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DiscardLess

Strategies for the gradual elimination of discards in European fisheries

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Identification of standard ecosystem evaluation criteria for the assessment of the Discard Mitigation Strategies

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Executive Summary

Standard criteria and indicators to assess the most relevant effects of discards on MSFD descriptors are required to ensure that the evaluation of the Discard Mitigation Strategies suggested in *DiscardLess* focuses on aspects relevant to the Good Environmental Status. The descriptors considered in *DiscardLess* to evaluate whether the Discard Mitigation Strategies promote GES are: the descriptors D1 (biodiversity), D3 (commercial fish and shellfish), D4 (food web), D5 (eutrophication) and D6 (sea-floor integrity). *DiscardLess* uses a selection of the simulation models developed with Ecopath with Ecosim, OSMOSE, Atlantis, ISIS-Fish, and StrathE2E to assess the outcomes of scenarios in different case studies based on standard criteria. In D1.2, *DiscardLess* defined the criteria and indicators to be used in determining the effects of discards on marine ecosystems. Indicators were defined for the following criteria: population abundance or biomass (D1), population demographic characteristics (D1), composition and relative proportions of ecosystem components (D1), fishing mortality (D3), spawning stock biomass (D3), proportion of fish larger than the mean size of maturity (D3), performance of key predator species using their production per unit biomass (D4), proportion of large fish (D4), abundance trends of functionally groups or species (D4), nutrients concentration in the water column (D5), chlorophyll concentration in the water column (D5), dissolved oxygen changes and size of the area concerned (D5), and bottom trawling effort maps (D6). Discard Mitigation Strategies will be translated into scenarios and assessed by using projections. Resulting time series of criteria will be compared across strategies and to the baseline scenarios.

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Contents

1 Introduction

The European Union (EU) Marine Strategy Framework Directive (MSFD) defines the marine environment as "a precious heritage that must be protected, preserved and, where practicable, restored with the ultimate aim of maintaining biodiversity and providing oceans which are clean, healthy and productive (EU Directive 2008/56/EC)." The Marine Strategy requires member states to adopt an ecosystem approach to management human activities that puts emphasis on the health of the ecosystem alongside the sustainable use of marine goods and services. The Marine Directive aims to achieve Good Environmental Status (GES) of most European marine waters by 2020. To help Member States (MS) interpret what GES means in practice, the Directive sets out, in Annex I, eleven qualitative descriptors which describe what the environment will look like when GES has been achieved.

Within this context, the European Commission has adopted criteria for assessing GES of marine waters (Commission Decision 2010/477/EU), in relation to the 11 descriptors of the MSFD. Although a great effort has been put into developing methodological standards for assessing GES in a coherent manner to support the ecosystem-based approach to management, there is still a substantial need to develop additional scientific understanding to determine appropriated ecosystem metrics.

The European Union 7th FP project DEVOTES (DEVelopment Of innovative Tools for understanding marine biodiversity and assessing good Environmental Status) has built a catalogue of models and their derived indicators to assess which models provide information about indicators outlined in the MSFD, particularly on biodiversity, food webs, non-indigenous species and seafloor integrity descriptors (Piroddi et al., 2015). Additionally, the IndiSeas project (funded by IOC/UNESCO, EUROCEANS, the FRB project EMIBIOS, IRD, and the 7th FP project MEECE) have analysed indicators of the status of different ecosystem (Shin and Shannon, 2010).

Probably more importantly has been the work developed by the ICES scientific community and associated partners in providing scientific guidance to define GES indicators and standards. ICES and JRC has established Task Groups for each of qualitative Descriptors with the aim of developing criteria and methodological standards for each Descriptor and a Management Group to provide information on a number of issues that are common to all of the Descriptors (overarching reference: Cardoso et al., 2010, see sections below for more recent information). More recently, ICES suggested some revisions for the MSFD to consider humans impacts on the functioning of the ecosystems (ICES, 2015).

On the basis of the work carried out in those different projects and task groups, we selected a list of criteria to assess the most important effects of discards on fish stocks and marine ecosystems. These criteria, or ecosystem metrics, will be used to evaluate the results of all the impact assessments carried out throughout the project, and visualise trade-offs. Using standard evaluation metrics will ensure that the evaluation of the Discard Mitigation Strategies suggested in *DiscardLess* focuses on aspects relevant to the Good Environmental Status as defined in the MSFD.

2 MSFD Descriptors to be considered in *DiscardLess*

The commission produced in 2010 a set of detailed criteria and indicators to help MS implement the Marine Directive (2010/477/EU). Criteria and indicators are distinctive technical features, which help make the descriptors more concrete and quantifiable. Based on these descriptors, criteria and indicators MS could assess the current status on marine waters, monitor their evolution and should set targets to achieve GES. The relationship among descriptors, criteria and indicators is summarised in Table 1.

The descriptors considered useful to evaluate whether the new Common Fisheries Policy promote GES are: the descriptors D1 (biodiversity), D3 (commercial fish and shellfish), D4 (food web), D5 (eutrophication) and D6 (sea-floor integrity). Here we present a general overview of the five descriptors considered in the WP1 of *DiscardLess* together with the associated criteria and indicators proposed by the Commission in 2010 (Table 1).

2.1 Descriptor D1, Biodiversity

"Biological diversity is maintained. The quality and occurrence of habitats and the distribution and abundance of species are in line with prevailing physiographic, geographic and climatic conditions." Criteria used to evaluate descriptor 1 should work on three levels (species, habitat and ecosystem) and focus on the marine species given in Annex III of the directive (angiosperms, macro-algae, invertebrates; phytoplankton, zooplankton; fish; mammals; reptiles; birds).

2.2 Descriptor D3, Commercial fish and shellfish

"Populations of all commercially exploited fish and shellfish are within safe biological limits, exhibiting a population age and size distribution that is indicative of a healthy stock." Criteria used to evaluate descriptor 3 should consider the level of pressure of the fishing activity, the life history of the considered species and the population structure of the fishing stock.

2.3 Descriptor D4, Food web

"All elements of the marine food webs, to the extent that they are known, occur at normal abundance and diversity and levels capable of ensuring the long-term abundance of the species and the retention of their full reproductive capacity." Criteria to evaluate descriptor 4 should try to identify key links that substantially influence energy flows and the structure of the food-web.

2.4 Descriptor 5, Eutrophication

"Human-induced eutrophication is minimised, especially adverse effects thereof, such as losses in biodiversity, ecosystem degradation, harmful algae blooms and oxygen deficiency in bottom waters." Criteria to evaluate descriptor 5 should consider nutrient levels as well as direct and indirect effects that are ecologically relevant at the relevant temporal scales.

2.5 Descriptor 6, Sea-floor integrity

"Sea-floor integrity is at a level that ensures that the structure and functions of the ecosystems are safeguarded and benthic ecosystems, in particular, are not adversely affected." Criteria to evaluate descriptor 6 should consider both the level of physical damages to the seafloor as well as the status of the benthic community.

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DiscardLess

Table 1: Qualitative descriptors, criteria and indicators, selected by European Commission (2010), and to be used in the assessment of the environmental status of marine waters, in the context of the Marine Strategy Framework Directive (Adapted from Borja et al. 2013). The indicators in bold are discussed in the section below.

Descriptor	Criteria	Indicator
D1. Biological diversity	1.1. Species distribution	1.1.1. Distributional range
		1.1.2. Distributional pattern within the latter
		1.1.3. Area covered by the species (for sessile/benthic species)
	1.2. Population size	1.2.1. **Population abundance and/or biomass**
	1.3. Population condition	1.3.1. **Population demographic characteristics**
		1.3.2. Population genetic structure
	1.4. Habitat distribution	1.4.1. Distributional range
		1.4.2. Distributional pattern
	1.5. Habitat extent	1.5.1. Habitat area
		1.5.2. Habitat volume, where relevant
	1.6. Habitat condition	1.6.1. Condition of the typical species and communities
		1.6.2. Relative abundance and/or biomass, as appropriate
		1.6.3. Physical, hydrological and chemical conditions
	1.7. Ecosystem structure	1.7.1. **Composition and relative proportions of ecosystem components (habitats, species)**
D3. Exploited fish and shellfish	3.1. Level of pressure of the fishing activity	3.1.1. **Fishing mortality (F)**
		3.1.2. Catch/biomass ratio
	3.2. Reproductive capacity of the stock	3.2.1. **Spawning Stock Biomass (SSB)**
		3.2.2. Biomass indices (if 3.2.1 not possible)
	3.3. Population age and size distribution	3.3.1. **Proportion of fish larger than the mean size of first sexual maturation**
		3.3.2. Mean maximum length across all species found in research vessel surveys
		3.3.3. 95% percentile of the fish length distribution observed in research vessel surveys
		3.3.4. Size at first sexual maturation
D4. Food webs	4.1. Productivity of key species or trophic groups	4.1.1. **Performance of key predator species using their production per unit biomass**
	4.2. Prop. of selected species at the top of food web	4.2.1. **Large fish (by weight)**
	4.3. Abundance/distribution of key trophic groups	4.3.1. **Abundance trends of functionally important selected groups/species**
D5. Human-induced eutrophication	5.1. Nutrients levels	5.1.1. **Nutrients concentration in the water column**
		5.1.2. Nutrient ratios (silica, nitrogen and phosphorus)
	5.2. Direct effects of nutrient enrichment	5.2.1. **Chlorophyll concentration in the water column**
		5.2.2. Water transparency related to increase in suspended algae
		5.2.3. Abundance of opportunistic macroalgae
		5.2.4. Species shift in floristic composition such as diatom to flagellate ratio, benthic to pelagic shifts, as well as bloom events of nuisance/toxic algal blooms caused by human activities
	5.3. Indirect effects of nutrient enrichment	5.3.1. Abundance of perennial seaweeds and seagrasses impacted by decrease in water transparency
		5.3.2. **Dissolved oxygen changes and size of the area concerned**
D6. Seafloor integrity	6.1. Physical damage, having regard to substrate characteristics	6.1.1. Type, abundance, biomass and areal extent of relevant biogenic substrate
		6.1.2. **Extent of the seabed significantly affected by human activities for the different substrate types**
	6.2. Condition of benthic community	6.2.1. Presence of particularly sensitive and/or tolerant species
		6.2.2. Multi-metric indices assessing benthic community condition and functionality, such as species diversity and richness, proportion of opportunistic to sensitive species
		6.2.3. Proportion of biomass or number of individuals in the macrobenthos above specified length/size
		6.2.4. Parameters describing the characteristics of the size spectrum of the benthic community

3 Modelling approaches used in *DiscardLess*

Discardless will use a selection of the existing parameterized simulation models developed with: Ecopath with Ecosim (EwE), OSMOSE, Atlantis, ISIS-Fish, and StrathE2E, to assess the outcomes of scenarios in different case studies (Table 2). Each modelling tool is briefly presented here, for more details please refer to the deliverable D1.1.

Table 2: Operational models expected to be used in Discardless case studies

Case studies	Azores	Eastern Med.	Western Med.	Bay of Biscay	Celtic Sea	E. English Channel	North Sea and W. Scotland
EwE	X	X	X	X	X		
OSMOSE						X	
ISIS-Fish			X			X	
Atlantis						X	
StrathE2E							X

3.1 Ecopath with Ecosim (EwE)

Ecopath with Ecosim (EwE) is a food-web facility that can be used to build trophic static mass-balanced snapshots (Ecopath) and to create temporal dynamic (Ecosim) of an ecosystem (Christensen and Pauly, 1992; Walters et al., 1997; Pauly et al., 2000; Walters et al., 2000; Christensen and Walters, 2004, http://www.ecopath.org).

EwE models will be used in 5 of our Case studies: the Azores (Morato et al., submitted), the Eastern Mediterranean (the North Aegean Sea, Tsagarakis et al 2010), the Western Mediterranean (in the Balearic islands, Moranta et al. 2014), the Bay of Biscay (Lassalle et al, 2011), and the Celtic Sea (Lauria, 2012).

3.2 Atlantis

Atlantis (Fulton, 2010, http://atlantis.cmar.csiro.au/) is a modelling framework intended for use in management strategy evaluation (MSE) studies. It therefore includes representations of each significant component of the adaptive management cycle (Jones, 2009), including the biophysical system, the human users of the system (industry).

Atlantis has been implemented on the Eastern Channel and coupled to different fisher's behaviour model (Girardin, 2015) to study the spatial dynamics of demersal fisheries, and their impacts on the ecosystem.

3.3 OSMOSE

OSMOSE (object-oriented Simulator of Marine ecOystems Exploitation model) is a multispecies and Individual-based model (IBM) which focuses on fish species (Shin and Cury 2001, 2004; Shin et al., 2004, http://www.osmose-model.org). The central hypothesis of the model is that fish predation is opportunistic, based on spatial co-occurrence and size adequacy between a predator and its prey (size-based opportunistic predation). Representing explicitly the main species of the ecosystem (in biomass, catch and trophic role), this spatial model represents fish individuals grouped into schools, which undergo major processes of fish life cycle (growth, reproduction, migration and mortality from predation, natural and starvation) and a fishing mortality distinct for each species.

Osmose has been implemented in the Eastern Channel using seasonal plankton field provided by the NPZD model EcoMARS3D, and is being used to investigate predation and competition relationships, variable in time and space and according to forcing factors such as fishing pressure and environmental variations (Travers et al, 2009).

3.4 ISIS-Fish

ISIS–Fish is a deterministic fisheries dynamic simulation model designed for the bio-economic evaluation of management impact on mixed fisheries. It describes the spatial dynamics of multi-fleets, multi-species fisheries at a monthly time scale. The fishing mortality is the result of spatio-temporal interaction between population abundance resulting from the population submodel and fishing effort provided by the exploitation and management submodels. The model is coupled with fleet behaviour models to account for fisher changes in strategies in response to environmental, economic and regulatory conditions (Pelletier et al., 2009, http://www.isis-fish.org/en/index.html).

ISIS-Fish has been implemented in the Eastern Channel (Lehuta et al., 2014), and will also be implemented in the Western Mediterranean region in the course of the project.

3.5 StrathE2E

StrathE2E simulates the fluxes of nutrients (nitrogen) through ecosystems from dissolved inorganic (nitrate and ammonia), through plankton, benthos and fish, to birds and mammals, regeneration through excretion and mineralization of detritus in the water column and sediment and physical exchanges across geographic boundaries. Pelagic, demersal and invertebrate fisheries are explicitly represented in the model, including by-catch and discarding processes.

StrathE2E has been implemented in the North Sea (Heath, 2012), and applied to simulate cascading trophic effects of alternative illustrative implementations of a landing obligation (Heath et al., 2014).

4 Standard criteria used in *DiscardLess* to determine the effects of discards on marine ecosystems

DiscardLess partners involved in this report reviewed the existing literature with recommendations on the indicators to be used in assessing each criteria under the MSFD descriptors. Also, the group has consulted other partners to discuss what indicators could be applied to the modelling strategies adopted by DiscardLess. The indicators haven't been discussed with *DiscardLess* stakeholders within specific workshops, beyond what was achieved during the kick-off meeting in April 2015. However, it is acknowledged that such involvement of stakeholders is largely taking place within the ICES work on MSFD. *DiscardLess* has made sure to define models' indicators that are entirely consistent with ICES', thus indirectly including some stakeholders' views.

In general, the group found that only a selection of the indicators listed by the European Commission (Table 1, lines in bold) can be measured with our selection of models. They are described below, and for each descriptor a table summarizes which indicator can be computed which each model.

4.1 Descriptor D1 Biological diversity

4.1.1 Criterion 1.2 Population size

- **Indicator 1.2.1: Population abundance and/or biomass**

Functional groups rather than populations will be "surveyed", except for species modelled individually (most of the time important commercial species or species with ecological or conservation significance). The grouping recommended in the recent review of descriptor 1 (EC JRC, 2015) will be followed as much as possible and adjusted to each model.

4.1.2 Criterion 1.3: Population condition

- **Indicator 1.3.1 Population demographic characteristics**

Population demographic characteristics will be measured using the age or size structure (e.g. % at age) as proxies.

4.1.3 Criterion 1.7: Ecosystem structure

- **Indicator 1.7.1: Composition and relative proportions of ecosystem components (habitats, species)**

The methods suggested in the recent review of this criterion (Ecological Evaluation Index, BENTIX, PREI, species diversity, EC JRC, 2015) cannot be used with our models, although functional diversity can be explored, using transformed diversity indices (e.g. modified Kempton's diversity index, Ainsworth and Pitcher, 2006, or the N90 diversity index, Farriols et al., 2015 which is suitable to monitor changes in biodiversity due to anthropogenic impacts and therefore address ICES recommendations (ICES, 2015)

Therefore, the indicators identified as performing well in the previous projects Devotes and IndiSeas will be used (Shin et al., 2010a; Shin et al., 2012; Heymans et al., 2014; Shannon et al., 2014; Piroddi et al., 2015), i.e.:

- Primary production/TST (PP/TST), primary production over the sum of all the flows through the ecosystem (Heymans et al., 2014),

- Total System Throughput (TST) is a measure of total trophic flows (sum of all the flows) within an ecosystem and considered an overall measure of the "ecological size" of the system (Heymans et al., 2014),

- Total Biomass (TBco, excluding first trophic level), total biomass of the community excluding detritus and primary producers (Heymans et al., 2014),

Table 3: Indicators selected for the GES descriptor 1

	EwE	OSMOSE	ISIS	Atlantis	StrathE2E
Population biomass	Yes	Yes	Yes	Yes	Yes
Population demographics	Adults/Juveniles when life stanza	Yes	Yes	Yes for vertebrates	Adults/Juveniles
Ecosystem components	All	TST, TBco		All	All

4.2 Descriptor D3 (commercial fish and shellfish)

For all the exploited groups and species:

4.2.1 Criterion 3.1: Level of pressure of the fishing activity

- **Indicator 3.1.1: F/F_{MSY}.** Data deficiencies and/or the lack of quantitative stock assessment may result in the use of agreed approximations of F_{MSY} rather than F_{MSY}. Potential changes in F_{MSY} values will be monitored in task 1.5 (i.e. Monitoring changes in fish stocks and sensitive components).

The following indicator will also be computed:

- F/F_{BL}, i.e. the fishing mortality in the given scenario compared to F in the baseline scenario.

4.2.2 Criterion 3.2: Reproductive capacity of the stock

- **Indicator 3.2.1: SSB/SSB_{MSY}** . Where it is not possible to determine a reliable value for SSBMSY, an appropriate reference point needs to be identified. ICES recommend the use of MSY $B_{trigger}$ for this purpose (ICES, 2015).

- SSB /SSB_{BL}, i.e. the Spawning Stock Biomass in the given scenario compared to the SSB in the baseline scenario.

4.2.3 Criterion 3.3: Population age and size distribution

The size/age at maturity is forced in the models used in this project, so only the indicator 3.3.1 can be adapted to our purpose:

- **indicator 3.3.1: Proportion of mature animals**, as measured by the larger, bigger, or older than the size or age of maturation depending on the model.

According to the latest ICES recommendations (ICES, 2015), the selectivity pattern of the fisheries exploiting each species/groups by computing:

- Age/size structure of the catch (AS-C).

4.2.4 Others

In addition, the following indicators will be computed:

- Total Catches (TC), total landings and discards (TL+TD), and catch composition (CC),
- Discard rate (discard/catch) per species (DR),
- Age/size structure of the discards (AS-D),
- Proportion of exploited species with declining biomass (PDB),
- % of TAC consumption (evidence trade off in exploitation).

Table 4: Indicators selected for the GES descriptor 2. Notes 1: F is an input to the model, 2: only for groups with life stanza.

	EwE	**OSMOSE**	**ISIS**	**Atlantis**	**StrathE2E**
F/F_{ref}	Yes [1]	Yes[1]	Yes	Yes	Yes
B/B_{ref}	Yes	Yes	Yes	Yes	Yes
% mature	Yes [2]	Yes	Yes	% older than 1st age of mat	No
Others	TC TL+TD CC PDB %TAC	TC CC AS PDB	All	All	TC TL+TD DR PDB %TAC

4.3 Descriptor D4 (food web)

4.3.1 Criterion 4.1: Productivity of key species or trophic groups

- **Indicator 4.1.1: Production per unit biomass of key predator species/groups**. Birds and marine mammals should be included in that list.

4.3.2 Criterion 4.2: Proportion of selected species at the top of food web

- **Indicator 4.2.1 Biomass of fish larger than a given threshold or their proportion over the total biomass of fish**.
-

4.3.3 Criterion 4.3: Abundance/distribution of key trophic groups

- **Indicator 4.3.1: Abundance trends of functionally important selected groups**.

The functionally important groups are described (European Commission, 2010) as:

- Groups with fast turnover rates (e.g. phytoplankton, zooplankton, jellyfish, bivalve molluscs, short-living pelagic fish) that will respond quickly to ecosystem change and are useful as early warning indicators that will respond quickly to ecosystem change and are useful as early warning indicators,
- Groups/species that are targeted by human activities or that are indirectly affected by them (in particular, by-catch and discards),

- Habitat-defining groups/species,
- Groups/species at the top of the food web,
- Long-distance anadromous and catadromous migrating species,
- Groups/species that are tightly linked to specific groups/species at another trophic level.

It has to be noted that a revision of the criteria 4 has been recommended (ICES, 2015) which would reduce the number of criteria to 2:

The Criterion 4.1 Foodweb structure which would correspond to the previous 4.2 and 4.3 and include the following indicators: (4.1.1) Abundance/biomass of trophic guilds; and (4.1.2) Size distribution of trophic guilds.

The Criterion 4.2 Foodweb function which would include the previous and slightly modified indicator 4.1.1, i.e. productivity of trophic guilds.

In any case, the list of indicators computed in this project will be updated according to the latest developments.

Additional indicators will be computed based on Devotes, Indiseas and Ulanowicz (1986):

- Relative Ascendency is a dimensionless index of the organisation of the food web and it's calculated as Ascendency/Capacity (A/C),
- Relative overhead is a dimensionless index of the ecosystem's strength in reserve and is calculated as Overhead/Capacity (O/C).

Table 5: Indicators selected for the GES descriptor 4.

	EwE	OSMOSE	ISIS	Atlantis	StrathE2E
Performance of key predators	Yes	Yes		Yes	Yes
Large Fish		Yes	Yes	Yes	No
Abundance trends	Yes	Yes	Yes (some)	Yes	Yes

4.4 Descriptor D5 (eutrophication)

Reduction in the amount of discards is unlikely to have any significant effects on eutrophication. However, the effect of DMS on the nutrients and chlorophyll concentrations in the water column and the sediment will be monitored in the case of the Atlantis and StrathE2E models.

4.5 Descriptor D6 (sea-floor integrity)

Some of the models can compute bottom trawling effort maps (ISIS-Fish, Atlantis, StrathE2E), but none of them simulate the impact of trawling on benthic or demersal fauna/flora/habitats apart from direct fishing mortality. (Although StrathE2E simulates the effect of trawling on the sediment biogeochemistry.)

4.5.1 Criterion 6.1: Physical damage, having regard to substrate characteristics

- **Indicator 6.1.2: Extent of the seabed significantly affected by human activities for the different substrate types**.

As for descriptor 4, ICES has suggested some revisions including the rephrasing of 6.1 as "Damage to the sea-floor, having regard to both pressure(s) on, and sensitivity of, habitat", and of 6.1.2 as "Extent of the sea-floor significantly affected by human activities for the different substrate types (including biogenic)" (ICES, 2015).

Table 7: Indicators selected for the GES descriptor 5

	EwE	**OSMOSE**	**ISIS**	**Atlantis**	**StrathE2E**
Bottom trawling effort map			Yes	Yes (coarse spatial definition)	Yes

5 Discard Mitigation Strategies evaluation

The impact assessments will be run in the spirit of the Management strategy evaluation (MSE) approach (Sainsbury et al, 2000). MSE consists in the assessment of the consequences of a range of management strategies or scenarios and the presentation of the results such as to make visible the trade-offs in performance across a range of management objectives. In contrast to other approaches to fisheries assessment, it does not seek to proscribe an optimal strategy or decision, but rather to provide the decision maker with the information on which to base a rational decision, given their own objectives, preferences, and attitudes to risk.

In task 1.3, a set of scenarios including a baseline scenario (i.e. *business as usual*; a simulation with no landing obligation implemented) is parameterised for our models. Discard Mitigation Strategies provided by the other Work Packages will also be translated into scenarios (i.e. alternative parameterisations) and assessed by using 15 to 30 years projections. Resulting indicators time series will be compared across strategies and to the baseline scenarios values (e.g. Forrest et al., 2015). Then scenarios ranked for each indicator or indicator values can be pulled together in composite indices by themes (e.g. Fulton et al., 2014), plotted per scenarios compared to baseline, or simply presented as traffic light (Table 8).

Table 8: MSE schematic representation of the results obtained with each of the impact assessment tools (operating models) used: the scenarios (i.e. DMS) will be tested with each of the impact assessment tools/models and the results will be assessed using the criteria listed in this deliverable.

	Criteria A	Criteria B	Criteria C	Criteria D
Scenario 1	Good	Intermediate	Intermediate	Intermediate
Scenario 2	Intermediate	Intermediate	Good	Good
Scenario 3	Bad	Bad	Bad	Good

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