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.
Big fish or small fish: size based methods to evaluate direct and indirect ecosystem effects of fishing

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.
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.
Pages: 656-667
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Peer-reviewed: Yes

**Publication information**
Journal: Fish and Fisheries
Volume: 18
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
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Volume: 73
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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 2.98
Web of Science (2017): Impact factor 2.906
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
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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
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
Pages: 217-241
Publication date: 2016
Peer-reviewed: Yes

Publication information
Journal: Annual Review of Marine Science
Volume: 8
Issue number: 3
ISSN (Print): 1941-1405
Ratings:
Web of Science (2019): Indexed yes
Web of Science (2018): Indexed yes
Scopus rating (2017): CiteScore 14.37 SJR 6.449 SNIP 5.298
Web of Science (2017): Impact factor 12.867
Web of Science (2017): Indexed yes
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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Journal: Canadian Journal of Fisheries and Aquatic Sciences
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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
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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
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.
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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
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.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Centre for Ocean Life, University of California at Santa Barbara
Contributors: Burgess, M. G., Diekert, F. K., Jacobsen, N. S., Andersen, K. H., Gaines, S. D.
Pages: 1216-1226
Publication date: 2016
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.
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.
A comparison of multispecies models with potential use for strategic fisheries management

General information
State: Published
Organisations: National Institute of Aquatic Resources, Centre for Ocean Life
Contributors: Jacobsen, N. S.
Publication date: 2014
Peer-reviewed: No
Event: Abstract from Mini symposium on size-based approaches to fish and fisheries, Copenhagen, Denmark.
Research output: Research › Conference abstract for conference – Annual report year: 2014

Fiskevingel er fremtidens nytårstorsk

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Organisations: National Institute of Aquatic Resources, Centre for Ocean Life
Contributors: Jacobsen, N. S.
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Publication date: 2014
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Journal: Aktuel naturvidenskab
Issue number: 3
ISSN (Print): 1399-2309
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Original language: Danish
URLs:
Research output: Communication › Journal article – Annual report year: 2014

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.

General information
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Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Section for Ecosystem based Marine Management
Contributors: Jacobsen, N. S., Gislason, H., Andersen, K. H.
Publication date: 2014
Peer-reviewed: Yes

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Volume: 281
Issue number: 1775
ISSN (Print): 0962-8452
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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 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
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
Publication date: 2013
Event: Abstract from International Workshop on Trait-based approaches to Ocean Life, Copenhagen, Denmark.

URLs:
Research output: Research - peer-review › Conference abstract for conference – Annual report year: 2013
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:
Research output: Research › Conference abstract for conference – Annual report year: 2013

En revision af traditionelle koncepter i fiskeriet. Er balanceret fiskeri en mulig forvaltningsstrategi?

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Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Section for Ecosystem based Marine Management
Contributors: Jacobsen, N. S., Andersen, K. H., Gislason, H.
Publication date: 2013
Peer-reviewed: No
Event: Abstract from 17. Danske havforskermøde, Roskilde, Denmark.
Research output: Research › Conference abstract for conference – Annual report year: 2013

Projects:

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

Activities:

ICES - Working Group on the Ecosystem Effects of Fishing Activities - WGECO (External organisation)
Period: 2014
Nis Sand Jacobsen (Participant)
National Institute of Aquatic Resources
Centre for Ocean Life
Degree of recognition: International

Related external organisation

ICES - Working Group on the Ecosystem Effects of Fishing Activities - WGECO
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar