Organisations: National Institute of Aquatic Resources, Centre for Ocean Life, Section for Marine Ecology and Oceanography
Contributors: Prowe, F., Andersen, K. H., Kjærboe, T., Visser, A.
Publication date: 2013
Peer-reviewed: No
Event: Abstract from International Liège Colloquium, Liège, Belgium.
Research output: Research › Conference abstract for conference – Annual report year: 2013

Zooplankton feeding traits and community composition in a global ecosystem model

General information
State: Published
Organisations: National Institute of Aquatic Resources, Centre for Ocean Life, Section for Marine Ecology and Oceanography
Contributors: Prowe, F., Andersen, K. H., Kjærboe, T., Visser, A.
Publication date: 2013
Peer-reviewed: No
Event: Poster session presented at International Workshop on Trait-based approaches to Ocean Life, Copenhagen, Denmark.
Research output: Research › Poster – Annual report year: 2013

Management trade-offs emerging from forage and predator fishery interactions

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Population Ecology and Genetics
Contributors: Houle, J. E., Andersen, K. H., Farnsworth, K. D., Reid, D. G.
Publication date: 2012
Peer-reviewed: No
Event: Poster session presented at The ICES/PICES Symposium on Forage Fish Interactions, Nantes, France.
Research output: Research › Poster – Annual report year: 2012
Marine ecology and fisheries

General information
State: Published
Organisations: Section for Population Ecology and Genetics, National Institute of Aquatic Resources
Contributors: Jennings, S., Andersen, K. H., Blanchard, J. L.
Number of pages: 392
Pages: 261-270
Publication date: 2012

Host publication information
Title of host publication: Metabolic Ecology: a scaling approach
Place of publication: Oxford
Publisher: Wiley-Blackwell
Editors: Sibley, R. M., Brown, J. H., Kodric-Brown, A.
ISBN (Print): 978-0-470-67152-8
Source: orbit
Source-ID: 277475
Research output: Research - peer-review : Book chapter – Annual report year: 2012

Editorial comment: Body size and the (re)unification of ecology

General information
State: Published
Organisations: Section for Population Ecology and Genetics, National Institute of Aquatic Resources
Pages: xv-xxix
Publication date: 2011
Peer-reviewed: Yes

Publication information
Journal: Advances in Ecological Research
Volume: 45
ISSN (Print): 0065-2504
Ratings:
BFI (2019): BFI-level 2
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 4.06 SJR 2.524 SNIP 1.52
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 3.7 SJR 2.075 SNIP 1.298
Web of Science (2016): Impact factor 5.056
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 4.79 SJR 3.342 SNIP 1.807
Web of Science (2015): Impact factor 3.92
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 3.56 SJR 1.911 SNIP 1.392
Web of Science (2014): Impact factor 4.04
BFI (2013): BFI-level 2
Scopus rating (2013): CiteScore 5.07 SJR 1.393 SNIP 1.064
Web of Science (2013): Impact factor 6.25
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): CiteScore 8.17 SJR 4.264 SNIP 3.329
Web of Science (2012): Impact factor 3.08
Effects of future climate on physiology and egg production in Baltic Sea sprat

General information
State: Published
Organisations: Section for Population Ecology and Genetics, National Institute of Aquatic Resources
Contributors: Frisk, C., Temming, A., Herrmann, J., Madsen, K. S., Andersen, K. H.
Publication date: 2011
Peer-reviewed: No
Event: Poster session presented at ICES Council Meeting 2011, Gdansk, Poland.

Food web framework for size-structured populations
We synthesise traditional unstructured food webs, allometric body size scaling, trait-based modelling, and physiologically structured modelling to provide a novel and ecologically relevant tool for size-structured food webs. The framework allows food web models to include ontogenetic growth and life-history omnivory at the individual level by resolving the population structure of each species as a size-spectrum. Each species is characterised by the trait 'size at maturation', and all model parameters are made species independent through scaling with individual body size and size at maturation. Parameter values are determined from cross-species analysis of fish communities as life-history omnivory is widespread in aquatic systems, but may be reparameterised for other systems. An ensemble of food webs is generated and the resulting communities are analysed at four levels of organisation: community level, species level, trait level, and individual level. The model may be solved analytically by assuming that the community spectrum follows a power law. The analytical solution provides a baseline expectation of the results of complex food web simulations, and agrees well with the predictions of the full model on biomass distribution as a function of individual size, biomass distribution as a function of size at maturation, and relation between predator–prey mass ratio of preferred and eaten food. The full model additionally
predicts the diversity distribution as a function of size at maturation.

**General information**
State: Published
Organisations: Section for Population Ecology and Genetics, National Institute of Aquatic Resources
Contributors: Hartvig, M., Andersen, K. H., Beyer, J.
Pages: 113-122
Publication date: 2011
Peer-reviewed: Yes

**Publication information**
Journal: Journal of Theoretical Biology
Volume: 272
Issue number: 1
ISSN (Print): 0022-5193
Ratings:
BFI (2019): BFI-level 1
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 1.93 SJR 0.746 SNIP 0.83
Web of Science (2017): Impact factor 1.833
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.16 SJR 0.934 SNIP 0.915
Web of Science (2016): Impact factor 2.113
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 2.21 SJR 1.072 SNIP 0.989
Web of Science (2015): Impact factor 2.049
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 2.25 SJR 1.076 SNIP 1.035
Web of Science (2014): Impact factor 2.116
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 2.44 SJR 1.044 SNIP 1.039
Web of Science (2013): Impact factor 2.303
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 2.5 SJR 0.947 SNIP 1.032
Web of Science (2012): Impact factor 2.351
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 2.44 SJR 0.81 SNIP 1.019
Web of Science (2011): Impact factor 2.208
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.081 SNIP 0.972
Web of Science (2010): Impact factor 2.371
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.139 SNIP 1.067
General classification of maturation reaction-norm shape from size-based processes

Phenotypic plasticity of size at maturation is commonly described using size–age maturation reaction norms (MRNs). MRNs for age and size at maturation are analyzed and classified into three general categories related to different size scalings of growth and mortality. The underlying model for growth and mortality is based on processes at the level of the individual, and is motivated by the energy budget of fish. MRN shape is a balance between opposing factors and depends on subtle details of size dependence of growth and mortality. MRNs with both positive and negative slopes are predicted, and for certain mortality conditions also a lower critical spawning mass. The model is applied to predict a generic fishery-induced evolutionary response and allows assessment of climate change impact on MRNs. Our work stresses the importance of using realistic size dependence of mortality and growth, since this strongly influences the predicted MRNs and sensitivity to harvest pressure.

General information

State: Published
Organisations: Section for Population Ecology and Genetics, National Institute of Aquatic Resources
Contributors: Christensen, A., Andersen, K. H.
Pages: 1004-1027
Publication date: 2011
Peer-reviewed: Yes

Publication information

Journal: Bulletin of Mathematical Biology
Volume: 73
Issue number: 5
ISSN (Print): 0092-8240
Ratings:
BFI (2019): BFI-level 2
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 1.47 SJR 0.717 SNIP 0.944
Web of Science (2017): Impact factor 1.484
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scenarios of ecological and economic consequences of rebuilding paths of depleted populations

General information
State: Published
Organisations: Section for Population Ecology and Genetics, National Institute of Aquatic Resources, Section for Ocean Ecology and Climate
Calculation of expected rates of fisheries-induced evolution in data-poor situations

A central part of an impact assessment of the evolutionary effects of fishing is a calculation of the expected rates of fishing induced by current fishing practice and an evaluation of how alternative fishing patterns may reduce evolutionary impacts of fishing. Here a general size-based framework for modeling the demography of fish based on size-based prescriptions of natural mortality, growth, and fishing is presented. Life history theory is used to reduce the necessary parameter set by utilizing relations between parameters making the framework particularly well suited for data-poor situations where only the size at maturation or the asymptotic size is known. The framework is applied to perform the modeling part of an evolutionary impact assessment using basic quantitative genetics to calculated expected rates of evolution on size at maturation, growth rate, and investment in gonads. A sensitivity analysis of the parameter values is performed, and calculations of how different fishing patterns influences the results are presented.
in predation mortality and food limitation. The cascade is damped as it comes further away from the perturbed trophic level. Fishing on several trophic levels leads to a disappearance of the signature of the trophic cascade. Differences in fishing patterns among ecosystems might influence whether a trophic cascade is observed.

**General information**

State: Published
Organisations: Section for Population Ecology and Genetics, National Institute of Aquatic Resources
Contributors: Andersen, K. H., Pedersen, M.
Pages: 795-802
Publication date: 2010
Peer-reviewed: Yes

**Publication information**

Journal: Royal Society of London. Proceedings. Biological Sciences
Volume: 277
Issue number: 1682
ISSN (Print): 0962-8452
Ratings:
BFI (2019): BFI-level 2
Web of Science (2019): Indexed yes
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
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 4.18 SJR 3.422 SNIP 1.895
Web of Science (2014): Impact factor 5.051
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): CiteScore 5.08 SJR 3.441 SNIP 1.9
Web of Science (2013): Impact factor 5.292
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): CiteScore 4.99 SJR 3.258 SNIP 1.972
Web of Science (2012): Impact factor 5.683
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): CiteScore 5.02 SJR 3.555 SNIP 1.88
Web of Science (2011): Impact factor 5.415
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 3.288 SNIP 1.753
Web of Science (2010): Impact factor 5.064
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Deriving fish behaviour related patterns in fishing pressure from DST data

General information
State: Published
Organisations: Section for Population Ecology and Genetics, National Institute of Aquatic Resources
Contributors: Neuenfeldt, S., Andersen, K. H., Kristensen, K.
Publication date: 2010
Peer-reviewed: No
URLs:
Source: orbit
Source-ID: 256646
Research output: Research › Poster – Annual report year: 2010

Direct and indirect community effects of rebuilding plans
Many fish communities are heavily exploited and rebuilding plans need to be implemented for depleted species. Within an ecosystem approach to management, development of rebuilding plans should include consideration of the expected consequences of the rebuilding of the target species on the rest of the marine community. Using size- and trait-based single-species and community models, a general assessment is made of the direct and indirect ecological consequences of a rebuilding plan based on a reduction in fishing mortality. If fishing mortality is sufficiently reduced, the time-scale of rebuilding is in the order of the time to reach maturation of an individual, and the expected trajectory can be reliably predicted by a single-species model. Indirect effects of increased abundance are a decrease in individuals in the trophic levels above and below the target species. The decrease in biomass of the neighbouring trophic levels is expected to be much smaller than the increase in the target species and to be largest in species on the trophic level above. We discuss which effects could be responsible when a rebuilding plan does not result in the expected increase and how our results could be applied in a practical management situation.

General information
State: Published
Organisations: Section for Population Ecology and Genetics, National Institute of Aquatic Resources
Contributors: Andersen, K. H., Rice, J. C.
Pages: 1980-1988
Publication date: 2010
How Gaussian competition leads to lumpy or uniform species distributions

A central model in theoretical ecology considers the competition of a range of species for a broad spectrum of resources. Recent studies have shown that essentially two different outcomes are possible. Either the species surviving competition are more or less uniformly distributed over the resource spectrum, or their distribution is "lumped" (or "clumped"), consisting of clusters of species with similar resource use that are separated by gaps in resource space. Which of these outcomes will occur crucially depends on the competition kernel, which reflects the shape of the resource utilization pattern of the competing species. Most models considered in the literature assume a Gaussian competition kernel. This is unfortunate, since predictions based on such a Gaussian assumption are not robust. In fact, Gaussian kernels are a border case scenario, and slight deviations from this function can lead to either uniform or lumped species distributions. Here, we illustrate the non-robustness of the Gaussian assumption by simulating different implementations of the standard competition model with constant carrying capacity. In this scenario, lumped species distributions can come about by secondary ecological or evolutionary mechanisms or by details of the numerical implementation of the model. We analyze the origin of this sensitivity and discuss it in the context of recent applications of the model.

General information

State: Published
Organisations: Section for Population Ecology and Genetics, National Institute of Aquatic Resources, Universitat de les Illes Balears, University of Copenhagen
Pages: 89-96
Publication date: 2010
Peer-reviewed: Yes

Publication information
Journal: Theoretical Ecology
Volume: 3
Issue number: 2
ISSN (Print): 1874-1738
Ratings:
BFI (2019): BFI-level 1
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 1.48 SJR 0.873 SNIP 0.727
Web of Science (2017): Impact factor 1.453
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.81 SJR 1.149 SNIP 0.861
Web of Science (2016): Impact factor 1.221
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 1.71 SJR 1.29 SNIP 0.762
Web of Science (2015): Impact factor 2.085
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 1.86 SJR 1.42 SNIP 0.976
Web of Science (2014): Impact factor 1.553
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 2.2 SJR 1.472 SNIP 0.913
Web of Science (2013): Impact factor 1.732
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 2.4 SJR 1.661 SNIP 1.041
Web of Science (2012): Impact factor 2.052
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 1.74 SJR 1.346 SNIP 0.692
Web of Science (2011): Impact factor 1.545
ISI indexed (2011): ISI indexed no
Scopus rating (2010): SJR 1.176 SNIP 0.923
Web of Science (2010): Impact factor 1.364
Web of Science (2010): Indexed yes
Scopus rating (2009): SJR 0.996 SNIP 0.68
Original language: English
DOIs:
10.1007/s12080-009-0056-2
Source: orbit
Source-ID: 252524
Research output: Research - peer-review › Journal article – Annual report year: 2010

Size-based assessment of ecosystem effects of fishery management decisions

General information
State: Published
Organisations: Section for Population Ecology and Genetics, National Institute of Aquatic Resources
Contributors: Andersen, K. H., Berg, C. W.
Publication date: 2010
Peer-reviewed: No
URLs:
http://www.ices.dk/products/CMdocs/CM-2010/C/C2510.pdf
Source: orbit
Source-ID: 267499
Research output: Research › Poster – Annual report year: 2010

Thermal niche of Atlantic cod Gadus morhua: limits, tolerance and optima

Recent studies in the marine environment have suggested that the limited phenotypic plasticity of cold-adapted species such as Atlantic cod Gadus morhua L. will cause distributions to shift toward the poles in response to rising sea temperatures. Some cod stocks are predicted to collapse, but this remains speculative because almost no information is available on the thermal tolerance of cod in its natural environment. We used electronic tags to measure the thermal experience of 384 adult Atlantic cod from 8 different stocks in the northeast Atlantic. Over 100000 d of data were collected in total. The data demonstrate that cod is an adaptable and tolerant species capable of surviving and growing in a wide range of temperate marine climates. The total thermal niche ranged from −1.5 to 19°C; this range was narrower (1 to 8°C) during the spawning season. Cod in each of the stocks studied had a thermal niche of approximately 12°C, but latitudinal differences in water temperature meant that cod in the warmer, southern regions experienced 3 times the degree days (DD; ~4000 DD yr−1) than individuals from northern regions (~1200 DD yr−1). Growth rates increased with temperature, reaching a maximum in those cod with a mean thermal history of between 8 and 10°C. Our direct observations of habitat occupation suggest that adult cod will be able to tolerate warming seas, but that climate change will affect cod populations at earlier life-history stages as well as exerting effects on cod prey species.

General information
State: Published
Organisations: Section for Population Ecology and Genetics, National Institute of Aquatic Resources
Pages: 1-13
Expected rate of fisheries-induced evolution is slow

Commercial fisheries exert high mortalities on the stocks they exploit, and the consequent selection pressure leads to fisheries-induced evolution of growth rate, age and size at maturation, and reproductive output. Productivity and yields may decline as a result, but little is known about the rate at which such changes are likely to occur. Fisheries-induced evolution of exploited populations has recently become a subject of concern for policy makers, fisheries managers, and the general public, with prominent calls for mitigating management action. We make a general evolutionary impact assessment of fisheries by calculating the expected rate of fisheries-induced evolution and the consequent changes in yield. Rates of evolution are expected to be ≈0.1–0.6% per year, and the consequent reductions in fisheries yield are <0.7% per year. These rates are at least a factor of 5 lower than published values based on experiments and analyses of population time series, and we explain why the published rates may be overestimates. Dealing with evolutionary effects of fishing is less urgent than reducing the direct detrimental effects of overfishing on exploited stocks and on their marine ecosystems.
Expected rate of fisheries-induced evolution is slow

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General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Centre for Ocean Life
Contributors: Andersen, K. H., Brander, K.
Publication date: 2009
Peer-reviewed: No
Event: Poster session presented at ICES/PICES/UNCOVER Symposium 2009 on Rebuilding Depleted Fish Stocks, Warnemünde/Rostock, Germany.
Research output: Research - peer-review → Journal article – Annual report year: 2009

How community ecology links natural mortality, growth, and production of fish populations

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources
Contributors: Andersen, K. H., Farnsworth, K., Pedersen, M., Gislason, H., Beyer, J.
Pages: 1978-1984
Publication date: 2009
Peer-reviewed: Yes

Publication information
Journal: ICES Journal of Marine Science
Volume: 66
Issue number: 9
ISSN (Print): 1054-3139
Ratings:
BFI (2019): BFI-level 1
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 1
Hvorfor kører Michael Rasmussen så hurtigt op ad bakke? Og hvorfor vinder Tom Boonen spurterne?

**Indirect effects of recovery strategies**

For a higher organism to grow another organism has to die. This obvious and fundamental relation means that if one species group increases in abundance, the prey species will suffer increased mortality. One the other hand, the predators of said species will have a more abundant food supply. Size-based models of fish communities indicate that that relationship has lawful dynamics that continue to be expressed, even when individuals species become rarer - as predators or as prey. An ecosystem based management recovery strategies of a given species or group of species should therefore not be seen in isolation, but the expected consequences for the rest of the ecosystem must be analyzed. We use a general size- and trait-based model to calculate the ecosystem effects of fishing and recovery. We present a general analysis of a recovery strategies targeting either large fishes (consumer fishery), small fishes (forage fish fishery), or the ecosystem as a whole. We calculate expected recovery time and demonstrate indirect effects on prey, predators and beyond, and provide some insight into the relative difficulty of selective rebuilding of populations of large or small fish.

**Optimal behaviour and dynamical impact in a plankton predator-prey system**

We use a general size- and trait-based model to calculate the ecosystem effects of fishing and recovery. We present a general analysis of a recovery strategies targeting either large fishes (consumer fishery), small fishes (forage fish fishery), or the ecosystem as a whole. We calculate expected recovery time and demonstrate indirect effects on prey, predators and beyond, and provide some insight into the relative difficulty of selective rebuilding of populations of large or small fish.

**Reply to Kinnison et al.: Effects of fishing on phenotypes**

We use a general size- and trait-based model to calculate the ecosystem effects of fishing and recovery. We present a general analysis of a recovery strategies targeting either large fishes (consumer fishery), small fishes (forage fish fishery), or the ecosystem as a whole. We calculate expected recovery time and demonstrate indirect effects on prey, predators and beyond, and provide some insight into the relative difficulty of selective rebuilding of populations of large or small fish.
Some Atlantic cod Gadus morhua in the Baltic Sea visit hypoxic water briefly but often

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources
Contributors: Neuenfeldt, S., Andersen, K. H., Hinrichsen, H.
Pages: 290-294
Publication date: 2009
Peer-reviewed: Yes

Publication information
Journal: Journal of Fish Biology
Volume: 75
Issue number: 1
ISSN (Print): 0022-1112
Ratings:
BFI (2019): BFI-level 1
Web of Science (2019): Indexed yes
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
Species competition: coexistence, exclusion and clustering

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources
Contributors: Hernandez-Garcia, E., Lopez, C., Pigolotti, S., Andersen, K. H.
Pages: 3183-3195
Publication date: 2009
Peer-reviewed: Yes
Trophic and individual efficiencies of size-structured communities

Individual and trophic efficiencies of size-structured communities are derived from mechanistically based principles at the individual level. The derivations are relevant for communities with a size-based trophic structure, i.e. where trophic level is strongly correlated with individual size as in many aquatic systems. The derivations are used to link Lindeman's trophic theory and trophic theory based on average individuals with explicit individual-level size spectrum theory. The trophic efficiency based on the transfer of mass between trophic levels through predator-prey interactions is demonstrated to be valid only when somatic growth can be ignored. Taking somatic growth into account yields an average individual growth efficiency that is smaller than the trophic efficiency.
Atlantic cod Gadus morhua L. in the Baltic Sea visit hypoxic water briefly but often

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources
Contributors: Neuenfeldt, S., Andersen, K. H., Hinrichsen, H.
Publication date: 2008
Peer-reviewed: No
Source: orbit
Source-ID: 229166
Research output: Research - peer-review › Journal article – Annual report year: 2009

Geolocation of North Sea cod (Gadus morhua) using Hidden Markov Models and behavioural switching
When geolocating fish based on archival tag data, a realistic assessment of uncertainty is essential. Here, we describe an application of a novel Fokker–Planck-based method to geolocate Atlantic cod (Gadus morhua) in the North Sea area. In this study, the geolocation relies mainly on matching tidal patterns in depth measurements when a fish spends a prolonged period of time at the seabed with a tidal database. Each day, the method provides a nonparametric probability
distribution of the position of a tagged fish and therefore avoids enforcing a particular distribution, such as a Gaussian
distribution. In addition to the tidal component of the geolocation, the model incorporates two behavioural states, either high
or low activity, estimated directly from the depth data, that affect the diffusivity parameter of the model and improves the
precision and realism of the geolocation significantly. The new method provides access to the probability distribution of the
position of the fish that in turn provides a range of useful descriptive statistics, such as the path of the most probable
movement. We compare the method with existing alternatives and discuss its potential in making population inference
from archival tag data.

General information
State: Published
Organisations: Mathematical Statistics, Department of Informatics and Mathematical Modeling, Section for Population- and
Ecosystem Dynamics, National Institute of Aquatic Resources
Pages: 2367-2377
Publication date: 2008
Peer-reviewed: Yes

Publication information
Journal: Canadian Journal of Fisheries and Aquatic Sciences
Volume: 65
Issue number: 11
ISSN (Print): 0706-652X
Ratings:
BFI (2019): BFI-level 2
Web of Science (2019): Indexed yes
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
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
Hvad betyder Øresund for naboområderne?

**General information**

State: Published  
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources  
Contributors: Neuenfeldt, S., Andersen, K. H.  
Pages: 7  
Publication date: 2008  
Peer-reviewed: Unknown

**Publication information**

Journal: Fiskeri Tidende  
Volume: 15  
Issue number: 7  
ISSN (Print): 0909-7325  
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: 249822

Research output: Communication › Contribution to newspaper - Newspaper article – Annual report year: 2008
Life-history constraints on the success of the many small eggs reproductive strategy
The reproductive strategy of most fishes is to produce a large number of tiny eggs, leading to a huge difference between egg size and asymptotic body size. The viability of this strategy is examined by calculating the life-time reproductive success $R_0$ as a function of the asymptotic body size. A simple criterion for the optimality of producing small eggs is found, depending on the rate of predation relative to the specific rate of consumption. Secondly it is shown that the success of the reproductive strategy is increasing with asymptotic body size. Finally the existence of both upper and lower limits on the allowed asymptotic sizes is demonstrated. A metabolic upper limit to asymptotic body size for all higher animals is derived.
Process-based model for direct and indirect effects of hydrographic conditions on Central Baltic (Gadus morhua) cod egg mortality

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources, Institute Management
Contributors: Andersen, K. H., Möllmann, C., Köster, F.
Pages: 84-88
Publication date: 2008
Peer-reviewed: Yes

Publication information
Journal: Fisheries Oceanography
Volume: 17
Issue number: 2
ISSN (Print): 1054-6006
Ratings:
BFI (2019): BFI-level 2
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 1.86
Web of Science (2017): Impact factor 1.794
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.19
Web of Science (2016): Impact factor 1.578
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 2.4
Web of Science (2015): Impact factor 2.73
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 2.61
Trophic cascades in size-spectra

General information
State: Published
Organisations: Section for Population Ecology and Genetics, National Institute of Aquatic Resources
Contributors: Andersen, K. H.
Publication date: 2008
Peer-reviewed: No

Publication information
Journal: ICES C.M.
Volume: F:09
Original language: English
Source: orbit
Source-ID: 224701
Research output: Research › Journal article – Annual report year: 2008

Eulerian techniques for individual-based models with additive components

General information
Reconstructing migrations of individual cod (Gadus morhua L.) in the Baltic Sea by using electronic data storage tags

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources, Section for Fisheries Advice
Contributors: Neuenfeldt, S., Hinrichsen, H., Nielsen, A., Andersen, K. H.
Pages: 526-535
Publication date: 2007
Peer-reviewed: Yes

Publication information
Journal: Fisheries Oceanography
Volume: 16
Issue number: 6
ISSN (Print): 1054-6006
Ratings:
BFI (2019): BFI-level 2
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 1.86
Web of Science (2017): Impact factor 1.794
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.19
Web of Science (2016): Impact factor 1.578
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 2.4
Web of Science (2015): Impact factor 2.73
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 2.61
Web of Science (2014): Impact factor 2.543
Spatia and temporal heterogeneity of the cod spawning environment in the Bornholm Basin, Baltic Sea

General information
State: Published
Organisations: Section for Monitoring, National Institute of Aquatic Resources, Institute Management, Section for Population- and Ecosystem Dynamics
Contributors: Hinrichsen, H., Voss, R., Wieland, K., Köster, F., Andersen, K. H., Margonski, P.
Pages: 245-254
Publication date: 2007
Peer-reviewed: Yes

Publication information
Journal: Marine Ecology - Progress Series
Volume: 345
ISSN (Print): 0171-8630
Ratings:
BFI (2019): BFI-level 2
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2

DOI: 10.1111/j.1365-2419.2007.00458.x
Source: orbit
Source-ID: 226764
Research output: Research - peer-review » Journal article – Annual report year: 2007
The evolutionary pressure from fishing on size at maturation of Baltic cod
Using the particle filter to geolocate Atlantic cod (Gadus morhua) in the Baltic Sea, with special emphasis on determining uncertainty

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources, Section for Population Ecology and Genetics
Contributors: Andersen, K. H., Nielsen, A., Thygesen, U. H., Hinrichsen, H., Neuenfeldt, S.
Pages: 618-627
Publication date: 2007
Peer-reviewed: Yes

Publication information
Journal: Canadian Journal of Fisheries and Aquatic Sciences
Volume: 64
Issue number: 4
ISSN (Print): 0706-652X
Ratings:
BFI (2019): BFI-level 2
Web of Science (2019): Indexed yes
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
Asymptotic size determines species abundance in the marine size spectrum

The majority of higher organisms in the marine environment display indeterminate growth; that is, they continue to grow throughout their life, limited by an asymptotic size. We derive the abundance of species as a function of their asymptotic size. The derivation is based on size-spectrum theory, where population structure is derived from physiology and simple
arguments regarding the predator-prey interaction. Using a hypothesis of constant satiation, which states that the average degree of satiation is independent of the size of an organism, the number of individuals with a given size is found to be proportional to the weight raised to the power -2.05, independent of the predator/prey size ratio. This is the first time the spectrum exponent has been derived solely on the basis of processes at the individual level. The theory furthermore predicts that the parameters in the von Bertalanffy growth function are related as K proportional to L-infinity(-1).

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources
Contributors: Andersen, K. H., Beyer, J.
Pages: 54-61
Publication date: 2006
Peer-reviewed: Yes

Publication information
Journal: American Naturalist
Volume: 168
Issue number: 1
ISSN (Print): 0003-0147
Ratings:
BFI (2019): BFI-level 2
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 3.81 SJR 2.661 SNIP 1.321
Web of Science (2017): Impact factor 4.265
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 3.63 SJR 2.823 SNIP 1.363
Web of Science (2016): Impact factor 4.167
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 3.52 SJR 2.841 SNIP 1.356
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 4.22 SJR 3.283 SNIP 1.6
Web of Science (2014): Impact factor 3.832
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): CiteScore 4.52 SJR 3.206 SNIP 1.638
Web of Science (2013): Impact factor 4.454
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): CiteScore 4.68 SJR 3.446 SNIP 1.666
Web of Science (2012): Impact factor 4.552
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): CiteScore 4.72 SJR 3.911 SNIP 1.703
Web of Science (2011): Impact factor 4.725
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 4.26 SNIP 1.751
Web of Science (2010): Impact factor 4.736
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 4.015 SNIP 1.756
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 4.067 SNIP 1.716
Scopus rating (2007): SJR 4.327 SNIP 1.864
Scopus rating (2006): SJR 4.39 SNIP 1.991
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 4.031 SNIP 1.996
Scopus rating (2004): SJR 4.124 SNIP 2.02
Scopus rating (2003): SJR 4.18 SNIP 2.215
Scopus rating (2001): SJR 4.044 SNIP 1.992
Scopus rating (2000): SJR 4.341 SNIP 2.086
Scopus rating (1999): SJR 4.056 SNIP 1.951
Original language: English
DOIs:
10.1086/504849
Source: orbit
Source-ID: 224697
Research output: Research - peer-review › Journal article – Annual report year: 2006

Geolocation of tagged Baltic Cod using the particle filter

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources, Section for Fisheries Advice
Contributors: Andersen, K. H., Nielsen, A., Thygesen, U. H., Hinrichsen, H., Neuenfeldt, S.
Pages: 1-2
Publication date: 2006

Host publication information
Title of host publication: International Council for the Exploration of the Sea
Volume: Q:05
Place of publication: Copenhagen
Publisher: I C E S
ISBN (Print): 87-7482-051-6
(ICES C.M. 2006/; No. Q:05).

Bibliographical note
Extended abstract
Source: orbit
Source-ID: 284450
Research output: Research › Conference abstract in proceedings – Annual report year: 2006

Management options for reversing depressed maturation-size in Baltic Cod

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources
Contributors: Andersen, K. H., Farnsworth, K., Thygesen, U. H., Beyer, J.
Pages: 1-3
Publication date: 2006

Host publication information
Title of host publication: International Council for the Exploration of the Sea
Volume: H:04
Place of publication: Copenhagen
Publisher: I C E S
ISBN (Print): 87-7482-051-6
(ICES C.M./2006; No. H:04).

Bibliographical note
Extended abstract
Source: orbit
Torskens hemmelige liv

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources
Contributors: Andersen, K. H., Neuenfeldt, S.
Pages: 3-10
Publication date: 2006
Peer-reviewed: No

Publication information
Journal: Fisk og Hav
Issue number: 61
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:
Source: orbit
Source-ID: 224704
Research output: Research › Journal article – Annual report year: 2006

How optimal life history changes with the community size-spectrum

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources
Contributors: Thygesen, U. H., Farnsworth, K., Andersen, K. H., Beyer, J.
Pages: 1323-1331
Publication date: 2005
Peer-reviewed: Yes

Publication information
Journal: Proceedings of the Royal Society B-Biological Sciences
Volume: 272
Issue number: 1570
ISSN (Print): 0962-8452
Ratings:
BFI (2019): BFI-level 2
Web of Science (2019): Indexed yes
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
Web of Science (2015): Indexed yes
Corridors of barchan dunes: Stability and size selection

Barchans are crescentic dunes propagating on a solid ground. They form dune fields in the shape of elongated corridors in which the size and spacing between dunes are rather well selected. We show that even very realistic models for solitary dunes do not reproduce these corridors. Instead, two instabilities take place. First, barchans receive a sand flux at their back proportional to their width while the sand escapes only from their horns. Large dunes proportionally capture more sand than they lose, while the situation is reversed for small ones: therefore, solitary dunes cannot remain in a steady state. Second, the propagation speed of dunes decreases with the size of the dune: this leads, through the collision process, to a coarsening of barchan fields. We show that these phenomena are not specific to the model, but result from general and robust mechanisms. The length scales needed for these instabilities to develop are derived and discussed. They turn out to be much smaller than the dune field length. As a conclusion, there should exist further, yet unknown,
mechanisms regulating and selecting the size of dunes.

**General information**

State: Published
Organisations: Department of Mechanical Engineering, Laboratoire de Physique Statistique de l'ENS, Universite Ibn Zohr, Laboratoire des Milieux Désordonnés et Hétérogènes
Pages: 011304
Publication date: 2004
Peer-reviewed: Yes

**Publication information**

Volume: 69
Issue number: 1
ISSN (Print): 1063-651X
Ratings:
BFI (2019): BFI-level 1
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 2.14 SJR 0.979 SNIP 0.987
Web of Science (2017): Impact factor 2.284
Web of Science (2017): Indexed yes
Scopus rating (2016): CiteScore 1.95 SJR 1.271 SNIP 1.018
Web of Science (2016): Impact factor 2.366
Web of Science (2016): Indexed yes
Scopus rating (2015): CiteScore 1.89 SJR 1.183 SNIP 1.043
Web of Science (2015): Impact factor 2.252
Web of Science (2015): Indexed yes
Scopus rating (2014): CiteScore 2.05 SJR 1.244 SNIP 1.135
Web of Science (2014): Indexed yes
Scopus rating (2013): CiteScore 2.28 SJR 1.307 SNIP 1.214
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
Scopus rating (2012): CiteScore 2.28 SJR 1.414 SNIP 1.205
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
Scopus rating (2011): CiteScore 2.28 SJR 1.48 SNIP 1.211
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
Scopus rating (2010): SJR 1.692 SNIP 1.203
Web of Science (2010): Indexed yes
Scopus rating (2009): SJR 1.708 SNIP 1.246
Web of Science (2009): Indexed yes
Scopus rating (2008): SJR 1.972 SNIP 1.298
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.615 SNIP 1.063
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.266 SNIP 0.867
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 1.204 SNIP 0.795
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 1.194 SNIP 0.907
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 1.366 SNIP 1.127
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 1.962 SNIP 1.106
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 1.904 SNIP 1.637
Web of Science (2001): Indexed yes
Scopus rating (2000): SJR 1.84 SNIP 1.249
Web of Science (2000): Indexed yes
Scopus rating (1999): SJR 1.88 SNIP 1.225
Original language: English
Keywords: THRESHOLD, CALIFORNIA, SLOPE, HILLS, SOUTHERN PERU, VELOCITIES, WIND-FLOW, SALTATION, SHAPES, IMPERIAL VALLEY
Electronic versions:
Hersen.pdf
DOIs:
10.1103/PhysRevE.69.011304
URLs:

Bibliographical note
Source: orbit
Source-ID: 259622
Research output: Research - peer-review › Journal article – Annual report year: 2004

Process oriented model of egg mortality for Central Baltic cod, Gadus morhua callarias L.

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources
Contributors: Andersen, K. H., Möllmann, C.
Pages: 1-14
Publication date: 2004
Peer-reviewed: No

Publication information
Journal: ICES C.M. 2004/
Volume: P:25
Original language: English
Source: orbit
Source-ID: 224702
Research output: Research › Conference article – Annual report year: 2004

The wave plus current flow over vortex ripples at an arbitrary angle
This work concerns the wave plus current flow over a sand bed covered by vortex ripples, with the current and the waves coming from different angles. Experiments were performed in a basin, where current and waves were perpendicular, in order to determine the conditions (current strength) leading to a regular ripple pattern formation. Numerical simulations were conducted changing the direction between the waves and the current from 0 degrees to 90 degrees and the ratio between the current strength and the wave orbital velocity from 0.2 to 1.5. Close to the bed, the current aligns parallel to the ripple crests, leading to a veering current profile with the vertical coordinate. The current-related friction coefficient was calculated. It was found that it decreases as the angle approaches 90 degrees, while it increases for decreasing values of the current with a trend that can be described by a power law. (C) 2002 Elsevier Science B.V. All rights reserved.

General information
State: Published
Organisations: Department of Mechanical Engineering, National Institute of Aquatic Resources, Centre for Ocean Life, University of Catania
Contributors: Andersen, K. H., Faraci, C.
Pages: 431-441
Publication date: 2003
Peer-reviewed: Yes
Pattern dynamics of vortex ripples in sand: Nonlinear modeling and experimental validation

Vortex ripples in sand are studied experimentally in a one-dimensional setup with periodic boundary conditions. The nonlinear evolution, far from the onset of instability, is analyzed in the framework of a simple model developed for homogeneous patterns. The interaction function describing the mass transport between neighboring ripples is extracted from experimental runs using a recently proposed method for data analysis, and the predictions of the model are compared to the experiment. An analytic explanation of the wavelength selection mechanism in the model is provided, and the width of the stable band of ripples is measured.

General information
State: Published
Organisations: Department of Mechanical Engineering, Universität Potsdam, Universität Duisburg-Essen, University of Copenhagen
Contributors: Andersen, K. H., Abel, M., Krug, J., Ellegaard, C., Søndergaard, L. R., Udesen, J.
Pages: 234302
Publication date: 2002
Peer-reviewed: Yes

Publication information
Journal: Physical Review Letters
Volume: 88
Issue number: 23
ISSN (Print): 0031-9007
Ratings:
BFI (2019): BFI-level 2
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 7.58 SJR 3.622 SNIP 2.464
Web of Science (2017): Impact factor 8.839
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 6.33 SJR 4.196 SNIP 2.61
Web of Science (2016): Impact factor 8.462
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
A particle model of rolling grain ripples under waves

A simple model for the formation of rolling grain ripples on a flat sand bed by the oscillatory flow generated by a surface wave is presented. An equation of motion is derived for the individual ripples, seen as "particles," on the otherwise flat bed. The model accounts for the initial appearance of the ripples, the subsequent coarsening of the ripples, and the final equilibrium state. The model is related to the physical parameters of the problem, and an analytical approximation for the equilibrium spacing of the ripples is developed. It is found that the spacing between the ripples scales with the square-root of the nondimensional shear stress (the Shields parameter) on a flat bed. The results of the model are compared with measurements, and reasonable agreement between the model and the measurements is demonstrated. ©2001 American Institute of Physics.

General information
State: Published
Organisations: Department of Hydrodynamics and Water Resources
Contributors: Andersen, K. H.
Pages: 58-64
Publication date: 2001
Peer-reviewed: Yes

Publication information
Journal: Physics of Fluids
Volume: 13
Issue number: 1
ISSN (Print): 1070-6631
Ratings:
BFI (2019): BFI-level 1
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 2.51 SJR 1.19 SNIP 1.278
Web of Science (2017): Impact factor 2.279
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.16 SJR 1.331 SNIP 1.356
Web of Science (2016): Impact factor 2.232
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.35 SNIP 1.282
Web of Science (2015): Impact factor 2.017
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.375 SNIP 1.414
Web of Science (2014): Impact factor 2.031
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.419 SNIP 1.471
Web of Science (2013): Impact factor 2.04
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.202 SNIP 1.44
Web of Science (2012): Impact factor 1.942
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
We introduce order parameter models for describing the dynamics of sand ripple patterns under oscillatory flow. A crucial ingredient of these models is the mass transport between adjacent ripples, which we obtain from detailed numerical simulations for a range of ripple sizes. Using this mass transport function, our models predict the existence of a stable band of wave numbers limited by secondary instabilities. Small ripples coarsen in our models and this process leads to a sharply selected final wave number, in agreement with experimental observations.
Pattern formation - Instabilities in sand ripples
Sand ripples are seen below shallow wavy water and are formed whenever water oscillates over a bed of sand. Here we analyse the instabilities that can upset this perfect patterning when the ripples are subjected to large changes in driving amplitude or frequency, causing them to deform both parallel and transverse to their crests. Our results reveal new pattern-forming instabilities in granular matter exposed to fluid flow with strong vorticity.

General information
State: Published
Organisations: Technical University of Denmark, Technical University of Denmark, Danish Defence Research Establishment
Pages: 324-324
Publication date: 2001
Peer-reviewed: Yes

Publication information
Journal: Nature
Volume: 410
Issue number: 6826
ISSN (Print): 0028-0836
Ratings:
BFI (2019): BFI-level 3
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 3
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 14.59
Web of Science (2017): Impact factor 19.181
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 13.33
Web of Science (2016): Impact factor 19.304
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 14.38
Web of Science (2015): Impact factor 17.184
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 14.22
Web of Science (2014): Impact factor 14.547
Stability balloon for two-dimensional vortex ripple patterns

Patterns of vortex ripples form when a sand bed is subjected to an oscillatory fluid flow. Here we describe experiments on the response of regular vortex ripple patterns to sudden changes of the driving amplitude a or frequency f. A sufficient decrease of f leads to a "freezing" of the pattern, while a sufficient increase of f leads to a supercritical secondary "pearling" instability. Sufficient changes in the amplitude a lead to subcritical secondary "doubling" and "bulging" instabilities. Our findings are summarized in a "stability balloon" for vortex ripple pattern formation.
BFI (2019): BFI-level 2
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 7.58 SJR 3.622 SNIP 2.464
Web of Science (2017): Impact factor 8.839
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 6.33 SJR 4.196 SNIP 2.61
Web of Science (2016): Impact factor 8.462
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 5.76 SJR 4.656 SNIP 2.538
Web of Science (2015): Impact factor 7.645
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 6.62 SJR 5.232 SNIP 2.71
Web of Science (2014): Impact factor 7.512
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): CiteScore 7.46 SJR 5.675 SNIP 2.781
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): CiteScore 7.19 SJR 6.292 SNIP 2.867
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): CiteScore 7.02 SJR 6.314 SNIP 2.905
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 6.45 SNIP 2.757
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 6.325 SNIP 2.947
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 6.194 SNIP 2.837
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 5.95 SNIP 2.738
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 4.781 SNIP 2.443
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 4.082 SNIP 2.101
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 3.847 SNIP 2.122
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 4.661 SNIP 2.651
Web of Science (2003): Indexed yes
Web of Science (2002): Indexed yes
The dissipation of waves over a rippled bed

General information
State: Published
Organisations: Department of Mechanical Engineering
Contributors: Andersen, K. H., Lohman, M.
Publication date: 2001

Host publication information
Title of host publication: Proceedings of 27th International Conference on Coastal Engineering
Place of publication: Reston, Virginia, USA
Publisher: American Society of Civil Engineers
Source: orbit
Source-ID: 253381
Research output: Research - peer-review › Journal article – Annual report year: 2001

Pulses in the Zero-Spacing Limit of the GOY Model
We study the propagation of localised disturbances in a turbulent, but momentarily quiescent and unforced shell model (an approximation of the Navier-Stokes equations on a set of exponentially spaced momentum shells). These disturbances represent bursts of turbulence travelling down the inertial range, which is thought to be responsible for the intermittency observed in turbulence. Starting from the GOY shell model, we go to the limit where the distance between succeeding shells approaches zero ("the zero spacing limit") and helicity conservation is retained. We obtain a discrete field theory which is numerically shown to have pulse solutions travelling with constant speed and with unchanged form. We give numerical evidence that the model might even be exactly integrable, although the continuum limit seems to be singular and the pulses show an unusual super exponential decay to zero as exp(-constant sigma") when n --> infinity, where a is the golden mean. For finite momentum shell spacing, we argue that the pulses should accelerate, moving to infinity in a finite time. Finally, we show that the maximal Lyapunov exponent of the GOY model approaches zero in this limit. (C) 2000 Elsevier Science B.V. All rights reserved.

General information
State: Published
Organisations: Department of Hydrodynamics and Water Resources, Department of Physics, Niels Bohr Institute
Contributors: Andersen, K. H., Jensen, M., Nielsen, J., Olesen, P., Bohr, T.
Pages: 44-62
Publication date: 2000
Peer-reviewed: Yes

Publication information
Journal: Physica D: Nonlinear Phenomena
Volume: 138
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Web of Science (2019): Indexed yes
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 1.75 SJR 0.861 SNIP 1.158
Web of Science (2017): Impact factor 1.96
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.71 SJR 0.847 SNIP 1.211
Web of Science (2016): Impact factor 1.514
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 1.79 SJR 1.041 SNIP 1.29
Web of Science (2015): Impact factor 1.579
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 1.71 SJR 1.068 SNIP 1.209
Web of Science (2014): Impact factor 1.636
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 1.76 SJR 1.071 SNIP 1.347
Web of Science (2013): Impact factor 1.829
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 1.69 SJR 1.083 SNIP 1.226
Web of Science (2012): Impact factor 1.669
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 1.58 SJR 0.982 SNIP 1.165
Web of Science (2011): Impact factor 1.594
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.061 SNIP 1.127
Web of Science (2010): Impact factor 1.557
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.023 SNIP 1.164
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 1.33 SNIP 1.225
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.394 SNIP 1.311
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.14 SNIP 1.16
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 1.37 SNIP 1.29
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 1.073 SNIP 1.231
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 1.401 SNIP 1.605
Web of Science (2003): Indexed yes
Simple stochastic models showing strong anomalous diffusion

We show that strong anomalous diffusion, i.e. $\langle |x(t)|^q \rangle \sim t^{q \nu(q)}$ where $q \nu(q)$ is a nonlinear function of $q$, is a generic phenomenon within a class of generalized continuous-time random walks. For such class of systems it is possible to compute analytically $\nu(2n)$ where $n$ is an integer number. The presence of strong anomalous diffusion implies that the data collapse of the probability density function $P(x,t) = t^{-\nu(x/t^\nu)}$ cannot hold, a part (sometimes) in the limit of very small $x/t^\nu$ now $\nu = \lim_{q \to 0} \nu(q)$. Moreover the comparison with previous numerical results shows that the shape of $F(x/t^\nu)$ is not universal, i.e., one can have systems with the same $\nu$ but different $F$.

General information

State: Published
Organisations: University of Rome La Sapienza
Contributors: Andersen, K. H., Castiglione, P., Mazzino, A., Vulpiani, A.
Pages: 447-452
Publication date: 2000
Peer-reviewed: Yes

Publication information

Journal: European Physical Journal B. Condensed Matter and Complex Systems
Volume: 18
Issue number: 3
ISSN (Print): 1434-6028
Ratings:
BFI (2019): BFI-level 1
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 1.2 SJR 0.43 SNIP 0.596
Web of Science (2017): Impact factor 1.536
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.11 SJR 0.424 SNIP 0.604
Web of Science (2016): Impact factor 1.436
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 1.13 SJR 0.514 SNIP 0.654
Web of Science (2015): Impact factor 1.223
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 1.25 SJR 0.653 SNIP 0.689
Web of Science (2014): Impact factor 1.345
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 1.42 SJR 0.724 SNIP 0.796
Shell model for time-correlated random advection of passive scalars

We study a minimal shell model for the advection of a passive scalar by a Gaussian time-correlated velocity field. The anomalous scaling properties of the white noise limit are studied analytically. The effect of the time correlations are investigated using perturbation theory around the white noise limit and nonperturbatively by numerical integration. The time correlation of the velocity field is seen to enhance the intermittency of the passive scalar. [S1063-651X(99)07711-9].

General information
State: Published
Organisations: Department of Hydrodynamics and Water Resources, Niels Bohr Institute
Contributors: Andersen, K. H., Muratore-Ginanneschi, P.
Pages: 6663-6681
Publication date: 1999
Peer-reviewed: Yes

Publication information
Volume: 60
Wave plus current over a ripple-covered bed

This paper concerns the combined wave and current boundary layer flow over a ripple-covered bed. The study comprises experiments as well as a numerical modelling study: the experimental part comprises laser Doppler anemometry (LDA) velocity and turbulence measurements, and a flow-visualization study in the laboratory with ripples, 22 cm in length, and 3.5 cm in height. One wave-alone, three current-alone, and three combined waves and current tests were conducted. The wave-velocity-to-current-velocity ratio ranges from 1 to 2.4. The orbital-amplitude-to-ripple-length ratio (at the bed) is 0.41. The effect of superimposing waves on a current is to displace the velocity profile to higher elevations. The velocity profiles exhibit two “logarithmic layers”, one associated with the actual roughness of the bed (the actual ripple roughness), and the other with the apparent roughness induced by the waves. The apparent roughness is, for the tested cases, found an order of magnitude larger than the actual bed roughness. The turbulence near the bottom increases markedly during the time when the lee-wake vortices are washed over the ripples. The numerical part of the study gives a detailed numerical description of the now around fixed ripples by use of a k - w model to calculate the roughness, and friction of a rippled bed. (C) 1999 Elsevier Science B.V. All rights reserved.
A simple model for the various pattern dynamics of dunes

General information
State: Published
Organisations: Department of Hydrodynamics and Water Resources
Contributors: Nishimori, H., Yamasaki, M., Andersen, K. H.
Pages: 257--272
Publication date: 1998
Peer-reviewed: Yes
Bursts and shocks in a continuum shell model

General information
State: Published
Organisations: Department of Physics, Niels Bohr Institute
Contributors: Andersen, K. H., Bohr, T., Jensen, M., Olesen, P.
Pages: 121-130
Publication date: 1998
Peer-reviewed: Yes

Publication information
Journal: Journal de Physique IV
Volume: 8
ISSN (Print): 1155-4339
Ratings:
BFI (2008): BFI-level 1
Web of Science (2005): Indexed yes
Web of Science (2004): Indexed yes
Web of Science (2003): Indexed yes
Web of Science (2002): Indexed yes
Web of Science (2000): Indexed yes
Original language: English
Source: orbit
Source-ID: 171831

Measurement of the velocity profile in and above a field of Laminaria Hyperborea

General information
State: Published
Organisations: Department of Hydrodynamics and Water Resources
Contributors: Andersen, K. H., Nielsen, J., Mork, M.
Pages: 193-196
Publication date: 1996
Peer-reviewed: Yes

Publication information
Journal: Sarsia
Volume: 81
Original language: English
Source: orbit
Source-ID: 165547

Projects:

Cost of physiological defense mechanisms in marine dinoflagellates
Ryderheim, F., PhD Student, National Institute of Aquatic Resources
Kjærboe, T., Main Supervisor, National Institute of Aquatic Resources
Andersen, K. H., Supervisor, National Institute of Aquatic Resources
Juel Hansen, P., Supervisor
Fonde
01/09/2018 → 31/08/2021
Award relations: Cost of physiological defense mechanisms in marine dinoflagellates
Mechanistic approach to ocean ecology (39427)
The overarching goal of the proposed research is to develop a mechanistically underpinned, trait-based model of marine plankton ecosystems ranging across multiple trophic levels from bacteria to zooplankton. The rationale and methods and rooted in the trait-based approach developed by the Centre for Ocean Life. Zooplankton has a key role in the model, and the themes guiding model design are trait biogeography (i.e., spatio-temporal distributions of traits) and vertical material fluxes and carbon sequestration. The work will be organized in four interlinked work packages (WPs), each guided by a particular research question. All models will be implemented in a physical setting, and WPs 1-3 represent an increasing degree of complexity from unicellular plankton in a 0D environment toward a full size-based model in 2D environment. WP1 and 2 develop the unicellular and multicellular components, WP3 the full size based model, and WP4 sets up the model for the California Current system and tests the model against field observations collected by the Zooglider and through the CalCOFI monitoring program. The project is coordinated by DTU Aqua. The project is funded by Gordon and Betty Moore Foundation.

Understanding the biodiversity-ecosystem functioning relationship in marine food webs through large-scale observations and modelling

Statistisk modellering af marine økosystemer

Reduktion af lakseinfektioner
Marine management of ecosystem dynamics under climate change (MARmaED) (39300)
MARmaED is an EU Initial Training Network that unifies specific and complementary competences in marine sciences from Norway, Finland, Denmark, the Netherlands, Germany and France to investigate how the cumulative stress from biodiversity loss, climate change and harvesting will affect Europe’s complex marine systems and the consequences for optimal resource management. MARmaED incorporates feedbacks between the socioeconomic and the ecological systems that give rise to critical transitions. This project is coordinated by University of Oslo, Norway. The project is funded by EU, Marie Curie.

Andersen, K. H., Project Manager, National Institute of Aquatic Resources, Centre for Ocean Life
Lindegren, M., Project Participant, National Institute of Aquatic Resources
van Gemert, R., PhD Student, National Institute of Aquatic Resources
Beukhof, E., PhD Student, National Institute of Aquatic Resources

Sustainable bycatch in Danish fishery - Reasonable management under the landing obligation (39028)
he project facilitated a more robust advice of by-catch species in the Danish fishery in the Skagerrak by suggesting and testing stock assessment approaches for data poor stocks as well as providing guidance for various options to reduce by-catch without limiting the target fishery. The approach applied in the projects was suggested to be adopted for other areas where the landing obligation potentially can be restrictive for target fisheries (mixed-fish cases). Through thorough exploration of existing data in survey time-series it was possible to provide size-based life-history models to gauge the sensitivity of stocks in relation to fishing pressure. The models were used to determine relevant biological reference points for the most relevant by-catch species and the resulting assessment and stock status was then compared to the prevailing ICES/RGLIFE classification. Finally, the project suggested upgrading the stocks to a higher and less restrictive ICES category for management purposes where possible. This project was coordinated by DTU Aqua. The project was funded by the Danish Ministry of Food, Agriculture and Fisheries and the European Fisheries Fund (EFF).

Worsøe Clausen, L., Project Manager, National Institute of Aquatic Resources, Section for Marine Living Resources
Gislason, H., Project Participant, National Institute of Aquatic Resources
Andersen, K. H., Project Participant, National Institute of Aquatic Resources
Jørgensen, O. A., Project Participant, National Institute of Aquatic Resources
Kokkalis, A., PhD Student, National Institute of Aquatic Resources

A trait-based approach for predicting fish community structure, function and services under climate change and exploitation
Beukhof, E., PhD Student, National Institute of Aquatic Resources
Lindegren, M., Main Supervisor, National Institute of Aquatic Resources
Andersen, K. H., Supervisor, National Institute of Aquatic Resources
Marie Curie (EU-stipendium)

Density-dependent processes in marine fish stocks
van Gemert, R., PhD Student, National Institute of Aquatic Resources
Andersen, K. H., Main Supervisor, National Institute of Aquatic Resources
Lindegren, M., Supervisor, National Institute of Aquatic Resources
Nielsen, A., Examiner, National Institute of Aquatic Resources
Enberg, K. S., Examiner
van Kooten, T., Examiner
Marie Curie (EU-stipendium)
15/11/2015 → 15/02/2019
Award relations: Density-dependent processes in marine fish stocks
Project: PhD

Trait Ecology of Plankton in a Changing Marine Environment
Hansen, A. N., PhD Student, National Institute of Aquatic Resources
Visser, A., Main Supervisor, National Institute of Aquatic Resources
Andersen, K. H., Supervisor, National Institute of Aquatic Resources
Samfinansieret - Andet
15/12/2014 → 13/02/2019
Award relations: Trait Ecology of Plankton in a Changing Marine Environment
Project: PhD

State-Space Modelling in Marine Science
Albertsen, C. M., PhD Student, National Institute of Aquatic Resources
Nielsen, A., Main Supervisor, National Institute of Aquatic Resources
Thygesen, U. H., Supervisor, National Institute of Aquatic Resources
Andersen, K. H., Examiner, National Institute of Aquatic Resources
Cadigan, N. G., Examiner
Fernández, C., Examiner
Samfinansieret - Andet
01/12/2014 → 28/02/2018
Award relations: State-Space Modelling in Marine Science
Project: PhD

Analysis of trait-based models in marine ecosystems
Heilmann, I. L. T., PhD Student, Department of Applied Mathematics and Computer Science
Sørensen, M. P., Main Supervisor, Department of Applied Mathematics and Computer Science
Andersen, K. H., Supervisor, National Institute of Aquatic Resources
Starke, J., Supervisor, Department of Applied Mathematics and Computer Science
Thygesen, U. H., Supervisor, National Institute of Aquatic Resources
Karamehmedovic, M., Examiner, Department of Applied Mathematics and Computer Science
Andreasen, V., Examiner
Wyller, J. A., Examiner
Institut stipendie (DTU) Samf.
01/10/2012 → 22/09/2017
Award relations: Analysis of trait-based models in marine ecosystems
Project: PhD

Rekruttering af brisling
Frisk, C., PhD Student, National Institute of Aquatic Resources
Andersen, K. H., Main Supervisor, National Institute of Aquatic Resources
Kraus, G., Supervisor, National Institute of Aquatic Resources
Andersen, N. G., Examiner, National Institute of Aquatic Resources
Jørgensen, C., Examiner
Peck, M. A., Examiner
Offentlig finansiering
01/01/2008 → 22/08/2012
Award relations: Rekruttering af brisling
Project: PhD

Modelling the competition between two closely-related copepod species in Arctic under climate change
Sainmont, J., PhD Student, National Institute of Aquatic Resources
Visser, A., Main Supervisor, National Institute of Aquatic Resources
Andersen, K. H., Supervisor, National Institute of Aquatic Resources
Mariani, P., Examiner, National Institute of Aquatic Resources
Aksnes, D. L., Examiner
Banas, N. S., Examiner
Institut, samfinansiering
01/12/2010 → 07/05/2014
Award relations: Modelling the competition between two closely-related copepod species in Arctic under climate change

**Project:** PhD

*A trait-based approach towards understanding benthic-pelagic pathways in marine ecosystems*

Pécuchet, L., PhD Student, National Institute of Aquatic Resources
Lindegren, M., Main Supervisor, National Institute of Aquatic Resources
Andersen, K. H., Supervisor, National Institute of Aquatic Resources
Payne, M., Supervisor, National Institute of Aquatic Resources
MacKenzie, B., Examiner, National Institute of Aquatic Resources
Nordstrøm, M. C., Examiner
Primicerio, R., Examiner
1/3 FUU, 1/3 inst 1/3 Andet
15/12/2013 → 06/06/2017

Award relations: A trait-based approach towards understanding benthic-pelagic pathways in marine ecosystems

**Project:** PhD

*Trait-based analysis and modelling of fish communities*

Olsson, K., PhD Student, National Institute of Aquatic Resources
Gislason, H., Main Supervisor, National Institute of Aquatic Resources
Andersen, K. H., Supervisor, National Institute of Aquatic Resources
Christensen, A., Examiner, National Institute of Aquatic Resources
Falster, D., Examiner
Jørgensen, C., Examiner
1/3 FUU, 1/3 inst 1/3 Andet
01/03/2012 → 01/07/2015

Award relations: Trait-based analysis and modelling of fish communities

**Project:** PhD

*Operationalization of trait-based modelling for an ecosystem approach to fisheries*

Jacobsen, N. S., PhD Student, National Institute of Aquatic Resources
Andersen, K. H., Main Supervisor, National Institute of Aquatic Resources
Gislason, H., Supervisor, National Institute of Aquatic Resources
Nielsen, J. R., Examiner, National Institute of Aquatic Resources
Jennings, S., Examiner
Law, R., Examiner
Eksternt finansieret virksomhed
01/11/2012 → 15/12/2015

Award relations: Operationalization of trait-based modelling for an ecosystem approach to fisheries

**Project:** PhD

*Grey-box methods for size-based estimation of fish stocks*

Kokkalis, A., PhD Student, National Institute of Aquatic Resources
Andersen, K. H., Main Supervisor, National Institute of Aquatic Resources
Nielsen, A., Supervisor, National Institute of Aquatic Resources
Thygesen, U. H., Supervisor, National Institute of Aquatic Resources
Mosegaard, H., Examiner, National Institute of Aquatic Resources
Fernández, C., Examiner
O’Brien, C. M., Examiner
Fernández, C., Examiner
O’Brien, C. M., Examiner
Eksternt finansieret virksomhed
01/03/2012 → 02/06/2016

Award relations: Grey-box methods for size-based estimation of fish stocks

**Project:** PhD

*Demography of fished Populations: Yield, Resilience and Evolutionary Change*

Verdiell, N. C., PhD Student, National Institute of Aquatic Resources
Andersen, K. H., Main Supervisor, National Institute of Aquatic Resources
MacKenzie, B., Supervisor, National Institute of Aquatic Resources
Vaupel, J. W., Supervisor
Gislason, H., Examiner, National Institute of Aquatic Resources
Caswell, H., Examiner
Understanding the mechanisms of stock recovery (UNCOVER) (38104)
The UNCOVER project has produced a rational scientific basis for developing Long-Term Management Plans (LTMP) and recovery strategies for 11 of the ecologically and socioeconomically most important fish stocks/fisheries in the Norwegian and Barents Seas, the North Sea, the Baltic Sea and the Bay of Biscay and Iberian Peninsula. UNCOVER’s objectives were to: (i) identify changes experienced during stock depletion/collapses, (ii) to understand prospects for recovery, (iii) to enhance the scientific understanding of the mechanisms of fish stock/fishery recovery, and (iv) to formulate recommendations how best to implement LTMPs/recovery plans. The project recommends that such plans ideally should include: (i) Consideration of stock-regulating environmental processes, (ii) Incorporation of fisheries effects on stock structure and reproductive potential, (iii) Consideration of changes in habitat dynamics due to global change, (iv) Incorporation of biological and technological multispecies interactions, (v) Integration of economically optimized harvesting, (vi) Exploration of the socio-economic implications and political constraints from existing and alternative recovery plans, (vii) Investigations on the acceptance of plans by stakeholders and specifically incentives for compliance by the fishery, (viii) Agreements with and among stakeholders. UNCOVER has provided imperative policy support underpinning the following fundamental areas: (i) Evolution of the Common Fisheries Policy with respect to several aims of the ‘Green Paper’; (ii) Contributing to the Marine Strategy Framework Directive with respect to fish stocks/communities; (iii) achieving Maximum Sustainable Yield (MSY) for depleted fish stocks. This has been done by contributing to LTMPs/recovery plans for fish stocks/fisheries, demonstrating how to shift from scientific advice based on limit reference points towards setting and attaining targets such as MSY, and furthering ecosystem-based management through incorporating multispecies, environmental and habitat, climate variability/change, and human dimensions into these plans. The project was coordinated by Institut für Ostseefischerei, Bundesforschungsanstalt für Fischerei, Germany.
Köster, F., Contact Person, National Institute of Aquatic Resources
Neuenschwander, S., Project Manager, National Institute of Aquatic Resources
MacKenzie, B., Project Manager, National Institute of Aquatic Resources
Tomkiewicz, J., Project Participant, National Institute of Aquatic Resources
Vinh, M., Project Participant, National Institute of Aquatic Resources
Payne, M., Project Participant, National Institute of Aquatic Resources
Munk, P., Project Participant, National Institute of Aquatic Resources
Støttrup, J. G., Project Participant, National Institute of Aquatic Resources
Storr-Paulsen, M., Project Participant, National Institute of Aquatic Resources
Eg Nielsen, E., Project Participant, National Institute of Aquatic Resources, Section for Marine Living Resources
Bønder, K., Project Participant, National Institute of Aquatic Resources
Andersen, K. H., Project Participant, National Institute of Aquatic Resources
Huwer, B., Project Participant, National Institute of Aquatic Resources
Bastardie, F., Project Participant, National Institute of Aquatic Resources
01/01/2006 → 31/12/2010
Keywords: Research areas: Marine Living Resources & Fish Biology
Collaborators: Christian-Albrechts-Universität zu Kiel, Federal Research Centre for Fisheries, Instituto Español de Oceanografía, University of Aberdeen, Nikolai M. Knipovich Polar Research Institute of Marine Fisheries and Oceanography, Aalborg University, Cefas Weymouth Laboratory, University of Portsmouth, IFREMER, University of Bergen, Institute of Marine Research, Sea Fisheries Institute, Nederlands Instituut voor Visserij Onderzoek b.v., Marine Laboratory, Marine Research Unit, Marine and Food Technological Centre, University of Hamburg
Project: Research
Modelling the impact of hydrography and lower trophic production on fish recruitment (MODREC) (38114)
The recruitment of fish stocks is strongly influenced by fluctuations in climate and physical environment leading to strong and seemingly unpredictable year-to-year variations in year class strength. The aim of this project is to develop a model framework for conducting detailed recruitment studies on fish stocks. The framework will be applied for two commercially important fish stocks: sprat and sandeel, in order to improve the understanding of climate effects via bottom-up control and explain the observed high variability in reproductive success in these stocks. The framework will be built on existing hydrographic models by adding descriptions of primary and zooplankton production. The project is coordinated by DTU Aqua.

Andersen, K. H., Project Manager, National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography
Christensen, A., Project Participant, National Institute of Aquatic Resources
Frisk, C., Project Participant, National Institute of Aquatic Resources
Munk, P., Project Participant, National Institute of Aquatic Resources
Mariani, P., Project Participant, National Institute of Aquatic Resources
01/01/2007 → 31/12/2009
Keywords: Research area: Marine Populations and Ecosystem Dynamics
Collaborators: Aarhus University, Danish Meteorological Institute
Project: Research

Center for Ocean Life (COOL) - a Villum-Kahn Rasmussen Centre of excellence for the study of life in a changing ocean (38960)
Our goal is to develop a fundamental understanding and predictive capability of marine ecosystems through the use of novel trait-based approaches and models. The Centre is organized around three main research activities: - Identification and mechanistic description of the traits and trade-offs required to characterize the main Darwinian missions (feed, survive, reproduce) of the various life forms in the ocean through experimental and theoretical work, as well as analysis of literature data. - Models: scaling of individual behavior to population and ecosystem dynamics through the development of trait-based models. - Testing model prediction by comparing to observed trait patterns in the ocean. The Centre involves biologists, physicists, chemists, and mathematicians and has a very strong training component through the supervision of master students, and about 30 PhD and postdoctoral fellows as well as by offering PhD summer schools and organizing international workshops. The Centre in addition host many visiting students and scientists. The Centre is lead by DTU Aqua. The project is funded by the Villum Kahn-Rasmussen Foundation (Velux Foundations) as well as through various national and European fellowship programs (Research Council, H.C. Ørsted Fellowship programme, Marie Curie, Carlsberg Foundation, etc).

Kiørboe, T., Project Manager, National Institute of Aquatic Resources, Centre for Ocean Life
Andersen, K. H., Project Participant, National Institute of Aquatic Resources
Visser, A., Project Participant, National Institute of Aquatic Resources
Stedmon, C., Project Participant, National Institute of Aquatic Resources
Gislon, H., Project Participant, National Institute of Aquatic Resources
Payne, M., Project Participant, National Institute of Aquatic Resources
Thygesen, U. H., Project Participant, National Institute of Aquatic Resources
MacKenzie, B., Project Participant, National Institute of Aquatic Resources
Mariani, P., Project Participant, National Institute of Aquatic Resources
Nielsen, T. G., Project Participant, National Institute of Aquatic Resources
01/01/2012 → 31/12/2017
Keywords: Research areas: Oceanography & Marine Populations and Ecosystem Dynamics & Marine Living Resources & Ecosystem based Marine Management
Collaborators: Michigan State University, University of Bergen, Kiel University, University of Copenhagen, Massachusetts Institute of Technology, University of Oxford, Roskilde University
Project: Research

Forage fish interactions (FACTS) (38781)
Removal of a forage fish has consequences for both predators and prey of forage fish. As everything is connected, every management action has a price which goes beyond the apparent, direct effect on the target species. The fishery on forage fish can therefore not be seen in isolation, as the immediate gain in profit from the fishery has to be discounted by the lowered potential for production of large piscivorous fish. Management actions on other species also influences forage fish, i.e. conservation efforts on marine mammals or sea birds have direct consequences for the predation pressure on forage fish. The objective of the project was to provide insight and quantitative advice on the ecosystem wide consequences of management actions directly or indirectly related to forage fish. The two overarching questions were: - What are the consequences of forage fish fisheries on (a) predator growth and abundance, (b) economic output of fisheries on piscivorous species, and (c) ecosystem stability and the risk for regime shifts? - What are the consequences of changes in predator populations on forage fish populations and fisheries? The method was a combination of ecosystem models, of process studies aimed at feeding into the models, of economic models, and of data-analysis of existing data sources. The project covered four ecosystems in detail: Norwegian-Barents Sea, Baltic Sea, North Sea and Bay of Biscay.

FACTS brought together leading European fisheries and university institutes working on creating the tools for ecosystem based management. The active involvement of the institutes in the current management has provided a means for the
results of the project to feed into management. The project furthermore included a network component which has ensured a wider dissemination of methods and results within the marine scientific community. The project was coordinated by DTU Aqua. The project was funded by EU, Framework Programme 7.

Neuenfeldt, S., Project Manager, National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography
Haslund, O. H., Project Manager, National Institute of Aquatic Resources
Andersen, K. H., Project Participant, National Institute of Aquatic Resources
Rindorf, A., Project Participant, National Institute of Aquatic Resources
01/01/2010 → 31/12/2012
Keywords: Research areas: Marine Populations and Ecosystem Dynamics & Fish Biology & Ecosystem based Marine Management
Collaborators: Christian-Albrechts-Universität zu Kiel, Centre National de la Recherche Scientifique, Wageningen
IMARES, Marine and Food Technological Centre, University of Copenhagen, Spanish Institute of Oceanography, Cefas Weymouth Laboratory, IFREMER, University of St Andrews, Leibniz Institute for Baltic Sea Research Warnemünde (IOW), University of Southern Denmark, Institute of Marine Research, Finnish Game and Fisheries Research Institute, University of Hamburg
Project: Research

EURO-BASIN: European basin-scale analysis, synthesis and integration (EURO-BASIN) (38899)
EURO-BASIN was designed to advance our understanding on the variability, potential impacts, and feedbacks of global change and anthropogenic forcing on the structure, function and dynamics of the North Atlantic and associated shelf sea ecosystems as well as the key species influencing carbon sequestration and ecosystem functioning. Like the entire biosphere, marine ecosystems such as the North Atlantic and its associated shelf sea ecosystems can be characterized by emergent properties controlled by a dynamic network of interactions and relationships and not static entities. This system complexity is what Martin Luther King Jr. called "an inescapable network of mutuality" scientists today define as complex adaptive systems (CASs). EURO-BASIN has represented the first attempt of creating future prognosis of marine ecosystem states sensitive to CAS dynamics using as its test case the North Atlantic. Long-term prediction of the status of these CAS systems, population dynamics of key species and hence management of marine systems requires the implementation and advancement of an ecosystem approach for the management of marine resources sensitive to CAS dynamics. What is the ecosystem approach? Unlike a single species approach, the ecosystem approach takes into account population and ecosystem responses to changes in the Earth's climate, fisheries, and interactions between them. In EURO-BASIN not only did we monitor and assess how North Atlantic marine ecosystems behaved in the past, but also predict how they will respond under possible future climate change scenarios. Hence, the results of this project have provided important recommendations for better marine resource management in the European Union. The project had participants from 23 European universities and research institutions as well as collaborations with key institutions and Universities in the US and Canada. The project was coordinated by DTU Aqua. The project was funded by EU, Framework Programme 7.

St. John, M., Project Manager, National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography
Köster, F., Project Manager, National Institute of Aquatic Resources
MacKenzie, B., Project Manager, National Institute of Aquatic Resources
Andersen, K. H., Project Participant, National Institute of Aquatic Resources
Jonasdottir, S., Project Participant, National Institute of Aquatic Resources
Kierboe, T., Project Participant, National Institute of Aquatic Resources
Koeki, M., Project Participant, National Institute of Aquatic Resources
Project: Research

Trait based plankton ecology (38896)
Plankton is the dominating life-form in the ocean. It is mainly invisible and lives in a viscous world that is not part of our sensed experience. As a consequence, important properties of life in the oceans remain poorly understood. This project has aimed to further a cross-disciplinary research activity to promote an understanding of the dynamics of marine pelagic ecosystems that is based on mechanistic descriptions of the functioning of and interaction between its individuals. We provided trait-based descriptions of the key functions of plankton, formulate their associated trade-offs, and develop trait-based models of plankton ecosystem that we will test against observations. The core activity of the project was the development of mechanistic descriptions of key plankton traits and their trade-offs and development of trait-based models of pelagic systems. The immediate goal of the project was to achieve fundamental insights in the functioning of pelagic ecosystems but ultimately the models to examine effects of environmental changes and human impact. The project was a ‘precursor’ for the Centre for Ocean Life. The project was coordinated by DTU Aqua. The project was funded by the Danish Council for Independent Research.
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01/01/2011 → 31/12/2013
Keywords: Research areas: Oceanography & Marine Populations and Ecosystem Dynamics
Collaborators: Aarhus University, Roskilde University
Project: Research
Spa\textit{tially-explicit management methods for North Sea cod – a Danish fisher\-men-scientist collaboration (REX, REX II, REX III) (38430, 38431, 38541)}

The REX project started in 2006 as a protest from the Danish Fishermen Association because fishers had a less pessimistic perception of the status of the cod stock in the North Sea than ICES, and they considered the agreed TAC levels far too low. In particular the fishers considered the scientific surveys as inappropriate due to extremely low catches of large cod because of wrong gear and fishing on smooth bottom only. This seemed to call for more spatially-explicit oriented approaches and REX was born with an aim of getting closer to a common understanding of the true number of adult cod in the North Sea by focusing on communication and collaboration in developing and implementing a scientifically sound and robust survey strategy with commercial ships in a north-eastern area selected by the Danish Fishermen Association using three vessels presenting different fishing methods (flyshooter, trawler and gillnet). The development of the fishers-scientists collaboration with mutual respect has increased the understanding on both sides. In particular the emphasis on defining common goals, facing and solving conflicts immediately and extending thorough collaboration from survey planning, conducting of field work to interpretation of results during workshops have contributed to bridging the communication gap. A better understanding of cod biology has also been a focal point in these projects through the new field studies incorporating fishers’ knowledge. This includes distribution and migration, feeding behavior and importance of Hot-Spots (e.g. ship wrecks). Electronic tags were applied to learn about migration also in the Baltic. Together with the aim of continuing to obtain better assessments of the stocks such more mechanistically oriented studies are needed to answer two apparently simple questions “Where are the cod and why?” The REX projects have strengthened the scientific collaboration with fishermen and produced several results and types of knowledge that will influence future work on developing spatial explicit management tools. REX also represents capacity building for DTU Aqua’s interdisciplinary field research and monitoring towards the spatial dynamics of cod. The project is coordinated by DTU Aqua.

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Keywords: Research area: Marine Living Resources

Project: Research

\textit{Indicators for fisheries management in Europe (IMAGE) (38225)}

The Common Fisheries Policy (CFP) requires the progressive implementation of an ecosystem-based approach to fisheries management (EBFM). To implement effective management, it is essential to develop a framework that allows for the evaluation of different management strategies based on indicators. Indicators can support the decision making process by (i) describing the pressures affecting the ecosystem, the state of the ecosystem and the response of managers, (ii) tracking progress towards meeting management objectives and (iii) communicating trends in complex impacts and management processes to a non-specialist audience. The aim of this project was to develop an indicator-based operational framework that can support ecosystem-based management, and also show how this can be applied to test and evaluate different management strategies or sampling programs. The principal objectives of IMAGE were: -To develop an operational framework of candidate indicators (ecological, economic, social) that can support ecosystem-based fisheries management at the regional and pan-European scale -To elaborate these indicators in comprehensive dashboards (e.g. current values, trends, reference levels) -To develop methodology to integrate this information into tools
supporting the decision-making process-To develop a framework that can evaluate management strategies based on indicators-To advise on how indicators can be used to support EBFM in selected regional case studies based on the RAC areas. The project consisted of a conceptual phase where the operational framework was designed. This was followed by a phase of methodology development, an implementation phase consisting of regional case studies linked to the RACs and finally a pan-European evaluation and synthesis of the projects results. The results of this project contribute to the development of an effective EBFM in the context of the CFP, while also contributing to the applied science needed to support the emerging European Marine Strategy and Maritime Policy. The project was coordinated by Institute for Marine Resources and Ecosystem Studies (IMARES), The Netherlands.

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Tomczak, M., Project Participant
Jacobson, J. B., Project Participant
01/01/2006 → 31/12/2009
Keywords: Research area: Ecosystem Based Marine Management
Collaborators: Wageningen IMARES, COISPA Tecnologia & Ricerca, University of Tartu, Aalborg University, Cefas Weymouth Laboratory, IFREMER
Project: Research

MEECE: Marine ecosystem evolution in a changing environment (MEECE) (38131)
In order to advance our understanding and the predictive capacities necessary to resolve how marine ecosystems will respond to global change MEECE employed a combination of data synthesis, numerical simulation and targeted experimentation to further our knowledge of how marine ecosystems will respond to combinations of these climate change and anthropogenic drivers. A key objective of MEECE was to advance model coupling across trophic levels and create concepts and infrastructure to enable end-to-end modeling, from physics to fish, which has empirically been difficult due to different space and time scales involved, as well as relative emphasis of statistical and mechanistic aspects. Finally MEECE integrated modeling advancements with fishery management perspectives. The project was coordinated by Plymouth Marine Laboratory, UK, and had 21 partners from the EU. The project was funded by EU, Framework Programme 7.

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01/01/2008 → 15/10/2012
Keywords: Research areas: Marine Living Resources & Marine Populations and Ecosystem Dynamics & Fisheries Management
Project: Research

Resolving climatic impacts on fish stocks (RECLAIM) (38109)
Climate change will impact fisheries resources and challenge managers to develop sustainable exploitation strategies. Knowledge on the impacts of climate on fisheries resources is still fragmentary. RECLAIM will summarize current knowledge, test process understanding, improve predictive capacity and formulate future research hypotheses by examining trophic processes, geographical distributions and essential habitat requirements for marine and shellfish in the NE-Atlantic. A conceptual framework will be developed to distinguish between processes acting on individual (physiology, behavior), population (predation, competition) and ecosystem (physical habitat qualities, biological productivity, trophic coupling) levels. The framework structures a literature review to detects gaps in knowledge and, where possible, distinguishes between climate and anthropogenic influences. A comparative analysis follows quantifying climate variability and changes in distribution and productivity of (i) individual species, (ii) selected fish and shellfish communities, and (iii) ecosystem structure and functioning. Target species represent different commercially important resources, ecosystem components (pelagics, demersals), and play key trophic roles (wasp-waist, apex predators) within NE-Atlantic ecosystems. Changes in ecosystem structure and functioning will be analyzed from fisheries and scientific survey data including planktonic, benthic and fish production and consumption in relation to climate forcing and fishing. Relevant spatial and temporal scales of climate change and variability will be explored using time series analyses, spatial statistics
and coupled 3-D hydrodynamic ecosystem models. Using a variety of approaches, RECLAIM will both hind cast as well as forecast the effects of climate change on the productivity and distribution of fish and shellfish stocks to formulate hypotheses and research needs to be addressed in future EU research. The project is coordinated by IMARES, The Netherlands, and has nine partners from the EU.

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01/01/2007 → 31/12/2009

Keywords: Research area: Marine Populations and Ecosystem Dynamics
Project: Research

Climate change on marine ecosystems and resource economics (NorMER) (38898)

Marine ecosystems are under pressure from both anthropogenic climate change and high exploitation rates. A major challenge to managers and scientists is to identify ways that oceans can provide food and other services in a sustainable way under changing climatic and socioeconomic conditions. As physical, biological and socioeconomic factors interact at several levels, cross-disciplinary approaches are needed to meet this challenge. This Nordic project has (1) evaluated climate effects on Nordic marine ecosystems, (2) Build new tools for predicting biological consequences of climate change, (3) quantified impacts on profit, employment, and harvesting of cod. This has been achieved through the work of 16 PhDs, 4 postdocs, 1 climate scientist, and the combined expertise of 45 senior scientists located at 10 institutions in 8 Nordic countries. The project was coordinated by University of Oslo, Norway. The project was funded by Nordforsk, Nordic Council of Ministers.

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01/01/2011 → 31/12/2015

Keywords: Research areas: Oceanography & Marine Population and Ecosystem Dynamics & Population Genetics
Collaborators: Stockholm University, University of Bergen, University of Oslo, University of Helsinki, Greenland Institute of Natural Resources, Åbo Akademi University, University of Iceland, Swedish Meteorological and Hydrological Institute, University of the Faroe Islands
Project: Research

Morphology of ripples beneath surface waves

Using k-omega turbulence modelling the flow over ripples in oscillatory flow is calculated. Using this the bed load and the suspended transport can be calculated. Methods for making a phase-resolved update of the bottom is being developed
Fredsøe, J., Project Manager, Department of Hydrodynamics and Water Resources
Andersen, K. H., Project Participant, Department of Hydrodynamics and Water Resources
Bohr, T., Project Participant, University of Copenhagen
01/01/1996 → 01/01/9999
Collaborators: University of Copenhagen
Project: Research

Shell models of turbulence

Shell models of turbulence is studied for advection of a passive scaler. An continous limit is being developed for the GOY model
Andersen, K. H., Project Manager, Department of Hydrodynamics and Water Resources
06/08/1998 → 31/12/1999
Project: Research

Flow over a ripple-covered bed in waves

Turbulence modelling of wave/current flow over a ripple-covered bed has been achieved by a k-omega model. The model has been validated, using the results of an experimental study carried out earlier at ISVA. Mean, turbulence, and hydraulic-resistance properties of the flow have been obtained. The project has been funded partially by Marine Technique
(STVF) and EU (Coastal Morphodynamics, MAST2
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01/01/1996 → 31/12/1999
Project: Research

Activities:

ICES - Symposium on "Forage fish interactions: Creating the tools for ecosystem based management of marine resources" (External organisation)
Period: 2012 → …
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Degree of recognition: International

Related external organisation
ICES - Symposium on "Forage fish interactions: Creating the tools for ecosystem based management of marine resources"
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

ICES - Working Group on Fisheries-Induced Evolution - WGEVO (External organisation)
Period: 2012 → …
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Degree of recognition: International

Related external organisation
ICES - Working Group on Fisheries-Induced Evolution - WGEVO
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

ICES - Working Group on Maritime Systems - WGMARS (External organisation)
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Degree of recognition: International

Related external organisation
ICES - Working Group on Maritime Systems - WGMARS
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar