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A scoping review of systematic reviews on environmental effects of sunscreen ingredients

The Panel on Food Additives, Flavourings, Processing Aids, Materials in Contact with Food, and Cosmetics of the Norwegian Scientific Committee for Food and Environment

Report from the Norwegian Scientific Committee for Food and Environment (VKM) 2020: 14
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A scoping review of systematic reviews on environmental effects of sunscreen ingredients

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Competence of VKM experts

Persons working for VKM, either as appointed members of the Committee or as external experts, do this by virtue of their scientific expertise, not as representatives for their employers or third-party interests. The Civil Services Act instructions on legal competence apply for all work prepared by VKM.

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Summary

In this scoping review, research on the impact of sunscreen ingredients on the environment is mapped. The aims were 1) to determine the extent of evidence summarised in systematic reviews within this research area and 2) to map the evidence according to the ingredients studied, the hypotheses addressed, the type of endpoints studied as well as the reported key findings.

Systematic literature searches were performed to identify all summarised evidence in this research area. VKM identified 41 reviews; however, none of these included established methods to ensure objectivity, transparency and reproducibility. We extracted and mapped data, such as aim, test organism, endpoints, and sunscreen ingredient, from 31 of the reviews. The remaining 10 reviews were excluded due to inadequate reporting or lack of references to primary studies.

This scoping review shows that many primary studies have been performed within this research area. It also demonstrates a demand for more systematic approaches to summarise the existing data, which would provide valuable scientific basis for decision making and highlight knowledge gaps.

Key words: Environmental effects, Norwegian Scientific Committee for Food and Environment, scoping review, sunscreen, systematic reviews, VKM.

Sammendrag på norsk

I denne systematiske kartleggingsoversikten har VKM kartlagt forskning på miljøeffekter av ingredienser i solkrem. Hensikten var å få en oversikt over omfanget av systematiske oversiktsartikler (også kalt kunnskapsoppsummeringer, engelsk: systematic reviews) av forskning på dette området.

Det ble gjort systematiske litteratursøk for å identifisere oppsummert forskning på området. Det ble identifisert 41 oversiktsartikler, men ingen av disse fulgte etablerte metoder for å sikre objektivitet, gjennomsiktighet og etterprøvbarhet. Vi har hentet ut og kartlagt data, som formål, testorganisme, endepunkt og solkremingrediens, fra 31 av oversiktsartiklene. Data fra de resterende ti oversiktsartiklene ble ekskludert på grunn av mangelfull rapportering eller manglende referanser til primærstudier.

Kartleggingen viser at det er gjort mange primærstudier innenfor dette forskningsområdet, men at det er behov for systematiske oppsummeringer som viser de samlede forskningsresultatene fra alle relevante studier som er av tilstrekkelig kvalitet for bestemte problemstillinger. Denne typen oppsummert kunnskap vil utgjøre et viktig grunnlag for beslutningstakere og synliggjøre kunnskapshull.

Abbreviations

3-BC	3-benzylidene camphor
BP-1	benzophenone-1
BP-2	benzophenone-2
BP-3	benzophenone-3 (synonym: oxybenzone)
BP-4	benzophenone-4
BT	benzotriazole
BuP	butylparaben
BzP	benzylparaben
EHMC	2-ethyl-hexyl-4-trimethoxycinnamate
EP	ethylparaben
isoBP	isobutylparaben
4-MBC	4-methylbenzylidene camphor
MP	methylparaben
NP	nanoparticles
OCR	octocrylene
OD-PABA	octyl dimethyl p-aminobenzoic acid
OMC	octyl-methoxycinnamate
PP	propylparaben
ROS	reactive oxygen species
SR	systematic review
TC	triclosan
TCC	triclocarban
TiO_2	titanium dioxide
TiO_2-NP	titanium dioxide nanoparticles
VKM	the Norwegian Scientific Committee for Food and Environment
VKM Panel	the Panel on Food Additives, Flavourings, Processing Aids, Materials in Contact with Food, and Cosmetics of the Norwegian Scientific Committee for Food and Environment
ZnO	zinc oxide
ZnO-NP	zinc oxide nanoparticles

Definitions

Environmental effects: Effects on living organisms and their non-living environment.

Review (synonym: literature review, overview): A summary of the evidence on a certain topic. Different methods may be used in the preparation, and review articles are often not systematic.

Scoping review: A type of knowledge synthesis that follows a systematic approach to map evidence on a topic and identifies main concepts, theories, sources, and knowledge gaps (Tricco et al., 2018).

Sunscreen (topical sunscreen): Any preparation (such as creams, oils, gels, sprays) intended to be placed in contact with the human skin with a view exclusively or mainly to protecting [*sic*] it from UV radiation by absorbing, scattering or reflecting radiation (Regulation (EC) No 1223/2009).

Systematic review (synonym: systematic overview): A review of a clearly formulated question that uses systematic and explicit methods to identify, select, and critically appraise relevant research, and to collect and analyse data from the studies that are included in the review. Statistical methods (meta-analysis) may or may not be used to analyse and summarise the results of the included studies (Cochrane glossary).

1 Introduction

There are concerns regarding the potential harmful effects of sunscreen ingredients on the environment, e.g. coral reef bleaching. A few non-European countries are developing and passing legislation which may ban or limit the use of certain types of sunscreen ingredients (Narla and Lim, 2020). Given the current focus on potential environmental effects (effects on living organisms and their non-living environment) associated with sunscreen ingredients, it is timely to provide an overview of the research on this broad and diverse topic.

A scoping review follows a systematic approach to map the existing literature (evidence) in a field of interest in terms of the volume, nature, characteristics of the primary research such as main findings, concepts and theories, and knowledge gaps are identified (Arksey and O'Malley, 2005; Tricco et al., 2018). This scoping review on sunscreen ingredients and environmental effects is guided by the framework for scoping reviews proposed by Arksey and O'Malley (2005), the methodological advancement by Levac et al. (2010) and the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) extension for scoping reviews (Tricco et al., 2018). According to Levac et al. (2010), the six stages in a scoping review are: identifying the research question, identifying relevant studies, selecting studies, charting the data, collating, summarising and reporting the results and consulting with relevant stakeholders.

A general term that describes a summary of the evidence on a certain topic is "literature review", "review" or "overview". Different methods may be used in the preparation of a literature review, and the use of standards ensuring objectivity, transparency and reproducibility varies. A systematic review (SR) follows specific methods to ensure objectivity, transparency and reproducibility. It is a review of a clearly formulated question that uses systematic and explicit methods to identify, select, and critically appraise relevant research, and to collect and analyse data from the studies that are included in the review (Cochrane glossary). SRs seek to collate evidence that fits pre-specified eligibility criteria, and to minimise bias by using methods documented in advance with a protocol (Chandler et al., 2020). SR methodology is in widespread use in sectors of society where science can inform decision making, as the need for rigour, objectivity and transparency in reaching conclusions from a body of scientific information is evident in many areas of policy and practice (Collaboration for Environmental Evidence, 2018).

The aim of this scoping review is to determine the extent and characteristics of summarised evidence for environmental effects of sunscreen ingredients based on a systematic mapping of the research presented in published SRs as described in Table 1-1. The broad scope and extensive literature searches will ensure a general overview of the summarised research on this topic.

Table 1-1. The research questions addressed.

No	Research question
1	For which sunscreen ingredients are environmental effects studied?
2	What are the main hypotheses regarding environmental effects of sunscreen ingredients in reviews?
3	What are the outcomes/endpoints addressed?
4	What are the key findings that relate to the scoping review questions?

2 Methods

VKM decided to perform a scoping review on systematic reviews instead of primary studies since we wanted to map summarised research on this topic. The authors drafted a priori a protocol for this scoping review of SRs. The protocol was reviewed and approved by the members of the Panel on Food Additives, Flavourings, Processing Aids, Materials in Contact with Food, and Cosmetics of the Norwegian Scientific Committee for Food and Environment (VKM Panel). The final protocol was published on 22 April 2020 (VKM et al., 2020).

2.1 Literature search and study selection

An experienced research librarian drafted the search strategies (Marita Heinz, the library of the National Institute of Public Health, Norway) and these strategies were further refined based on discussions among members of the project group. The search was not restricted by particular dates or languages, but filters for reviews were used. We searched the databases Ovid MEDLINE(R), Embase, Web of Science, Scopus, Cochrane Database of Systematic Reviews, CRD (the Database of Abstracts of Reviews of Effects (DARE), NHS Economic Evaluation Database (NHS EED) and HTA), Epistemonikos. In addition, searches were performed in Prospero, Brage, Cristin and Open Grey System for Information on Grey Literature in Europe (Appendix 1 and 3). The search strategy and search terms are available in Appendix I (Section 6.1). We imported the identified records into EndNote (Thomson Reuters, version X9), removed duplicates, and imported the records into Rayyan (Ouzzani et al., 2016) for the study selection. The electronic database searches were supplemented by handsearching websites and scanning of reference lists of the publications obtained by the handsearching (Appendix 1 and 3). The literature searches were performed between April 20th and May 13th 2020.

To be included in this scoping review, records should be SRs focusing on any environmental effect associated with sunscreens or sunscreen ingredients. A publication qualified as an SR if 1) it described a specific research question and the specific criteria used for selecting studies, 2) the authors had performed a systematic literature search, and 3) included a quality assessment of the selected studies (Cochrane Glossary, 2020).

Two of the authors independently performed the study selection and screened titles and abstracts prior to assessing full-text articles. None of the identified reviews fulfilled any of the three criteria required for an SR.

2.2 Data charting and evidence synthesis

According to the protocol (VKM et al., 2020), we aimed to determine the extent and characteristics of evidence for environmental effects of sunscreen ingredients in published SRs. As no SRs were identified, we decided to deviate from the protocol and map data from the identified reviews focusing on environmental effect associated with sunscreen ingredients (Appendix 3). The authors and the members of the VKM Panel discussed and agreed on

which data elements should be included in the mapping process. The data elements selected for extraction included aim, hypotheses, type of research areas addressed, number of references to primary studies, type of sunscreen ingredients (substance group and chemical name), endpoints/outcomes addressed, and test organisms (group of organisms only, e.g. microorganisms, plants, invertebrates and vertebrates). Since none of the reviews used systematic and explicit methods to identify, select, and critically appraise relevant research, the key findings are of limited value to the results of the current report and were thus not included. The methodological quality of the reviews was not appraised as this was outside the scope of this scoping review.

Two of the authors jointly developed the data charting forms. One of the authors extracted data and the other validated the extraction. The extracted data were charted in tables. Prisma checklist for scoping reviews is shown in Appendix IV.

3 Results

3.1 Selection of sources of evidence

The database searches (searches 1 and 3) returned 940 records, and an additional 21 records (search 2) were identified through searches for pulications not indexed in the major databases (handsearching) (Figure 3.1-1).

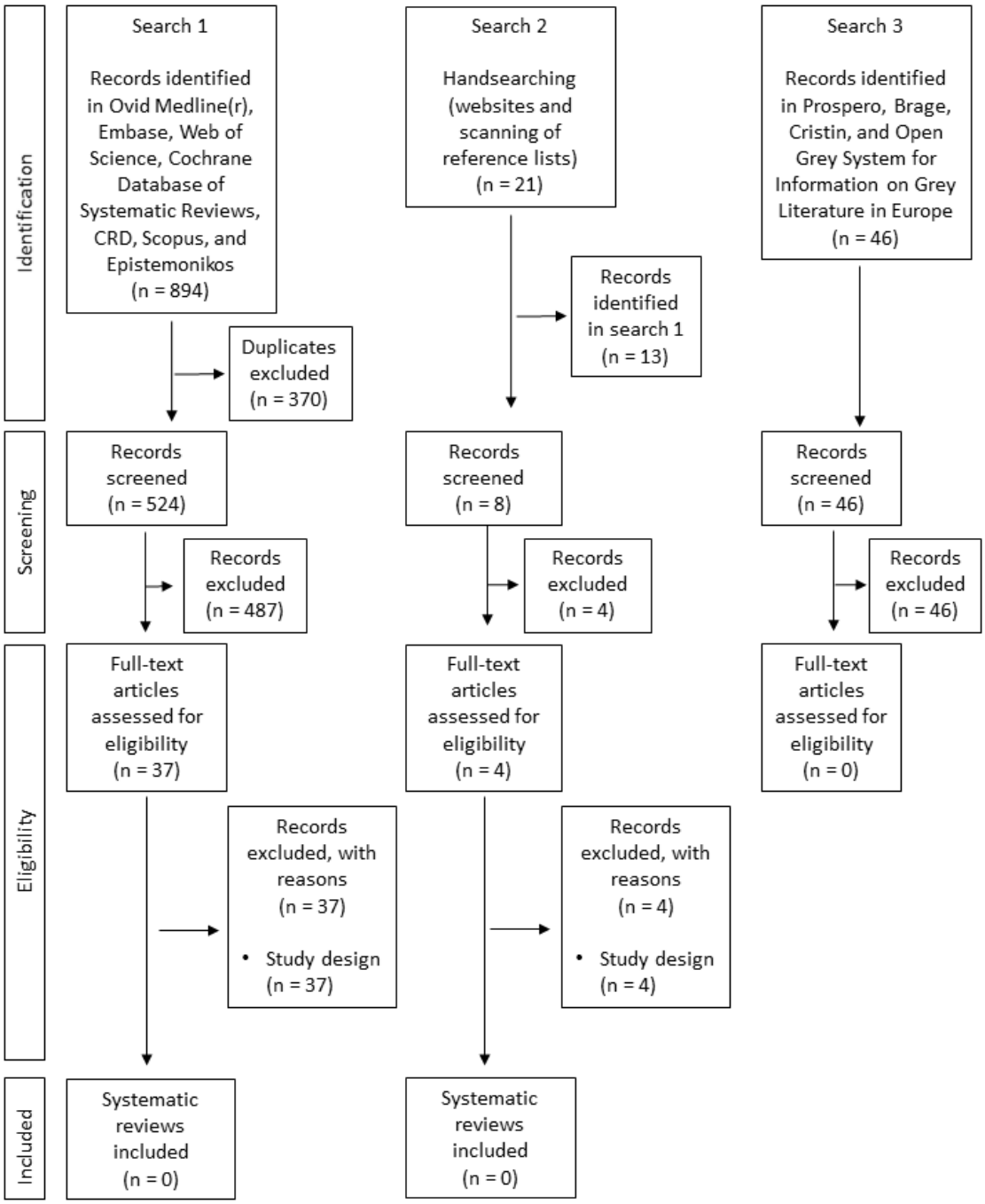

Figure 3.1-1. Flow diagram illustrating the process of selecting eligible systematic reviews.

After removal of 383 duplicates, two of the authors independently screened 578 records followed by eligibility assessment of 41 full-text articles.

Of the 41 reviews, ten were excluded from the evidence synthesis on the following basis: 1) the review did not refer to any primary studies (n=4), 2) type of studies and endpoints were not clearly described (n=4), 3) the aim of the review was not clearly described (n=2) (not shown in flow chart).

3.2 Study characteristics of the reviews

In most of the identified reviews, environmental effects were not the primary or only focus. In addition to environmental toxicity, human health effects (n=15) and occurrence (presence in the environment) (n=15) were the main research areas included. An overview of the main research areas addressed in the 31 reviews is given in Table 3.2-1.

No hypotheses were presented in the reviews. The aims of the reviews, as presented in the papers, are included in Appendix 2 (Table 7-1). Overview of funding, affiliation of the corresponding author, journal, and conflict of interest are presented in Appendix 2 (Table 7-2).

All primary studies included in the reviews were performed in a laboratory setting. The 31 reviews provided limited or no information concerning the characteristics of the primary studies included, such as study designs, the doses used, number of experimental animals/species, comparisons made and effect sizes. Eight of the 31 review papers summarised the study characteristics and findings in tables, whereas the remaining reviews described the included primary studies in the text. All reviews provided narrative syntheses of the findings. The number of included references of primary studies on sunscreen ingredients and environmental toxicity varied from two to 62. Combined, these reviews referenced more than 200 different primary studies (data not shown).

Table 3.2-1. The main research areas addressed in the reviews.

Reference	Environmental toxicity	Occurrence	Environmental fate and transport	Chemical and physical properties	Analytical methods	Human health effects	References on environmental toxicity (n)
Adler and DeLeo (2020)	x					x	2
Bilal et al. (2020)	x	x				x	5
Kar et al. (2020)	x	x					5
Raffa et al. (2019)	x					x	2
Schneider and Lim (2019a)	x					x	8
Schneider and Lim (2019b)	x	x					5
Sharma et al. (2019)	x			x		x	5
Shi et al. (2019)	x	x	x	x			15
Tumova et al. (2019)	x	x		x			13
DiNardo and Downs (2018)	x	x	x			x	2
Sruthi et al. (2018)	x					x	3
Zirwas and Andrasik (2018)	x					x	4
Juliano and Magrini (2017)	x	x	x				20
Rainieri et al. (2017)	x	x				x	28
Haynes et al. (2017)	x		x	x			23
Hopkins and Blaney (2016)	x	x					17
Wang et al. (2016)	x	x					19
Alotaibi et al. (2015)	x	x	x	x	x		11
Maipas and Nicolopoulou-Stamati (2015)	x					x	19
Rykowska and Wasiak (2015)	x		x				4
Sánchez-Quiles and Tovar-Sánchez (2015)	x	x			x		12
Kim and Choi (2014)	x	x		x		x	7
Minetto et al. (2014)	x						21

Reference	Environmental toxicity	Occurrence	Environmental fate and transport	Chemical and physical properties	Analytical methods	Human health effects	References on environmental toxicity (n)
Ma et al. (2013)	x			x			25
Wong et al. (2013)	x		x			x	21
Gago-Ferrero et al. (2012)	x	x	x	x	x		8
Tourinho et al. (2012)	x		x				12
Brausch and Rand (2011)	x	x					62
Skocaj et al. (2011)	x			x		x	22
Scown et al. (2010)	x	x	x				11
Sharma (2009)	x			x		x	7

3.3 Synthesis of results

The substance group addressed in most of the reviews consisted of UV filters (n=28). Four review papers addressed both organic and inorganic UV filters, two papers did not specify the UV filter, and 14 and 16 reviews reported on organic or inorganic UV filters, respectively. The second most addressed substance group consisted of fragrances (n=6), followed by preservatives (n=4) and stabilisers (n=2) (Table 3.3-1).

Table 3.3-1. Overview of sunscreen ingredients addressed in the reviews.

Reference	Fragrance	Preservative	Stabiliser	UV filter, inorganic	UV filter, organic	UV filter not specified
Adler and DeLeo (2020)				ZnO-NP, TiO_2-NP	BP-3	
Bilal et al. (2020)				ZnO-NP, TiO_2-NP		
Kar et al. (2020)	Nitro musks and polycyclic musks	BzP, BuP, EP, MP, TC, TCC				x
Raffa et al. (2019)					EHMC, BP-3	

Reference	Fragrance	Preservative	Stabiliser	UV filter, inorganic	UV filter, organic	UV filter not specified
Schneider and Lim (2019a)				TiO_2-NP, ZnO-NP		
Schneider and Lim (2019b)					BP-3, 4-MBC, OCR	
Sharma et al. (2019)				TiO_2-NP		
Shi et al. (2019)			BTs			
Tumova et al. (2019)	Polycyclic musks					
DiNardo and Downs (2018)					BP-3	
Sruthi et al. (2018)				ZnO-NP		
Zirwas and Andrasik (2018)				TiO_2, ZnO	BP-3	
Juliano and Magrini (2017)		TC		TiO_2-NP, ZnO-NP	BP-1, BP-2, BP-3, 3-BC, 4-MBC	
Rainieri et al. (2017)	Nitro musks and polycyclic musks				BP-3, EHMC, 3-BC, 4-MBC	
Haynes et al. (2017)				TiO_2-NP		
Hopkins and Blaney (2016)	Nitro musks and polycyclic musks	Parabens, TC, TCC			OMC, BP-3, BP-4, 4-MBC	
Wang et al. (2016)	Camphor and cinnamate derivatives				BPs	
Alotaibi et al. (2015)			BT and 5-methyl-benzotriazole			
Maipas and Nicolopoulou-Stamati (2015)					BP-1, BP-2, BP-3, BP-4, EHMC, OMC, OD-PABA, 3-BC, 4-MBC	

Reference	Fragrance	Preservative	Stabiliser	UV filter, inorganic	UV filter, organic	UV filter not specified
Rykowska and Wasiak (2015)						x
Sánchez-Quiles and Tovar-Sánchez (2015)				TiO_2-NP, ZnO-NP	4-MBC, BP-4, 3-BC, OMC, BP-3	
Kim and Choi (2014)					BP-3	
Minetto et al. (2014)				TiO_2-NP		
Ma et al. (2013)				ZnO-NP		
Wong et al. (2013)				TiO_2-NP, ZnO-NP		
Gago-Ferrero et al. (2012)					BP-1, BP-2, BP-3, BP-4, EHMC, OD-PABA, 3-BC, 4-MBC, OCR	
Tourinho et al. (2012)				TiO_2-NP, ZnO-NP		
Brausch and Rand (2011)	Nitro musks and polycyclic musks	Biphenolyl, BzP, BuP, EP, isoBP, MP, PP, TC, TCC			BP-3, BP-4, 4-MBC, EHMC	
Skocaj et al. (2011)				TiO_2-NP		
Scown et al. (2010)				TiO_2-NP		
Sharma (2009)				TiO_2-NP		

3-BC = 3-benzylidene camphor; BP-1 = benzophenone-1; BP-2 = benzophenone-2; BP-3 = benzophenone-3; BP-4 = benzophenone-4; BT = benzotriazole; BuP = butylparaben; BzP = benzylparaben; EHMC = 2-ethyl-hexyl-4-trimethoxycinnamate; EP = ethylparaben; isoBP = isobutylparaben; 4-MBC = 4-methylbenzylidene camphor; MP = methylparaben;OCR = octocrylene; OD-PABA = octyl dimethyl p-aminobenzoic acid; OMC = octyl-methoxycinnamate; PP = propylparaben; TC = triclosan; TCC = triclocarban; TiO2 = titanium dioxide; TiO2-NP = titanium dioxide nanoparticles; ZnO = zinc oxide; ZnO-NP = zinc oxide nanoparticles.

All except one of the review papers addressed toxicity of sunscreen ingredients on aquatic organisms (n=30). For aquatic toxicity the most frequently studied organisms were invertebrates (n=29) and vertebrates (n=24) (Table 3.3-2). Aquatic invertebrate model organisms included corals, crustaceans and molluscs. Aquatic vertebrate test organisms were predominantly fish; however, three reviews also covered amphibians.

Eleven of the 31 reviews included toxicity data on terrestrial organisms, more specifically invertebrates (n=9) and plants (n=5). One review paper addressed toxicity of sunscreen ingredients on terrestrial organisms only.

Table 3.3-2. Overview of test organisms addressed in the reviews.

Reference	**Aquatic**				**Terrestrial**		**Type of studies**	
	Microorganisms	**Algae**	**Invertebrates**	**Vertebrates**	**Plants**	**Invertebrates**	***In vivo***	***In vitro***
Adler and DeLeo (2020)			x				x	x
Bilal et al. (2020)	x	x	x	x			x	x
Kar et al. (2020)		x	x	x			x	
Raffa et al. (2019)			x				x	x
Schneider and Lim (2019a)		x	x	x	x	x	x	x
Schneider and Lim (2019b)		x	x				x	x
Sharma et al. (2019)		x	x	x			x	x
Shi et al. (2019)	x	x	x	x	x		x	x
Tumova et al. (2019)		x	x	x				
DiNardo and Downs (2018)			x				x	x
Sruthi et al. (2018)		x	x	x	x	x	x	
Zirwas and Andrasik (2018)			x				x	x
Juliano and Magrini (2017)		x	x	x			x	x
Rainieri et al. (2017)		x	x	x		x	x	
Haynes et al. (2017)	x	x	x	x			x	x
Hopkins and Blaney (2016)		x	x	x		x	x	
Wang et al. (2016)			x	x			x	x
Alotaibi et al. (2015)	x				x		x	

Reference	Aquatic				Terrestrial		Type of studies	
	Microorganisms	Algae	Invertebrates	Vertebrates	Plants	Invertebrates	*In vivo*	*In vitro*
Maipas and Nicolopoulou-Stamati (2015)			x	x		x	x	
Rykowska and Wasiak (2015)			x	x			x	
Sánchez-Quiles and Tovar-Sánchez (2015)	x	x	x	x			x	x
Kim and Choi (2014)		x	x	x			x	
Minetto et al. (2014)	x	x	x	x			x	x
Ma et al. (2013)		x	x	x		x	x	
Wong et al. (2013)	x	x	x	x			x	x
Gago-Ferrero et al. (2012)		x	x	x			x	
Tourinho et al. (2012)						x		
Brausch and Rand (2011)	x	x	x	x			x	x
Skocaj et al. (2011)		x	x	x	x	x	x	x
Scown et al. (2010)	x	x	x	x			x	x
Sharma (2009)	x	x	x	x		x	x	x

An overview of the most frequently addressed endpoints in the reviews is given in Table 3.3-3. Acute endpoints such as mortality and mobility/immobilisation were addressed in 26 of the review papers. Chronic endpoints addressed were coral bleaching, growth, growth inhibition, biomass production, reproduction, development, and endocrine effects. Other endpoints were ROS production and DNA damage.

Coral bleaching was addressed in eight review papers, all published from 2017 to 2020, whereas no specific publication year pattern was identified for the other endpoints. From 2009 to 2014, ten reviews on sunscreen ingredients and environmental effects were identified, however, for the subsequent five years (2015-2020), there was a doubling in published reviews on this topic (n=21).

Table 3.3-3. The endpoints most frequently addressed.

Reference	Coral bleaching	Mortality	Mobility/ immobilisation	Growth/ growth inhibition/ biomass production	Reproduction and development	Endocrine effects	ROS production/ oxidative stress	DNA damage
Adler and DeLeo (2020)	x	x	x					x
Bilal et al. (2020)		x			x	x	x	
Kar et al. (2020)		x		x	x	x		
Raffa et al. (2019)	x	x						
Schneider and Lim (2019a)	x	x		x				
Schneider and Lim (2019b)	x	x		x				
Sharma et al. (2019)	x	x		x				
Shi et al. (2019)		x	x	x	x			
Tumova et al. (2019)		x		x	x	x		
DiNardo and Downs (2018)	x	x						x
Sruthi et al. (2018)				x	x			
Zirwas and Andrasik (2018)	x	x						x
Juliano and Magrini (2017)	x	x			x	x	x	
Rainieri et al. (2017)		x			x	x		
Haynes et al. (2017)		x		x			x	x
Hopkins and Blaney (2016)		x		x	x	x		x
Wang et al. (2016)						x		
Alotaibi et al. (2015)		x		x				
Maipas and Nicolopoulou-Stamati (2015)						x		
Rykowska and Wasiak (2015)						x		
Sánchez-Quiles and Tovar-Sánchez (2015)		x		x		x		
Kim and Choi (2014)			x	x	x	x		

Reference	Coral bleaching	Mortality	Mobility/ immobilisation	Growth/ growth inhibition/ biomass production	Reproduction and development	Endocrine effects	ROS production/ oxidative stress	DNA damage
Minetto et al. (2014)		x		x	x		x	x
Ma et al. (2013)		x		x	x			x
Wong et al. (2013)		x	x	x	x		x	x
Gago-Ferrero et al. (2012)								
Tourinho et al. (2012)		x	x	x	x		x	
Brausch and Rand (2011)		x	x	x	x	x		
Skocaj et al. (2011)		x		x	x			x
Scown et al. (2010)		x	x	x	x			x
Sharma (2009)		x		x				

4 Discussion and conclusion

To our knowledge, this scoping review is the first to map the summarised evidence on sunscreen ingredients and environmental effects. The aim of this scoping review was to map evidence from SRs, more specifically; 1) for which sunscreen ingredients are environmental effects studied, 2) what are the main hypotheses, 3) what are the endpoints addressed, and 4) what are the key findings. The literature search did not identify any SRs on this topic. We identified 41 reviews on sunscreen ingredients and environmental effects; however, ten of these where excluded due to poor reporting or lack of reference to primary studies. From the remaining 31 reviews, we extracted data on type of sunscreen ingredients, endpoints, and test organisms. Hypotheses were not extracted as none were identified, and key findings were not extracted as they were considered of limited value to the results of the current study.

A systematic literature search is important to identify all relevant studies and subsequently to reduce the risk of bias in the evidence base. None of the 41 reviews included a description of the literature search and selection process. Although the existing reviews on environmental effects of sunscreen ingredients might have applied a systematic approach in the search and selection of primary studies, the literature search and eligibility criteria for inclusion were not described, and the reader cannot judge whether all relevant publications have been included. In addition, it is important to perform a quality evaluation of the identified studies and to account for risk of bias in the data synthesis. If not, the findings might be inaccurate or biased. Evaluation of risk of bias were not reported in any of the included reviews, and all studies were presented as equally important, thus significant bias to the reported findings might have been introduced.

While traditional approaches to literature reviews can highlight scientific topics, their findings are limited for drawing conclusions on causal relationships if explicit methods to identify, select, and critically appraise relevant research are not used and reported. Systematic reviews are increasingly seen as viable and important means of reliably summarising scientific evidence to support decision making in policy and practice across disciplines (Haddaway et al., 2020). Guidelines and reporting standards for systematic approaches for environmental research have been developed in recent years (Collaboration for Environmental Evidence, 2013; Collaboration for Environmental Evidence, 2018; Haddaway et al., 2018; Livoreil et al., 2017; Pullin and Stewart, 2006) and several recent papers call for a more widespread use of systematic review methodology in environmental and conservation science Haddaway et al. (2020); O'Leary et al. (2016); Westgate and Lindenmayer (2017). Implementing rigorous methods in a field takes time, and it is likely that reviews applying a systematic approach in environmental science will further increase in the future.

This scoping review has identified the lack of SRs within the research field of environmental effects of sunscreen ingredients. Further, it was revealed that a vast number of primary studies on this topic exists, especially on toxicity of aquatic organisms. However, there is a

demand for more systematic approaches to summarise the existing data, which would provide valuable scientific basis for decision making.

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6 Appendix I Literature searches

6.1 Literature search 1

These searches were performed by Marita Heinz, Senior Librarian at the Norwegian Institute of Public Health.

Database: Ovid MEDLINE(R) and Epub Ahead of Print, In-Process & Other Non-Indexed Citations, Daily and Versions(R) <1946 to April 17, 2020>
Date of search: 20.04.2020
Result: 182

1	Sunscreening Agents/	5512
2	(sunblock? or "sun block?" or "sun tan lotion?" or "suntan lotion?" or suntanlotion? or "sun lotion?" or sunlotion? or "sun screen?" or sunscreen? or "sunburn cream?" or "sun burn cream?" or sunburncream? or "sun cream?" or suncream? or "block out?" or blockout? or ((ultraviolet or ultra violet or UV or UVA or UVB or UVC) adj2 filter?)).tw,kf.	6783
3	1 or 2	8770
4	Environmental Pollutants/ or Water Pollutants/ or Water Pollutants, Chemical/ or Soil Pollutants/ or environmental microbiology/ or food microbiology/ or soil microbiology/ or water microbiology/ or waste water/	284453
5	(Pollution or polluted or Pollutant or Pollutants or micropollutant* or environment* or effluent* or waste water* or wastewater* or food microbiology or soil microbiology or water microbiology).tw,kf.	1122410
6	exp Aquatic Organisms/ or exp Chlorophyta/ or Diatoms/ or Haptophyta/ or exp Dinoflagellida/	48807
7	(((Aquatic or freshwater or "fresh water" or marine or abyssal or "cold seep" or "deep sea" or estuarine or "hydrothermal vent" or intertidal or pelagic or nektonic or neustonic or periphytic or Aphotic or bathyal or abyssal or hadal) adj (species or organism?)) or bentho* or (benthic adj (organism? or species or zone? or foraminifera)) or macrobentho* or microphytobentho* or nekton or necton or neuston or Pleuston or periphyton? or plankton* or planktic* or bacterioplankt* or "marine bacterium" or holoplankt* or macroplankt* or meroplankt* or mesoplankt* or microplankt* or nanoplankt* or nannoplankt* or phytoplankt* or picoplankt* or zooplankt* or alga or algae or Chlorophyt* or Chlorophycea* or Sphaeropleales or Scenedesmus* or Desmodesmus or diatom* or bacillariophy* or Coscinodiscophyceae* or Thalassiosira* or Haptophy* or coccolithophor* or	96446

	prymnesi* or emiliania* or pavlova* or phaeocystis* or pleurochrysis* or Isochrysis* or Chlamydomonadales* or Volvocales* or Volvocida* or volvocine* or Dunaliella* or Skeletonema* or Chlorodendrophyce* or Chlorodendrale* or Tetraselmis* or Chaetoceros* or Phaeodactylum or Dinoflagell* or Dinomastigot* or Dinophyceae or Dinophyt* or Mesokaryot* or Pyrrhophyceae or Pyrrhophyt* or Pyrrophyceae or Pyrrophyt* or Alexandrium or Microalga* or microphyte* or macroalga* or Seaweed or Kelp).tw,kf.	
8	exp ecosystem/	193841
9	(ecosystem? or ecological or biodiversity or biological diversity or microflora? or Microbiota? or Mycobiome? or Microbial or agroecosystem? or biomass* or biome? or microbiome? or microorganism? or microbe? or microclimate or Ecotype or ecospecies or ecovar or ((Endangered or threatened) adj (Species or organism?)) or biosphere or biota or biocenose or biocenoses or fauna or macrofauna or macroinvertebrate? or meiofauna or Meiobentho* or wildlife or flora or macrophyte? or biotope or ecotone or food chain? or food web? or habitat? or indicator organism? or indicator species or keystone organism? or keystone species or mesocosm? or metapopulation? or microcosm? or rhizosphere or microhabitat? or ((biological or biotic or organism or organismal or natural or animal or fungal or fungus or archaea or archaeal or bacteria or bacterial or plant or herb or shrub or tree or protistan or ciliate or flagellate or protozoan or climax) adj (community or communities)) or biocenoses or biocenosis or biocoenoses or biocoenosis or species dominance or species refuge* or species refugia or species refugium or trophic cascade* or forest? or rainforest? or taiga? or grassland? or savanna? or savannah? or pampas or prairie? or puszta? or steppe? or veldt? or Tundra? or Wetland? or estuary or Estuaries or coastal water? or ocean? or sea or seas or intertidal zone* or littoral* or pelagic zone* or lake? or river? or riparian* or limnetic or photic zone* or Aphotic zone* or bathyal zone* or abyssal zone* or hadal zone*).tw,kf.	837280
10	Ecotoxicology/	2954
11	("eco toxicity" or "eco toxicology" or ecotoxicity or ecotoxicology).tw,kf.	5604
12	exp Invertebrates/	619615
13	(invertebrate* or arthropod* or mandibulat* or Tetraconat* or Crustacea* or Branchiopod* or Cladocera* or "water flea*" or Daphnia* or "freshwater flea*" or Helminth* or aschelminth* or "parasitic worm*" or "parasite worm*" or "flat worm*" or flatworm* or platyhelminth* or Turbellaria* or Planaria* or Rhabditophora* or Triclad* or Dugesiidae* or Dugesia* or hexapod* or insect* or Dicondylia* or Palaeoptera* or paleoptera* or Pterygot* or Neoptera* or	328810

	Holometabola* or Endopterygot* or Antliophora* or Mecopteroidea* or Diptera* or flies or fly or Nematocera* or Culicomorpha* or Chironomid* or Chironomus* or midge or midges or Maxillopod* or Harpacticoid* or Tigriopus* or Malacostraca* or Peracarid* or Amphipod* or copepod* or calanoid* or Acartia* or echinoderm* or Echinoidea* or clypeasteroida* or "sand dollar*" or Paracentrotus* or Anostraca* or "fairy shrimp*" or Artemia* or "brine shrimp*" or mollusc* or mollusk* or gastropod* or slug or slugs or Vetigastropod* or abalone* or Haliotidae* or Haliotis* or "Sulculus diversicolor*" or "Sulculus diversicolour*" or annelid* or "segmented worm*" or Polychaet* or "bristle worm*" or bristleworm* or "Elasmopus rapax*" or "Scrobicularia plana*" or "Hediste diversicolor*" or "Hediste diversicolour*" or "Corophium Volutator*" or Acropora or Anthozoa* or Acroporidae or Pocillopora or Pocilloporidae or Porites or Renilla or actinia* or coelenterat* or Cnidaria* or "Millepora complanata" or "Stylophora pistillata" or bivalv* or Lamellibranchiata or mussel* or clam or clams or Mytilidae or Mytilus or lugworm* or Arenicola or coral? or reef?).tw,kf.	
14	vertebrates/ or exp amphibians/ or exp birds/ or exp fishes/ or mammals/ or eutheria/ or exp artiodactyla/ or exp carnivora/ or exp cetacea/ or chiroptera/ or hyraxes/ or exp insectivora/ or exp lagomorpha/ or exp perissodactyla/ or primates/ or haplorhini/ or catarrhini/ or exp cercopithecidae/ or hominidae/ or gorilla gorilla/ or neanderthals/ or pan paniscus/ or pan troglodytes/ or exp pongo/ or exp hylobatidae/ or exp platyrrhini/ or exp tarsii/ or exp strepsirhini/ or exp rodentia/ or exp scandentia/ or exp sirenia/ or exp cingulata/ or exp marsupialia/ or exp monotremata/ or exp proboscidea mammal/ or exp reptiles/	5139641
15	(Vertebrate* or fish or fishes or bird? or seabird? or shorebird? or Amphibian* or mammal* or reptile* or tetrapod? or amniote? or amniota or reptilia* or sauropsid? or teleost* or Smegmamorpha* or gasterosteid* or gasterosteiform* or synbranchid* or Beloniforme* or belonidae* or needlefish* or Oryzias or oryziin* or medaka* or "japanese killifish*" or "japanese rice fish*" or "Danio rerio*" or zebrafish* or "zebra fish*" or "Brachydanio rerio*" or "Cyprinus rerio*" or "Danio frankei" or "zebra danio*" or "b rerio*" or "d rerio*" or Cyprinidae or cyprinid* or Cypriniformes or catastomus or catostomidae or catostomus or cobitidae or loach* or misgurnus or salmon* or Trout* or char or chars or salvelinus or oncorhynchus or "salmo gairdneri*" or steelhead* or "Salmo mykiss*" or "Pimephales promelas" or "fathead minnow*" or Pimephale* or "Paralichthys californicus" or halibut* or flounder* or Flatfish* or Pleuronectidae*).tw,kf.	753815
16	or/4-15	7393388
17	3 and 16	2259

18	limit 17 to "reviews (maximizes specificity)"	11
19	Meta-Analysis/ or (review* or metaanal* or "meta anal*").tw,kf,bt.	2165482
20	(17 and 19) or 18	182

Database: Embase 1974 to 2020 April 17
Date: 20.04.2020
Result: 247

1	sunscreen/	10495
2	(sunblock? or "sun block?" or "sun tan lotion?" or "suntan lotion?" or suntanlotion? or "sun lotion?" or sunlotion? or "sun screen?" or sunscreen? or "sunburn cream?" or "sun burn cream?" or sunburncream? or "sun cream?" or suncream? or "block out?" or blockout? or ((ultraviolet or ultra violet or UV or UVA or UVB or UVC) adj2 filter?)).tw,kw.	9247
3	1 or 2	13559
4	pollution/ or pollutant/ or soil pollution/ or soil pollutant/ or soil pollution control/ or water pollution/ or sea pollution/ or water contamination/ or water pollutant/ or water pollution control/ or water pollution indicator/ or environmental microbiology/ or effluent/ or waste water/	223202
5	(Pollution or polluted or Pollutant or Pollutants or micropollutant* or environment* or effluent* or waste water* or wastewater* or food microbiology or soil microbiology or water microbiology).tw,kw.	1358945
6	exp aquatic species/ or exp aquatic environment/ or exp alga/	175592
7	(((Aquatic or freshwater or "fresh water" or marine or abyssal or "cold seep" or "deep sea" or estuarine or "hydrothermal vent" or intertidal or pelagic or nektonic or neustonic or periphytic or Aphotic or bathyal or abyssal or hadal) adj (species or organism?)) or bentho* or (benthic adj (organism? or species or zone? or foraminifera)) or macrobentho* or microphytobentho* or nekton or necton or neuston or Pleuston or periphyton? or plankton* or planktic* or bacterioplankt* or "marine bacterium" or holoplankt* or macroplankt* or meroplankt* or mesoplankt* or microplankt* or nanoplankt* or nannoplankt* or phytoplankt* or picoplankt* or zooplankt* or alga or algae or Chlorophyt* or Chlorophycea* or Sphaeropleales or Scenedesmus* or Desmodesmus or diatom* or bacillariophy* or Coscinodiscophyceae* or Thalassiosira* or Haptophy* or coccolithophor* or prymnesi* or emiliania* or pavlova* or phaeocystis* or pleurochrysis* or Isochrysis* or Chlamydomonadales* or Volvocales* or Volvocida* or volvocine* or Dunaliella* or Skeletonema* or Chlorodendrophyce* or Chlorodendrale* or	101748

	Tetraselmis* or Chaetoceros* or Phaeodactylum or Dinoflagell* or Dinomastigot* or Dinophyceae or Dinophyt* or Mesokaryot* or Pyrrhophyceae or Pyrrhophyt* or Pyrrophyceae or Pyrrophyt* or Alexandrium or Microalga* or microphyte* or macroalga* or Seaweed or Kelp).tw,kw.	
8	exp ecosystem/ or exp river ecosystem/ or lake ecosystem/ or ecosystem health/ or ecosystem monitoring/ or exp biodiversity/ or microflora/ or soil microflora/ or Ecotype/ or endangered species/ or microclimate/	375226
9	(ecosystem? or ecological or biodiversity or biological diversity or microflora? or Microbiota? or Mycobiome? or Microbial or agroecosystem? or biomass* or biome? or microbiome? or microorganism? or microbe? or microclimate or Ecotype or ecospecies or ecovar or ((Endangered or threatened) adj (Species or organism?)) or biosphere or biota or biocenose or biocenoses or fauna or macrofauna or macroinvertebrate? or meiofauna or Meiobentho* or wildlife or flora or macrophyte? or biotope or ecotone or food chain? or food web? or habitat? or indicator organism? or indicator species or keystone organism? or keystone species or mesocosm? or metapopulation? or microcosm? or rhizosphere or microhabitat? or ((biological or biotic or organism or organismal or natural or animal or fungal or fungus or archaea or archaeal or bacteria or bacterial or plant or herb or shrub or tree or protistan or ciliate or flagellate or protozoan or climax) adj (community or communities)) or biocenoses or biocenosis or biocoenoses or biocoenosis or species dominance or species refuge* or species refugia or species refugium or trophic cascade* or forest? or rainforest? or taiga? or grassland? or savanna? or savannah? or pampas or prairie? or puszta? or steppe? or veldt? or Tundra? or Wetland? or estuary or Estuaries or coastal water? or ocean? or sea or seas or intertidal zone* or littoral* or pelagic zone* or lake? or river? or riparian* or limnetic or photic zone* or Aphotic zone* or bathyal zone* or abyssal zone* or hadal zone*).tw,kw.	1047124
10	Ecotoxicity/	10619
11	("eco toxicity" or "eco toxicology" or ecotoxicity or ecotoxicology).tw,kw.	7417
12	exp invertebrate/ or helminth/	672307
13	(invertebrate* or arthropod* or mandibulat* or Tetraconat* or Crustacea* or Branchiopod* or Cladocera* or "water flea*" or Daphnia* or "freshwater flea*" or Helminth* or aschelminth* or "parasitic worm*" or "parasite worm*" or "flat worm*" or flatworm* or platyhelminth* or Turbellaria* or Planaria* or Rhabditophora* or Triclad* or Dugesiidae* or Dugesia* or hexapod* or insect* or Dicondylia* or Palaeoptera* or paleoptera* or Pterygot* or Neoptera* or Holometabola* or Endopterygot* or Antliophora* or Mecopteroidea* or Diptera* or flies or fly or Nematocera* or Culicomorpha* or Chironomid* or Chironomus* or	343436

	midge or midges or Maxillopod* or Harpacticoid* or Tigriopus* or Malacostraca* or Peracarid* or Amphipod* or copepod* or calanoid* or Acartia* or echinoderm* or Echinoidea* or clypeasteroida* or "sand dollar*" or Paracentrotus* or Anostraca* or "fairy shrimp*" or Artemia* or "brine shrimp*" or mollusc* or mollusk* or gastropod* or slug or slugs or Vetigastropod* or abalone* or Haliotidae* or Haliotis* or "Sulculus diversicolor*" or "Sulculus diversicolour*" or annelid* or "segmented worm*" or Polychaet* or "bristle worm*" or bristleworm* or "Elasmopus rapax*" or "Scrobicularia plana*" or "Hediste diversicolor*" or "Hediste diversicolour*" or "Corophium Volutator*" or Acropora or Anthozoa* or Acroporidae or Pocillopora or Pocilloporidae or Porites or Renilla or actinia* or coelenterat* or Cnidaria* or "Millepora complanata" or "Stylophora pistillata" or bivalv* or Lamellibranchiata or mussel* or clam or clams or Mytilidae or Mytilus or lugworm* or Arenicola or coral? or reef?).tw,kw.	
14	hominid/ or exp chimpanzee/ or exp gorilla/ or homo neanderthalensis/ or exp orangutan/ or ape/ or exp hylobatidae/ or catarrhini/ or exp cercopithecidae/ or simian/ or exp platyrrhini/ or haplorhini/ or exp tarsiiform/ or primate/ or exp prosimian/ or euarchontoglires/ or exp dermoptera/ or exp glires/ or exp scandentia/ or placental mammal/ or exp afrotheria/ or exp boreoeutheria/ or exp laurasiatheria/ or exp xenarthra/ or therian/ or exp marsupial/ or mammal/ or exp "calf (mammal)"/ or exp monotreme/ or amniote/ or exp reptile/ or exp sauropsid/ or tetrapod/ or exp amphibia/ or vertebrate/ or exp fish/	4828160
15	(Vertebrate* or fish or fishes or bird? or seabird? or shorebird? or Amphibian* or mammal* or reptile* or tetrapod? or amniote? or amniota or reptilia* or sauropsid? or teleost* or Smegmamorpha* or gasterosteid* or gasterosteiform* or synbranchid* or Beloniforme* or belonidae* or needlefish* or Oryzias or oryziin* or medaka* or "japanese killifish*" or "japanese rice fish*" or "Danio rerio*" or zebrafish* or "zebra fish*" or "Brachydanio rerio*" or "Cyprinus rerio*" or "Danio frankei" or "zebra danio*" or "b rerio*" or "d rerio*" or Cyprinidae or cyprinid* or Cypriniformes or catastomus or catostomidae or catostomus or cobitidae or loach* or misgurnus or salmon* or Trout* or char or chars or salvelinus or oncorhynchus or "salmo gairdneri*" or steelhead* or "Salmo mykiss*" or "Pimephales promelas" or "fathead minnow*" or Pimephale* or "Paralichthys californicus" or halibut* or flounder* or Flatfish* or Pleuronectidae*).tw,kw.	831905
16	or/4-15	7539705
17	3 and 16	2781
18	limit 17 to "reviews (maximizes specificity)"	15

19	Meta-Analysis/ or "systematic review"/ or (review* or metaanal* or "meta anal*").tw,kw.	2809615
20	(17 and 19) or 18	298
21	limit 20 to (conference abstracts or embase)	247

Database: Web of Science
Date: 20.04.2020
Result: 221

# 11	221	#10 AND #9 *Indexes=SCI-EXPANDED, SSCI, A&HCI, ESCI Timespan=All years*
# 10	2,479,268	TOPIC: ("review*" or "metaanal*" or "meta anal*") *Indexes=SCI-EXPANDED, SSCI, A&HCI, ESCI Timespan=All years*
# 9	2,382	#8 AND #1 *Indexes=SCI-EXPANDED, SSCI, A&HCI, ESCI Timespan=All years*
# 8	5,714,683	#7 OR #6 OR #5 OR #4 OR #3 OR #2 *Indexes=SCI-EXPANDED, SSCI, A&HCI, ESCI Timespan=All years*
# 7	1,182,439	TOPIC: ("Vertebrate*" or "fish" or "fishes" or "bird$" or "seabird$" or "shorebird$" or "Amphibian*" or "mammal*" or "reptile*" or "tetrapod$" or "amniote$" or "amniota" or "reptilia*" or "sauropsid$" or "teleost*" or "Smegmamorpha*" or "gasterosteid*" or "gasterosteiform*" or "synbranchid*" or "Beloniforme*" or "belonidae*" or "needlefish*" or "Oryzias" or "oryziin*" or "medaka*" or "japanese killifish*" or "japanese rice fish*" or "Danio rerio*" or "zebrafish*" or "zebra fish*" or "Brachydanio rerio*" or "Cyprinus rerio*" or "Danio frankei" or "zebra danio*" or "b rerio*" or "d rerio*" or "Cyprinidae" or "cyprinid*" or "Cypriniformes" or "catastomus" or "catostomidae" or "catostomus" or "cobitidae" or "loach*" or "misgurnus" or "salmon*" or "Trout*" or "char" or "chars" or "salvelinus" or "oncorhynchus" or "salmo gairdneri*" or "steelhead*" or "Salmo mykiss*" or "Pimephales promelas" or "fathead minnow*" or "Pimephale*" or "Paralichthys californicus" or "halibut*" or "flounder*" or "Flatfish*" or "Pleuronectidae*") *Indexes=SCI-EXPANDED, SSCI, A&HCI, ESCI Timespan=All years*
# 6	696,036	TOPIC: ("invertebrate*" or "arthropod*" or "mandibulat*" or "Tetraconat*" or "Crustacea*" or "Branchiopod*" or "Cladocera*" or "water flea*" or "Daphnia*" or "freshwater flea*" or "Helminth*" or "aschelminth*" or "parasitic worm*" or "parasite worm*" or "flat worm*" or "flatworm*" or "platyhelminth*" or "Turbellaria*" or "Planaria*" or "Rhabditophora*" or "Triclad*" or "Dugesiidae*" or "Dugesia*" or "hexapod*" or "insect*" or "Dicondylia*" or "Palaeoptera*" or "paleoptera*" or "Pterygot*" or "Neoptera*" or "Holometabola*" or "Endopterygot*" or "Antliophora*" or "Mecopteroidea*" or "Diptera*" or "flies"

		or "fly" or "Nematocera*" or "Culicomorpha*" or "Chironomid*" or "Chironomus*" or "midge" or "midges" or "Maxillopod*" or "Harpacticoid*" or "Tigriopus*" or "Malacostraca*" or "Peracarid*" or "Amphipod*" or "copepod*" or "calanoid*" or "Acartia*" or "echinoderm*" or "Echinoidea*" or "clypeasteroida*" or "sand dollar*" or "Paracentrotus*" or "Anostraca*" or "fairy shrimp*" or "Artemia*" or "brine shrimp*" or "mollusc*" or "mollusk*" or "gastropod*" or "slug" or "slugs" or "Vetigastropod*" or "abalone*" or "Haliotidae*" or "Haliotis*" or "Sulculus diversicolor*" or "Sulculus diversicolour*" or "annelid*" or "segmented worm*" or "Polychaet*" or "bristle worm*" or "bristleworm*" or "Elasmopus rapax*" or "Scrobicularia plana*" or "Hediste diversicolor*" or "Hediste diversicolour*" or "Corophium Volutator*" or "Acropora" or "Anthozoa*" or "Acroporidae" or "Pocillopora" or "Pocilloporidae" or "Porites" or "Renilla" or "actinia*" or "coelenterat*" or "Cnidaria*" or "Millepora complanata" or "Stylophora pistillata" or "bivalv*" or "Lamellibranchiata" or "mussel*" or "clam" or "clams" or "Mytilidae" or "Mytilus" or "lugworm*" or "Arenicola" or "coral$" or "reef$") *Indexes=SCI-EXPANDED, SSCI, A&HCI, ESCI Timespan=All years*
# 5	11,108	TOPIC: ("eco toxicity" or "eco toxicology" or "ecotoxicity" or "ecotoxicology") *Indexes=SCI-EXPANDED, SSCI, A&HCI, ESCI Timespan=All years*
# 4	2,524,326	TOPIC: ("ecosystem$" or "ecological" or "biodiversity" or "biological diversity" or "microflora$" or "Microbiota$" or "Mycobiome$" or "Microbial" or "agroecosystem$" or "biomass*" or "biome$" or "microbiome$" or "microorganism$" or "microbe$" or "microclimate" or "Ecotype" or "ecospecies" or "ecovar" or (("Endangered" or "threatened") NEAR/0 ("Species" or "organism$")) or "biosphere" or "biota" or "biocenose" or "biocenoses" or " fauna" or "macrofauna" or "macroinvertebrate$" or "meiofauna" or "Meiobentho*" or "wildlife" or "flora" or "macrophyte$" or "biotope" or "ecotone" or "food chain$" or "food web$" or "habitat$" or "indicator organism$" or "indicator species" or "keystone organism$" or "keystone species" or "mesocosm$" or "metapopulation$" or "microcosm$" or "rhizosphere" or "microhabitat$" or (("biological" or "biotic" or "organism" or "organismal" or "natural" or "animal" or "fungal" or "fungus" or "archaea" or "archaeal" or "bacteria" or "bacterial" or "plant" or "herb" or "shrub" or "tree" or "protistan" or "ciliate" or "flagellate" or "protozoan" or "climax") NEAR/0 ("community" or "communities")) or "biocenoses" or "biocenosis" or "biocoenoses" or "biocoenosis" or "species dominance" or "species refuge*" or "species refugia" or "species refugium" or "trophic cascade*" or "forest$" or "rainforest$" or "taiga$" or "grassland$" or "savanna$" or "savannah$" or "pampas" or "prairie$" or "puszta$" or "steppe$" or "veldt$" or "Tundra$" or "Wetland$" or "estuary" or "Estuaries" or "coastal water$" or "ocean$" or "sea" or "seas" or "intertidal zone*" or "littoral*" or "pelagic zone*" or "lake$" or "river$" or "riparian*" or "limnetic" or "photic zone*" or "Aphotic zone*" or "bathyal zone*" or "abyssal zone*" or "hadal zone*") *Indexes=SCI-EXPANDED, SSCI, A&HCI, ESCI Timespan=All years*

# 3	302,841	TOPIC: ((("Aquatic" or "freshwater" or "fresh water" or "marine" or "abyssal" or "cold seep" or "deep sea" or "estuarine" or "hydrothermal vent" or "intertidal" or "pelagic" or "nektonic" or "neustonic" or "periphytic" or "Aphotic" or "bathyal" or "abyssal" or "hadal") NEAR/0 ("species" or "organism$")) or "bentho*" or ("benthic" NEAR/0 ("organism$" or "species" or "zone$" or "foraminifera")) or "macrobentho*" or "microphytobentho*" or "nekton" or "necton" or "neuston" or "Pleuston" or "periphyton$" or "plankton*" or "planktic*" or "bacterioplankt*" or "marine bacterium" or "holoplankt*" or "macroplankt*" or "meroplankt*" or "mesoplankt*" or "microplankt*" or "nanoplankt*" or "nannoplankt*" or "phytoplankt*" or "picoplankt*" or "zooplankt*" or "alga" or "algae" or "Chlorophyt*" or "Chlorophycea*" or "Sphaeropleales" or "Scenedesmus*" or "Desmodesmus" or "diatom*" or "bacillariophy*" or "Coscinodiscophyceae*" or "Thalassiosira*" or "Haptophy*" or "coccolithophor*" or "prymnesi*" or "emiliania*" or "pavlova*" or "phaeocystis*" or "pleurochrysis*" or "Isochrysis*" or "Chlamydomonadales*" or "Volvocales*" or "Volvocida*" or "volvocine*" or "Dunaliella*" or "Skeletonema*" or "Chlorodendrophyce*" or "Chlorodendrale*" or "Tetraselmis*" or "Chaetoceros*" or "Phaeodactylum" or "Dinoflagell*" or "Dinomastigot*" or "Dinophyceae" or "Dinophyt*" or "Mesokaryot*" or "Pyrrhophyceae" or "Pyrrhophyt*" or "Pyrrophyceae" or "Pyrrophyt*" or "Alexandrium" or "Microalga*" or "microphyte*" or "macroalga*" or "Seaweed" or "Kelp") *Indexes=SCI-EXPANDED, SSCI, A&HCI, ESCI Timespan=All years*
# 2	2,626,487	TOPIC: ("Pollution" or "polluted" or "Pollutant" or "Pollutants" or "micropollutant*" or "environment*" or "effluent*" or "waste water*" or "wastewater*" or "food microbiology" or "soil microbiology" or "water microbiology") *Indexes=SCI-EXPANDED, SSCI, A&HCI, ESCI Timespan=All years*
# 1	9,676	TOPIC: ("sunblock$" or "sun block$" or "sun tan lotion$" or "suntan lotion$" or "suntanlotion$" or "sun lotion$" or "sunlotion$" or "sun screen$" or "sunscreen$" or "sunburn cream$" or "sun burn cream$" or "sunburncream$" or "sun cream$" or "suncream$" or "block out$" or "blockout$" or (("ultraviolet" or "ultra violet" or "UV" or "UVA" or "UVB" OR "UVC") NEAR/1 "filter$")) *Indexes=SCI-EXPANDED, SSCI, A&HCI, ESCI Timespan=All years*

Database: Scopus
Date: 21.04.2020
Result: 234

1	TITLE sunblock* or "sun block*" or "sun tan lotion*" or "suntan lotion*" or suntanlotion* or "sun lotion*" or sunlotion* or "sun screen*" or sunscreen* or "sunburn cream*" or "sun burn cream*" or sunburncream* or "sun cream*" or suncream*	3,270

2	ABS sunblock* or "sun block*" or "sun tan lotion*" or "suntan lotion*" or suntanlotion* or "sun lotion*" or sunlotion* or "sun screen*" or sunscreen* or "sunburn cream*" or "sun burn cream*" or sunburncream* or "sun cream*" or suncream*	7,285
3	TITLE "block out*" or blockout* or ((ultraviolet or "ultra violet" or UV or UVA or UVB or UVC) W/1 filter*)	1,162
4	ABS "block out*" or blockout* or ((ultraviolet or "ultra violet" or UV or UVA or UVB or UVC) W/1 filter*)	4,109
5	#1 OR #2 OR #3 OR #4	12,012
6	TITLE Pollution or polluted or Pollutant or Pollutants or micropollutant* or environment* or effluent* or "waste water*" or wastewater* or "food microbiology" or "soil microbiology" or "water microbiology"	918,097
7	ABS Pollution or polluted or Pollutant or Pollutants or micropollutant* or environment* or effluent* or "waste water*" or wastewater* or "food microbiology" or "soil microbiology" or "water microbiology"	4,148,421
8	TITLE ((Aquatic or freshwater or "fresh water" or marine or abyssal or "cold seep" or "deep sea" or estuarine or "hydrothermal vent" or intertidal or pelagic or nektonic or neustonic or periphytic or Aphotic or bathyal or abyssal or hadal) PRE/0 species)	1,423
9	ABS ((Aquatic or freshwater or "fresh water" or marine or abyssal or "cold seep" or "deep sea" or estuarine or "hydrothermal vent" or intertidal or pelagic or nektonic or neustonic or periphytic or Aphotic or bathyal or abyssal or hadal) PRE/0 species)	14,299
10	TITLE ((Aquatic or freshwater or "fresh water" or marine or abyssal or "cold seep" or "deep sea" or estuarine or "hydrothermal vent" or intertidal or pelagic or nektonic or neustonic or periphytic or Aphotic or bathyal or abyssal or hadal) PRE/0 organism*)	3,195
11	ABS ((Aquatic or freshwater or "fresh water" or marine or abyssal or "cold seep" or "deep sea" or estuarine or "hydrothermal vent" or intertidal or pelagic or nektonic or neustonic or periphytic or Aphotic or bathyal or abyssal or hadal) PRE/0 organism*)	21,361
12	TITLE bentho* or (benthic PRE/0 (organism* or species or zone or zones or foraminifera)) or macrobentho* or microphytobentho* or nekton or necton or neuston or Pleuston or periphyton* or plankton* or planktic* or bacterioplankt* or "marine bacterium"	22,454
13	ABS bentho* or (benthic PRE/0 (organism* or species or zone or zones or foraminifera)) or macrobentho* or microphytobentho* or nekton or necton or neuston or Pleuston or periphyton* or plankton* or planktic* or bacterioplankt* or "marine bacterium"	70,665
14	TITLE holoplankt* or macroplankt* or meroplankt* or mesoplankt* or microplankt* or nanoplankt* or nannoplankt* or phytoplankt* or picoplankt* or zooplankt* or alga or algae or Chlorophyt* or Chlorophycea* or Sphaeropleales or Scenedesmus* or Desmodesmus	61,375
15	ABS holoplankt* or macroplankt* or meroplankt* or mesoplankt* or microplankt* or nanoplankt* or nannoplankt* or phytoplankt* or picoplankt* or zooplankt* or alga or algae or Chlorophyt* or Chlorophycea* or Sphaeropleales or Scenedesmus* or Desmodesmus	159,138

16	TITLE diatom* or bacillariophy* or Coscinodiscophyceae* or Thalassiosira* or Haptophy* or coccolithophor* or prymnesi* or emiliania* or pavlova* or phaeocystis* or pleurochrysis* or Isochrysis* or Chlamydomonadales* or Volvocales* or Volvocida* or volvocine*	26,927
17	ABS diatom* or bacillariophy* or Coscinodiscophyceae* or Thalassiosira* or Haptophy* or coccolithophor* or prymnesi* or emiliania* or pavlova* or phaeocystis* or pleurochrysis* or Isochrysis* or Chlamydomonadales* or Volvocales* or Volvocida* or volvocine*	63,573
18	TITLE Dunaliella* or Skeletonema* or Chlorodendrophyce* or Chlorodendrale* or Tetraselmis* or Chaetoceros* or Phaeodactylum or Dinoflagell* or Dinomastigot* or Dinophyceae or Dinophyt* or Mesokaryot* or Pyrrhophyceae or Pyrrhophyt*	11,118
19	ABS Dunaliella* or Skeletonema* or Chlorodendrophyce* or Chlorodendrale* or Tetraselmis* or Chaetoceros* or Phaeodactylum or Dinoflagell* or Dinomastigot* or Dinophyceae or Dinophyt* or Mesokaryot* or Pyrrhophyceae or Pyrrhophyt*	24,735
20	TITLE Pyrrophyceae or Pyrrophyt* or Alexandrium or Microalga* or microphyte* or macroalga* or Seaweed or Kelp or ecosystem* or ecological or biodiversity or "biological diversity" or microflora* or Microbiota* or Mycobiome* or Microbial or agroecosystem*	314,106
21	ABS Pyrrophyceae or Pyrrophyt* or Alexandrium or Microalga* or microphyte* or macroalga* or Seaweed or Kelp or ecosystem* or ecological or biodiversity or "biological diversity" or microflora* or Microbiota* or Mycobiome* or Microbial or agroecosystem*	993,562
22	TITLE biomass* or biome or biomes or microbiome* or microorganism* or microbe* or microclimate or Ecotype or ecospecies or ecovar or ((Endangered or threatened) PRE/0 (Species or organism*)) or biosphere or biota or biocenose or biocenoses or fauna or macrofauna	161,853
23	ABS biomass* or biome or biomes or microbiome* or microorganism* or microbe* or microclimate or Ecotype or ecospecies or ecovar or ((Endangered or threatened) PRE/0 (Species or organism*)) or biosphere or biota or biocenose or biocenoses or fauna or macrofauna	717,265
24	TITLE macroinvertebrate* or meiofauna or Meiobentho* or wildlife or flora or macrophyte* or biotope or ecotone or "food chain*" or "food web*" or habitat or habitats or "indicator organism*" or "indicator species" or "keystone organism*" or "keystone species"	112,069
25	ABS macroinvertebrate* or meiofauna or Meiobentho* or wildlife or flora or macrophyte* or biotope or ecotone or "food chain*" or "food web*" or habitat or habitats or "indicator organism*" or "indicator species" or "keystone organism*" or "keystone species"	441,695
26	TITLE mesocosm* or metapopulation* or microcosm* or rhizosphere or microhabitat*	18,248
27	ABS mesocosm* or metapopulation* or microcosm* or rhizosphere or microhabitat*	61,723

28	TITLE ((biological or biotic or organism or organismal or natural or animal or fungal or fungus or archaea or archaeal or bacteria or bacterial or plant or herb or shrub or tree or protistan or ciliate or flagellate or protozoan or climax) PRE/0 community)	17,285
29	ABS ((biological or biotic or organism or organismal or natural or animal or fungal or fungus or archaea or archaeal or bacteria or bacterial or plant or herb or shrub or tree or protistan or ciliate or flagellate or protozoan or climax) PRE/0 community)	61,957
30	TITLE ((biological or biotic or organism or organismal or natural or animal or fungal or fungus or archaea or archaeal or bacteria or bacterial or plant or herb or shrub or tree or protistan or ciliate or flagellate or protozoan or climax) PRE/0 communities)	17,285
31	ABS ((biological or biotic or organism or organismal or natural or animal or fungal or fungus or archaea or archaeal or bacteria or bacterial or plant or herb or shrub or tree or protistan or ciliate or flagellate or protozoan or climax) PRE/0 communities)	61,957
32	TITLE biocenoses or biocenosis or biocoenoses or biocoenosis or "species dominance" or "species refuge*" or "species refugia" or "species refugium" or "trophic cascade*" or forest or forests or rainforest* or taiga or taigas or grassland*	186,558
33	ABS biocenoses or biocenosis or biocoenoses or biocoenosis or "species dominance" or "species refuge*" or "species refugia" or "species refugium" or "trophic cascade*" or forest or forests or rainforest* or taiga or taigas or grassland*	431,020
34	TITLE savanna or savannas or savannah* or pampas or prairie* or puszta or pusztas or steppe or steppes or veldt or veldts or Tundra or Tundras or Wetland* or estuary or Estuaries or "coastal water*" or ocean or oceans or sea or seas	375,447
35	#6 OR #7 OR #8 OR #9 OR #10 OR #11 OR #12 OR #13 OR #14 OR #15 OR #16 OR #17 OR #18 OR #19 OR #20 OR #21 OR #22 OR #23 OR #24 OR #25 OR #26 OR #27 OR #28 OR #29 OR #30 OR #31 OR #32 OR #33 OR #34	6,420,933
36	ABS savanna or savannas or savannah* or pampas or prairie* or puszta or pusztas or steppe or steppes or veldt or veldts or Tundra or Tundras or Wetland* or estuary or Estuaries or "coastal water*" or ocean or oceans or sea or seas	875,607
37	TITLE "intertidal zone*" or littoral* or "pelagic zone*" or lake or lakes or river or rivers or riparian* or limnetic or "photic zone*" or "Aphotic zone*" or "bathyal zone*" or "abyssal zone*" or "hadal zone*"	274,102
38	ABS "intertidal zone*" or littoral* or "pelagic zone*" or lake or lakes or river or rivers or riparian* or limnetic or "photic zone*" or "Aphotic zone*" or "bathyal zone*" or "abyssal zone*" or "hadal zone*"	615,753
39	TITLE "eco toxicity" or "eco toxicology" or ecotoxicity or ecotoxicology	2,544
40	ABS "eco toxicity" or "eco toxicology" or ecotoxicity or ecotoxicology	7,222

41	TITLE invertebrate* or arthropod* or mandibulat* or Tetraconat* or Crustacea* or Branchiopod* or Cladocera* or "water flea*" or Daphnia* or "freshwater flea*" or Helminth* or aschelminth* or "parasitic worm*" or "parasite worm*" or "flat worm*" or flatworm*	60,672
42	ABS invertebrate* or arthropod* or mandibulat* or Tetraconat* or Crustacea* or Branchiopod* or Cladocera* or "water flea*" or Daphnia* or "freshwater flea*" or Helminth* or aschelminth* or "parasitic worm*" or "parasite worm*" or "flat worm*" or flatworm*	148,425
43	TITLE platyhelminth* or Turbellaria* or Planaria* or Rhabditophora* or Triclad* or Dugesiidae* or Dugesia* or hexapod* or insect* or Dicondylia* or Palaeoptera* or paleoptera* or Pterygot* or Neoptera* or Holometabola* or Endopterygot* or Antliophora*	93,160
44	ABS platyhelminth* or Turbellaria* or Planaria* or Rhabditophora* or Triclad* or Dugesiidae* or Dugesia* or hexapod* or insect* or Dicondylia* or Palaeoptera* or paleoptera* or Pterygot* or Neoptera* or Holometabola* or Endopterygot* or Antliophora*	244,443
45	TITLE Mecopteroidea* or Diptera* or flies or fly or Nematocera* or Culicomorpha* or Chironomid* or Chironomus* or midge or midges or Maxillopod* or Harpacticoid* or Tigriopus* or Malacostraca* or Peracarid* or Amphipod* or copepod* or calanoid* or Acartia*	99,882
46	ABS Mecopteroidea* or Diptera* or flies or fly or Nematocera* or Culicomorpha* or Chironomid* or Chironomus* or midge or midges or Maxillopod* or Harpacticoid* or Tigriopus* or Malacostraca* or Peracarid* or Amphipod* or copepod* or calanoid* or Acartia*	187,929
47	TITLE echinoderm* or Echinoidea* or clypeasteroida* or "sand dollar*" or Paracentrotus* or Anostraca* or "fairy shrimp*" or Artemia* or "brine shrimp*" or mollusc* or mollusk* or gastropod* or slug or slugs or Vetigastropod* or abalone*	43,927
48	ABS echinoderm* or Echinoidea* or clypeasteroida* or "sand dollar*" or Paracentrotus* or Anostraca* or "fairy shrimp*" or Artemia* or "brine shrimp*" or mollusc* or mollusk* or gastropod* or slug or slugs or Vetigastropod* or abalone*	81,526
49	TITLE Haliotidae* or Haliotis* or "Sulculus diversicolor*" or "Sulculus diversicolour*" or annelid* or "segmented worm*" or Polychaet* or "bristle worm*" or bristleworm* or "Elasmopus rapax*" or "Scrobicularia plana*"	10,858
50	ABS Haliotidae* or Haliotis* or "Sulculus diversicolor*" or "Sulculus diversicolour*" or annelid* or "segmented worm*" or Polychaet* or "bristle worm*" or bristleworm* or "Elasmopus rapax*" or "Scrobicularia plana*"	17,098
51	TITLE "Hediste diversicolor*" or "Hediste diversicolour*" or "Corophium Volutator*" or Acropora or Anthozoa* or Acroporidae or Pocillopora or Pocilloporidae or Porites or Renilla or actinia* or coelenterat* or Cnidaria* or "Millepora complanata"	5,999
52	ABS "Hediste diversicolor*" or "Hediste diversicolour*" or "Corophium Volutator*" or Acropora or Anthozoa* or Acroporidae or Pocillopora or Pocilloporidae or Porites or Renilla or actinia* or coelenterat* or Cnidaria* or "Millepora complanata"	12,409

53	TITLE "Stylophora pistillata" or bivalv* or Lamellibranchiata or mussel* or clam or clams or Mytilidae or Mytilus or lugworm* or Arenicola or coral or corals or reef or reefs	66,859
54	ABS "Stylophora pistillata" or bivalv* or Lamellibranchiata or mussel* or clam or clams or Mytilidae or Mytilus or lugworm* or Arenicola or coral or corals or reef or reefs	114,400
55	TITLE Vertebrate* or fish or fishes or bird or birds or seabird* or shorebird* or Amphibian* or mammal* or reptile* or tetrapod* or amniote or amniotes or amniota or reptilia* or sauropsid* or teleost* or Smegmamorpha* or gasterosteid* or gasterosteiform*	332,583
56	ABS Vertebrate* or fish or fishes or bird or birds or seabird* or shorebird* or Amphibian* or mammal* or reptile* or tetrapod* or amniote or amniotes or amniota or reptilia* or sauropsid* or teleost* or Smegmamorpha* or gasterosteid* or gasterosteiform*	1,000,137
57	TITLE synbranchid* or Beloniforme* or belonidae* or needlefish* or Oryzias or oryziin* or medaka* or "japanese killifish*" or "japanese rice fish*" or "Danio rerio*" or zebrafish* or "zebra fish*" or "Brachydanio rerio*" or "Cyprinus rerio*" or "Danio frankei"	26,319
58	ABS synbranchid* or Beloniforme* or belonidae* or needlefish* or Oryzias or oryziin* or medaka* or "japanese killifish*" or "japanese rice fish*" or "Danio rerio*" or zebrafish* or "zebra fish*" or "Brachydanio rerio*" or "Cyprinus rerio*" or "Danio frankei"	41,630
59	TITLE "zebra danio*" or "b rerio*" or "d rerio*" or Cyprinidae or cyprinid* or Cypriniformes or catastomus or catostomidae or catostomus or cobitidae or loach* or misgurnus or salmon* or Trout* or char or chars or salvelinus or oncorhynchus or "salmo gairdneri*"	121,652
60	ABS "zebra danio*" or "b rerio*" or "d rerio*" or Cyprinidae or cyprinid* or Cypriniformes or catastomus or catostomidae or catostomus or cobitidae or loach* or misgurnus or salmon* or Trout* or char or chars or salvelinus or oncorhynchus or "salmo gairdneri*"	193,553
61	TITLE steelhead* or "Salmo mykiss*" or "Pimephales promelas" or "fathead minnow*" or Pimephale* or "Paralichthys californicus" or halibut* or flounder* or Flatfish* or Pleuronectidae*	8,403
62	ABS steelhead* or "Salmo mykiss*" or "Pimephales promelas" or "fathead minnow*" or Pimephale* or "Paralichthys californicus" or halibut* or flounder* or Flatfish* or Pleuronectidae*	14,207
63	#35 OR #36 OR #37 OR #38 OR #39 OR #40 OR #41 OR #42 OR #43 OR #44 OR #45 OR #46 OR #47 OR #48 OR #49 OR #50 OR #51 OR #52 OR #53 OR #54 OR #55 OR #56 OR #57 OR #58 OR #59 OR #60 OR #61 OR #62	8,419,241
64	#5 AND #63	2,420
65	TITLE review* or metaanal* or "meta anal*"	889,140
66	ABS review* or metaanal* or "meta anal*"	3,361,589
67	#35 OR #36	3,751,726
68	#34 AND #37	227
69	#64 AND (LIMIT-TO (DOCTYPE, "re"))	234
70	#68 or #69	234

Database: Cochrane Database of Systematic Reviews: Issue 4 of 12, April 2020
Date: 21.04.2020
Results: 1

#1	[mh ^"Sunscreening Agents"]	319
#2	(sunblock? or (sun NEXT block?) or ("sun tan" NEXT lotion?) or (suntan NEXT lotion?) or suntanlotion? or (sun NEXT lotion?) or sunlotion? or (sun NEXT screen?) or sunscreen? or (sunburn NEXT cream?) or ("sun burn" NEXT cream?) or sunburncream? or (sun NEXT cream?) or suncream? or (block NEXT out?) or blockout? or ((ultraviolet or ultra violet or UV or UVA or UVB or UVC) NEAR/2 filter?)):ti,ab	785
#3	#1 or #2	869
#4	[mh ^"Environmental Pollutants"]	30
#5	[mh ^"Water Pollutants"]	2
#6	[mh ^"Water Pollutants, Chemical"]	25
#7	[mh ^"Soil Pollutants"]	6
#8	[mh ^"environmental microbiology"]	19
#9	[mh ^"food microbiology"]	51
#10	[mh ^"soil microbiology"]	4
#11	[mh ^"water microbiology"]	73
#12	[mh ^"waste water"]	1
#13	(Pollution or polluted or Pollutant or Pollutants or micropollutant* or environment* or effluent* or (waste NEXT water*) or wastewater* or "food microbiology" or "soil microbiology" or "water microbiology"):ti,ab	21675
#14	[mh "Aquatic Organisms"]	56
#15	[mh "Chlorophyta"]	30
#16	[mh ^"Diatoms"]	1
#17	[mh ^"Haptophyta"]	0
#18	[mh "Dinoflagellida"]	2
#19	(((Aquatic or freshwater or "fresh water" or marine or abyssal or "cold seep" or "deep sea" or estuarine or "hydrothermal vent" or intertidal or pelagic or nektonic or neustonic or periphytic or Aphotic or bathyal or abyssal or hadal) NEXT (species or organism?)) or bentho* or (benthic NEXT (organism? or species or zone? or foraminifera)) or macrobentho* or microphytobentho* or nekton or necton or neuston or Pleuston or periphyton? or plankton* or planktic* or bacterioplankt* or "marine bacterium" or holoplankt* or macroplankt* or meroplankt* or mesoplankt* or microplankt* or nanoplankt* or nannoplankt* or phytoplankt* or picoplankt* or zooplankt* or alga or algae or Chlorophyt* or Chlorophycea* or Sphaeropleales or Scenedesmus* or Desmodesmus or diatom* or bacillariophy* or Coscinodiscophyceae* or Thalassiosira* or Haptophy* or coccolithophor* or prymnesi* or emiliania* or pavlova* or phaeocystis* or pleurochrysis* or Isochrysis* or Chlamydomonadales* or Volvocales* or Volvocida* or volvocine* or Dunaliella* or Skeletonema* or Chlorodendrophyce* or Chlorodendrale* or Tetraselmis* or Chaetoceros* or Phaeodactylum or Dinoflagell* or Dinomastigot* or Dinophyceae or Dinophyt* or Mesokaryot* or Pyrrhophyceae or Pyrrhophyt* or Pyrrophyceae or Pyrrophyt* or Alexandrium or Microalga* or microphyte* or macroalga* or Seaweed or Kelp):ti,ab	388

#20	[mh "ecosystem"]	655
#21	(ecosystem? or ecological or biodiversity or "biological diversity" or microflora? or Microbiota? or Mycobiome? or Microbial or agroecosystem? or biomass* or biome? or microbiome? or microorganism? or microbe? or microclimate or Ecotype or ecospecies or ecovar or ((Endangered or threatened) NEXT (Species or organism?)) or biosphere or biota or biocenose or biocenoses or fauna or macrofauna or macroinvertebrate? or meiofauna or Meiobentho* or wildlife or flora or macrophyte? or biotope or ecotone or (food NEXT chain?) or (food NEXT web?) or habitat? or (indicator NEXT organism?) or "indicator species" or (keystone NEXT organism?) or "keystone species" or mesocosm? or metapopulation? or microcosm? or rhizosphere or microhabitat? or ((biological or biotic or organism or organismal or natural or animal or fungal or fungus or archaea or archaeal or bacteria or bacterial or plant or herb or shrub or tree or protistan or ciliate or flagellate or protozoan or climax) NEXT (community or communities)) or biocenoses or biocenosis or biocoenoses or biocoenosis or "species dominance" or (species NEXT refuge*) or "species refugia" or "species refugium" or (trophic NEXT cascade*) or forest? or rainforest? or taiga? or grassland? or savanna? or savannah? or pampas or prairie? or puszta? or steppe? or veldt? or Tundra? or Wetland? or estuary or Estuaries or (coastal NEXT water?) or ocean? or sea or seas or (intertidal NEXT zone*) or littoral* or (pelagic NEXT zone*) or lake? or river? or riparian* or limnetic or (photic NEXT zone*) or (Aphotic NEXT zone*) or (bathyal NEXT zone*) or (abyssal NEXT zone*) or (hadal NEXT zone*)):ti,ab	22709
#22	[mh ^"Ecotoxicology"]	0
#23	("eco toxicity" or "eco toxicology" or ecotoxicity or ecotoxicology):ti,ab	2
#24	[mh "Invertebrates"]	1769
#25	(invertebrate* or arthropod* or mandibulat* or Tetraconat* or Crustacea* or Branchiopod* or Cladocera* or (water NEXT flea*) or Daphnia* or (freshwater NEXT flea*) or Helminth* or aschelminth* or (parasitic NEXT worm*) or (parasite NEXT worm*) or (flat NEXT worm*) or flatworm* or platyhelminth* or Turbellaria* or Planaria* or Rhabditophora* or Triclad* or Dugesiidae* or Dugesia* or hexapod* or insect* or Dicondylia* or Palaeoptera* or paleoptera* or Pterygot* or Neoptera* or Holometabola* or Endopterygot* or Antliophora* or Mecopteroidea* or Diptera* or flies or fly or Nematocera* or Culicomorpha* or Chironomid* or Chironomus* or midge or midges or Maxillopod* or Harpacticoid* or Tigriopus* or Malacostraca* or Peracarid* or Amphipod* or copepod* or calanoid* or Acartia* or echinoderm* or Echinoidea* or clypeasteroida* or (sand NEXT dollar*) or Paracentrotus* or Anostraca* or (fairy NEXT shrimp*) or Artemia* or (brine NEXT shrimp*) or mollusc* or mollusk* or gastropod* or slug or slugs or Vetigastropod* or abalone* or Haliotidae* or Haliotis* or (Sulculus NEXT diversicolor*) or (Sulculus NEXT diversicolour*) or annelid* or (segmented NEXT worm*) or Polychaet* or (bristle NEXT worm*) or bristleworm* or (Elasmopus NEXT rapax*) or (Scrobicularia NEXT plana*) or (Hediste NEXT diversicolor*) or (Hediste NEXT diversicolour*) or (Corophium NEXT Volutator*) or Acropora or Anthozoa* or Acroporidae or Pocillopora or Pocilloporidae or Porites or Renilla or actinia* or coelenterat* or Cnidaria* or "Millepora complanata" or "Stylophora pistillata" or bivalv* or Lamellibranchiata or mussel* or clam or clams or Mytilidae or Mytilus or lugworm* or Arenicola or coral? or reef?):ti,ab	2257
#26	[mh ^"vertebrates"]	0

#27	[mh "amphibians"]	10
#28	[mh "birds"]	203
#29	[mh "fishes"]	292
#30	[mh ^"mammals"]	0
#31	[mh ^"eutheria"]	0
#32	[mh "artiodactyla"]	1684
#33	[mh "carnivora"]	602
#34	[mh "cetacea"]	6
#35	[mh ^"chiroptera"]	1
#36	[mh ^"hyraxes"]	0
#37	[mh "insectivora"]	0
#38	[mh "lagomorpha"]	417
#39	[mh "perissodactyla"]	122
#40	[mh ^"primates"]	2
#41	[mh ^"haplorhini"]	47
#42	[mh ^"catarrhini"]	0
#43	[mh "cercopithecidae"]	206
#44	[mh ^"hominidae"]	3
#45	[mh ^"gorilla gorilla"]	0
#46	[mh ^"neanderthals"]	0
#47	[mh ^"pan paniscus"]	1
#48	[mh ^"pan troglodytes"]	12
#49	[mh "pongo"]	0
#50	[mh "hylobatidae"]	0
#51	[mh "platyrrhini"]	7
#52	[mh "tarsii"]	0
#53	[mh "strepsirhini"]	0
#54	[mh "rodentia"]	1961
#55	[mh "scandentia"]	0
#56	[mh "sirenia"]	0
#57	[mh "cingulata"]	1
#58	[mh "marsupialia"]	8
#59	[mh "monotremata"]	0
#60	[mh "proboscidea mammal"]	0
#61	[mh "reptiles"]	122
#62	(Vertebrate* or fish or fishes or bird? or seabird? or shorebird? or Amphibian* or mammal* or reptile* or tetrapod? or amniote? or amniota or reptilia* or sauropsid? or teleost* or Smegmamorpha* or gasterosteid* or gasterosteiform* or synbranchid* or Beloniforme* or belonidae* or needlefish* or Oryzias or oryziin* or medaka* or (japanese NEXT killifish*) or ("japanese rice" NEXT fish*) or (Danio NEXT rerio*) or zebrafish* or (zebra NEXT fish*) or (Brachydanio NEXT rerio*) or (Cyprinus NEXT rerio*) or "Danio frankei" or (zebra NEXT danio*) or (b NEXT rerio*) or (d NEXT rerio*) or Cyprinidae or cyprinid* or Cypriniformes or catastomus or catostomidae or catostomus or cobitidae or loach* or misgurnus or salmon* or Trout* or char or chars or salvelinus or oncorhynchus or (salmo NEXT gairdneri*) or steelhead* or (Salmo NEXT mykiss*) or "Pimephales promelas" or (fathead NEXT	8274

	minnow*) or Pimephale* or "Paralichthys californicus" or halibut* or flounder* or Flatfish* or Pleuronectidae*):ti,ab	
#63	(Higgins and Green, -#62-#62)	59111
#64	#3 AND #63	67
#65	#3 AND #63 in Cochrane Reviews, Cochrane Protocols	1

Database: CRD - The Database of Abstracts of Reviews of Effects (DARE), NHS Economic Evaluation Database (NHS EED) and HTA
Date: 21.04.2020
Results: 3

1	MeSH DESCRIPTOR Sunscreening Agents	15
2	((sunblock? or "sun block?" or "sun tan lotion?" or "suntan lotion?" or "sun lotion?" or sunlotion? or "sun screen?" or sunscreen? or "sunburn cream?" or "sun burn cream?" or sunburncream? or "sun cream?" or suncream? or "block out?" or blockout? or ((ultraviolet or ultra violet or UV or UVA or UVB or UVC) NEAR1 filter?) or (filter? NEAR1 (ultraviolet or ultra violet or UV or UVA or UVB or UVC))))	18
3	#1 OR #2	24
4	MeSH DESCRIPTOR Environmental Pollutants	2
5	MeSH DESCRIPTOR Water Pollutants	1
6	MeSH DESCRIPTOR Water Pollutants, Chemical	3
7	MeSH DESCRIPTOR Soil Pollutants	0
8	MeSH DESCRIPTOR environmental microbiology	3
9	MeSH DESCRIPTOR food microbiology	4
10	MeSH DESCRIPTOR Soil Microbiology	0
11	MeSH DESCRIPTOR Water Microbiology	3
12	MeSH DESCRIPTOR waste water	0
13	((Pollution or polluted or Pollutant or Pollutants or micropollutant* or environment* or effluent* or waste water* or wastewater* or "food microbiology" or "soil microbiology" or "water microbiology"))	1198
14	MeSH DESCRIPTOR Aquatic Organisms EXPLODE ALL TREES	0
15	MeSH DESCRIPTOR Chlorophyta EXPLODE ALL TREES	0
16	MeSH DESCRIPTOR Diatoms	0
17	MeSH DESCRIPTOR Haptophyta	0
18	MeSH DESCRIPTOR Dinoflagellida EXPLODE ALL TREES	0
19	((((Aquatic or freshwater or "fresh water" or marine or abyssal or "cold seep" or "deep sea" or estuarine or "hydrothermal vent" or intertidal or pelagic or nektonic or neustonic or periphytic or Aphotic or bathyal or abyssal or hadal) NEAR0 (species or organism?)) or bentho* or (benthic NEAR0 (organism? or species or zone? or foraminifera)) or macrobentho* or microphytobentho* or nekton or necton or neuston or Pleuston or periphyton? or plankton* or planktic* or bacterioplankt* or "marine bacterium" or holoplankt* or macroplankt* or meroplankt* or mesoplankt* or microplankt* or nanoplankt* or nannoplankt* or phytoplankt* or picoplankt* or zooplankt* or alga or algae or Chlorophyt* or Chlorophycea* or Sphaeropleales or Scenedesmus* or Desmodesmus or diatom* or bacillariophy* or Coscinodiscophyceae* or Thalassiosira* or Haptophy* or coccolithophor* or prymnesi* or emiliania* or pavlova* or phaeocystis* or pleurochrysis* or Isochrysis*	4

	or Chlamydomonadales* or Volvocales* or Volvocida* or volvocine* or Dunaliella* or Skeletonema* or Chlorodendrophyce* or Chlorodendrale* or Tetraselmis* or Chaetoceros* or Phaeodactylum or Dinoflagell* or Dinomastigot* or Dinophyceae or Dinophyt* or Mesokaryot* or Pyrrhophyceae or Pyrrhophyt* or Pyrrophyceae or Pyrrophyt* or Alexandrium or Microalga* or microphyte* or macroalga* or Seaweed or Kelp))	
20	MeSH DESCRIPTOR ecosystem EXPLODE ALL TREES	11
21	((ecosystem? or ecological or biodiversity or "biological diversity" or microflora? or Microbiota? or Mycobiome? or Microbial or agroecosystem? or biomass* or biome? or microbiome? or microorganism? or microbe? or microclimate or Ecotype or ecospecies or ecovar or ((Endangered or threatened) NEAR0 (Species or organism?)) or biosphere or biota or biocenose or biocenoses or fauna or macrofauna or macroinvertebrate? or meiofauna or Meiobentho* or wildlife or flora or macrophyte? or biotope or ecotone or "food chain?" or "food web?" or habitat? or "indicator organism?" or "indicator species" or "keystone organism?" or "keystone species" or mesocosm? or metapopulation? or microcosm? or rhizosphere or microhabitat? or ((biological or biotic or organism or organismal or natural or animal or fungal or fungus or archaea or archaeal or bacteria or bacterial or plant or herb or shrub or tree or protistan or ciliate or flagellate or protozoan or climax) NEAR0 (community or communities)) or biocenoses or biocenosis or biocoenoses or biocoenosis or "species dominance" or "species refuge*" or "species refugia" or "species refugium" or "trophic cascade*" or forest? or rainforest? or taiga? or grassland? or savanna? or savannah? or pampas or prairie? or puszta? or steppe? or veldt? or Tundra? or Wetland? or estuary or Estuaries or "coastal water?" or ocean? or sea or seas or "intertidal zone*" or littoral* or "pelagic zone*" or lake? or river? or riparian* or limnetic or "photic zone*" or "Aphotic zone*" or "bathyal zone*" or "abyssal zone*" or "hadal zone*"))	1593
22	MeSH DESCRIPTOR Ecotoxicology	0
23	(("eco toxicity" or "eco toxicology" or ecotoxicity or ecotoxicology))	0
24	MeSH DESCRIPTOR Invertebrates EXPLODE ALL TREES	75
25	((invertebrate* or arthropod* or mandibulat* or Tetraconat* or Crustacea* or Branchiopod* or Cladocera* or "water flea*" or Daphnia* or "freshwater flea*" or Helminth* or aschelminth* or "parasitic worm*" or "parasite worm*" or "flat worm*" or flatworm* or platyhelminth* or Turbellaria* or Planaria* or Rhabditophora* or Triclad* or Dugesiidae* or Dugesia* or hexapod* or insect* or Dicondylia* or Palaeoptera* or paleoptera* or Pterygot* or Neoptera* or Holometabola* or Endopterygot* or Antliophora* or Mecopteroidea* or Diptera* or flies or fly or Nematocera* or Culicomorpha* or Chironomid* or Chironomus* or midge or midges or Maxillopod* or Harpacticoid* or Tigriopus* or Malacostraca* or Peracarid* or Amphipod* or copepod* or calanoid* or Acartia* or echinoderm* or Echinoidea* or clypeasteroida* or "sand dollar*" or Paracentrotus* or Anostraca* or "fairy shrimp*" or Artemia* or "brine shrimp*" or mollusc* or mollusk* or gastropod* or slug or slugs or Vetigastropod* or abalone* or Haliotidae* or Haliotis* or "Sulculus diversicolor*" or "Sulculus diversicolour*" or annelid* or "segmented worm*" or Polychaet* or "bristle worm*" or bristleworm* or "Elasmopus rapax*" or "Scrobicularia plana*" or "Hediste diversicolor*" or "Hediste diversicolour*" or "Corophium Volutator*" or Acropora or Anthozoa* or Acroporidae or Pocillopora or Pocilloporidae or Porites or Renilla or actinia* or coelenterat* or Cnidaria* or	139

	"Millepora complanata" or "Stylophora pistillata" or bivalv* or Lamellibranchiata or mussel* or clam or clams or Mytilidae or Mytilus or lugworm* or Arenicola or coral? or reef?))	
26	MeSH DESCRIPTOR vertebrates	0
27	MeSH DESCRIPTOR amphibians EXPLODE ALL TREES	0
28	MeSH DESCRIPTOR birds EXPLODE ALL TREES	3
29	MeSH DESCRIPTOR fishes EXPLODE ALL TREES	16
30	MeSH DESCRIPTOR mammals	0
31	MeSH DESCRIPTOR artiodactyla EXPLODE ALL TREES	27
32	MeSH DESCRIPTOR carnivora EXPLODE ALL TREES	20
33	MeSH DESCRIPTOR cetacea EXPLODE ALL TREES	0
34	MeSH DESCRIPTOR chiroptera	0
35	MeSH DESCRIPTOR hyraxes	0
36	MeSH DESCRIPTOR insectivora EXPLODE ALL TREES	0
37	MeSH DESCRIPTOR lagomorpha EXPLODE ALL TREES	9
38	MeSH DESCRIPTOR perissodactyla EXPLODE ALL TREES	8
39	MeSH DESCRIPTOR primates	0
40	MeSH DESCRIPTOR haplorhini	0
41	MeSH DESCRIPTOR catarrhini	0
42	MeSH DESCRIPTOR cercopithecidae EXPLODE ALL TREES	2
43	MeSH DESCRIPTOR hominidae	0
44	MeSH DESCRIPTOR Gorilla gorilla	0
45	MeSH DESCRIPTOR Neanderthals	0
46	MeSH DESCRIPTOR Pan paniscus	0
47	MeSH DESCRIPTOR Pan troglodytes	0
48	MeSH DESCRIPTOR Pongo EXPLODE ALL TREES	0
49	MeSH DESCRIPTOR hylobatidae EXPLODE ALL TREES	0
50	MeSH DESCRIPTOR platyrrhini EXPLODE ALL TREES	0
51	MeSH DESCRIPTOR tarsii EXPLODE ALL TREES	0
52	MeSH DESCRIPTOR strepsirhini EXPLODE ALL TREES	0
53	MeSH DESCRIPTOR rodentia EXPLODE ALL TREES	21
54	MeSH DESCRIPTOR scandentia EXPLODE ALL TREES	0
55	MeSH DESCRIPTOR sirenia EXPLODE ALL TREES	0
56	MeSH DESCRIPTOR marsupialia EXPLODE ALL TREES	0
57	MeSH DESCRIPTOR monotremata EXPLODE ALL TREES	0
58	MeSH DESCRIPTOR proboscidea mammal EXPLODE ALL TREES	0
59	MeSH DESCRIPTOR reptiles EXPLODE ALL TREES	2
60	((Vertebrate* or fish or fishes or bird? or seabird? or shorebird? or Amphibian* or mammal* or reptile* or tetrapod? or amniote? or amniota or reptilia* or sauropsid? or teleost* or Smegmamorpha* or gasterosteid* or gasterosteiform* or synbranchid* or Beloniforme* or belonidae* or needlefish* or Oryzias or oryziin* or medaka* or "japanese killifish*" or "japanese rice fish*" or "Danio rerio*" or zebrafish* or "zebra fish*" or "Brachydanio rerio*" or "Cyprinus rerio*" or "Danio frankei" or "zebra danio*" or "b rerio*" or "d rerio*" or Cyprinidae or cyprinid* or Cypriniformes or catastomus or catostomidae or catostomus or cobitidae or loach* or misgurnus or salmon* or Trout* or char or chars or salvelinus or oncorhynchus or "salmo gairdneri*" or steelhead* or "Salmo mykiss*" or "Pimephales promelas" or	353

	"fathead minnow*" or Pimephale* or "Paralichthys californicus" or halibut* or flounder* or Flatfish* or Pleuronectidae*))	
61	#4 OR #5 OR #6 OR #7 OR #8 OR #9 OR #10 OR #11 OR #12 OR #13 OR #14 OR #15 OR #16 OR #17 OR #18 OR #19 OR #20 OR #21 OR #22 OR #23 OR #24 OR #25 OR #26 OR #27 OR #28 OR #29 OR #30 OR #31 OR #32 OR #33 OR #34 OR #35 OR #36 OR #37 OR #38 OR #39 OR #40 OR #41 OR #42 OR #43 OR #44 OR #45 OR #46 OR #47 OR #48 OR #49 OR #50 OR #51 OR #52 OR #53 OR #54 OR #55 OR #56 OR #57 OR #58 OR #59 OR #60	3313
62	#3 AND #61	3

Database: Epistemonikos
Date: 21.04.2020
Result: 6

Title/abstract= (sunblock* or "sun block" or "sun blocks" or "sun tan lotion" or "sun tan lotions" or "suntan lotion" or "suntan lotions" or "sun lotion" or "sun lotions" or sunlotion* or "sun screen" or "sun screens" or sunscreen* or "sunburn cream" or "sunburn creams" or "sun burn cream" or "sun burn cream" or sunburncream* or "sun cream" or "sun creams" or suncream* or "block out" or "block outs" or blockout* or "ultraviolet filter" or "ultra violet filter" or "UV filter" or "UVA filter" or "UVB filter" or "UVC filter" or "UV A filter" or "UV B filter" or "UV C filter" or "ultraviolet filters" or "ultra violet filters" or "UV filters" or "UVA filters" or "UVB filters" or "UVC filters" or "UV A filters" or "UV B filters" or "UV C filters") AND (Pollution or polluted or Pollutant or Pollutants or micropollutant* or environment* or effluent* or "waste water" or "waste waters" or wastewater* or "food microbiology" or "soil microbiology" or "water microbiology" or Aquatic or freshwater or "fresh water" or marine or abyssal or "cold seep" or "deep sea" or estuarine or "hydrothermal vent" or intertidal or pelagic or nektonic or neustonic or periphytic or Aphotic or bathyal or abyssal or hadal or bentho* or benthic or macrobentho* or microphytobentho* or nekton or necton or neuston or Pleuston or periphyton* or plankton* or planktic* or bacterioplankt* or "marine bacterium" or holoplankt* or macroplankt* or meroplankt* or mesoplankt* or microplankt* or nanoplankt* or nannoplankt* or phytoplankt* or picoplankt* or zooplankt*) = 0 Broad synthesis, 4 systematic Reviews, 0 Structured summary of systematic reviews)

Title/abstract= (sunblock* or "sun block" or "sun blocks" or "sun tan lotion" or "sun tan lotions" or "suntan lotion" or "suntan lotions" or "sun lotion" or "sun lotions" or sunlotion* or "sun screen" or "sun screens" or sunscreen* or "sunburn cream" or "sunburn creams" or "sun burn cream" or "sun burn cream" or sunburncream* or "sun cream" or "sun creams" or suncream* or "block out" or "block outs" or blockout* or "ultraviolet filter" or "ultra violet filter" or "UV filter" or "UVA filter" or "UVB filter" or "UVC filter" or "UV A filter" or "UV B filter" or "UV C filter" or "ultraviolet filters" or "ultra violet filters" or "UV filters" or "UVA filters" or "UVB filters" or "UVC filters" or "UV A filters" or "UV B filters" or "UV C filters") AND (alga or algae or Chlorophyt* or Chlorophycea* or Sphaeropleales or Scenedesmus* or Desmodesmus or diatom* or bacillariophy* or Coscinodiscophyceae* or Thalassiosira* or Haptophy* or coccolithophor* or prymnesi* or emiliania* or pavlova* or phaeocystis* or pleurochrysis* or Isochrysis* or Chlamydomonadales* or Volvocales* or Volvocida* or volvocine* or Dunaliella* or Skeletonema* or Chlorodendrophyce* or Chlorodendrale* or Tetraselmis* or Chaetoceros* or Phaeodactylum or Dinoflagell* or Dinomastigot* or Dinophyceae or Dinophyt* or Mesokaryot* or Pyrrhophyceae or Pyrrhophyt* or Pyrrophyceae or Pyrrophyt* or Alexandrium or Microalga* or microphyte* or macroalga* or Seaweed or Kelp) = 0 Broad synthesis, 0 systematic Reviews, 0 Structured summary of systematic reviews)

Title/abstract= (sunblock* or "sun block" or "sun blocks" or "sun tan lotion" or "sun tan lotions" or "suntan lotion" or "suntan lotions" or "sun lotion" or "sun lotions" or sunlotion* or "sun screen" or "sun screens" or sunscreen* or "sunburn cream" or "sunburn creams" or "sun burn cream" or "sun

burn cream" or sunburncream* or "sun cream" or "sun creams" or suncream* or "block out" or "block outs" or blockout* or "ultraviolet filter" or "ultra violet filter" or "UV filter" or "UVA filter" or "UVB filter" or "UVC filter" or "UV A filter" or "UV B filter" or "UV C filter" or "ultraviolet filters" or "ultra violet filters" or "UV filters" or "UVA filters" or "UVB filters" or "UVC filters" or "UV A filters" or "UV B filters" or "UV C filters") AND (ecosystem* or ecological or biodiversity or "biological diversity" or microflora* or Microbiota* or Mycobiome* or Microbial or agroecosystem* or biomass* or biome* or microbiome* or microorganism* or microbe* or microclimate or Ecotype or ecospecies or ecovar or "Endangered Species" or "threatened Species" or "Endangered organism" or "threatened organism" or "Endangered organisms" or "threatened organisms" or biosphere or biota or biocenose or biocenoses or fauna or macrofauna or macroinvertebrate* or meiofauna or Meiobentho* or wildlife or flora or macrophyte* or biotope or ecotone or "food chain" or "food chains" or "food webs" or "food web" or habitat or habitats or "indicator organism" or "indicator organisms" or "indicator species" or "keystone organism" or "keystone organisms" or "keystone species") = 0 Broad synthesis, 3 systematic Reviews, 0 Structured summary of systematic reviews)

(sunblock* or "sun block" or "sun blocks" or "sun tan lotion" or "sun tan lotions" or "suntan lotion" or "suntan lotions" or "sun lotion" or "sun lotions" or sunlotion* or "sun screen" or "sun screens" or sunscreen* or "sunburn cream" or "sunburn creams" or "sun burn cream" or "sun burn cream" or sunburncream* or "sun cream" or "sun creams" or suncream* or "block out" or "block outs" or blockout* or "ultraviolet filter" or "ultra violet filter" or "UV filter" or "UVA filter" or "UVB filter" or "UVC filter" or "UV A filter" or "UV B filter" or "UV C filter" or "ultraviolet filters" or "ultra violet filters" or "UV filters" or "UVA filters" or "UVB filters" or "UVC filters" or "UV A filters" or "UV B filters" or "UV C filters") AND (mesocosm* or metapopulation* or microcosm* or rhizosphere or microhabitat* or "biological community" or "biotic community" or "organism community" or "organismal community" or "natural community" or "animal community" or "fungal community" or "fungus community" or "archaea community" or "archaeal community" or "bacteria community" or "bacterial community" or "plant community" or "herb community" or "shrub community" or "tree community" or "protistan community" or "ciliate community" or "flagellate community" or "protozoan community" or "climax community" or "biological communities" or "biotic communities" or "organism communities" or "organismal communities" or "natural communities" or "animal communities" or "fungal communities" or "fungus communities" or "archaea communities" or "archaeal communities" or "bacteria communities" or "bacterial communities" or "plant communities" or "herb communities" or "shrub communities" or "tree communities" or "protistan communities" or "ciliate communities" or "flagellate communities" or "protozoan communities" or "climax communities") = 0 Broad synthesis, 0 systematic Reviews, 0 Structured summary of systematic reviews)

(sunblock* or "sun block" or "sun blocks" or "sun tan lotion" or "sun tan lotions" or "suntan lotion" or "suntan lotions" or "sun lotion" or "sun lotions" or sunlotion* or "sun screen" or "sun screens" or sunscreen* or "sunburn cream" or "sunburn creams" or "sun burn cream" or "sun burn cream" or sunburncream* or "sun cream" or "sun creams" or suncream* or "block out" or "block outs" or blockout* or "ultraviolet filter" or "ultra violet filter" or "UV filter" or "UVA filter" or "UVB filter" or "UVC filter" or "UV A filter" or "UV B filter" or "UV C filter" or "ultraviolet filters" or "ultra violet filters" or "UV filters" or "UVA filters" or "UVB filters" or "UVC filters" or "UV A filters" or "UV B filters" or "UV C filters") AND (biocenoses or biocenosis or biocoenoses or biocoenosis or species dominance or "species refuge" or "species refuges" or "species refugia" or "species refugium" or "trophic cascade" or "trophic cascades" or forest or forests or rainforest* or taiga or taigas or grassland* or savanna or savannas or savannah* or pampas or prairie* or puszta* or steppe or steppes or veldt or veldts or Tundra or Tundras or Wetland* or estuary or Estuaries or "coastal water" or "coastal waters" or ocean or oceans or sea or seas or "intertidal zone" or "intertidal zones" or littoral* or "pelagic zone" or "pelagic zones" or lake or lakes or river or rivers or riparian* or limnetic or "photic zone" or "photic zones" or "Aphotic zone" or "Aphotic zones" or "bathyal zone" or "bathyal zones" or "abyssal zone" or "abyssal zones" or "hadal zone" or "hadal zones" or "eco toxicity" or "eco toxicology" or ecotoxicity or ecotoxicology) = 0 Broad synthesis, 2 systematic Reviews, 0 Structured summary of systematic reviews)

(sunblock* or "sun block" or "sun blocks" or "sun tan lotion" or "sun tan lotions" or "suntan lotion" or "suntan lotions" or "sun lotion" or "sun lotions" or sunlotion* or "sun screen" or "sun screens" or sunscreen* or "sunburn cream" or "sunburn creams" or "sun burn cream" or "sun burn cream" or sunburncream* or "sun cream" or "sun creams" or suncream* or "block out" or "block outs" or blockout* or "ultraviolet filter" or "ultra violet filter" or "UV filter" or "UVA filter" or "UVB filter" or "UVC filter" or "UV A filter" or "UV B filter" or "UV C filter" or "ultraviolet filters" or "ultra violet filters" or "UV filters" or "UVA filters" or "UVB filters" or "UVC filters" or "UV A filters" or "UV B filters" or "UV C filters") AND (invertebrate* or arthropod* or mandibulat* or Tetraconat* or Crustacea* or Branchiopod* or Cladocera* or "water flea" or "water fleas" or Daphnia* or Helminth* or aschelminth* or "parasitic worm" or "parasitic worms" or "parasite worm" or "parasite worms" or "flat worm" or "flat worms" or flatworm* or platyhelminth* or Turbellaria* or Planaria* or Rhabditophora* or Triclad* or Dugesiidae* or Dugesia* or hexapod* or insect* or Dicondylia* or Palaeoptera* or paleoptera* or Pterygot* or Neoptera* or Holometabola* or Endopterygot* or Antliophora* or Mecopteroidea* or Diptera* or flies or fly or Nematocera* or Culicomorpha* or Chironomid* or Chironomus* or midge or midges or Maxillopod* or Harpacticoid* or Tigriopus* or Malacostraca* or Peracarid* or Amphipod* or copepod* or calanoid* or Acartia* or echinoderm* or Echinoidea* or clypeasteroida* or "sand dollar" or "sand dollars" or Paracentrotus* or Anostraca* or "fairy shrimp" or "fairy shrimps" or Artemia* or "brine shrimp" or "brine shrimps" or mollusc* or mollusk* or gastropod* or slug or slugs or Vetigastropod* or abalone* or Haliotidae* or Haliotis* or diversicolor* or diversicolour*" or annelid* or "segmented worm" or "segmented worms" or Polychaet* or "bristle worm" or "bristle worms" or bristleworm* or Elasmopus or Scrobicularia or "Corophium Volutator" or "Corophium Volutators") = 0 Broad synthesis, 0 systematic Reviews, 0 Structured summary of systematic reviews)

(sunblock* or "sun block" or "sun blocks" or "sun tan lotion" or "sun tan lotions" or "suntan lotion" or "suntan lotions" or "sun lotion" or "sun lotions" or sunlotion* or "sun screen" or "sun screens" or sunscreen* or "sunburn cream" or "sunburn creams" or "sun burn cream" or "sun burn cream" or sunburncream* or "sun cream" or "sun creams" or suncream* or "block out" or "block outs" or blockout* or "ultraviolet filter" or "ultra violet filter" or "UV filter" or "UVA filter" or "UVB filter" or "UVC filter" or "UV A filter" or "UV B filter" or "UV C filter" or "ultraviolet filters" or "ultra violet filters" or "UV filters" or "UVA filters" or "UVB filters" or "UVC filters" or "UV A filters" or "UV B filters" or "UV C filters") AND (Acropora or Anthozoa* or Acroporidae or Pocillopora or Pocilloporidae or Porites or Renilla or actinia* or coelenterat* or Cnidaria* or "Millepora complanata" or "Stylophora pistillata" or bivalv* or Lamellibranchiata or mussel* or clam or clams or Mytilidae or Mytilus or lugworm* or Arenicola or coral or corals or reef or reefs or Vertebrate* or fish or fishes or bird or birds or seabird* or shorebird* or Amphibian* or mammal* or reptile* or tetrapod* or amniote* or amniota or reptilia* or sauropsid* or teleost* or Smegmamorpha* or gasterosteid* or gasterosteiform* or synbranchid* or Beloniforme* or belonidae* or needlefish* or Oryzias or oryziin* or medaka* or killifish* or rerio or rerios or zebrafish* or "Danio frankei" or "zebra danio" or "zebra danios" or Cyprinidae or cyprinid* or Cypriniformes or catastomus or catostomidae or catostomus or cobitidae or loach* or misgurnus or salmon* or Trout* or char or chars or salvelinus or oncorhynchus or salmo or steelhead* or "Pimephales promelas" or "fathead minnow" or "fathead minnows" or Pimephale* or "Paralichthys californicus" or halibut* or flounder* or Flatfish* or Pleuronectidae*) = 0 Broad synthesis, 0 systematic Reviews, 0 Structured summary of systematic reviews)

6.2 Literature search 3

The author C.S. performed these literature searches.

Database: Prospero
Date: 13.05.2020
Result: 13

Search terms:
Sunscreen + systematic review
UV filter + systematic review

Database: Brage
Date: 13.05.2020
Result: 28

Search terms:
Sunscreen review

Database: Cristin
Date: 13.05.2020
Result: 4
Search terms:
Sunscreen review

Database: Open Grey System for Information on Grey Literature in Europe
Date: 13.05.2020
Result: 1

Search terms:
Sunscreen review
UV filter review

6.3 Studies excluded after full-text assessment

An overview of articles excluded after full-text assessment is given in Table 6.2-1. The reason for exclusion were study design, as none of the identified reviews fulfilled the criteria for SRs.

Table 6.2-1. Articles excluded after full-text assessment of eligibility.

Search 1	
1.	Adler and DeLeo (2020)
2.	Alotaibi et al. (2015)
3.	Bilal et al. (2020)
4.	Brausch and Rand (2011)

5.	Careghini et al. (2015)
6.	DiNardo and Downs (2018)
7.	Gago-Ferrero et al. (2012)
8.	Hopkins and Blaney (2016)
9.	Juliano and Magrini (2017)
10.	Jurado et al. (2019)
11.	Kar et al. (2020)
12.	Kim and Choi (2014)
13.	Ma et al. (2013)
14.	Maipas and Nicolopoulou-Stamati (2015)
15.	Parra-Luna et al. (2020)
16.	Raffa et al. (2019)
17.	Rainieri et al. (2017)
18.	Raj et al. (2012)
19.	Rykowska and Wasiak (2015)
20.	Sánchez-Quiles and Tovar-Sánchez (2015)
21.	Schneider and Lim (2019a)
22.	Schneider and Lim (2019b)
23.	Scown et al. (2010)
24.	Sharifan and Ma (2017)
25.	Sharma et al. (2019)
26.	Shi et al. (2019)
27.	Singer et al. (2019)
28.	Skocaj et al. (2011)
29.	Sruthi et al. (2018)
30.	Stuart et al. (2012)
31.	Ternes et al. (2003)
32.	Tourinho et al. (2012)
33.	Tumova et al. (2019)
34.	Wang et al. (2016)
35.	Wiechers and Musee (2010)
36.	Wohlleben et al. (2019)
37.	Zirwas and Andrasik (2018)
Search 2	
38.	Haynes et al. (2017)
39.	Minetto et al. (2014)
40.	Sharma (2009)
41.	Wong et al. (2013)

7 Appendix II Study characteristics

Study characteristics of the reviews are presented in Table 7-1 and 7-2.

Table 7-1. The aim of the reviews.

Reference	Aim
Adler and DeLeo (2020)	To provide an up-to-date synopsis of the literature on the safety of sunscreen active ingredients in humans and the environment.
Bilal et al. (2020)	To spotlight a current overview of toxic ingredients used in formulating cosmetics.
Kar et al. (2020)	To provide guidance concerning improved and reliable application of computational models for ecotoxicity prediction.
Raffa et al. (2019)	Review the evidence for claims of a deleterious effect (direct or indirect) of some organic UV filters on coral reef health, the potential for a rise in skin cancer incidence and solutions to the dilemma that are currently being investigated.
Schneider and Lim (2019a)	Discuss the role of inorganic filters in photoprotection, and evaluate their reported potential environmental impact.
Schneider and Lim (2019b)	Examine the prevalence of UV filters in water, as well as their proposed environmental impact.
Sharma et al. (2019)	Explore the potentially alarming impact that TiO2 can have on aquatic life and on human health.
Shi et al. (2019)	Review the occurrence and fate of six selected benzotriazole compounds in different environmental and biological matrices, as well as the transformation and toxicity.
Tumova et al. (2019)	Summarise published information on effects of polycyclic musks on aquatic organisms and discuss whether the experimental design of toxicological studies involving these substances could influence the results obtained.
DiNardo and Downs (2018)	Examine the scientific evidence related to oxybenzone.
Sruthi et al. (2018)	Review the toxicity mechanism of ZnO NPs along with its biomedical applications.
Zirwas and Andrasik (2018)	Review evidence regarding the effects of sunscreen ingredients on corals and provide practical guidance for counselling patients on how to select sunscreens that minimize the potential for harm to coral reefs.
Juliano and Magrini (2017)	Give an overview of some cosmetic ingredients that are considered environmental emerging pollutants of particular concern.

Reference	Aim
Rainieri et al. (2017)	Focus on occurrence of musks and organic UV filters in the marine environment, toxic effects identified so far, and methods used to identify such effects.
Haynes et al. (2017)	Summarise the current knowledge of the photocatalytic effects of TiO2 nanoparticles on aquatic organisms, discuss limitations of these studies, and outline environmentally relevant factors that need to be considered in future experiments.
Hopkins and Blaney (2016)	Aggregate recent literature findings to better understand the environmentally relevant concentration ranges of personal care products in various compartments (e.g., raw wastewater, wastewater effluent, and surface water, among others).
Wang et al. (2016)	Summarise the recent advances on the evaluation of the potential endocrine disruptors and the mechanism for many kinds of UV filters such as benzophenones, camphor derivatives and cinnamate derivatives.
Alotaibi et al. (2015)	Assess contemporary methods to detect benzotriazoles using high-performance liquid chromatography, and provide information regarding their occurrence, degradation and toxicity within the environment.
Maipas and Nicolopoulou-Stamati (2015)	Focus on the ability of UV filter chemicals to cause endocrine and/or reproductive impairments.
Rykowska and Wasiak (2015)	Review the types of emerging organic groundwater contaminants, which are found in the natural environment in many countries all around the world.
Sánchez-Quiles and Tovar-Sánchez (2015)	Evaluate the environmental implications of commercial sunscreens and their main components as a source of chemicals in the coastal ecosystem.
Kim and Choi (2014)	Review available articles regarding the physicochemical properties, toxicokinetics, environmental occurrence, and toxic effects of BP-3 and its suspected metabolites.
Minetto et al. (2014)	Highlight and discuss issues concerning nano TiO_2 toxicity data with saltwater species evidencing (i) the role of testing matrices (ii) the exposure conditions and (iii) the consequent ecotoxicological effects on various models.
Ma et al. (2013)	Review literature on toxicity of manufactured ZnO nanoparticles to ecological receptors across different taxa: bacteria, algae and plants, aquatic and terrestrial invertebrates and vertebrates.
Wong et al. (2013)	Provide a comprehensive review on the processes which ultimately govern the toxicity of nanomaterials to aquatic organisms.
Gago-Ferrero et al. (2012)	Summarise scarce and scattered information about the profiles of UV filters in aquatic organisms, analytical methods, bioaccumulation/biomagnification, ecotoxicity, and environmental analysis and risk assessment.

Reference	Aim
Tourinho et al. (2012)	Summarise available data and theories related to factors affecting the behavior, fate, and bioavailability of manufactured metal-based nanoparticles in soils, and their toxicity to soil organisms.
Brausch and Rand (2011)	Summarise recent publications regarding environmental concentrations (surface water) and aquatic toxicity of personal care products (PCPs) in order to identify research needs and to estimate hazard as a result of release into the aquatic environment.
Skocaj et al. (2011)	Review and discuss the latest findings on potential hazard of exposure to nano-sized TiO_2 for humans and environment with regard to particle size and crystal structure, route of exposure, as well as the effect of ultraviolet irradiation-induced photocatalysis.
Scown et al. (2010)	Critically evaluate currently knowledge on sources and discharge of engineered nanoparticles to the aquatic environment, how physicochemical characteristics affect their fate and behaviour and availability for uptake into aquatic organisms, and assess reported toxicological effects.
Sharma (2009)	Review the aggregation of nano-TiO_2 under natural conditions, and discuss toxicity in the aquatic environment.

Table 7-2. Study characteristics of the reviews.

Reference	Funding	Institution of the corresponding author	Conflict of interest declared by the authors	Journal
Adler and DeLeo (2020)	Not reported	Department of Dermatology, Keck School of Medicine, University of Southern California, USA	No conflict of interest	Current Dermatology Reports
Bilal et al. (2020)	This research received no external funding.	School of Life Science and Food Engineering, Huaiyin Institute of Technology, China	No conflict of interest	Cosmetics
Kar et al. (2020)	The National Science Foundation and the European Commission	Drug Theoretics and Cheminformatics laboratory, Department of Pharmaceutical Technology, Jadavpur University, India; Laboratory of Environmental Chemistry and Toxicology, Department of Environmental Health Sciences, Italy	No conflict of interest	Green Chemistry

Reference	Funding	Institution of the corresponding author	Conflict of interest declared by the authors	Journal
Raffa et al. (2019)	NR	University of Arizona College of Pharmacy, USA	NR	Journal of Clinical Pharmacy and Therapeutics
Schneider and Lim (2019a)	None	Department of Dermatology, Henry Ford Medical Center – New Center One, USA	One author is an investigator/co-investigator for Ferndale, Estee Lauder, Unigen and Incyte.	Journal of the American Academy of Dermatology
Schneider and Lim (2019b)	NR	Department of Dermatology, Henry Ford Medical Center – New Center One, USA	One author is an investigator/co-investigator for Ferndale, Estee Lauder, Unigen and Incyte.	Photodermatology, Photoimmunology & Photomedicine
Sharma et al. (2019)	NIH grant, Grants from the office of the DEGI, NIH RISE grant, and NSF REU grants	Department of Chemistry, University of Puerto Rico Río Piedras, USA	No conflict of interest	Materials
Shi et al. (2019)	The National Natural Science Foundation of China	The Environmental Research Institute, MOE Key Laboratory of Theoretical Chemistry of Environment, South China Normal University, China	NR	Science of the Total Environment
Tumova et al. (2019)	The projects CENAKVA CZ.1.05/2.1.00/01.0024 and CENAKVA II, and a project of the Grant Agency of the University of South Bohemia	University of South Bohemia in České Budějovice, Faculty of Fisheries and Protection of Waters, South Bohemian Research Center of Aquaculture and Biodiversity of Hydrocenoses, Czech Republic	NR	Science of the Total Environment
DiNardo and Downs (2018)	NR	Vesuvius, VA, USA	NR	Journal of Cosmetic Dermatology

Reference	Funding	Institution of the corresponding author	Conflict of interest declared by the authors	Journal
Sruthi et al. (2018)	NR	Toxicology Division, Biomedical Technology Wing, Sree Chitra Tirunal Institute for Medical Sciences and Technology, India	No conflict of interest	Materials Today Chemistry
Zirwas and Andrasik (2018)	NR	Ohio University College of Osteopathic Medicine, USA	NR	SKINmed
Juliano and Magrini (2017)	Ministero dell'Istruzione, dell'Universitàedella Ricerca, Italy	Department of Chemistry and Pharmacy, University of Sassari, Italy	No conflict of interest	Cosmetics
Rainieri et al. (2017)	The European Union Seventh Framework Programme under the ECsafeSEAFOOD project	Faculty of Agriculture and Life Sciences, University of Maribor, Slovenia	NR	Food and Chemical Toxicology
Haynes et al. (2017)	Grants from National Science Foundation's Environmental Nanotechnology program (CBET-1336358) and U.S. Department of Agriculture/NIFA to one author	University of Connecticut, Department of Marine Sciences, USA	The author's affiliation is as shown on the coverpage. The authors have sole responsibility for the writing and content of the paper.	Aquatic Toxicology
Hopkins and Blaney (2016)	The UMBC start up program	University of Maryland Baltimore County, Department of Chemical, Biochemical and Environmental Engineering, USA	NR	Environment International

Reference	Funding	Institution of the corresponding author	Conflict of interest declared by the authors	Journal
Wang et al. (2016)	The Major Science and Technology Projects of Zhejiang Province, the National Natural Science Foundation of China, the Guangzhou Key Laboratory of Environmental Exposure and Health and the Fundamental Research Funds for the Central Universities	Institute of Environmental Science, College of Environmental and Resource Sciences, Zhejiang University, China; Key Laboratory of Health Risk Factors for Seafood of Zhejiang Province, China; Guangzhou Key Laboratory of Environmental Exposure and Health, School of Environment, Jinan University, China	No conflict of interest	International Journal of Environmental Research and Public Health
Alotaibi et al. (2015)	The King Abdullah Scholarship Program and King Saud University scholarship program	School of Chemistry and Biochemistry, University of Western Australia, Australia	NR	Water, Air and Soil Pollution
Maipas and Nicolopoulou-Stamati (2015)	NR	National and Kapodistrian University of Athens, School of Medicine, First Department of Pathology and Cytology Unit, 1st Pathology Laboratory, Greece	No conflict of interest	Hormones
Rykowska and Wasiak (2015)	NR	Faculty of Chemistry, A. Mickiewicz University, Poland	NR	Open Chemistry
Sánchez-Quiles and Tovar-Sánchez (2015)	One author was supported by the JAE-predoc program of the Spanish National Research Council	Department of Global Change Research, Mediterranean Institute for Advanced Studies, Spain	NR	Environment International
Kim and Choi (2014)	The National Research Foundation of Korea	Department of Environmental Health, School of Public Health, Seoul National University, Republic of Korea	NR	Environment International
Minetto et al. (2014)	NR	Department of Environmental Sciences, Informatics and Statistics, University Ca' Foscari Venice, Italy	NR	Environment International

Reference	Funding	Institution of the corresponding author	Conflict of interest declared by the authors	Journal
Ma et al. (2013)	One author held a National Research Council Research Associate ship Award at U.S. Environmental Protection Agency (Mid-Continent Ecology Division laboratory) while this research was performed	Mid-Continent Ecology Division, National Health and Environmental Effects Research Laboratory, U.S. Environmental Protection Agency, USA	NR	Environmental Pollution
Wong et al. (2013)	The University Grants Committee of the Hong Kong Special Administration Region, China through the Areaof Excellence Scheme	The Swire Institute of Marine Science and School of Biological Sciences, The University of Hong Kong, China	NR	Reviews in Nanoscience and Nanotechnology
Gago-Ferrero et al. (2012)	The Spanish Ministry of Economy and Competitiveness (the projects SCARCE and CEMAGUA	Department of Environmental Chemistry, Institute of Environmental Assessment and Water Research, Spanish Council of Scientific Research, Spain	NR	Analytical and Bioanalytical Chemistry
Tourinho et al. (2012)	One author was supported by a PhD grant by the Portuguese Science and Technology Foundation	Department of Biology and the Centre for Environmental and Marine Studies, University of Aveiro, Aveiro, Portugal	NR	Environmental Toxicology and Chemistry
Brausch and Rand (2011)	NR	Ecotoxicology and Risk Assessment Laboratory, Southeast Environmental Research Center, Department of Earth and Environment, Florida International University, USA	NR	Chempsphere

Reference	Funding	Institution of the corresponding author	Conflict of interest declared by the authors	Journal
Skocaj et al. (2011)	The Slovenian Research Agency within the research programmes "Nanostructured Materials" and "Ecotoxicology, Toxicological Genomics and Carcinogenesis	Jožef Stefan Institute, Department for Nanostructured Materials, Slovenia.	No conflict of interest	Radiology and Oncology
Scown et al. (2010)	The Natural Environment Research Council the Environment Agency, United Kingdom	Ecotoxicology and Aquatic Biology Research Group, Hatherly Laboratories, University of Exeter, UK	NR	Critical Reviews in Toxicology
Sharma (2009)	NR	Chemistry Department, Florida Institute of Technology, USA	NR	Journal of Environmental Science and Health Part A

NR = not reported

8 Appendix III Deviations from the protocol

The project group undertook all deviations and presented them to the VKM Panel on the first following meeting for acceptance. Below are deviations from the a priori protocol (VKM et al., 2020) listed.

8.1 Literature search

In addition to the databases listed in the protocol, the databases Prospero, Brage, Cristin and Open Grey System for Information on Grey Literature in Europe were searched.

We scanned the reference lists of the publications obtained by the handsearching.

8.2 Study selection and mapping of data

The protocol described the identification of systematic reviews, however, as none were identified, it was decided to map data from the reviews on sunscreen ingredients and environmental effects excluded due to study design (not applying a systematic approach).

Which data elements that should be mapped were agreed upon by the authors and the members of the VKM Panel. The selection elements differed on several points from the protocol. Mainly the differences were:

Data not extracted: key findings, description of the control group, years of the publication of the studies included (range).

Data elements that were extracted but were not stated in the protocol: test organism, type of research areas addressed in the reviews.

9 Appendix IV Prisma checklist for scoping reviews

The Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) Checklist (Tricco et al., 2018) is shown in Table 9-1.

Table 9-1. The PRISMA-ScR Checklist.

SECTION	ITEM	PRISMA-ScR CHECKLIST ITEM	REPORTED ON PAGE #
TITLE			
Title	1	Identify the report as a scoping review.	1
ABSTRACT			
Structured summary	2	Provide a structured summary that includes (as applicable): background, objectives, eligibility criteria, sources of evidence, charting methods, results, and conclusions that relate to the review questions and objectives.	Not included
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known. Explain why the review questions/objectives lend themselves to a scoping review approach.	10
Objectives	4	Provide an explicit statement of the questions and objectives being addressed with reference to their key elements (e.g., population or participants, concepts, and context) or other relevant key elements used to conceptualize the review questions and/or objectives.	10-11
METHODS			
Protocol and registration	5	Indicate whether a review protocol exists; state if and where it can be accessed (e.g., a Web address); and if available, provide registration information, including the registration number.	Yes. Available at www.vkm.no
Eligibility criteria	6	Specify characteristics of the sources of evidence used as eligibility criteria (e.g., years considered, language, and publication status), and provide a rationale.	12
Information sources*	7	Describe all information sources in the search (e.g., databases with dates of coverage and contact with authors to identify additional sources), as well as the date the most recent search was executed.	12
Search	8	Present the full electronic search strategy for at least 1 database, including any limits used, such that it could be repeated.	Appendix I: 32-54
Selection of sources of evidence†	9	State the process for selecting sources of evidence (i.e., screening and eligibility) included in the scoping review.	12
Data charting process‡	10	Describe the methods of charting data from the included sources of evidence (e.g., calibrated forms or forms that have been tested by the team before their use, and whether data charting was done	12-13

SECTION	ITEM	PRISMA-ScR CHECKLIST ITEM	REPORTED ON PAGE #
		independently or in duplicate) and any processes for obtaining and confirming data from investigators.	
Data items	11	List and define all variables for which data were sought and any assumptions and simplifications made.	12-13
Critical appraisal of individual sources of evidence§	12	If done, provide a rationale for conducting a critical appraisal of included sources of evidence; describe the methods used and how this information was used in any data synthesis (if appropriate).	Not performed
Synthesis of results	13	Describe the methods of handling and summarizing the data that were charted.	13
RESULTS			
Selection of sources of evidence	14	Give numbers of sources of evidence screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally using a flow diagram.	14
Characteristics of sources of evidence	15	For each source of evidence, present characteristics for which data were charted and provide the citations.	15, Appendix II: 57-64
Critical appraisal within sources of evidence	16	If done, present data on critical appraisal of included sources of evidence (see item 12).	Not performed
Results of individual sources of evidence	17	For each included source of evidence, present the relevant data that were charted that relate to the review questions and objectives.	16-23
Synthesis of results	18	Summarize and/or present the charting results as they relate to the review questions and objectives.	16-23
DISCUSSION			
Summary of evidence	19	Summarize the main results (including an overview of concepts, themes, and types of evidence available), link to the review questions and objectives, and consider the relevance to key groups.	24
Limitations	20	Discuss the limitations of the scoping review process.	24
Conclusions	21	Provide a general interpretation of the results with respect to the review questions and objectives, as well as potential implications and/or next steps.	24-25
FUNDING			
Funding	22	Describe sources of funding for the included sources of evidence, as well as sources of funding for the scoping review. Describe the role of the funders of the scoping review.	No external funding

PRISMA-ScR = Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews.

* Where *sources of evidence* (see second footnote) are compiled from, such as bibliographic databases, social media platforms, and Web sites.

† A more inclusive/heterogeneous term used to account for the different types of evidence or data sources (e.g., quantitative and/or qualitative research, expert opinion, and policy documents) that may be eligible in a scoping review as opposed to only studies. This is not to be confused with *information sources* (see first footnote).

‡ The frameworks by Arksey and O'Malley (6) and Levac and colleagues (7) and the JBI guidance (4, 5) refer to

the process of data extraction in a scoping review as data charting.
§ The process of systematically examining research evidence to assess its validity, results, and relevance before using it to inform a decision. This term is used for items 12 and 19 instead of "risk of bias" (which is more applicable to systematic reviews of interventions) to include and acknowledge the various sources of evidence that may be used in a scoping review (e.g., quantitative and/or qualitative research, expert opinion, and policy document).