Guideline coding strategy

Most of the information should be extracted from the title, abstract, keywords, highlights and/or figures. Most of the time, the driver(s), the analyzed impact(s), the study population etc are usually detailed in these sections. Most of the time (sometimes it will be necessary), there is no need to dive in all the study details.

Studies published in French, German, Italian and Spanish are relevant. If it is not your language, just skip the article.

For all labels named as “other”, let them empty if you didn’t select “other” in a previous list

* **Include**

To be included, an article must fulfill few criteria:

* + Focuses on the North Sea marine ecosystem defined as the ICES divisions IVa, IVb and IVc (including fjords and estuaries if they fall in one the ICES divisions previously mentioned) or includes the North Sea in a bigger area (e.g., North East Atlantic).
  + Explicitly considers at least one of the five direct anthropogenic drivers of global change (climate change, direct exploitation (fishing activities), pollution (including eutrophication), biological invasion and sea-use change)
  + See our protocol paper for more details: [Identifying and addressing the anthropogenic drivers of global change in the North Sea: a systematic map protocol | Environmental Evidence | Full Text (biomedcentral.com)](https://environmentalevidencejournal.biomedcentral.com/articles/10.1186/s13750-021-00234-y)
  + The PDF contains the full article and not just an abstract. If an article is just an ‘abstract’, select include = NO and in exclusion criteria: “Only\_abstract”
  + Methodological papers are relevant if they apply the (new) methodology on a North Sea case study. If the method is described but not really applied in the North Sea, the paper is considered as irrelevant and should be excluded.
* **Exclusion criteria**
  + If you selected “No” for the label “Include”: select the main reason why. Only one answer is required. In order: not North Sea, not Anthropogenic driver, not good population (e.g., only “human” are affected or only on atmosphere) ... Select “other” only if you don’t find the reason of exclusion in the list established and write (short string, few words) in the “other exclusion criteria” the reason. Not right time period = papers assessing human impacts/anthropogenic drivers before 1850-1900 (pre-industrial period).
  + Only abstract: if you think the abstract is particularly relevant (see inclusion criteria in our protocol paper = in the North Sea, anthropogenic driver(s), time period ok etc), write “relevant\_abstract” in “other” without selecting “other” in the list. We will see if we can find the full article later.
  + Only governance: papers which talk about governance/policy only (i.e., without talking about the drivers, their impacts etc).
* **Paper type**
  + select only one answer among choices
  + A Meta-analysis is different from a review. A meta-analysis is a statistical analysis that combines the results of multiple scientific studies. A review just summarizes the existing literature on a given topic (as we are doing).
  + To be retained, a review paper must mention the “North Sea” or areas within the North Sea (e.g. the Wadden Sea) in tables and/or Figures OR mention the “North Sea” (or areas within) at least 2 times in the text.
* **Anthropogenic driver(s)**
  + Select only the main one(s). The driver must be explicitly considered or tested or analyzed. In most of the case it is easy to get by reading the title and abstract. There can be some doubts, for instance when temperature is mentioned. In that case, you can search on the paper if the term “climate change” (or any synonyms such as global warming) appears multiple times in the text, and if it really refers to anthropogenic climate change in the context of the sentences.
  + If they talk about anthropogenic impacts without precising (for instance in review papers) what are the anthropogenic drivers, select “global change”. If they talk about the 5 anthropogenic drivers, rather than to select the 5, select “global change”.
* **Precision of the driver(s)**
  + Select only the main one(s). The one(s) that is/are really considered in the article. Select “other” and precise in the label “precision of the driver if other” (few clear words) if you don’t find the correct element. Most of elements are already in the list so be sure that it’s really an “other”.
  + If they implemented a climate change scenario (SRES, RCP etc) with a climate model or biogeochemical model for isntance, select “other” and specify “climate\_change\_scenario” in the field “Precision of the driver(s) if other”. Why? Because under climate change scenarios, they do no only modify the temperature or salinity or hydrodynamics but all the physical and chemical variables.
  + Global change: only if they analyze “human activities” impacts (for instance) without mentioning precisely which specific driver.
* **Analyzed impact(s)**
  + “Analyzed impacts” refers to the “Nature of the study population” (for instance, if they work on the impact of a pollutant on biomass /abundance of benthic organisms, even if they say that the pollutant concentration has increased in area X and area Y in the water, in sediments etc between 2000 and 2020, the selected impact is "change\_biomass\_abundance" and NOT "change\_chemical\_water\_properties" or "change\_chemical\_properties")
  + Select only the main one(s). For most studies, it is usually one or two impacts that are assessed, rarely more. As for “anthropogenic driver” and “precision of the driver”, select only the one(s) that are explicitly studied in the paper. Select “Multiple” if more (or equal!) than three impacts were assessed. Select “other” if the impact is not in the list and fill in the corresponding label (with few clear words). Each “impact” in the list has its own definition:
    - Change\_biomass\_abundance: change in the number (or weight) of individuals within a population or ecosystem. Change in catch (volume) are considered as change in biomass/abundance.
    - Change\_demographic\_structure: age/size/sex ratio etc distribution/structure of a population, size spectrum
    - Change\_life\_history\_traits: number of generations per year, rate and timing of reproduction, survival, developmental rate, age and size at maturity, size at birth, longevity, growth and reproduction specificities etc
    - Change\_distribution: change in species distribution. Can be on the longitude latitude or vertically
    - Degradation\_habitat\_loss: degradation, destruction of an habitat
    - Change\_diversity: species richness, functional diversity. Must be measured with diversity indicators (Shannon, Simpson, Jaccard etc)
    - Change\_physiology: Physiological systems such as ion regulation, temperature regulation, stress, energetics, metabolic rates, sexual inversion etc
    - Change\_contamination\_level: only for living organisms. Change in pollutans concentration within organs, tissues etc for fish, seabirds, mammals etc
    - Change\_phenology: timing of seasonal activities (e.g., breeding). Phenology is the timing of annually recurrent biological events (blooms, migration, hatching, mating etc)
    - Change\_genetic: change in genes, alleles etc
    - Bioaccumulation\_TL: gradual accumulation of substances in an organism (pesticides, heavy metals, chemicals etc). It has to be explicitly studied (increase in concentration through the food web).
    - Change\_trophic\_functioning\_structure: change in predation, trophic structure and functioning, in trophic levels, top-down/bottom-up control, trophic efficiency etc
    - Change\_biogeochemical\_fluxes: phosphorus, carbon, nitrogen, ratio Cd:Ca, Cd:PO4
    - Change\_Harmful\_algal\_blooms: increase/decrease HAB etc
    - Change\_extrem\_events: marine heat waves, storm surges, floods etc
    - Change\_physical\_water\_properties: stratification, currents, flows etc
    - Change\_physical\_sediment\_properties: grain density, porosity, seabed structure, geomorphological changes etc
    - Change\_chemical\_water\_properties: pH, salinity, oxygen for instance. Not relevant if talks of particulate organic matter
    - Change\_chemical\_sediment\_properties
    - Coastal\_erosion\_sedimentation
    - Change\_toxins: biological toxins (Paralytic Shellfish Poisoning for instance)
    - Quantifivation\_driver: relevant ONLY in some cases. E.g., when the study analyses the fishing effort or a concentration in plastic only…If they measured temperature (for instance) do not select this item but “change\_physical…properties)
    - Other
* **Nature of the population**
  + select the main one(s) studied. Select other if the population is not in the list.
* **Organizational level**
  + select the main one(s). Usually, it is only one level. Each level has its own definition
    - Individual: only few individuals are considered (e.g., dead searbird collected on beaches, fish in an experimental studied (e.g., in a tank)), organisms contaminated by PCBs (only few individuals used).
    - Population: generally associated to “observations\_field\_measurement” or “modelling” methodologies (e.g. outputs of stock assessment models of a given species): set of individuals of a given species living in an ecosystem.
    - Community: refers to different populations in interaction: set of population living in a particular ecosystem at a given time. If 2-3 species are investigated individually (meaning that results are distinct for each species), the study organizational level is “population” and not “community”!
    - Ecosystem: consists of all the organisms and the physical environment with which they interact (biotic and abiotic): mostly associated with modelling approaches: low trophic levels model forced by a physical model, Ecopath model, high trophic levels model forced by a low trophic levels model…
    - Not applicable: if not on living organisms
* **ICES major locations**
  + Select one or two (e.g., IVa or IVb) or “whole North Sea” if all the divisions are included in the study. If the study is at the NE Atlantic scale (for instance), select “whole North Sea”.
* **ICES medium locations**
  + same than for “major locations”. The Wadden Sea corresponds to ICES Areas 4 and 5a (excepted if they mentioned a specific location in the Wadden Sea…). German Bight corresponds to ICES medium location 5a.
* **Habitat type(s)**
  + select the main one(s). To be filled if the information is easily accessible (in title, abstract, keywords or highlights). In some studies, the habitat is important and is described, in this case, specify it. In other studies, the habitat is not so important and is not explicitly mentioned, in this case, don’t precise it (select “not applicable”)
* **Main methodology**
  + select the main one(s). Generally, only one main methodology is employed.
    - Experimental: experiments in a lab, in mesocosm for instance.
    - Meta-analysis: the study is a meta-analysis. This type of studies follows a particular method (as the study we are conducted now)
    - Review: the study is a review only and not a meta analysis.
    - Modelling: they used a model (physical model, biogeochemical model, trophic model, fishing fleet model, stock assessment model etc), they model (e.g., with equations) a population, a dynamic, a process, an ecosystem etc.
    - observations field measurement: studies which performed statistical analysis only (parametric and non-parametric tests, anova, glm, gam etc). they analyzed observations/field measurements to find something.
* **Spatial dimension**
  + Is the study spatially explicit? it is “yes” only if results present a comparison between regions (or at least distinct results for 2 or more regions or results according to a longitudinal/latitudinal gradient). If there are different sampling sites, but that all data are pooled together, then it is not spatially explicit. Only the horizontal dimension is considered: studies talking about changes according to depth are not spatially explicit in our case.
  + Studies comparing a North Sea area with an area outside the North Sea are spatially explicit.
* **Temporal dimension**
  + Is the study temporally explicit? It is “yes” if the study compared different time periods (on a yearly basis for instance). Results must a temporal dimension.
* **Solution\_investigated**
  + Choose only one “solution”
  + the solution (“Management” or “Conservation\_protection” or “Restoration”) must be explicitly tested for, and not only used as an argument of discussion to explain a pattern in time series. A solution is investigated only if a given management strategy is explicitly mentioned in the result section.
    - Management: test effect of a new law on something or a new technique on something
    - Conservation\_protection: test measure to protect or conserve something (e.g., marine protected area)
    - Restoration: test a measure which restore something (oyster ground, saltmarsh, seagrass etc)
* **Comment**
  + only if necessary…