A novel approach for holistic environmental assessment of ships

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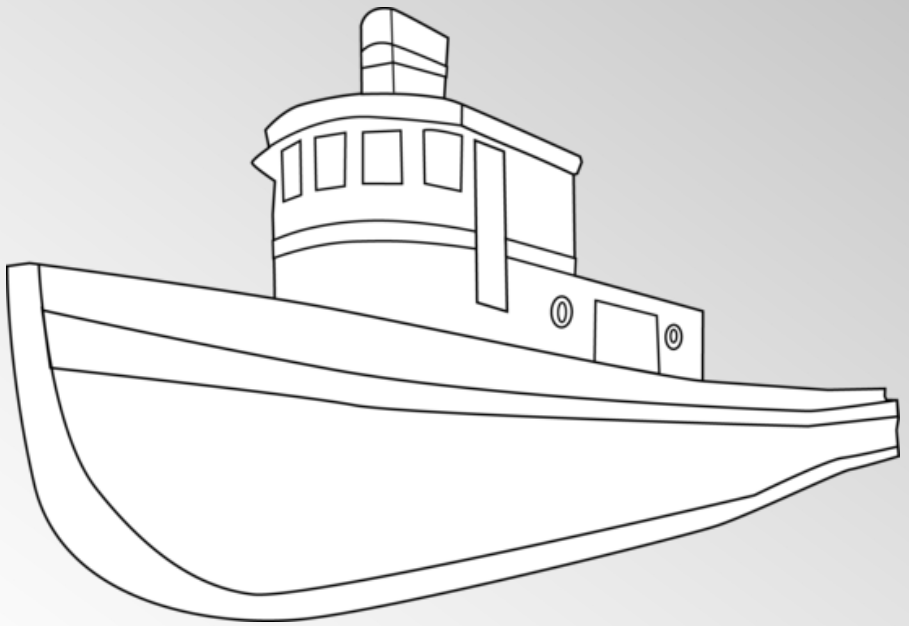
Presentation Summary

- Research Background
- Aim and Objectives
- Method of Assessment
- Results
- Proposal
- Conclusions



Research Background

- Independent environmental initiatives are increasingly common in the shipping sector
  - Initiatives have proliferated due to perception of global regulation as 'conservative'
- Initiatives can:
  - Boost environmental credentials
  - Bridge the time gap between adoption of regulation and when it enters force
- Previous work suggests weaknesses of some existing indices (Murphy *et al.,* 2013)

Reference: Murphy, A. J. Landamore, M. J. Pazouki, K. & Gibson, M. (2013) Modelling ship emission factors and emission indices. Low carbon shipping conference, London, 2013.

Aim and Objectives

To propose a framework for assessing the environmental performance of ships using a holistic approach.

- Critical analyses of existing environmental indices.
- Identify limitations
- New approach

Method of Assessment

Analysis of indices → **Limitations** → **Proposed approach**

Categorisation of initiatives

Indices identification

Indices formulation:
Indicators
Weightings
Scoring range

Holistic

Flexible environmental scope

Applicable to range of vessel types

Analysis of indices → Limitations → Proposed approach

Categorisation of initiatives

Total = 67

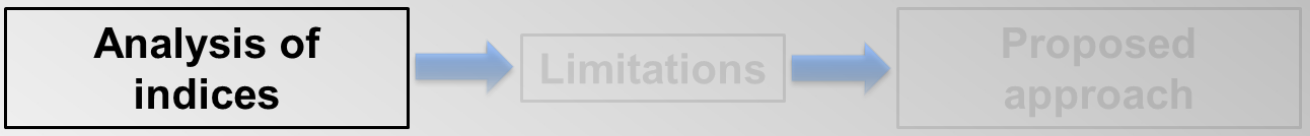
Location	
Global	19
Regional	4
Country	25
Port	16
N/A	3

Type	
Incentive (Award)	6
Incentive (Eco-label)	13
Incentive (Financial)	17
Regulation	4
Index	5
Other	22

Vessel applicability	
Multiple vessel types	36
Tankers	4
Container ships	1
Passenger vessels	5
N/A	21

Intended use	
Ports	19
Ship owners	27
Ports & ship owners	3
Cargo owners	3
Ship crew	2
Other (e.g. research)	13

Environmental scope	
Single	24
Multiple	21
N/A	22



Indices identification

Definition of environmental performance index (Svensson & Andersson, 2011):

"an index of aggregated environmental data or indicators for the purpose of communicating a ships or shipping company's environmental performance"

- Does it assess multiple environmental criteria?
- Can it differentiate environmental performance using a rating system?

Reference: Svensson, E. & Andersson, K. (2011) Inventory and Evaluation of Environmental Performance Indices for Shipping. International Association of Maritime Economics Conference 2012. [Online] Available from: http://publications.lib.chalmers.se/records/fulltext/162305.pdf (accessed 19/02/2016)

Analysis of indices → Limitations → Proposed approach

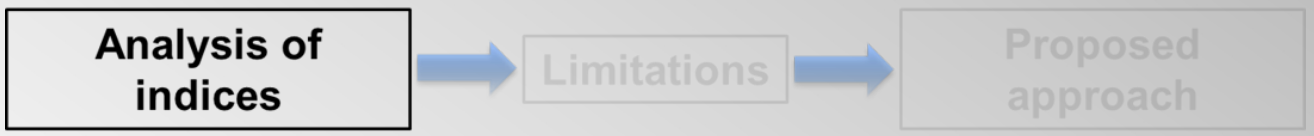
Indices identification

Type of Initiative		Environmental indicators	
		Single	Multiple
Index/rating system		2	3
Incentive	Financial	15	2
	Award	1	5
	Eco Label	3	10
Regulation		3	1
Other e.g. research projects, new technologies etc.		22	

Clean Shipping Index (CSI)

Clean Cargo Working Group Scorecard & Performance Metrics Tool (CCWG)

Environmental Ship Index (ESI)



Indices formulation:
Indicators
Weightings
Scoring range

Strengths/weaknesses & limitations

- Individual environmental indicators
- Relative importance of indicators
- Environmental ambition

Analysis of indices → Limitations → Proposed approach

Indices formulation:
Indicators
Weightings
Scoring range

Index	Environmental Indicator	Relative weighting (%)
CSI	NO_X	20
	SO_X	20
	CO_2	20
	Chemicals	20
	Water & waste	20
CCWG	NO_X	10
	SO_X	20
	CO_2	40
	Use of EMS	10
	Waste, water & chemicals	10
	Transparency	10
ESI	NO_X	59
	SO_X	28
	CO_2	3
	OPS	10

CSI: equal weighting

CCWG: weighted in favour of CO_2

ESI: weighted in favour of NO_X

- Indices 'favourable' towards certain indicators
- No justification for weightings
- Not an effective representation of overall environmental performance

Analysis of indices → Limitations → Proposed approach

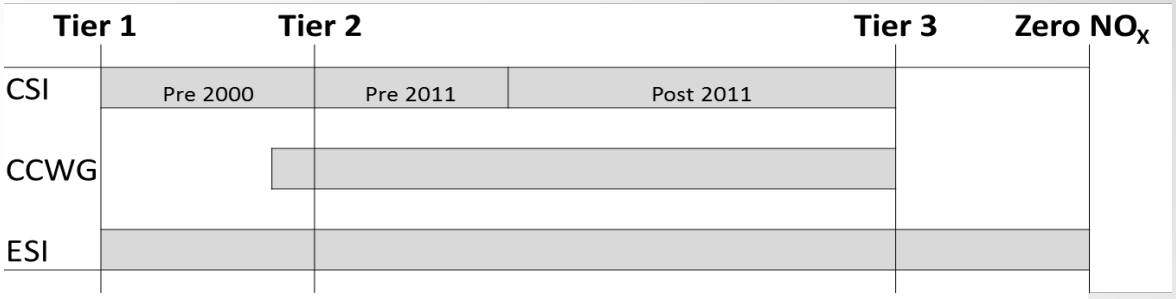
Indices formulation:

Indicators

Weightings

Scoring range

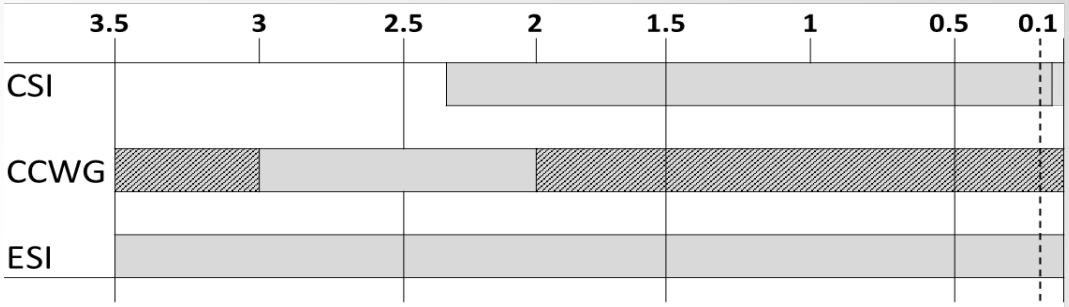
NO_X



ESI most 'ambitious'

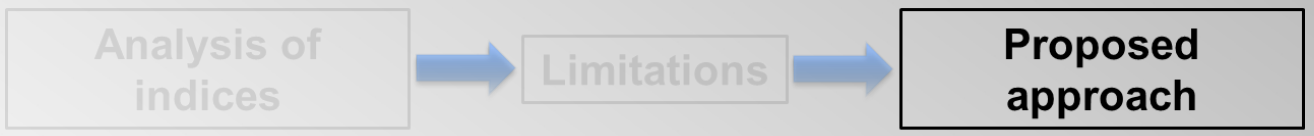
SO_X

For NO_X: CSI, CCWG do not encourage emission reductions beyond regulatory requirements



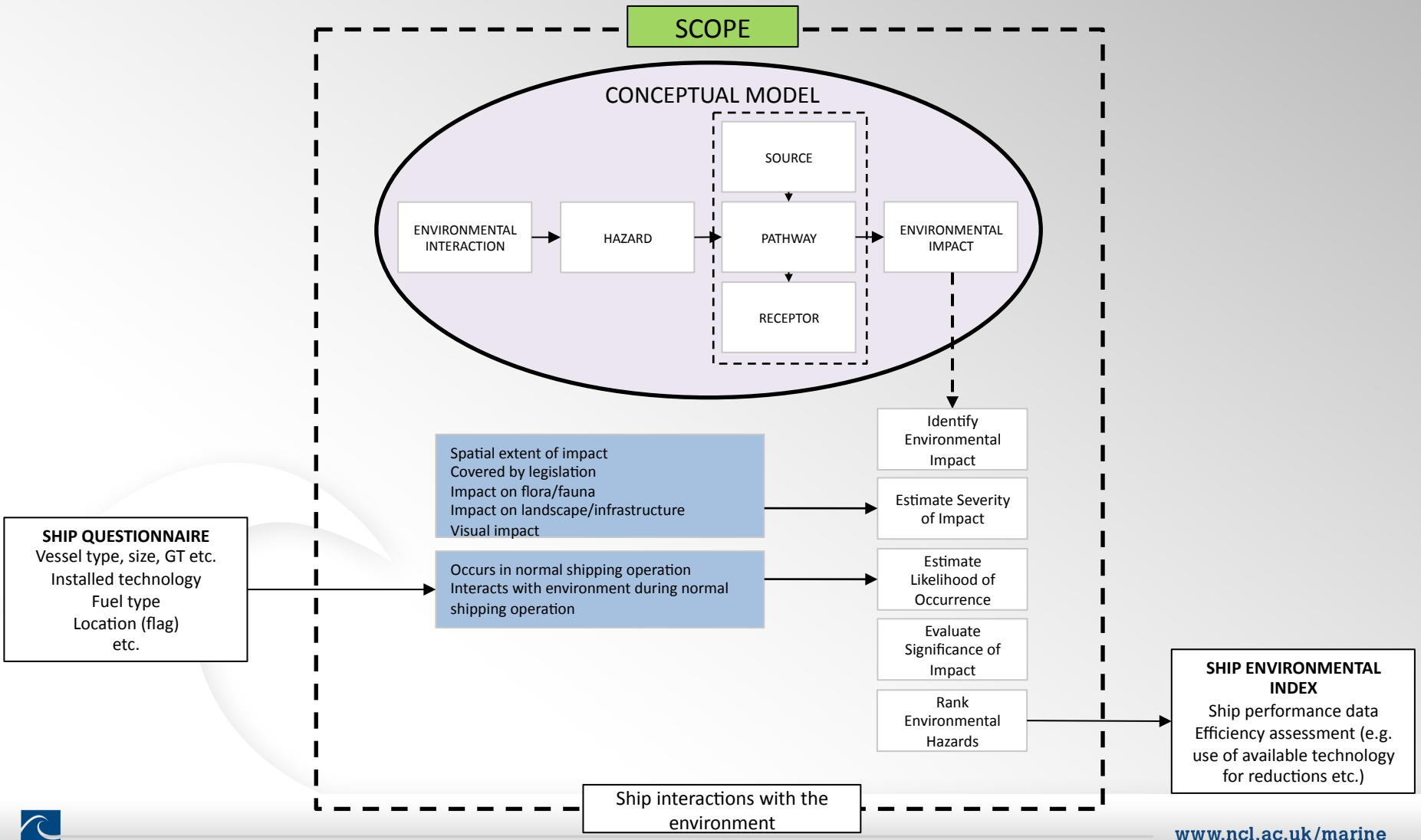
Analysis of indices → **Limitations** → Proposed approach

- Not applicable to all ship types, locations
- Rationale of scoring methods unclear
- Bias to certain environmental indicators
- Lack of environmental ambition
- Narrow environmental scope



- Holistic method of environmental assessment
- Applicable to all vessel types
- Broad, relevant environmental scope based on impacts
- Flexible mechanism to determine indicator weightings
- Environmentally ambitious methodology

Framework


SCOPE
CONCEPTUAL MODEL
SOURCE
ENVIRONMENTAL INTERACTION
HAZARD
PATHWAY
ENVIRONMENTAL IMPACT
RECEPTOR
Identify Environmental Impact
Spatial extent of impact
Covered by legislation
Impact on flora/fauna
Impact on landscape/infrastructure
Visual impact
Estimate Severity of Impact
SHIP QUESTIONNAIRE
Vessel type, size, GT etc.
Installed technology
Fuel type
Location (flag)
etc.
Occurs in normal shipping operation
Interacts with environment during normal shipping operation
Estimate Likelihood of Occurrence
Evaluate Significance of Impact
Rank Environmental Hazards
SHIP ENVIRONMENTAL INDEX
Ship performance data
Efficiency assessment (e.g. use of available technology for reductions etc.)
Ship interactions with the environment

Conclusions

- Limitations with existing environmental indices
- Not good indicators of ships' overall environmental performance
- Holistic framework proposed for developing future indices
  - Flexible
  - Effective
  - Ambitious

Thank You