Human pressures

Coastal Ecology II - 2020 Stefan Heinänen



Aim

- Why? Is this important?
- What? Definitions, clarifications
- How? Analyse manage



Photo by Antoine GIRET on Unsplash



CE II – what are we working on?

3 similar courses ongoing, is it confusing? The baseline assessment? Human pressures?



What human pressures?

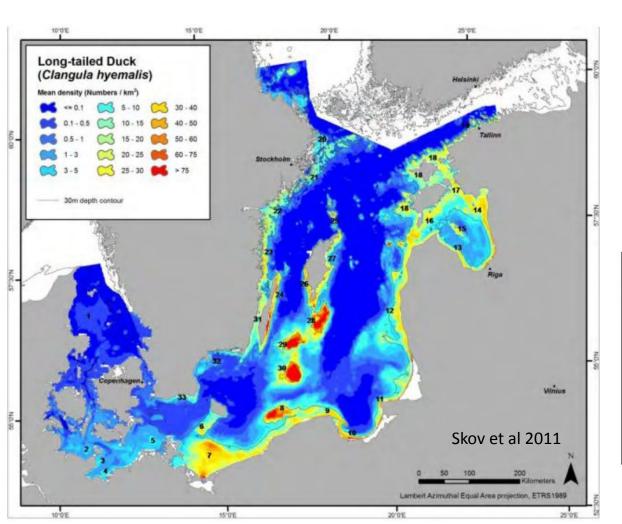
Any thoughts? In your home region, give examples



Human pressures from a bird perspective

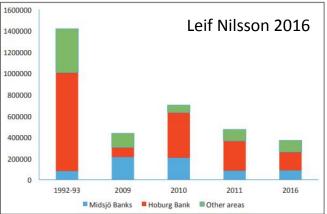


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Ca 65% reduction in population size from early 1990s until recently



Invasive species

Operationaloil spills from ships

By-catch

Pollution – hazardeous substances

Eutrophication

Climate change



Habitat destruction

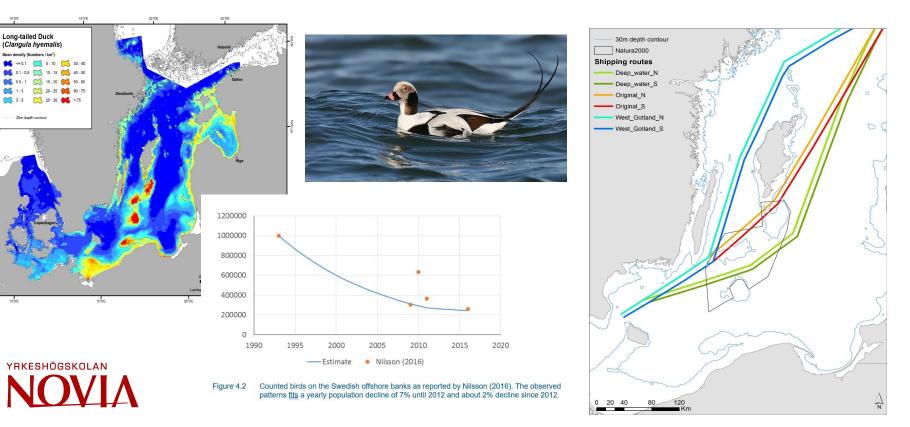
Displacement

Hunting



Changes in breeding areas

Case study – shipping & LTDs



Age structured population model

A population model (also called population viability analysis, PVA) is useful for predicting the growth rate and trend of a population over time based on a set of population parameters. Mortality and productivity are the fundamental components of the model and the balance between these two are summarised in the statistical term lambda (λ).

Lambda (rate of population change), λ =1-mortality rate + recruitment rate.

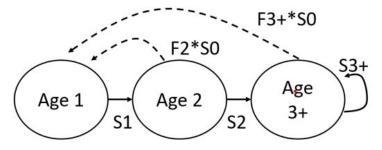
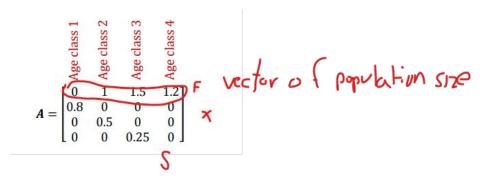


Figure 5.1 Flowchart of the age structured matrix model. S stand for survival and F for <u>fecundity</u> <u>because</u> the model is a pre-breeding census model the survival of Age class 0 (which is never counted is inserted as a fecundity parameter, modified from Flint (2015).



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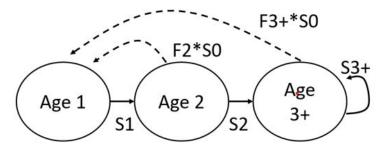


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N	Ο	V	Δ		

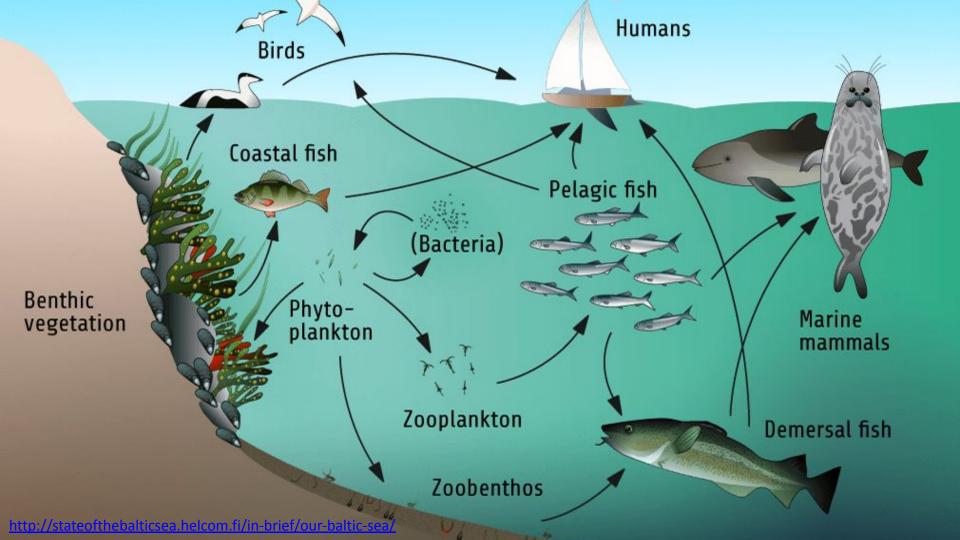
	Parameter	M1	M2	M3	Description	References
Mortality	Recurrent operational oil spills	0.035	as M1	0.02	0.11 on the Swedish offshore Banks, based on proportion in fishing nets.	M1: Larsson and Tydén 2005, M3: HaV rapport 2017
	Fishing bycatch	0.02	as M1	as M1	Assumed to be 2%, based on literature	Zydelis 2009, Bellebaum et al. 2013, Hearn et al. 2015
	Hunting	0.01	as M1	as M1	Based on hunting statistics	Hearn et al. 2015.
	Other mortality	0.095	as M1	as M1	"Estimated/assumed" to fit trend	Reviewed in Hearn et al. 2015
Survival	Sub-adult survival	0.74	as M1	0.755	10% less than adult survival	same ratio to adult as in <u>Koneff</u> et al. 2017
	Adult survival (1- mortaility)	0.84	as M1	0.855		Based on the mortality prop. listed

Results

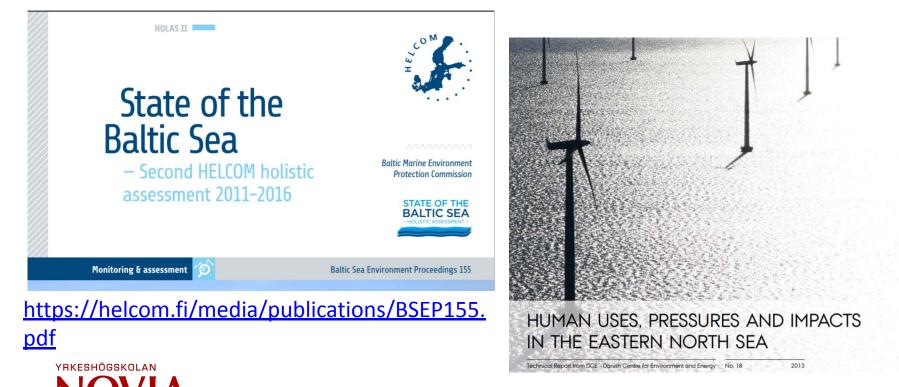
 Table 6.2
 Estimated growth rate (Lambda) and predicted female population size in 2026, for each submodel.

Model	Lambda	Estimated pop. size in 2026
M1: population parameters 1993-2012	0.928	155,836
M2: 2012->, increased fecund.	0.980	361,644
M3: 2012->, increased fecund. + lower oiling mortality	0.996	458,972
M2 + rerouted shipping	1.006	470,523
M3 + rerouted shipping	1.008	514,784

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Holistic approach in "Harmony"



https://www.dmu.dk/Pub/TR18.pdf

J- HELCOM

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HUMAN ACTIVITIES

	Land claim	N	Input of nutrients
DUVETEN	Canalisation, other watercourse modifications	M	
PHYSICAL RESTRUCTURING	Coastal defence, flood protection		Input of organic matter
	Offshore structures		
	Restructuring of seabed morphology		Input of hazardous substances
EXTRACTION OF	Extraction of minerals		
NON-LIVING RESOURCES	Extraction of oil and gas		Input of litter
PRODUCTION	Renewable energy generation and infrastructure		
PRODUCTION OF ENERGY	Non-renewable energy production		Input of sound
or Energy	Transmission of electricity and communications		
	Fish and shellfish harvesting		Input of other forms of energy
EXTRACTION OF	Fish and shellfish processing		Input or spread of
LIVING RESOURCES	Marine plant harvesting		non-indigenous species
	Hunting and collecting for other purposes		Input of genetically modified species,
	Aquacuture - marine		translocation of native species
CULTIVATION OF	Agriculture		
	Forestry		Input of microbial pathogens
	Transport infrastructure		
TRANSPORT	Transport - shipping		Disturbance of species
	Transport - land		Extraction of species
URBAN 6			or mortality/injury to species
INDUSTRIAL	Industrial uses		
	Waste treatment and disposal	9 HALZANNE	Physical disturbance to seabed
TOURISM &	Tourism and leisure infrastructure	112 XIN	Physical loss of seabed
LEISURE	Tourism and leisure activities		Physical loss of sedDed
SECURITY & DEFENCE	Military operations		Changes to hydrological conditions
EDUCATION & RESEARCH	Research, survey and educational activities		changes to hydrological conditions

PRESSURES

https://helcom.fi/media/publications/BSEP155.pdf

SUBSTANCES

ENERGY

BIOLOGICAL

PHYSICAL

Figure 3.1.

Human activities in the Baltic Sea and their connection to pressure types. The lines show which pressures are potentially connected to a certain human activity, without inferring the pressure intensity nor potential impacts in each case. The figure illustrates the level of complexity involved in the management of environmental pressures.



Eutrophication

Baltic Sea unaffected by eutrophication

- Clear water
- Natural level of algal blooms
- Natural distribution and occurrence of plants and animals
- Natural oxygen levels



Hazardous substances

Baltic Sea undisturbed by hazardous substances

- Concentrations of hazardous substances close to natural levels
- All fish are safe to eat
- Healthy wildlife
- Radioactivity at the pre-Chernobyl level

Biodiversity

Favourable status of Baltic Sea biodiversity

- Natural marine and coastal landscapes
- Thriving and balanced communities of plants and animals
- Viable populations of species



Maritime activities

Enviromentally friendly maritime activities

- Enforcement of international regulations no illegal discharges
- Safe maritime traffic without accidental pollution
- Efficient emergency and response capabilities
- Minimum sewage pollution from ships
- No introductions of alien species from ships
- Minimum air pollution from ships
- Zero discharges from offshore platforms
- Minimum threats from offshore installations

REVIEW ARTICLE

Front. Mar. Sci., 01 March 2016 | https://doi.org/10.3389/fmars.2016.00020



Overview of Integrative Assessment of Marine Systems: The Ecosystem Approach in Practice

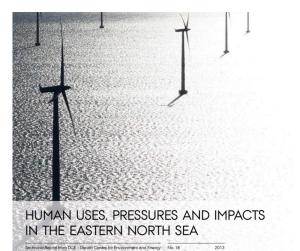
Angel Borja¹, Michael Elliott², Jesper H. Andersen³, Torsten Berg⁴, Jacob Carstensen⁵, Benjamin S. Halpern^{6,7,8}, Anna-Stiina Heiskanen⁹, Jacob Carstensen⁵, Georg Martin¹⁰ and Naiara Rodriguez-Ezpeleta¹

"To evaluate the health status of marine ecosystems we need a science-based, integrated Ecosystem Approach, that incorporates knowledge of ecosystem function and services provided that can be used to track how management decisions change the health of marine ecosystems"

"To undertake such an integrative assessment, it is necessary to understand the response of marine systems to human pressures"

Figure 1.11.

The environmental objectives for the Baltic Sea Action Plan are structured around the segments eutrophication, hazardous substances, biodiversity, and maritime activities.



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Human uses

Aquaculture

Fish farms Mussel farms

Maritime transport

Anchoring Commercial ports Commercial shipping, deep Commercial shipping, shallow Recreational shipping, shallow Recreational shipping, deep

Energy, industry, infrastructure

Submarine cables Oil and gas operations Offshore wind farms Oil spills Pipelines Coastal power plants Dredging Dredge dumping Pressures

Sealing

Abrasion

Smothering

Changes in siltation

Underwater noise

Thermal regime

Synthetic compounds

Non-synthetic substances

Salinity regime

Radio-nuclides

Organic matter

Electromagnetic

Microbial pathogens

Non-indigenous species

Biol. selective extraction

Other phys. disturbance

Nutrients

pH

Marine litter

Phys. selective extraction

cause

intensity

distance,

Causality, pressure

that can have impacts on Ecosystem Components

Benthic habitats

Euphotic mud

ability

Ecologi

Aphotic mud

Euphotic sand etc

Aphotic sand etc

Euphotic hard bottom

Aphotic hard bottom

Marine mammals

Harbour porpoise

Mink whale White-beaked dolphin

Seabirds

Razorbill Fulmar Gannett Kittiwake Guillemot

https://www.dmu.dk/Pub/TR18.pdf

Human uses and land-based pollution of the sea (33)

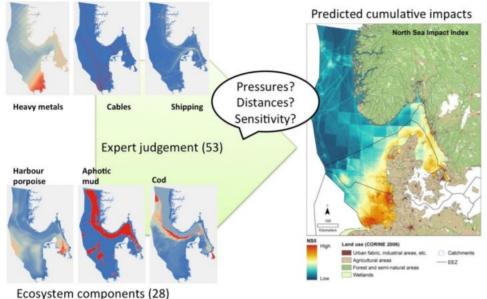
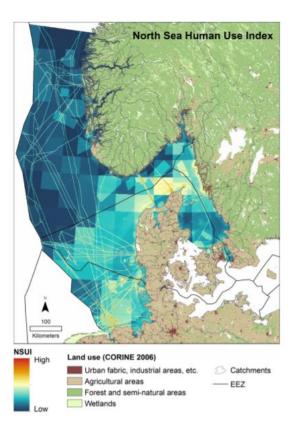
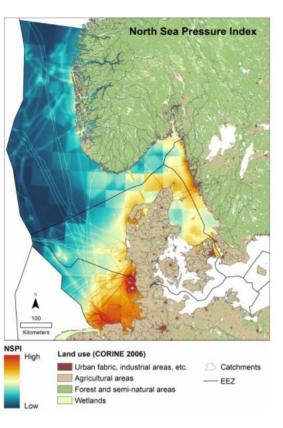
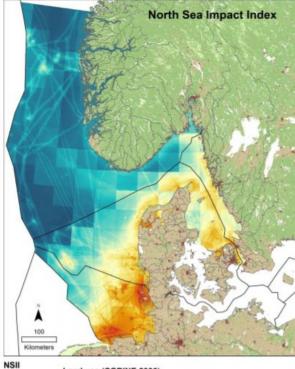


Figure 1. General approach: Expert judgement (involving individual replies by 53 experts) was used to combine data sets on the spatial distribution of 33 human maritime activities and types of land-based pollution (e.g. offshore oil and gas extraction, commercial fisheries using different gear types, and heavy metal pollution from land) with data on the spatial distribution of 28 ecosystem components, for example selected broad-scale seabed habitats, fish and marine mammal species.











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Global

IPBES is an independent intergovernmental body comprising over 130 member Governments. Established by Governments in 2012, IPBES provides policymakers with objective scientific assessments about the state of knowledge regarding the planet's biodiversity, ecosystems and the contributions they make to people, as well as options and actions to protect and sustainably use these vital natural assets.

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https://ipbes.net/sites/defa ult/files/2020-02/ipbes glob al assessment_report_sum mary for policymakers en. pdf

Natural ecosystems have declined by 47% 47 per cent on average, relative to their INDIRECT DRIVERS earliest estimated states. DIRECT DRIVERS Demographic SPECIES EXTINCTION RISK and Approximately 25 per cent of species are 25% sociocultural already threatened with extinction in **Terrestria** most animal and plant groups studied. Economic ECOLOGICAL COMMUNITIES and technological 23% Biotic integrity-the abundance of naturallyreshwater present species-has declined by 23 per cent on average in terrestrial communities.* Institutions and BIOMASS AND SPECIES ABUNDANCE governance Marine The global biomass of wild mammals has 82% fallen by 82 per cent.* Indicators of Conflicts vertebrate abundance have declined 40 60 80 100% and rapidly since 1970 epidemics Land/sea use change Direct exploitation NATURE FOR INDIGENOUS PEOPLES Climate change AND LOCAL COMMUNITIES Pollution 72 per cent of indicators developed by Invasive alien species 72%

DRIVERS

Others

alues and behaviour

EXAMPLES OF DECLINES IN NATURE

ECOSYSTEM EXTENT AND CONDITION

indigenous peoples and local communities

show ongoing deterioration of elements

* Since prehistory

of nature important to them

Figure SPM 2 Examples of global declines in nature, emphasizing declines in biodiversity, that have been and are being caused by direct and indirect drivers of change.

The direct drivers (land-/sea-use change; direct exploitation of organisms; climate change; pollution; and invasive alien species)⁶ result from an array of underlying societal causes⁷. These causes can be demographic (e.g., human population dynamics), sociocultural (e.g., consumption patterns), economic (e.g., trade), technological, or relating to institutions, governance, conflicts and epidemics. They are called indirect drivers⁸ and are underpinned by societal values and behaviours. The colour bands represent the relative global impact of direct drivers, from top to bottom, on terrestrial, freshwater and marine nature, as estimated from a global systematic review of studies published since 2005. Land- and sea-use change and direct exploitation account for more than 50 per cent of the global impact on land, in fresh water and in the sea, but each driver is dominant in certain contexts [2.2.6]. The circles illustrate the magnitude of the negative human impacts on a diverse selection of aspects of nature over a range of different time scales based on a global synthesis of indicators {2.2.5, 2.2.7}.

Solutions

https://ipbes.net/sites/defaul t/files/2020-02/ipbes_global_ assessment_report_summary _for_policymakers_en.pdf

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DIRECT INDIRECT DRIVERS DRIVERS EXAMPLES: Demographic Land/sea-use Fisheries and change sociocultural Agriculture Integrative, adaptive, informed and inclusive governance approaches including smart policy Energy Direct Economic and mixes, applied especially at leverage points exploitation technological Forestry Mining **MULTI ACTOR** institutions and Climate change Tourism governance **GOVERNANCE INTERVENTIONS** Pollution Infrastructure (LEVERS) Conflicts and vasive specie epidemics Conservation Others ote Incentives and capacity building LEVERAGE POINTS Cross-sectoral cooperation Embrace diverse visions Pre-emptive action of a good life Decision-making in the context of Iterative Reduce total consumption and waste resilience and uncertainty learning loop Unleash values and action · Environmental law and implementation Reduce inequalities Practice justice and inclusion in conservation · Internalize externalities and telecouplings · Ensure environmentally friendly technology, innovation and investment Promote education and knowledge generation and sharing

Figure SPM 9 Transformative change in global sustainability pathways.

Collaborative implementation of priority governance interventions (levers) targeting key points of intervention (leverage points) could enable transformative change from current trends towards more sustainable ones. Most levers can be applied at multiple leverage points by a range of actors, such as intergovernmental organizations, governments, non-governmental organizations, citizen and community groups, indigenous peoples and local communities, donor agencies, science and educational organizations, and the private sector, depending on the context. Implementing existing and new instruments through place-based governance interventions that are integrative, informed, inclusive and adaptive, using strategic policy mixes and learning from feedback, could enable global transformation.

Sustainable Development



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Figure 1. Sustainable development goals' icons, at https://sustainabledevelopment.un.org/post2015/transformingourworld.

Solutions and SCM curriculum

- Conservation Biology
- Marine spatial planning
- Integrated coastal zone management (SCM)
 - International forestry & agriculture
- Innovations
- Fisheries resources management



Human pressures and impacts in Pojo Bay?

Discuss in pairs

https://earth.google.com/web/@15.66051358,102.01424684,-200.01875842a,377784 6.3670975d,35y,356.15958168h,0t,0r

