Biodiversity knowledge synthesis: an introduction to meta-analyses and systematic reviews

- Metacoding -

3/10/23 - Montpellier

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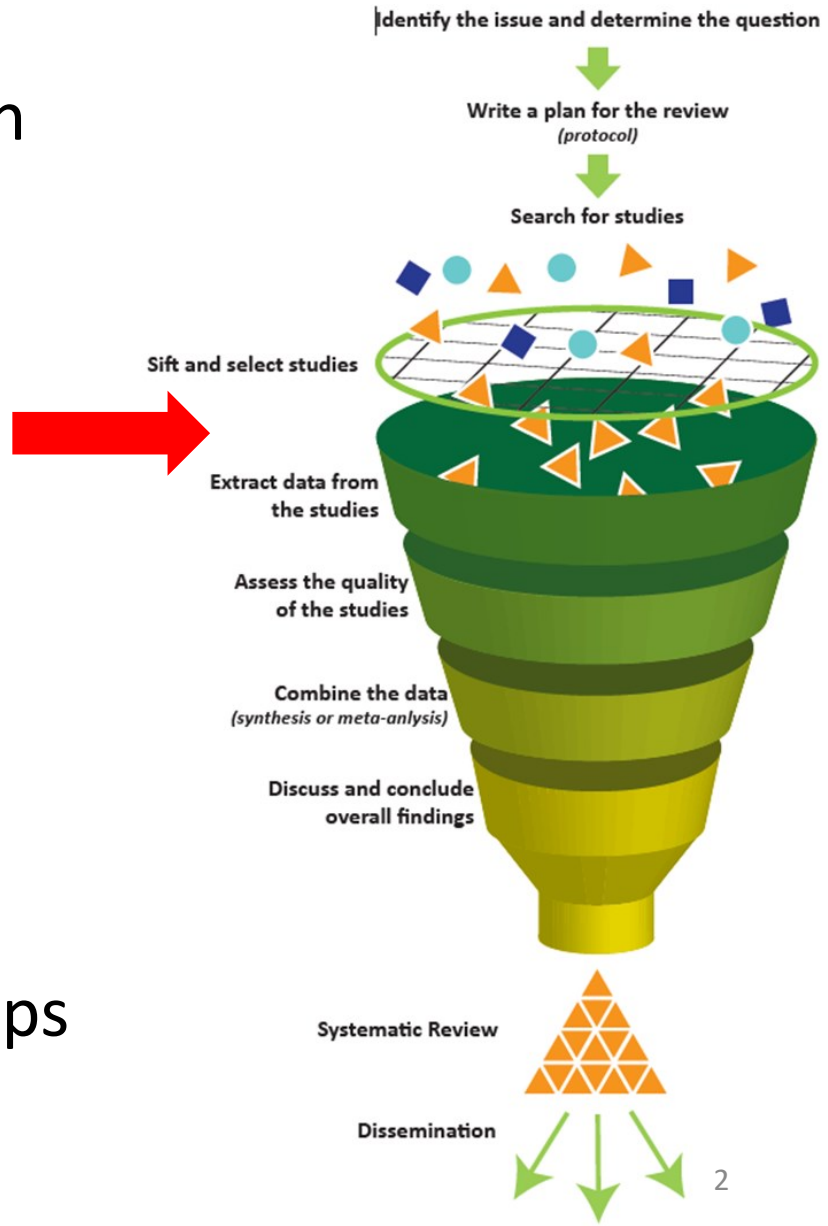
Metacoding

Describe/map the literature answering the question

- quantity
- nature

e.g. what populations are studied?
e.g. what types of intervention were studied?
e.g. what responses were measured?
+ how many studies for each category?

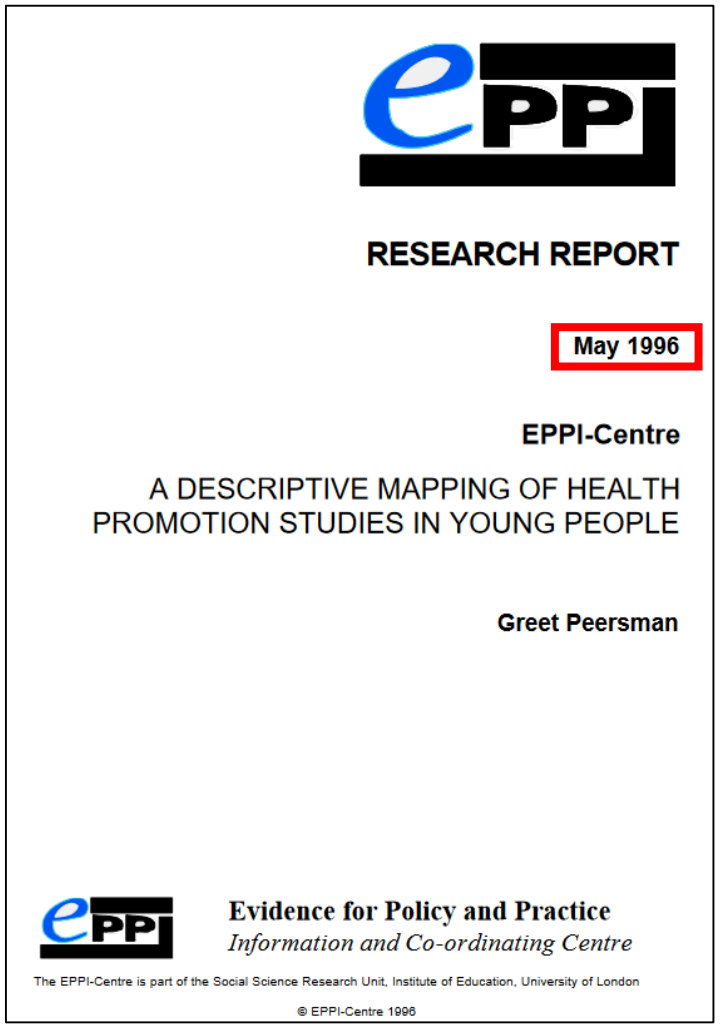
→ Identification of knowledge clusters
(future reviews / meta-analyses) and knowledge gaps



Jessica Kaufman, Cochrane Consumers & Communication Review Group, Centre for Health Communication and Participation, La Trobe University, 2011.

Systematic maps

Methodology developed by EPPI-Centre (social sciences)



RESEARCH REPORT

May 1996

EPPI-Centre

A DESCRIPTIVE MAPPING OF HEALTH PROMOTION STUDIES IN YOUNG PEOPLE

Greet Peersman

Evidence for Policy and Practice
Information and Co-ordinating Centre

The EPPI-Centre is part of the Social Science Research Unit, Institute of Education, University of London

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The politics of evidence and methodology: lessons from the EPPI-Centre

Ann Oakley, David Gough, Sandy Oliver and James Thomas

These challenges of synthesising social science research have led over time to a number of pragmatic adaptations in the technology of systematic reviews. Building on the mapping report commissioned by the DH in 1996 (Peersman, 1996), EPPI-Centre reviews increasingly use a two-stage model of systematic reviews. In stage one, the relevant literature is located and described in order to provide a 'map' of research activity in the area. 'Mapping' the literature is a useful product in itself, and it also helps to counter the objection that too much literature is found and discarded. It also helps researchers and policy makers to see what kinds of questions the research can be used to answer. One implication of a two-stage model is that some reviews may consist simply of a mapping stage; for example, a map of research on the effects of travel on children as a scoping study for further research on children's travel to school (Gough et al, 2001). In the second stage of a review, a smaller subset of studies is used to answer a more focused question. Criteria used to select the smaller

Systematic maps

In environmental sciences:

Same rigour as for systematic reviews (protocol, etc.)

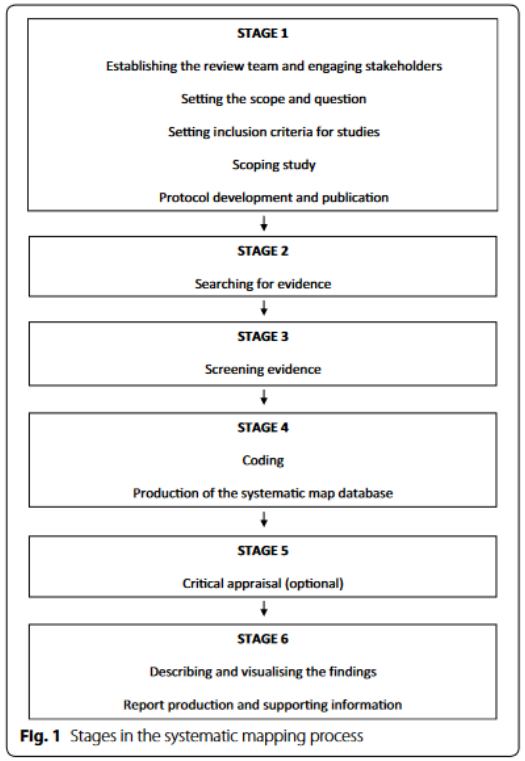


Fig. 1 Stages in the systematic mapping process

James *et al. Environ Evid (2016) 5:7*
DOI 10.1186/s13750-016-0059-6

Environmental Evidence

METHODOLOGY Open Access

CrossMark

A methodology for systematic mapping in environmental sciences

Katy L. James[1], Nicola P. Randall[1*] and Neal R. Haddaway[2]

Table 1 Differences between a systematic map and systematic review

Stage in 'evidence synthesis'	Systematic map	Systematic review
Objective	Describes the state of knowledge for a question or topic	Aims to answer questions with a quantitative or qualitative answer
Question formulation	Question can be open-framed or closed-framed. Topic can be broad or narrow	Question is usually closed-framed
Search strategy	No limitation on research evidence that can be included (e.g. primary and secondary research)	Evidence is limited to primary qualitative or quantitative research. For example comparative, prevalence or occurrence type studies
Article screening	Articles not obtainable at full text (where the full document is not available) or studies with limited data may be included	Article full text is usually required to extract relevant data
Data extraction	Information describing the study and its methods are extracted. Study results may not be extracted	Information describing the study and its methods and studies' qualitative and or quantitative results extracted
Critical appraisal	Critical appraisal optional	All included studies critically appraised for study internal and external validity
Synthesis	Trends in the literature, knowledge gaps and clusters identified but no 'synthesis of study results' carried out	Qualitative or quantitative synthesis of study results where possible using appropriate methodology (e.g. meta-analysis). Knowledge gaps identified
Report	Describes and catalogues available evidence relating to a topic of interest, identifying knowledge gaps and knowledge clusters. Implications for policy, practice and research made	Narrative and qualitative or quantitative synthesis study results (e.g. meta-analysis) to answer the question (where feasible). Implications for policy and practice, and identification of knowledge gaps for future research

Systematic maps

Environmental Evidence

On-site communication measures as a tool in outdoor recreation management: a systematic map

Communication is a central tool used to manage the balance between outdoor recreation and environmental protection in natural areas. Several studies have evaluated different communication measures in case stud...

Sofie Kjendlie Selvaag, Rose Keller, Øystein Aas, Vegard Gundersen and Frode Thomassen Singsaas

Environmental Evidence 2023 12:14

Systematic Map | Published on: 22 July 2023

What approaches exist to evaluate the effectiveness of UK-relevant natural flood management measures? A systematic map

This systematic map principally sought to understand the different forms of effectiveness that existing studies evaluate in relation to Natural Flood Management (NFM) in the UK with a supplementary question of...

Angela Connelly, Andrew Snow, Jeremy Carter, Jana Wendler, Rachel Lauwerijssen, Joseph Glentworth, Adam Barker, John Handley, Graham Haughton and James Rothwell

Environmental Evidence 2023 12:12

Systematic Map | Published on: 23 May 2023

Existing evidence on the impact of changes in marine ecosystem structure and functioning on ecosystem service delivery: a systematic map

The current biodiversity crisis underscores the urgent need for sustainable management of the human uses of nature. In the context of sustainability management, adopting the ecosystem service (ES) concept, i.e...

Carole Sylvie Campagne, Laurie-Anne Roy, Joseph Langridge, Joachim Claudet, Rémi Mongruel, Damien Beillouin and Éric Thiébaut

Environmental Evidence 2023 12:13

Systematic Map | Published on: 20 July 2023

What evidence exists on the impact of anthropogenic radiofrequency electromagnetic fields on animals and plants in the environment: a systematic map

Exposure to radiofrequency (RF) electromagnetic fields (EMF), particularly from telecommunications sources, is one of the most common and fastest growing anthropogenic factors on the environment. In many count...

Ken Karipidis, Chris Brzozek, Rohan Mate, Chhavi Raj Bhatt, Sarah Loughran and Andrew W Wood

Environmental Evidence 2023 12:9

Systematic Map | Published on: 11 May 2023

Systematic maps

Bernes *et al. Environ Evid (2017) 6:24*
DOI 10.1186/s13750-017-0103-1

Environmental Evidence

SYSTEMATIC MAP Open Access

How are biodiversity and dispersal of species affected by the management of roadsides? A systematic map

Claes Bernes[1*], James M. Bullock[2], Simon Jakobsson[3], Maj Rundlöf[4], Kris Verheyen[5] and Regina Lindborg[3]

Population: Roadsides

Intervention: Roadside management, e.g. mowing, removal of shrubs and saplings, pruning, coppicing, control of invasive/nuisance species, herbicide use, sowing or planting, burning, grazing by livestock, tillage and other forms of soil cultivation, mulching, topsoiling, use of erosion-control mats or blankets, fertiliser addition, liming, irrigation, ditching and maintenance of ditches

Comparator: Non-intervention or alternative forms of roadside management

Outcomes: (1) Measures of local or regional diversity of animals, plants, fungi or bacteria, e.g. alpha/beta/gamma species diversity, genetic diversity, abundance of individual species, or abundance of functional/taxonomic groups of organisms (including measures of the total abundance of vegetation).
(2) Measures of species dispersal along roads or roadsides, e.g. species distribution patterns or movement rates of individuals or propagules.

Table 2 Combinations of interventions and organism groups studied (No. of studies)

Intervention	Organism group													
	Graminoids	Herbs/ forbs	Woody plants	Bryophytes	Lichens	Fungi	Mammals	Birds	Reptiles	Insects	Other arthropods	Other invertebrates	Bacteria	All species
Vegetation disturbance														
Mowing	54	61	28	1	0	1	5	7	0	12	1	1	0	85
Pruning	1	1	1	0	0	0	0	0	0	0	0	0	0	1
Removal of shrubs/ saplings	2	3	4	0	0	0	3	2	1	1	0	1	0	9
Grazing	3	3	6	0	0	0	0	0	0	0	0	0	0	6
Burning	11	12	4	0	0	0	0	1	0	1	0	0	0	14
Heating	1	1	0	0	0	0	0	0	0	0	0	0	0	1
Herbicide use	67	72	21	0	0	0	0	0	0	1	0	1	0	86
Biological amendment														
Sowing	63	76	21	2	1	0	0	1	0	3	0	1	3	86
Planting	11	12	10	1	1	0	0	2	1	1	0	0	0	19
Mycorrhizal treatment	4	2	4	0	0	0	0	0	0	0	0	0	0	7
Soil amendment														
Fertiliser addition	31	31	13	0	0	1	0	0	0	0	0	0	1	39
Liming	9	17	1	0	0	0	0	0	0	0	0	0	0	18
Topsoiling	11	11	7	0	0	0	0	0	0	0	0	0	0	11
Mulching or compost application	32	33	17	0	0	1	0	0	0	0	0	0	3	41
Use of erosion-control mats/blankets	11	10	7	0	0	0	0	0	0	0	0	1	0	11
Irrigation	6	5	4	0	0	0	0	0	0	0	0	0	1	7
Soil cultivation (e.g. tillage)	13	19	6	1	1	0	0	0	0	0	0	0	0	23
Ditching or ditch maintenance	3	3	3	1	0	0	0	0	0	0	0	0	0	3
Control of invasive/nuisance species	43	52	18	0	0	0	0	0	0	1	0	0	0	61
Other interventions	5	6	3	0	0	0	0	0	0	2	0	0	0	11
All interventions	207	232	105	5	2	2	5	10	1	17	1	2	3	

Jakobsson *et al. Environ Evid (2018) 7:17*
https://doi.org/10.1186/s13750-018-0129-z

Environmental Evidence

SYSTEMATIC REVIEW Open Access

How does roadside vegetation management affect the diversity of vascular plants and invertebrates? A systematic review

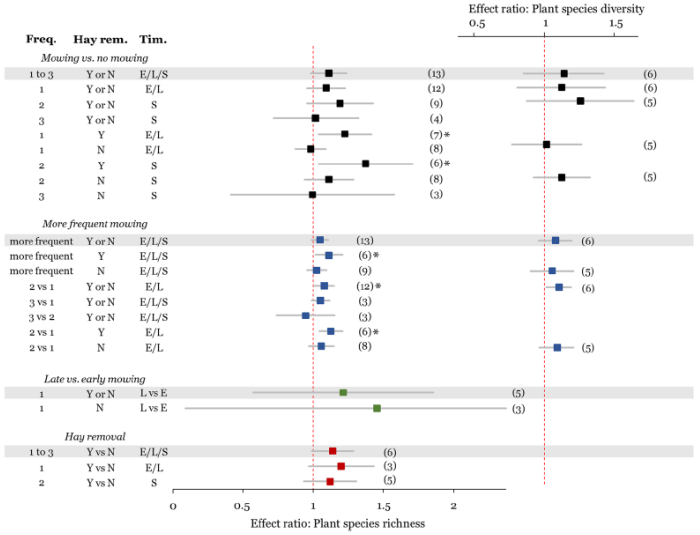
Simon Jakobsson[1*], Claes Bernes[2], James M. Bullock[3], Kris Verheyen[4] and Regina Lindborg[1]

Population: roadside habitats and the species of vascular plants and invertebrates found within them.

Intervention: maintenance or restoration of roadside habitats based on non-chemical vegetation removal such as mowing, grazing, burning, clearance of shrubs and saplings, coppicing, pruning, or mechanical removal of invasive plants.

Comparator: non-intervention or alternative forms of the interventions.

Outcomes: measures of functional/taxonomic diversity (including abundance) of vascular plants or invertebrates.



Metacoding

Extraction of meta-data = extraction of information describing **the study** and its methods

Coding = process of assigning **categories** to each **study** for a series of variables describing the framework and design of the study

→ Define the **study** (an article may contain several studies)
→ Define the variables to be extracted/coded and the categories (**code book**)

Metacoding

James KL, Randall NP, Haddaway NR. A methodology for systematic mapping in environmental sciences. Environ Evid. 2016;5:7.

Table 2 Examples of coding variables for systematic maps

Coding variable	Example of information that may be recorded
Full reference	Author(s), title, date, publisher
Year of publication	Date of publication in years
Publication type	Academic journal, book, conference paper or thesis
Language	Article language
Study country	Name of country
Linked study	Other articles reporting the same study
Data source	e.g. Primary or secondary research
Data type	e.g. Quantitative or qualitative
Study design	e.g. Experimental, quasi-experimental, observational, survey
Population(s)	e.g. Species, group
Intervention(s)	Type(s) of intervention investigated
Exposure(s)	Type(s) of exposure investigated
Comparator(s)	Type(s) of comparator used
Outcome(s) assessed	Types of outcome assessed
Sampling strategy	e.g. None specified, randomised, systematic
Length/period of study	e.g. Number of days, weeks, months, years or time period over which study was undertaken

Metacoding

! Warning !
Metacoding is time-consuming: **trade-off** between the amount of variables describing the study and the resources available to code.
→ What information is most relevant to the question?

Importance of **testing the coding book** on a sample of articles to check that it matches the content of the studies

Document the work (transparency, repeatability)

Decide what to do in case of **missing information** ("Not stated", contact the authors, complete via linked studies)

Coding book: example

Variables

	Column	Description	Dropdown/Meta-data	Example
Publication	Reviewer ID	Name of the reviewer who is extracting the meta-data	Meta-data	
	EPPI ID	Unique document ID	Meta-data	
	Citation	As Written	Meta-data	
	Authors	As Written	Meta-data	
	Title	As Written	Meta-data	
	Year	As Written	Meta-data	
	Journal	As Written	Meta-data	
	Pub Type	Type of article	Dropdown	
Mine description	Country	Country where mine is located	Dropdown	
	Region	Region or state where mine is located	Meta-data	
	Location	Specific name of the locality where the impact is being measured (site name)	Meta-data	City, impacted site name, etc.
	Mine/project name	Name of the mine or project	Meta-data	
	Latitude	Decimal degree location of site where research occurred	Meta-data	If not reported, retrieve external to paper based on closest available location or maps provided
	Longitude	Decimal degree location of site where research occurred	Meta-data	If not reported, retrieve external to paper based on closest available location or maps provided
	Key metals/ore extracted	The main ore extracted from the mine	Dropdown	
	Multiple metals list	If multiple selected in previous, List multiple metals extracted at the mine separate by se	Meta-data	Separate metas by semi colon (eg. Gold; Silver; Iron)
	Type or mine	Type of mining activity, expand the drop-down as necessary	Dropdown	e.g. open pit
	Prospecting	Y/N/NR/NS	Dropdown	
	Exploration	Y/N/NR/NS	Dropdown	
	Construction	Y/N/NR/NS	Dropdown	
	Operation	Y/N/NR/NS	Dropdown	
	Decomissioning & Closure	Y/N/NR/NS	Dropdown	
	Post-closure	Y/N/NR/NS	Dropdown	
	Remediation	Y/N/NR/NS	Dropdown	
	Abandonment	Y/N/NR/NS	Dropdown	
	Expansion	Y/N/NR/NS	Dropdown	
	Comment		Meta-data	
Study decription	Study Design	CI, BA, BACI, RCT, correlative, other	Dropdown	
	Study Design comments		Meta-data	
	Comparator Type	Description of the comparator used in the study	Dropdown	
	Study Setting		Dropdown	
	Study Design context	In situ, mesocosm, ex situ	Dropdown	
System	Population (who/what is affected) Description	Authors description of the population/system being impacted	Meta-data	Coastal habitat, as written by the author
	Population System	Is this a social, technological, or environmental	Dropdown	What system does the population described generally fall into.
	System affected	Describe population/system impacted (See sheet Impact coding)	Dropdown	
	Component affected	Follow coding based on system chosen (See sheet Impact coding)	Dropdown	
	Factor affected	Follow coding based on factor chosen (See sheet Impact coding)	Dropdown	
Impact/Mitigation	Impacts?	Does the study empirically investigate the impacts of mining?	Dropdown	Y/N/NR/NS
	Impact pathway (what is impacting the population)	Authors' short description of the impact	Meta-data	Compaction of the soil from mine traffic
	Mitigation?	Does the study empirically investigate mitigation measures? Y/N/unclear	Meta-data	Y/N/NR/NS
	Mitigation description	Authors' short description of the mitigation measure	Meta-data	Tarpaulin covers on trucks to reduce dust
	Impact being mitigated	Name the impact being mitigated	Dropdown	
Outcome	Measured outcome	Short description from authors of the outcome measured	Meta-data	
	Data Type	Quantitative or Qualitative data	Dropdown	
	Source of the information	Page or table from which outcome meta data can be found	Meta-data	

Haddaway et al. Environmental Evidence (2022) 11:30
https://doi.org/10.1186/s13750-022-00282-y

Environmental Evidence

SYSTEMATIC MAP Open Access

Evidence of the impacts of metal mining and the effectiveness of mining mitigation measures on social–ecological systems in Arctic and boreal regions: a systematic map

Neal R. Haddaway[1,2,3*], Adrienne Smith[4], Jessica J. Taylor[4], Christopher Andrews[4], Steven J. Cooke[4], Annika E. Nilsson[5] and Pamela Lesser[6]

Coding book: example

Categories

Codes	Notes		Codes	Notes
Publication Type			**Country**	
Article	journal articles		Canada	
Thesis	thesis (Masters or PhD)		USA	Alaska only
Conf	conference proceeding		Greenland	
Book	book		Iceland	
Book Chap	chapter in a book		Norway	including Svalbard
Report	report (government, consultant)		Sweden	
Other/Unlcear	e.g., news article, presentation etc.		Finland	
			Russia	
Key metals/ore extracted			The Faroe Islands	
Gold				
Iron			**Type of mine**	
Copper			Open pit	
Nickel			Strip mine	
Zinc			Quarry	
Silver			Underground mine	
Molybdenum			Surface mine	
Lead			Placer mine	
NR			Unclear	
Multiple			Expand as necessary	
Study design			**Comparator Type**	
BACI	Before-After-Control-Impact i.e.,		Same site/pop- Before	BA designs; no control site only before and after
BA	Before-after i.e., measured outcome		Reference site/population	Different unimpacted site/population; reference site;
CI	Control-impact i.e., measures outcome		Control	Where there are only two possible outcomes, e.g. positive
RCT	Randomized Controlled Trial; A study		Background values	Impacted sites/populations are compared to standard or
Correlative	Statistical relationship between		No control	No comparator; after impact only or correlative
I/A only	No comparator; after impact only		BACI (reference/control/before/after)	
			Expand as necessary	
Study Setting				
Field	Experimental, descriptive field study		**Study design context**	
Field+Lab analysis	Field work done and samples analyzed		In situ	Situated in the original, natural, or existing place or
Lab Experiment	Including indoor/outdoor facilities/app		ex situ	Outside, off site, or away from the natural location. For
Lab Exp + Field test	Prototype studied in lab/facility and tes		mesocosm	Bounded and partially enclosed outdoor experiment
Lab analysis	Sample analysis only			
Modelling				
Social Science	Interviews, surveys			

Haddaway et al. Environmental Evidence (2022) 11:30
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Coding book: example

Extraction sheet

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A3

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T
1	Publication									Mine description										
2	Article #	Reviewer ID	EPPI ID	Citation	Authors	Title	Year	Pub Type	Journal	Country	Region/State	Location	Mine/project name	Latitude	Longitude	Key metals/ore extracted	List Multiple Metals (semi-colon s	Type of mine	Prospecting	Exploration
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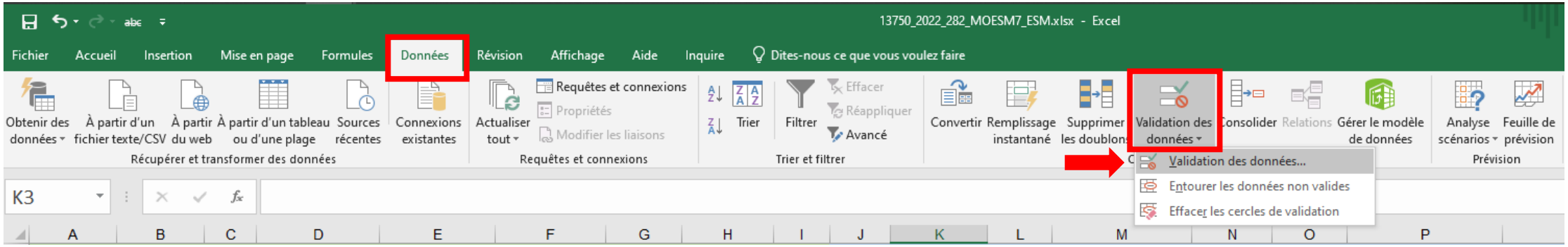
Variable descriptions | Possible codes | Extraction sheet

Coding: in practice with Excel

Defining constrained cells / drop-down lists



Coding: in practice with Excel

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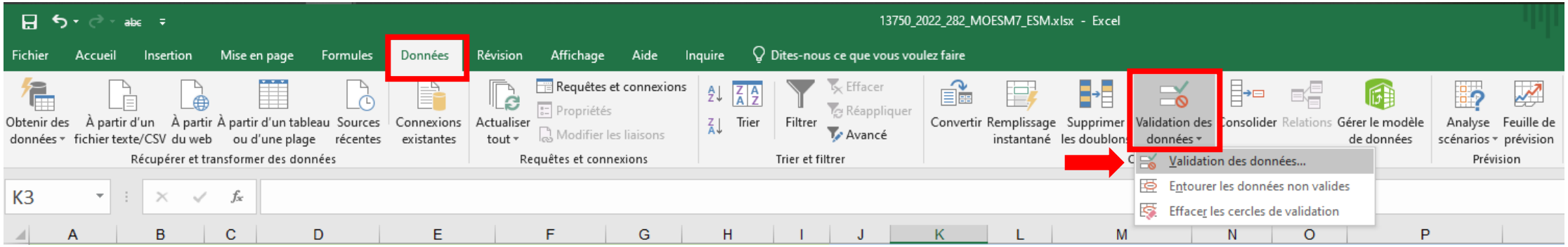
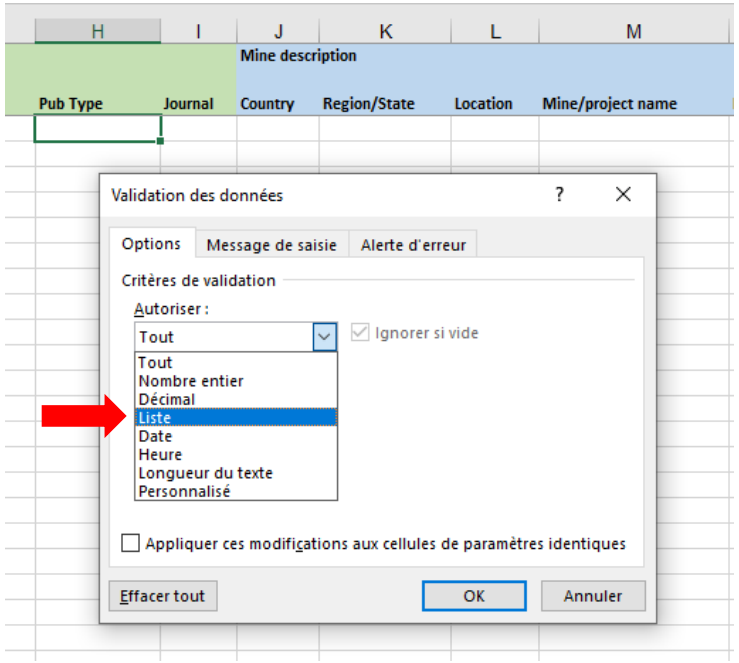
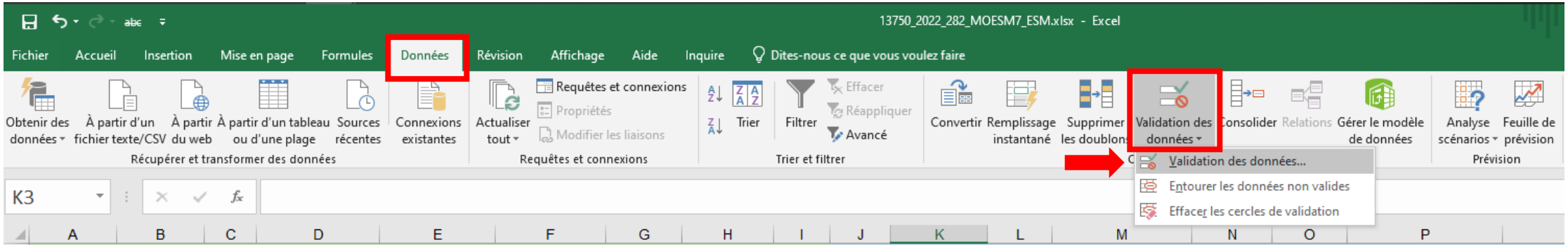
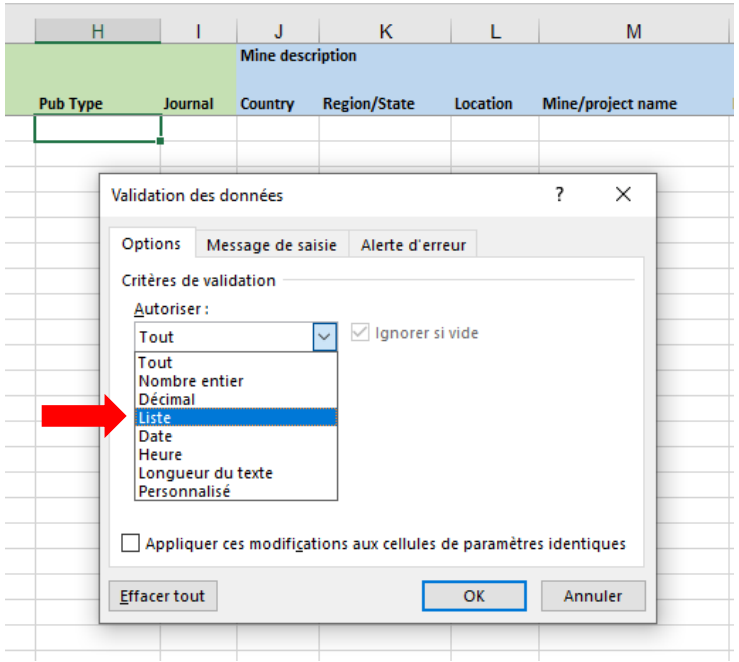


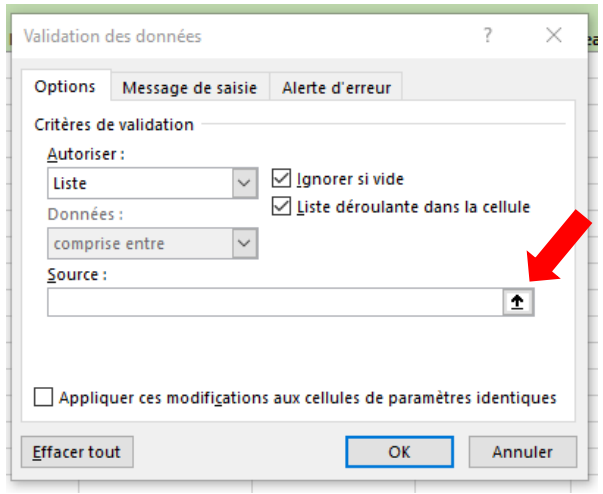


Coding: in practice with Excel

Defining constrained cells / drop-down lists

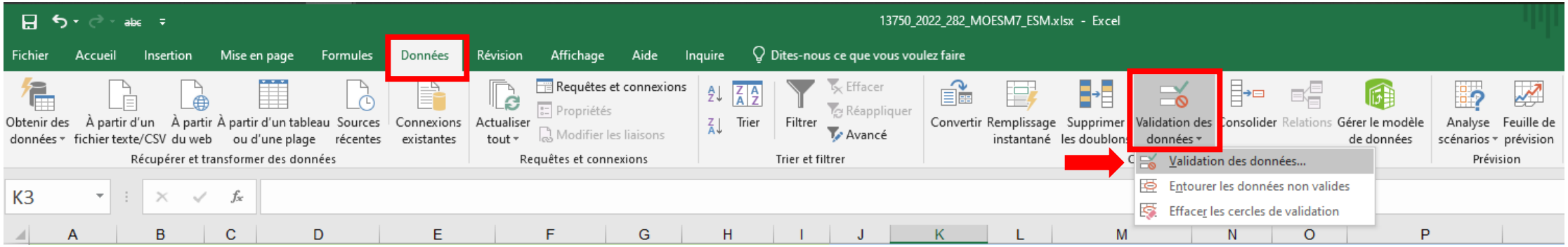


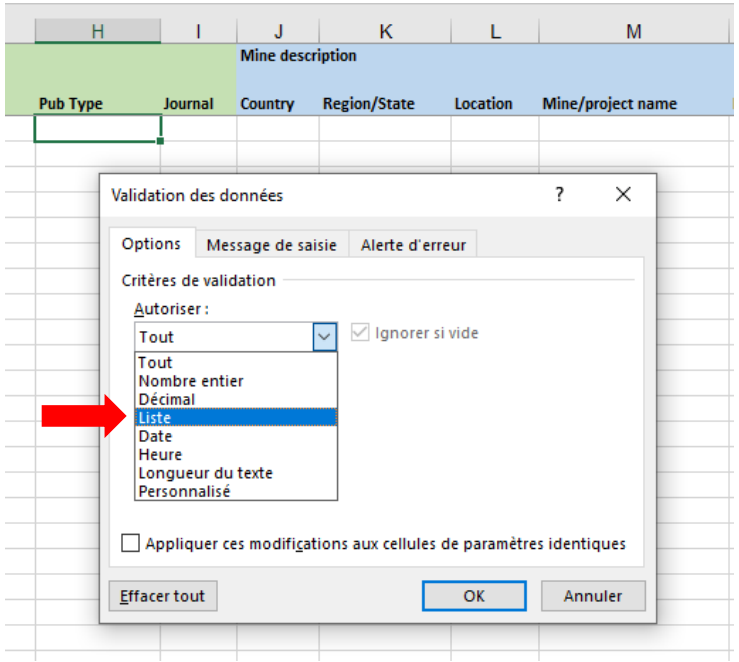


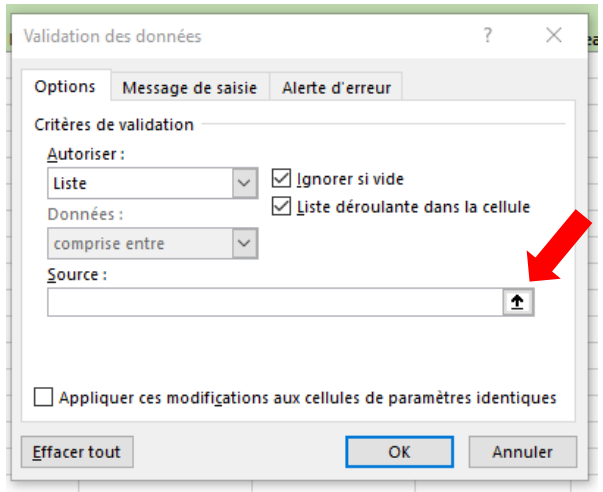


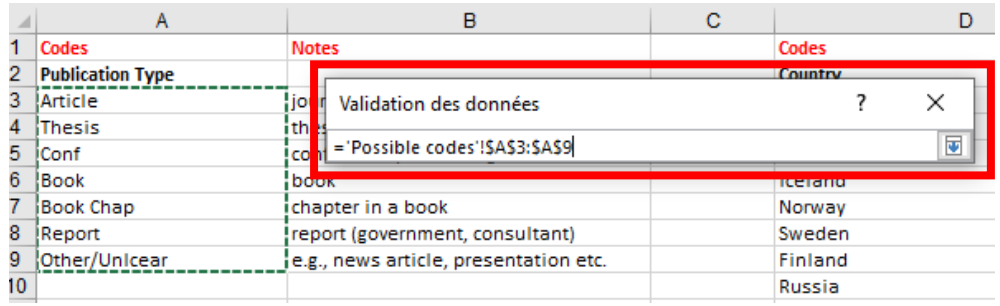
Coding: in practice with Excel

Defining constrained cells / drop-down lists



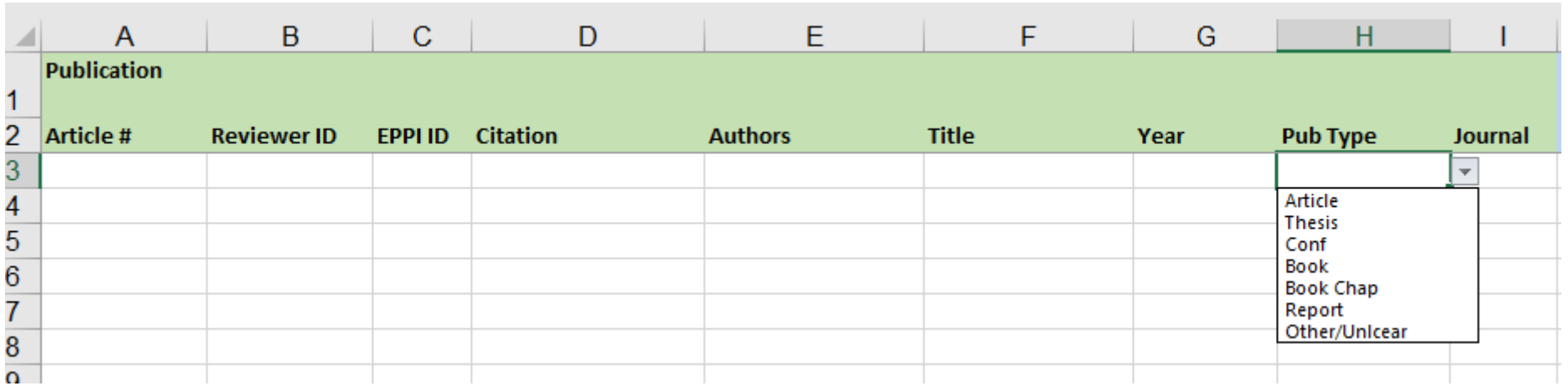


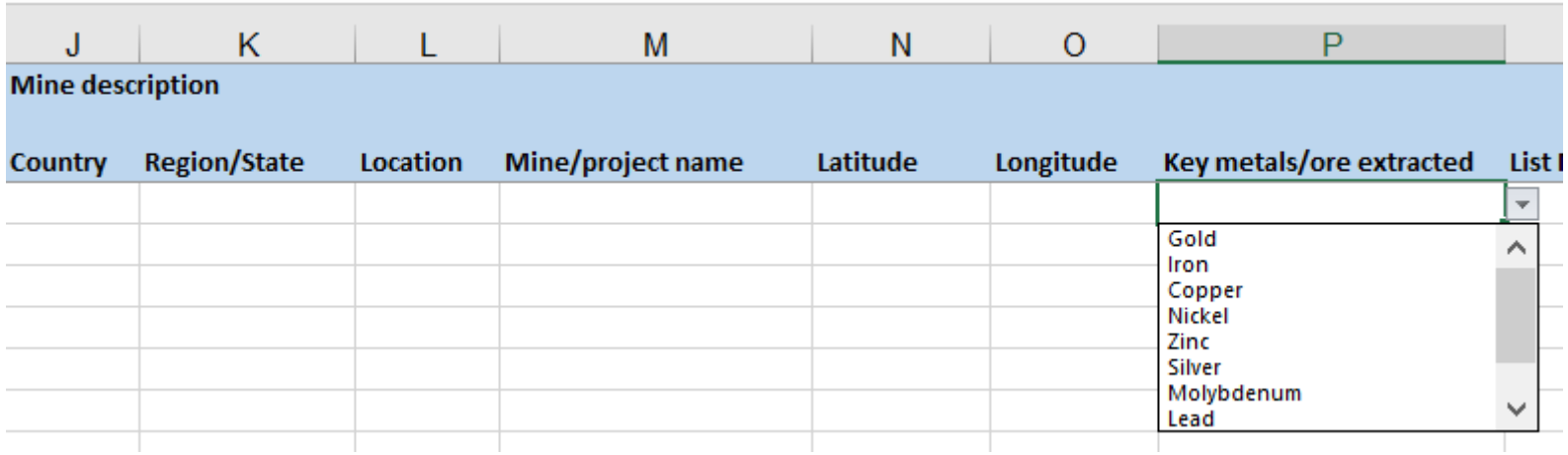




Coding: in practice with Excel

Defining constrained cells / drop-down lists





Consistency check

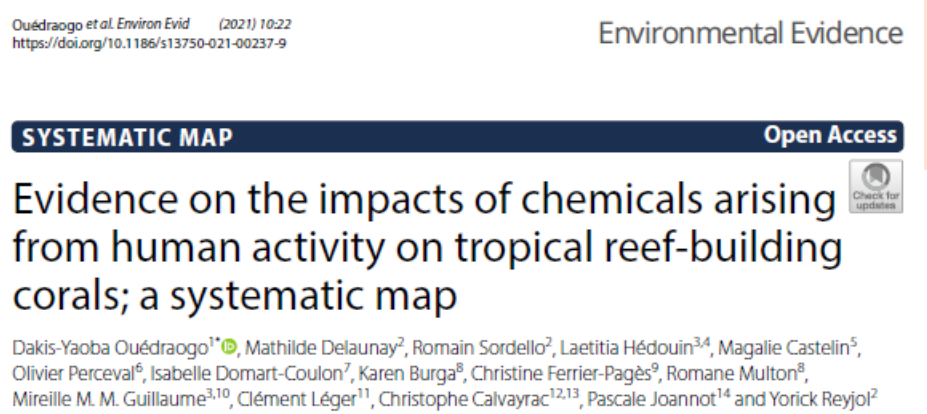
To be sure that the metacoding is objective / robust:

- metacoding of each study carried out **independently** by 2 people

- if several coders share the work, **check the consistency of the coding** between coders on a sample before starting the actual coding (discuss any disagreements)

- if only 1 coder, have someone to check a sample of the coding at the start of the work (discuss any disagreements)

TD


Ouédraogo et al. Environ Evid (2021) 10:22
https://doi.org/10.1186/s13750-021-00237-9

Environmental Evidence

SYSTEMATIC MAP Open Access

Evidence on the impacts of chemicals arising from human activity on tropical reef-building corals; a systematic map

Dakis-Yaoba Ouédraogo[1*], Mathilde Delaunay[2], Romain Sordello[2], Laetitia Hédouin[3,4], Magalie Castelin[5], Olivier Perceval[6], Isabelle Domart-Coulon[7], Karen Burga[8], Christine Ferrier-Pagès[9], Romane Multon[8], Mireille M. M. Guillaume[3,10], Clément Léger[11], Christophe Calvayrac[12,13], Pascale Joannot[14] and Yorick Reyjol[2]

Question: What evidence exists on the impacts of chemicals on tropical reef-building corals?

P : all tropical reef-building coral species

E : all chemicals

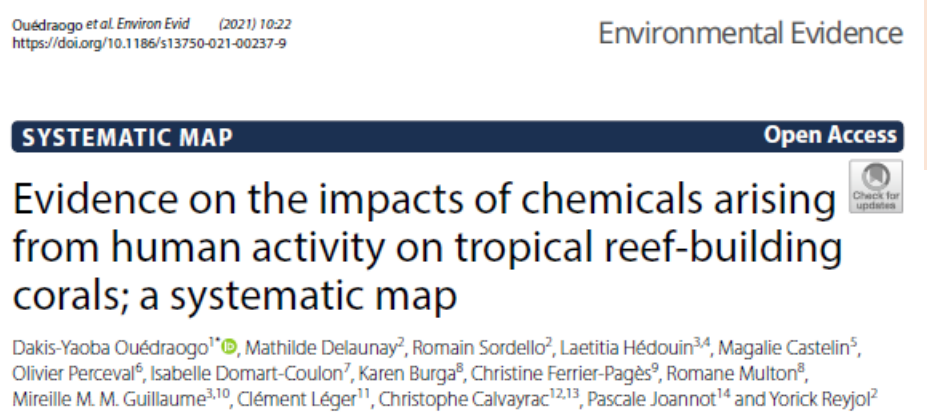
C : comparison exposed / not exposed; before/after exposure; range of exposure

0 : all outcomes at all levels of organisation (molecular, colony, community)

A **study** = **a taxon × an exposure × an outcome**

Total amount of literature to code: 908 documents

TD


Ouédraogo et al. Environ Evid (2021) 10:22
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Environmental Evidence

SYSTEMATIC MAP Open Access

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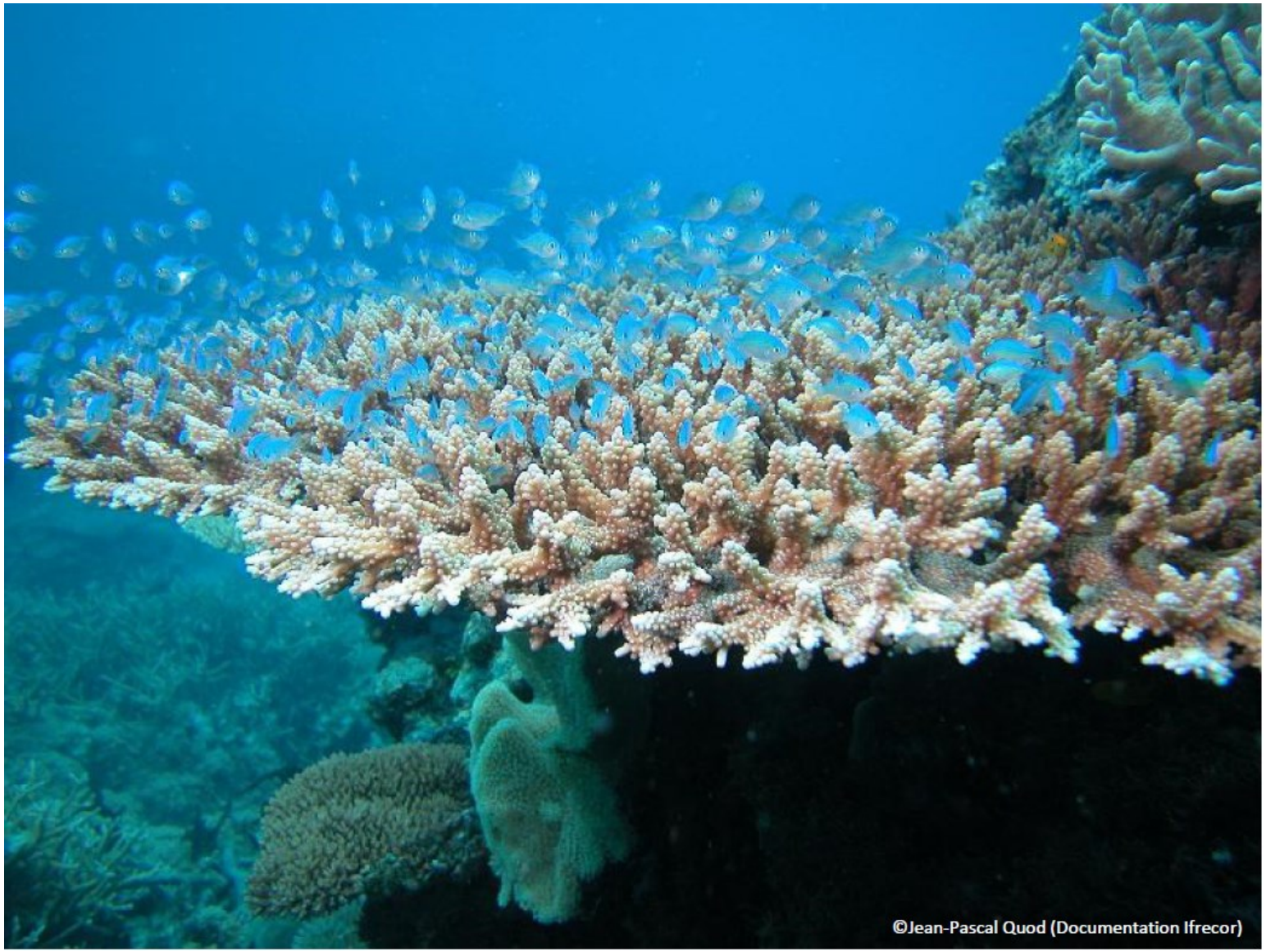
Sample of 3 articles :

1 – Prepare the Excel sheet, define the variables to be extracted/coded and the categories (10 min)

2 – Metacoding of 1-3 articles (15 min)

3 – Discussion (10 min)

TD



Variables to be extracted/coded

	Variable	Description	Value(s)
Bibliographic information	map_ID	Unique identifier given by the review team to each study of the map	A code number
	article_ID	Unique identifier given by the review team to each publication	A combinaison of number and letters
	source	Source of the publication	Scopus | WOS_CC | GS | CORE | GreenFile | Call_for_litterature | CoralTraitDatabase | ReefBase | Ecotox | IFRECOR | AIMS | IFREMER | ICRS | ICRI | LabexCorail | OATD | theseFR
	author	Author(s) of the publication	Text
	title	Title of the publication	Text
	year	Year of publication	YYYY
	journal	Publication journal	Text
	doi	DOI of the publication	Alphanumeric string of characters
	language	Language of the publication	English | French
	document_type	Publication type	Journal_article | Conf_proceedings | Book_chapter |PhD_thesis | MSc_thesis | BSc_thesis | Report
People who coded	metacod_name	Initials of the names of the people who coded the studies	Text

Variables to be extracted/coded

Study general description	study_ID	Unique identifier given by the review team to each study within an article or a thesis chapter	
	study_type	Type of study	Field_survey | Field_experiment | Laboratory_experiment
	country	Name of the country or territory where the study was conducted for in situ study or where samples were collected for ex situ study	ISO 3166 english short name
	region	Region of the country (according to Spalding et al. 2001)	Text
	latitude	Latitude where the study was conducted for in situ study or where samples were collected for ex situ study	Number or alphanumeric string of characters
	longitude	Longitude where the study was conducted for in situ study or where samples were collected for ex situ study	Number or alphanumeric string of characters
	coord_unit	Units of latitude and longitude	Text
	location	Location where the study was conducted for in situ study or where samples were collected for ex situ study (should be recorded when latitude and longitude are unknown)	Text

Variables to be extracted/coded

Population description	taxon_init	Name of the taxon studied as described by authors	Text
	taxon	Name of the taxon studied as updated by the review team. Taxon names were checked using the World Register of Marine Species (http://www.marinespecies.org/) and additional references. **Please note** that *Dipsastraea** does not fully match *Favia* as some *Favia* species in the Indo-Pacific have been transferred to other genera such as for instance *Goniastrea* . Also, *Pocillopora damicornis* has been split into several species including *Pocillopora acuta* . Thus the name *P. acuta* appears in the database from 2019. The two names have been combined here for analysis purposes, as there were *P. acuta* in the past which were called *P. damicornis* . And, *Fungia** includes other genus than *Fungia* such as *Danafungia* .	Text
	taxonlevel	Level of the taxon studied. When a study is about a community (several species or genera or families studied together as a group), the taxon level encoded is the closest common level (e.g. if several species of the same genus are studied together, the "Genus" level is indicated; if several species of the same family are studied together, the "Family" level is indicated; if several scleractinian species are studied together, the "Order" level is indicated).	Species | Genus | Family | Order | NA

Variables to be extracted/coded

General rules for coding:
If applicable, multiple values were delimited with a pipe |
NA was used as a substitute for missing data ("not available")
N/A means "non applicable"

Exposure description	exposure_raw	Type(s) of exposure as described by authors	Text
	exposure	Type(s) of exposure as defined by the review team	Detergent | Dispersant | Eutrophication | Hydrocarbon | Metal | Microplastic | Nanoparticle | Nutrient | Pesticide | Pharmaceutical | Undefined_pollutants | UV filter | Other
	combined	Is the exposure combined with other exposures (e.g. other chemicals, other pressures)?	Yes | No | Unknown | No/Unknown

Outcome description	outcome_raw	Type(s) of outcome as described by authors	Text
	outcome	Type(s) of outcome as defined by the review team	Bioaccumulation | BioaccumulationF | Bleaching | Calcification | Coral_diversity | Cover | Disease | Distribution | Genetic | Growth | Microbiome | Mortality | Physiology | Recruitment | Reproduction | Other
	outcome_level	Level of organization concerned by the measured outcome	Community | Colony | Individual | Tissue | Cellular | Molecular | Unknown
	chemical_accumulated	For Accumulation and Bioaccumulation outcomes only, type(s) of chemica	Hydrocarbon | Metal | Microplastic | Nanoparticle | Nutrient | Pesticide | Pharmaceutical | UV filter | Other | N/A

Comments	metacod_comment	Comments (e.g. description of other pressures)	Text
Linked studies	linked_study	Is the study linked with another one in the database?	No | unique identifier for linked studies
Knowledge cluster	cluster	Number of the knowledge cluster(s) to which the study belongs (see Figure	1 | 2 | 3 | 4 | 2&4 | N/A

TD

Tang et al. 2021

1 species × 1 exposure × 5 outcomes = **5 studies**

metacod_name	study_ID	study_type	country	region	latitude	longitude	coord_unit	location
DYO	1	Laboratory_experiment	Taiwan, Province of China	Southeast Asia	NA	NA	NA	Kenting National Park
DYO	2	Laboratory_experiment	Taiwan, Province of China	Southeast Asia	NA	NA	NA	Kenting National Park
DYO	3	Laboratory_experiment	Taiwan, Province of China	Southeast Asia	NA	NA	NA	Kenting National Park
DYO	4	Laboratory_experiment	Taiwan, Province of China	Southeast Asia	NA	NA	NA	Kenting National Park
DYO	5	Laboratory_experiment	Taiwan, Province of China	Southeast Asia	NA	NA	NA	Kenting National Park

taxon_init	taxon	taxonlevel	exposure_raw	exposure	combined	outcome_raw	outcome	outcome_level	chemical_ac	metacod_cor	linked_study
Seriatopora caliendrum	*Seriatopora caliendrum*	Species	Irgarol 1051	Pesticide	No	Effective and maximum quantum yield	Physiology	Colony	N/A	NA	NA
Seriatopora caliendrum	*Seriatopora caliendrum*	Species	Irgarol 1051	Pesticide	No	rETR	Physiology	Colony	N/A	NA	NA
Seriatopora caliendrum	*Seriatopora caliendrum*	Species	Irgarol 1051	Pesticide	No	Chl a content / symbiont	Physiology	Cellular	N/A	NA	NA
Seriatopora caliendrum	*Seriatopora caliendrum*	Species	Irgarol 1051	Pesticide	No	Oxidative condition of the coral (H2O2 content, H2O2 degradation activity, thiobarbituric acid-reacting substance content, lipid peroxidation, fat-soluble antioxidant capacity)	Physiology	Tissue	N/A	NA	NA
Seriatopora caliendrum	*Seriatopora caliendrum*	Species	Irgarol 1051	Pesticide	No	Symbiosome lipid profiles (glycerophosphocholine (GPC) profile)	Physiology	Cellular	N/A	NA	NA

TD

Hédouin et al. 2016

1 species × 2 exposures × 9 outcomes = **18 studies**

metacod_name	study_ID	study_type	country	region	latitude	longitude	coord_unit	location
DYO	1	Laboratory_experiment	United States of America	Polynesia	21°26'1.97"N	157°47'20.10"W	degrees-minutes-seconds	Coconut Island, Oahu, Hawaii
DYO	2	Laboratory_experiment	United States of America	Polynesia	21°26'1.97"N	157°47'20.10"W	degrees-minutes-seconds	Coconut Island, Oahu, Hawaii
DYO	3	Laboratory_experiment	United States of America	Polynesia	21°26'1.97"N	157°47'20.10"W	degrees-minutes-seconds	Coconut Island, Oahu, Hawaii
DYO	4	Laboratory_experiment	United States of America	Polynesia	21°26'1.97"N	157°47'20.10"W	degrees-minutes-seconds	Coconut Island, Oahu, Hawaii
DYO	5	Laboratory_experiment	United States of America	Polynesia	21°26'1.97"N	157°47'20.10"W	degrees-minutes-seconds	Coconut Island, Oahu, Hawaii
DYO	6	Laboratory_experiment	United States of America	Polynesia	21°26'1.97"N	157°47'20.10"W	degrees-minutes-seconds	Coconut Island, Oahu, Hawaii
DYO	7	Laboratory_experiment	United States of America	Polynesia	21°26'1.97"N	157°47'20.10"W	degrees-minutes-seconds	Coconut Island, Oahu, Hawaii
DYO	8	Laboratory_experiment	United States of America	Polynesia	21°26'1.97"N	157°47'20.10"W	degrees-minutes-seconds	Coconut Island, Oahu, Hawaii
DYO	9	Laboratory_experiment	United States of America	Polynesia	21°26'1.97"N	157°47'20.10"W	degrees-minutes-seconds	Coconut Island, Oahu, Hawaii
DYO	10	Laboratory_experiment	United States of America	Polynesia	21°26'1.97"N	157°47'20.10"W	degrees-minutes-seconds	Coconut Island, Oahu, Hawaii
DYO	11	Laboratory_experiment	United States of America	Polynesia	21°26'1.97"N	157°47'20.10"W	degrees-minutes-seconds	Coconut Island, Oahu, Hawaii
DYO	12	Laboratory_experiment	United States of America	Polynesia	21°26'1.97"N	157°47'20.10"W	degrees-minutes-seconds	Coconut Island, Oahu, Hawaii
DYO	13	Laboratory_experiment	United States of America	Polynesia	21°26'1.97"N	157°47'20.10"W	degrees-minutes-seconds	Coconut Island, Oahu, Hawaii
DYO	14	Laboratory_experiment	United States of America	Polynesia	21°26'1.97"N	157°47'20.10"W	degrees-minutes-seconds	Coconut Island, Oahu, Hawaii
DYO	15	Laboratory_experiment	United States of America	Polynesia	21°26'1.97"N	157°47'20.10"W	degrees-minutes-seconds	Coconut Island, Oahu, Hawaii
DYO	16	Laboratory_experiment	United States of America	Polynesia	21°26'1.97"N	157°47'20.10"W	degrees-minutes-seconds	Coconut Island, Oahu, Hawaii
DYO	17	Laboratory_experiment	United States of America	Polynesia	21°26'1.97"N	157°47'20.10"W	degrees-minutes-seconds	Coconut Island, Oahu, Hawaii
DYO	18	Laboratory_experiment	United States of America	Polynesia	21°26'1.97"N	157°47'20.10"W	degrees-minutes-seconds	Coconut Island, Oahu, Hawaii

TD

Hédouin et al. 2016

1 species × 2 exposures × 9 outcomes = **18 studies**

taxon_init	taxon	taxonlevel	exposure_raw	exposure	combined	outcome_raw	outcome	outcome_level	chemical_ac	metacod_cor	linked_study
Pocillopora damicornis	*Pocillopora damicornis*	Species	Copper (Cu)	Metal	No	Polyp contraction	Other	Individual	N/A	NA	No
Pocillopora damicornis	*Pocillopora damicornis*	Species	Copper (Cu)	Metal	No	Expulsion larvae	Reproduction	Colony	N/A	NA	No
Pocillopora damicornis	*Pocillopora damicornis*	Species	Copper (Cu)	Metal	No	Change in colour	Other	Colony	N/A	NA	No
Pocillopora damicornis	*Pocillopora damicornis*	Species	Copper (Cu)	Metal	No	Survival rate (adult, larvae)	Mortality	Colony	N/A	NA	No
Pocillopora damicornis	*Pocillopora damicornis*	Species	Copper (Cu)	Metal	No	Cu concentration in tissue	BioaccumulationF	Tissue	Metal	NA	No
Pocillopora damicornis	*Pocillopora damicornis*	Species	Copper (Cu)	Metal	No	Cu concentration in skeleton	BioaccumulationF	Colony	Metal	NA	No
Pocillopora damicornis	*Pocillopora damicornis*	Species	Copper (Cu)	Metal	No	Symbiodinium density	Microbiome	Tissue	N/A	NA	No
Pocillopora damicornis	*Pocillopora damicornis*	Species	Copper (Cu)	Metal	No	Chlorophyll a+c2 content	Physiology	Cellular	N/A	NA	No
Pocillopora damicornis	*Pocillopora damicornis*	Species	Copper (Cu)	Metal	No	Fv/Fm (Maximum dark-adapted quantum yield of the photosystem II)	Physiology	Colony	N/A	NA	No
Pocillopora damicornis	*Pocillopora damicornis*	Species	Lead (Pb)	Metal	No	Polyp contraction	Other	Individual	N/A	NA	No
Pocillopora damicornis	*Pocillopora damicornis*	Species	Lead (Pb)	Metal	No	Expulsion larvae	Reproduction	Colony	N/A	NA	No
Pocillopora damicornis	*Pocillopora damicornis*	Species	Lead (Pb)	Metal	No	Change in colour	Other	Colony	N/A	NA	No
Pocillopora damicornis	*Pocillopora damicornis*	Species	Lead (Pb)	Metal	No	Survival rate (adult, larvae)	Mortality	Colony	N/A	NA	No
Pocillopora damicornis	*Pocillopora damicornis*	Species	Lead (Pb)	Metal	No	Pb concentration in tissue	BioaccumulationF	Tissue	Metal	NA	No
Pocillopora damicornis	*Pocillopora damicornis*	Species	Lead (Pb)	Metal	No	Pb concentration in skeleton	BioaccumulationF	Colony	Metal	NA	No
Pocillopora damicornis	*Pocillopora damicornis*	Species	Lead (Pb)	Metal	No	Symbiodinium density	Microbiome	Tissue	N/A	NA	No
Pocillopora damicornis	*Pocillopora damicornis*	Species	Lead (Pb)	Metal	No	Chlorophyll a+c2 content	Physiology	Cellular	N/A	NA	No
Pocillopora damicornis	*Pocillopora damicornis*	Species	Lead (Pb)	Metal	No	Fv/Fm (Maximum dark-adapted quantum yield of the photosystem II)	Physiology	Colony	N/A	NA	No

TD

Kegler et al. 2015

1 species × [(2 exposure × 4 outcomes) + (2 exposure × 2 outcomes)]= **12 studies**

metacod_name	study_ID	study_type	country	region	latitude	longitude	coord_unit	location
DYO	1	Laboratory_experiment	Indonesia	Southeast Asia	08°20.259'S | 08°21.768'S	116°02.260'E | 116°01.897'E	degrees-decimal minutes	Lombok
DYO	2	Laboratory_experiment	Indonesia	Southeast Asia	08°20.259'S | 08°21.768'S	116°02.260'E | 116°01.897'E	degrees-decimal minutes	Lombok
DYO	3	Laboratory_experiment	Indonesia	Southeast Asia	08°20.259'S | 08°21.768'S	116°02.260'E | 116°01.897'E	degrees-decimal minutes	Lombok
DYO	4	Laboratory_experiment	Indonesia	Southeast Asia	08°20.259'S | 08°21.768'S	116°02.260'E | 116°01.897'E	degrees-decimal minutes	Lombok
DYO	5	Laboratory_experiment	Indonesia	Southeast Asia	08°20.259'S | 08°21.768'S	116°02.260'E | 116°01.897'E	degrees-decimal minutes	Lombok
DYO	6	Laboratory_experiment	Indonesia	Southeast Asia	08°20.259'S | 08°21.768'S	116°02.260'E | 116°01.897'E	degrees-decimal minutes	Lombok
DYO	7	Laboratory_experiment	Indonesia	Southeast Asia	08°20.259'S | 08°21.768'S	116°02.260'E | 116°01.897'E	degrees-decimal minutes	Lombok
DYO	8	Laboratory_experiment	Indonesia	Southeast Asia	08°20.259'S | 08°21.768'S	116°02.260'E | 116°01.897'E	degrees-decimal minutes	Lombok
DYO	9	Laboratory_experiment	Indonesia	Southeast Asia	08°20.259'S | 08°21.768'S	116°02.260'E | 116°01.897'E	degrees-decimal minutes	Lombok
DYO	10	Laboratory_experiment	Indonesia	Southeast Asia	08°20.259'S | 08°21.768'S	116°02.260'E | 116°01.897'E	degrees-decimal minutes	Lombok
DYO	11	Laboratory_experiment	Indonesia	Southeast Asia	08°20.259'S | 08°21.768'S	116°02.260'E | 116°01.897'E	degrees-decimal minutes	Lombok
DYO	12	Laboratory_experiment	Indonesia	Southeast Asia	08°20.259'S | 08°21.768'S	116°02.260'E | 116°01.897'E	degrees-decimal minutes	Lombok

TD

Kegler et al. 2015

1 espèce × [(2 exposition × 4 outcomes) + (2 exposition × 2 outcomes)]= **12 études**

taxon_init	taxon	taxonlevel	exposure_raw	exposure	combined	outcome_raw	outcome	outcome_level	chemical_ac	metacod_comment	linked_study
Pocillopora verrucosa	*Pocillopora verrucosa*	Species	Diesel	Hydrocarbon	Yes	Respiration rates	Physiology	Colony	N/A	NA	No
Pocillopora verrucosa	*Pocillopora verrucosa*	Species	Diesel	Hydrocarbon	Yes	Photosynthetic rates	Physiology	Colony	N/A	NA	No
Pocillopora verrucosa	*Pocillopora verrucosa*	Species	Diesel	Hydrocarbon	Yes	Maximum quantum yield (Fv/Fm)	Physiology	Colony	N/A	NA	No
Pocillopora verrucosa	*Pocillopora verrucosa*	Species	Diesel	Hydrocarbon	Yes	% tissue loss	Mortality	Colony	N/A	NA	No
Pocillopora verrucosa	*Pocillopora verrucosa*	Species	Diesel	Hydrocarbon	Yes	Respiration rates	Physiology	Colony	N/A	Combined with temperature	No
Pocillopora verrucosa	*Pocillopora verrucosa*	Species	Diesel	Hydrocarbon	Yes	Photosynthetic rates	Physiology	Colony	N/A	Combined with temperature	No
Pocillopora verrucosa	*Pocillopora verrucosa*	Species	Diesel	Hydrocarbon	Yes	Maximum quantum yield (Fv/Fm)	Physiology	Colony	N/A	Combined with temperature	No
Pocillopora verrucosa	*Pocillopora verrucosa*	Species	Diesel	Hydrocarbon	Yes	% tissue loss	Mortality	Colony	N/A	Combined with temperature	No
Pocillopora verrucosa	*Pocillopora verrucosa*	Species	surfactant LAS (linear alkylbenzene sulfonate)	Detergent	No	Maximum quantum yield (Fv/Fm)	Physiology	Colony	N/A	NA	No
Pocillopora verrucosa	*Pocillopora verrucosa*	Species	surfactant LAS (linear alkylbenzene sulfonate)	Detergent	No	% tissue loss	Mortality	Colony	N/A	NA	No
Pocillopora verrucosa	*Pocillopora verrucosa*	Species	surfactant LAS (linear alkylbenzene sulfonate)	Detergent	Yes	Maximum quantum yield (Fv/Fm)	Physiology	Colony	N/A	Combined with temperature	No
Pocillopora verrucosa	*Pocillopora verrucosa*	Species	surfactant LAS (linear alkylbenzene sulfonate)	Detergent	Yes	% tissue loss	Mortality	Colony	N/A	Combined with temperature	No