Environmental Impact of Currently Marketed Sunscreens

The National Academies of Sciences, Engineering and Medicine

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EPA's Statutory Authority & Appropriation

Clean Water Act 33 U.S.C. 1251 (1972) Section 101 (a)

"…restore and maintain the chemical, physical, and biological integrity of the Nation's waters."

Biological integrity – A balanced, integrated, adaptive community of organisms having a species composition, diversity and functional organization comparable to that of the natural habitat of a region

FY20 Omnibus

Environmental Impact of Currently Marketed Sunscreens – To better assess any potential environmental impacts of currently marketed sunscreen filters on the environment, the Agency is directed to contract with the National Academy of Sciences (NAS) to conduct a review of the scientific literature of currently marketed sunscreens' potential risks to the marine environment. This review should include any risks that sunscreen filters might pose to freshwater ecosystems, coral reefs, aquatic and marine life, and wetland ecosystems, and should identify any additional research needed to conduct aquatic environmental risk assessments. Additionally, the study should also review the current scientific literature on the potential public health implications associated with reduced use of currently marketed sunscreen ingredients for protection against excess ultraviolet radiation.

Sunscreen Media Attention

News Headlines

- NPR: Chemicals in sunscreen are harming coral reefs, says new study (Oct 20, 2015)
- Consumer Reports: The truth about 'reef safe' sunscreen (Feb 7, 2019)
- USA Today: Some sunscreens may kill corals, but should they be banned? Scientists are not so sure (Mar 9, 2019)
- National Geographic: What sunscreens are best for you – and the planet?(May 21, 2019)
- CNN: Florida could require a prescription for certain sunscreens that could harm coral reefs (Oct 16, 2019)
- BBC News: Palau is first country to ban 'reef toxic' sun cream (Jan 1, 2020)
- ABC News: Sunscreen pollution accelerating demise of coral reefs, experts say (Feb 22, 2020)

The New York Times

Hawaii Passes Bill Banning Sunscreen That Can Harm Coral Reefs

The legislation prohibits the distribution of sunscreens containing chemicals that scientists have found contributes to coral bleaching when washed off in the ocean.

Recent studies have led to a global push for more reef-safe sunscreens.
Chip Litherland for The New York Times

By Elaine Glusac

May 3, 2018

Benefits of Sunscreen

Skin Cancer (source: the Skin Cancer Foundation)

- Skin cancer is the most common cancer in the U.S. and worldwide.
- 1 in 5 Americans will develop skin cancer by age 70.
- More than 2 people die of skin cancer in the U.S. every hour.
- Having 5 or more sunburns doubles the risk for melanoma.
- The annual cost of treating skin cancers in the U.S. is estimated at $8.1 billion.
- Regular daily use of an SPF 15 or higher sunscreen reduces the risk of developing squamous cell carcinoma by about 40%.

EPA – NASEM

June 2020 EPA contracted with NASEM to review the state of science on sunscreen mineral and organic components' fate and effects in aquatic environments.

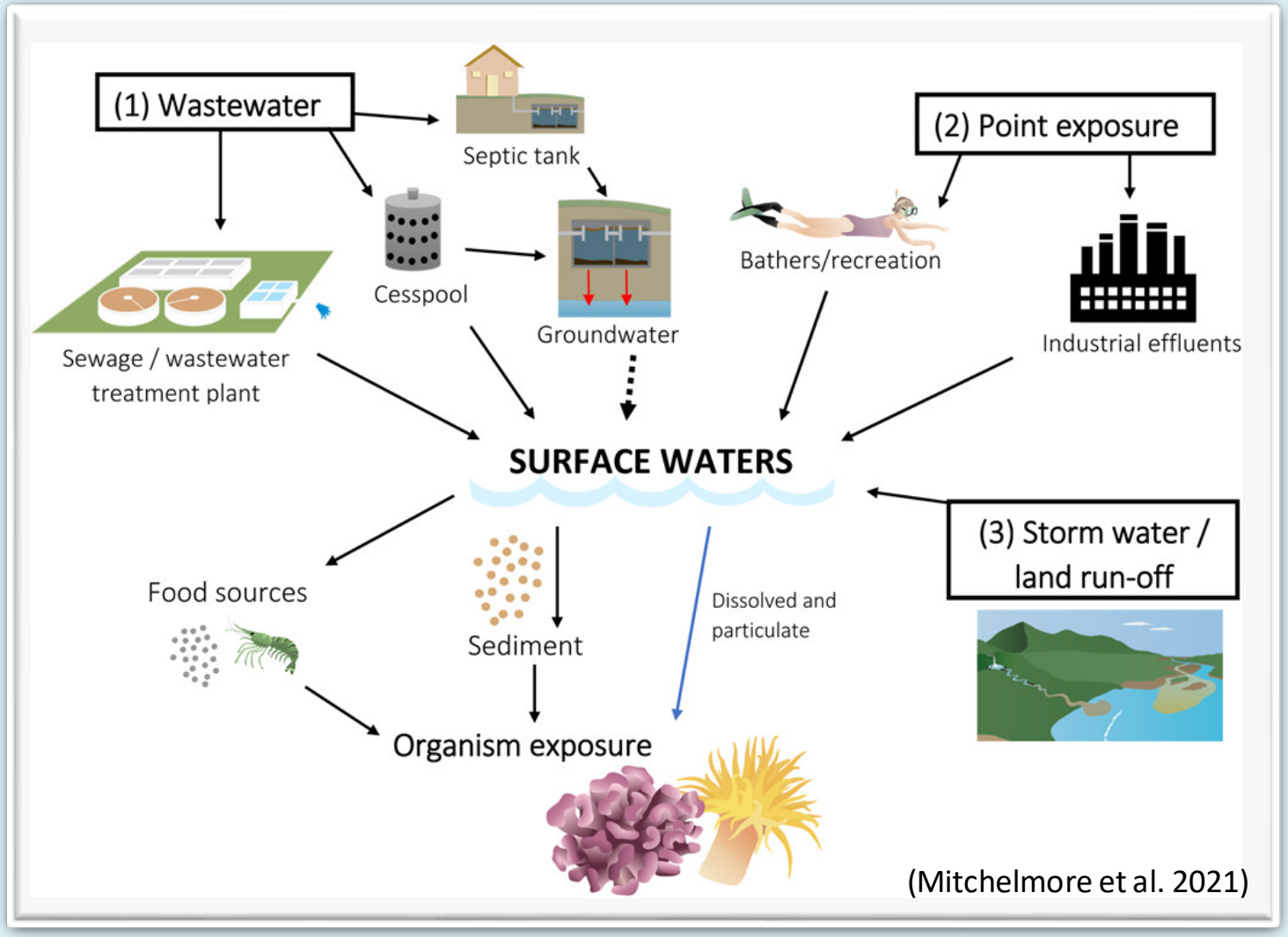
- Document of the scientific literature on active ingredients in currently marketed sunscreens that protect against ultra-violet radiation (UV filters)
- Summarize the scientific literature that informs:
  - potential risks of UV filters on aquatic environments
  - additional research needed (data gaps) to conduct adequate aquatic ecological risk assessments
  - potential public health implications of reduced sunscreen use

Scope of Work

- Sunscreen UV filters
  - Active ingredients (e.g., chemicals/oxybenzone, octinoxate; minerals/zinc oxide, titanium dioxide)
  - Formulations (e.g., sprays/nanoparticles, lotions)
- Ecological receptors (e.g., plants, invertebrates, vertebrates)
- Aquatic environments (freshwater ecosystems, estuaries, marine environments, wetland ecosystems, coral reefs, and inhabiting biota)
- Components of reports will inform the ecological risk assessment process
  - Problem formulation
  - Exposure analysis
  - Effects analysis
  - Identification of research needs (uncertainty)

Background

- Sunscreens enter the environment through recreational activities and waste effluent
- While various organisms can be exposed to sunscreen ingredients and their degradates, the source of urgency with the issue pertains to the global decline of coral reefs



(Mitchelmore et al. 2021)

Coral Reef Benefits

- Cover less than 1% of the ocean floor and support ~25% of all marine species
- Important food source for local communities
- Nurseries that are vital to world fisheries
- Coastal protection (erosion, storm surge, hurricanes, typhoons, tsunamis)
- Support jobs (fishing, tourism)
- Therapeutics (cancer treatment)
- Ecosystem services value ($375+ billion year)



Coral Reef Stressors

- Climate – increased ocean temperature, acidification, tropical storms, altered ocean circulation patterns
- Physical damage/destruction – dredging, quarrying, destructive fishing practices and gear, boat anchors and groundings, and recreational misuse
- Pollutants – sedimentation, nutrients, toxic substances, pathogens, trash
- Overfishing
- Coral harvesting
- Invasive species
- Sunscreen ingredients

Aggregate effects can decrease coral reef resilience and increase susceptibility to disease and invasive species

Knowledge Assessment

- Some active ingredients in marketed sunscreens have been reported to have adverse health outcomes in animals or biological processes (endocrine disruption, coral bleaching)
- Expanding research also reporting adverse health outcomes in other aquatic species (algae, crustaceans, fish)
- Concerns about effects of chemical UV filters have promoted use of mineral UV filters and alternatives to sunscreen
- Reduced use of sunscreen (without alternative protection) can result in increased skin cancer
- Municipalities that banned some sunscreen ingredients have not assessed human health consequences of their removal or replacement with mineral filters

Knowledge Assessment – Gaps

- Fate and transport of active sunscreen ingredients and degradation byproducts

- Caveats and limitations of research studies
  - Environmental concentrations
  - Exposure
  - Adverse Outcome Pathway
  - Surrogate species representation
  - Lab to field translation

- Social/behavioral

Comprehensive Literature Review

Focal areas of review

1. Potential risks of sunscreen on aquatic environments Consistent with risk assessment framework

2. Potential public health implications of reduced sunscreen use

3. Uncertainties and additional research needed (i.e., data gaps)

Area 1. Potential risks of sunscreen on aquatic environments

A. Characterization of sunscreen
   - Identification of sunscreen active ingredients and their degradates

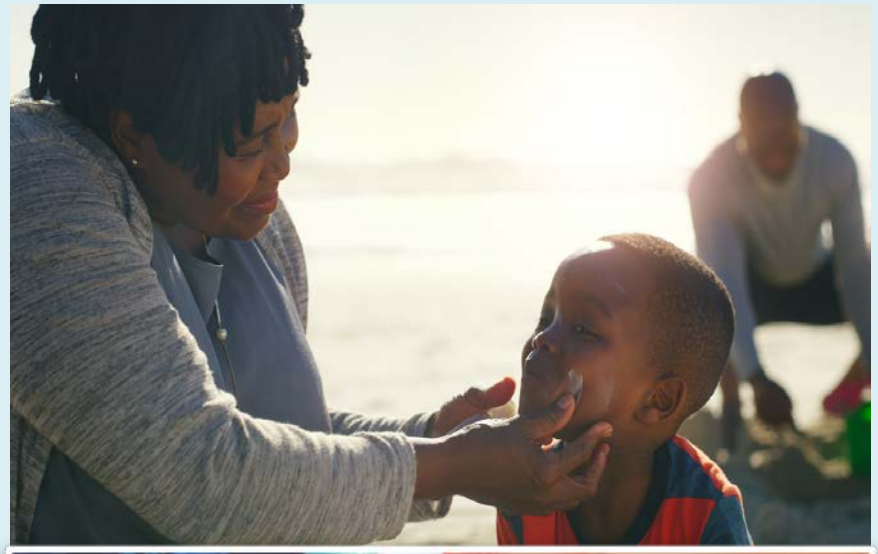
B. Environmental Exposure
   - Sources of sunscreens entering the environment
   - Potential routes of exposure to aquatic organisms
   - Factors influencing environmental fate and transport
   - Measured concentrations of sunscreen in aquatic environments

C. Ecological Effects
   - Organisms potentially exposed
   - Potential effects to aquatic organisms
   - Communities of ecological, economical, and commercial importance

Area 2. Potential public health implications of reduced sunscreen use

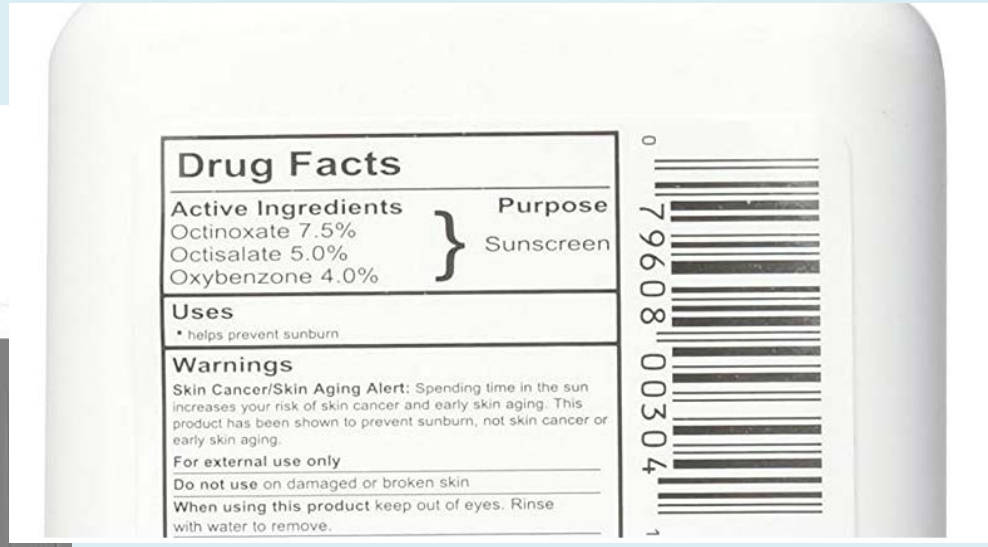
A. Identify public health concerns/consequences of reduced use of chemical sunscreen

B. Efficacy of alternative active ingredients



Area 3. Uncertainties and additional research needed (i.e., data gaps)

- Identify information gaps
  - Environmental relevance of laboratory studies
  - Half-life of sunscreen
  - Fate (degradation vs bioaccumulation)
- Highlight research priorities
- Assess feasibility of conducting comparative human and ecological risk assessments
- Industry standard labeling



Emphases and Considerations

Points of Emphasis

- Ranges and frequency of environmental concentrations in the water
- Aquatic organisms with highest risk of adverse effects
  - Taxa based on chemical mode of action
  - Threatened or endangered
- Relative risks of various sunscreen ingredients

Questions to Consider

- Do available data on environmental concentrations contain sampling bias?
- Do available effects data represent broad taxonomic diversity?
- Can susceptible taxa be identified for which data are lacking?
- Do data exist to identify environmentally-friendly sunscreen alternatives?

Questions?

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