Sunscreen Use in Hawaii

AN ASSESSMENT OF BEACH-GOER USE OF SUNSCREEN PRIOR TO IMPLEMENTATION OF THE 2021 CHEMICAL BAN

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Introduction

SUNSCREEN BAN IN HAWAII

On May 1, 2018, the state legislature of Hawaii passed legislation that will ban the sale of sunscreens containing oxybenzone and octinoxate, two chemicals that have been documented to have harmful effects on coral reef ecosystems. Studies have found that in sufficient concentrations these chemicals can damage coral DNA, cause deformities in juvenile corals, increase susceptibility to viral infections, and make corals more susceptible to bleaching (Danovaro et al. 2008, Downs et al. 2016), increasing the vulnerability of these ecosystems that are already threatened due to climate change, pollution, and other stressors (Hughes et al. 2003, Hoegh-Guldberg et al. 2007). While there is some debate over whether sunscreen concentrations typically reach these levels outside of laboratory settings (Hughes 2019), a recent assessment in Kahaluu Bay on the island of Hawaii measured concentrations of oxybenzone to be 262 times greater than levels considered high-risk by the U.S. Environmental Protection Agency (Dible 2019). In Hanauma Bay, levels ranging from 30 ng/L to 27,880 ng/L have been documented, with 63 ng/L considered the concentration at which toxicity is induced in corals (Downs 2018). Given the availability of effective broad-spectrum UV filters that are considered less detrimental to ocean (and potentially human) health, such as zinc oxide and titanium dioxide, many medical professionals and environmental toxicologists have advocated that a precautionary approach to sunscreen use is advisable (DiNardo and Downs 2018, Galamgam et al. 2018, Schneider and Lim 2019). Given these concerns, other locations, including Key West, Florida, the U.S. Virgin Islands, Bonaire, and Palau, have recently implemented similar chemical bans for sunscreens.

The chemical ban in Hawaii formally goes into effect on January 1, 2021, but education and outreach campaigns have been initiated prior to the ban to educate beach-goers about the potential deleterious effects of these chemicals in sunscreens. There has also been widespread coverage of the ban by national and international news outlets, raising public awareness about the potential harmful effects of sunscreen on coral reefs. One limitation of the state ban is that it only applies to sunscreens sold in the state of Hawaii; sunscreens brought to the state by visitors are not subject to the ban, and with tourist arrivals up to nearly 10 million people in 2018 (HTA 2019), there is concern that many of the sunscreens used in Hawaii will still contain oxybenzone and octinoxate. Several organizations based in Hawaii are working to increase visitor awareness of the hazards of these chemicals, as well as sun-protection alternatives, through multiple strategies such as holding sunscreen exchanges, placing signs in stores and beaches to promote the use of “reef-safe” sunscreens and sun-protective clothing, providing non-nano zinc-based sunscreens to clients on diving and snorkeling tours, and providing “reef-safe” sunscreen samples at hotels, guest rentals, and on arriving flights.

SURVEY PURPOSE

While the intent of the ban is to reduce concentrations of toxic chemicals from sunscreens in Hawaii's nearshore waters, little data has been collected about beach goers' use of sunscreens in Hawaii, the prevalence of these chemicals in sunscreens used by beach-goers, or public awareness of the effects of these chemicals. This presents a challenge both for gauging the effectiveness of the sunscreen ban in changing sunscreen use patterns, as well as for designing effective education and outreach strategies to reduce the prevalence of these chemicals in sunscreens used by visitors who purchase their sunscreen before arriving in Hawaii. In order to gain more information about sunscreen use and awareness in Hawaii, we conducted a survey of beach-goers to better understand the following topics:

1. The prevalence of oxybenzone and octinoxate in sunscreens currently used in Hawaii
2. Whether sunscreen is purchased in Hawaii or out of state, and what factors go into people's selection of sunscreens
3. Public awareness of the harmful effects of chemicals on coral ecosystems, and people's willingness to switch to "reef-safe" sunscreen alternatives

Methods

We surveyed a total of 1325 beach-goers at 4 different beach locations on 2 islands of Hawaii (Oahu and Hawaii Island) between September 2018 and March 2019. Sites on the island of Oahu included Hanauma Bay and Wakiki; sites on Hawaii Island included Kahaluu Beach Park and Waialea Bay / Puako (see figures 1 & 2). These sites were selected due to their high annual visitation rates and close proximity to coral reef ecosystems, making ocean water at these sites more likely to experience high concentrations of sunscreen chemicals that might affect coral health.

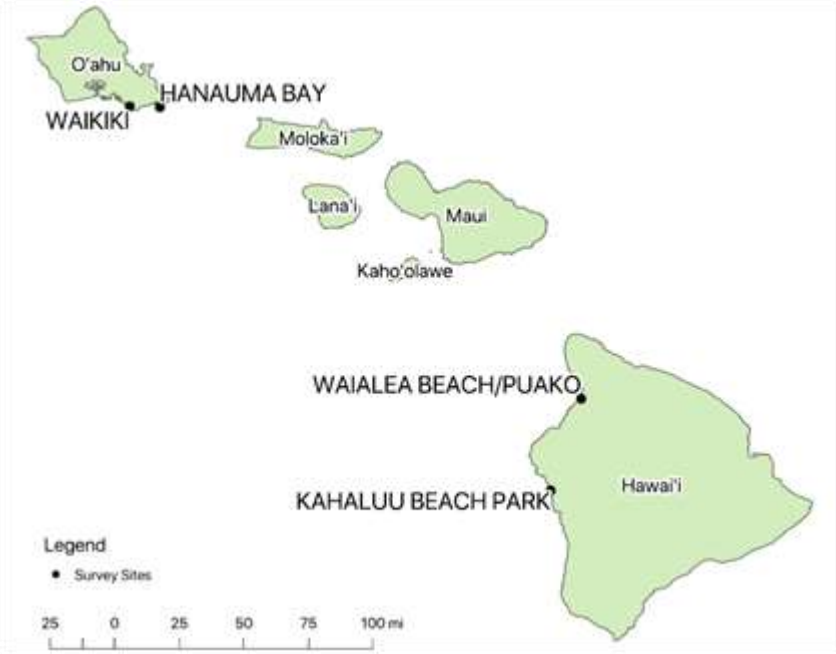

Figure 1: Survey sites on Oahu and Hawaii Island

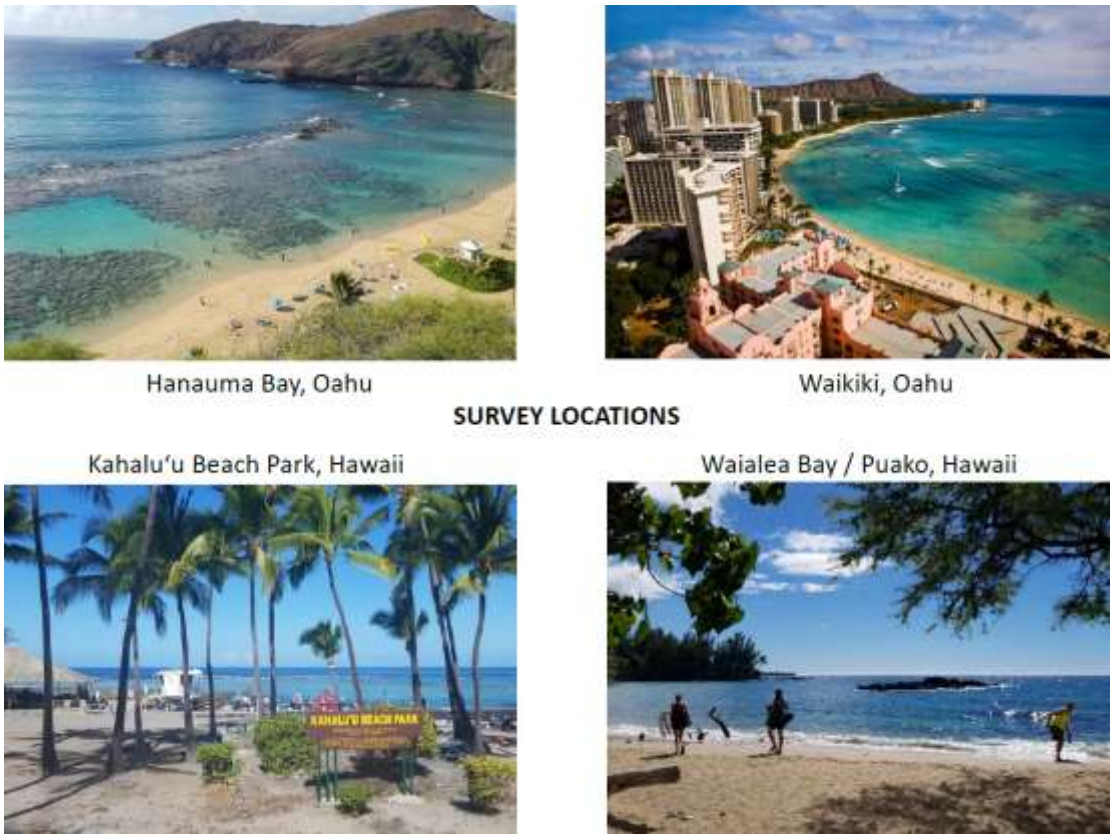

Figure 2. Survey locations on Oahu and Hawaii Island

Surveys were conducted between the hours of 9am and 3pm. We opportunistically sampled beach-goers 18 years of age and older, approaching anyone at the site who looked like he or she was likely to enter, or had already entered, the ocean (e.g. wearing swimming clothes, holding a mask and snorkel, had wet hair, etc.). Surveys took place on the beach or in adjacent beach park areas in all sites with the exception of Hanauma Bay, where visitors were surveyed in the park visitor center and in an area where visitors wait prior to watching a mandatory informational video. The survey was administered in person, primarily in English, with a Japanese translation available, as Japanese visitors represent the largest non-English speaking segment of tourist visitors to Hawaii (HTA 2018). Surveys took approximately 2 minutes to complete and were comprised of multiple choice and open-ended questions (see Appendix A and B for a copy of the survey in English and Japanese). After surveys were completed, responses were entered into a database using google forms, and exported for analysis in Microsoft excel. Survey totals by location are listed in table 1.

Survey site	Total surveys completed	Percent of total sample
Oahu		
Hanauma Bay	353	26.6%
Waikiki	397	30%
Hawaii Island		
Kahaluu Beach Park	389	29.4%
Waialea Bay / Puako	186	14%

Table 1: Total surveys administered and percent of total survey sample for each site. Note that Waialea Bay / Puako has lower total visitation than other sites and thus represented a smaller proportion of the total survey.

Results

SURVEY SAMPLE DEMOGRAPHICS

Of our total sample, 23% were Hawaii residents, 48% were visitors from other U.S. states, and 28% were international visitors. Fifty-nine percent of respondents were female and 41% were male. Respondent age was distributed across multiple categories, with 26-35 year olds having the largest proportion of respondents (27%) (Fig. 3). The majority of respondents were of white/Caucasian ethnicity, with Asian as the second most prevalent category (Fig. 4). While this total is reflective of the general demographics of tourist visitors to these sites in Hawaii, it likely under-represents total visitors from Asia, in part due to language limitations (the survey was only available in English and Japanese).

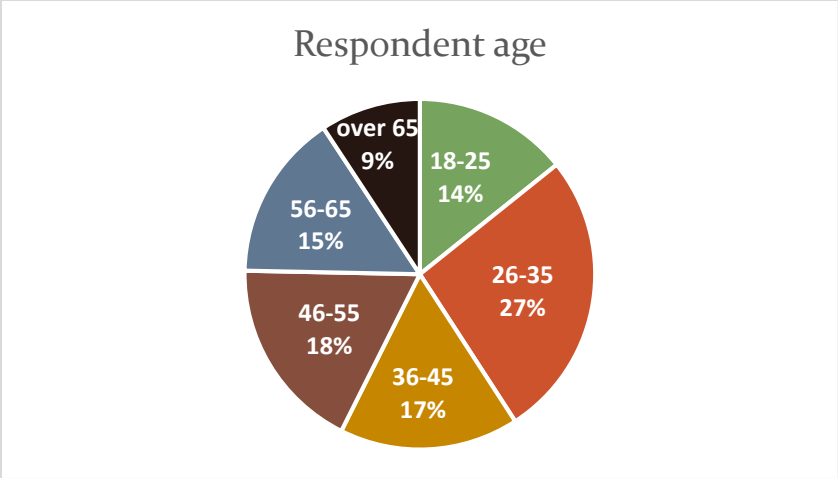

Figure 3: Age distribution of survey respondents

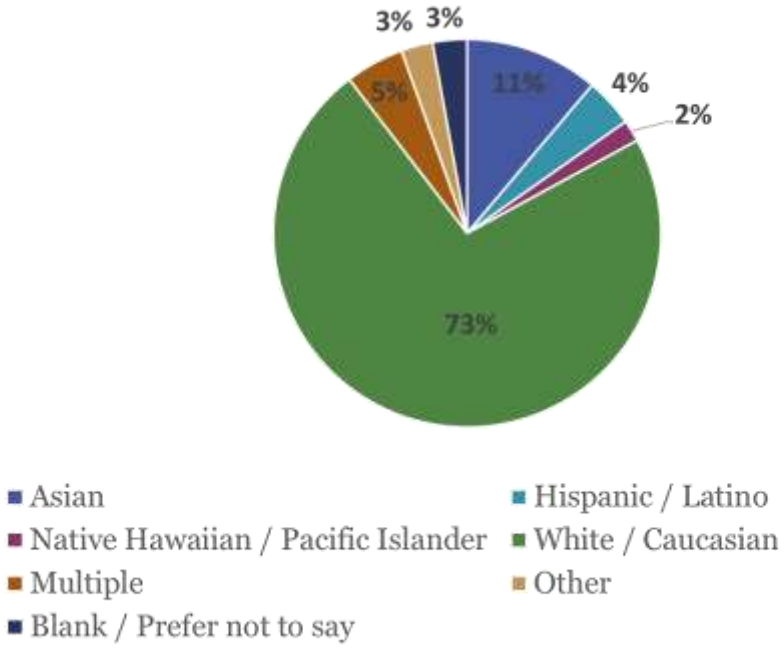

Figure 4: Race/ethnicity of survey sample

AWARENESS OF CHEMICAL EFFECTS ON CORAL REEF ECOSYSTEMS

Overall, beach-goers were largely aware of the potential harmful effects of sunscreen chemicals. Seventy-five percent of respondents responded yes to the question: "Are you aware that certain chemicals in some sunscreens (such as oxybenzone and octinoxate) are harmful to coral reefs, fish, and other ocean life?" (Fig. 5). Hawaii residents were the most of aware if this issue (92%), and international visitors the least aware (64%). Beach-goer

awareness varied by location (Figure 6), with respondents most aware of the issue at Waialea Bay / Puako, the location which also had the highest proportion of Hawaii residents.

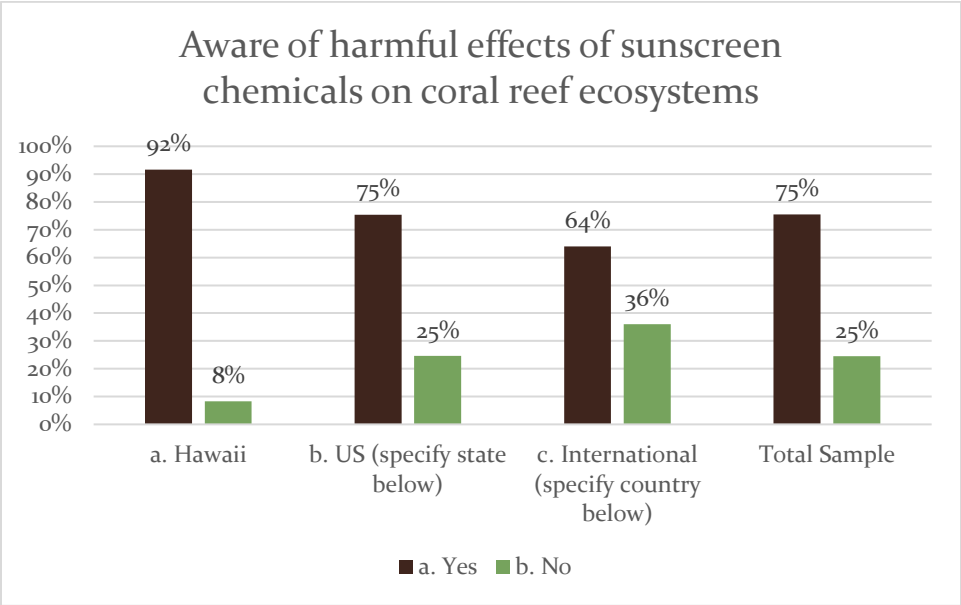

Figure 5: Responses to the question: "Are you aware that certain chemicals in some sunscreens (such as oxybenzone and octinoxate) are harmful to coral reefs, fish, and other ocean life?" by place of residence.

Respondents' awareness of chemical effects of certain sunscreen on coral reef ecosystems also correlated with respondents' educational attainment (x^2 (2, N=1265) = 18.98, p <0.001). Respondents who held graduate degrees were most likely to state that they were aware of the issue of chemicals in sunscreens (81%). Seventy-six percent of respondents who were college graduates or had attended college stated that they were aware of the issue of chemicals in sunscreens, and only 64% of respondents with a high school diploma or less were aware of the issue (Fig. 7).

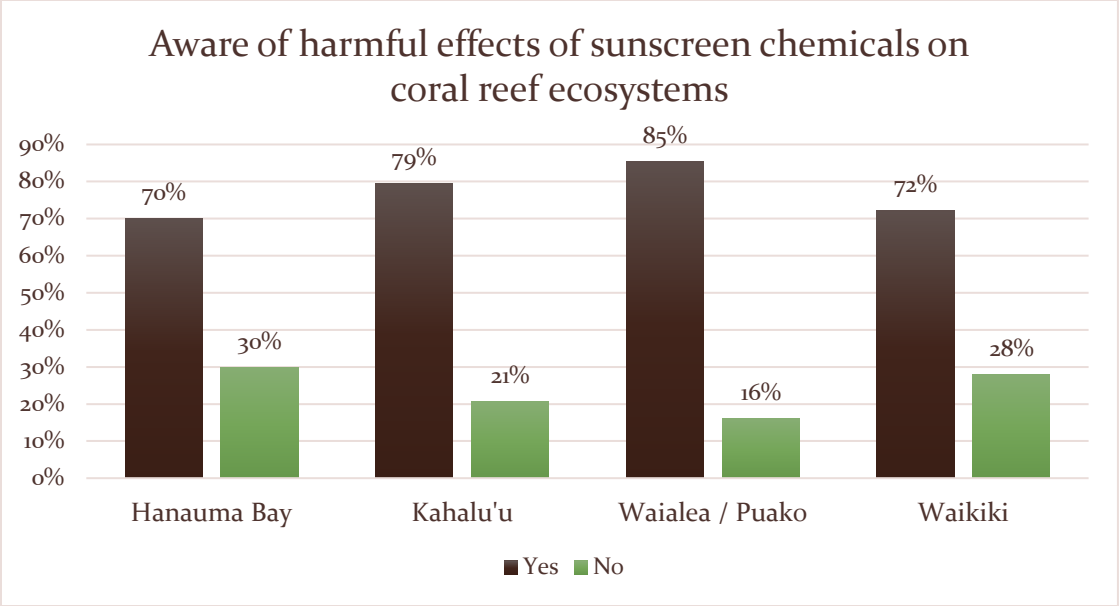

Figure 6: Responses to the question: "Are you aware that certain chemicals in some sunscreens (such as oxybenzone and octinoxate) are harmful to coral reefs, fish, and other ocean life?" by survey location.

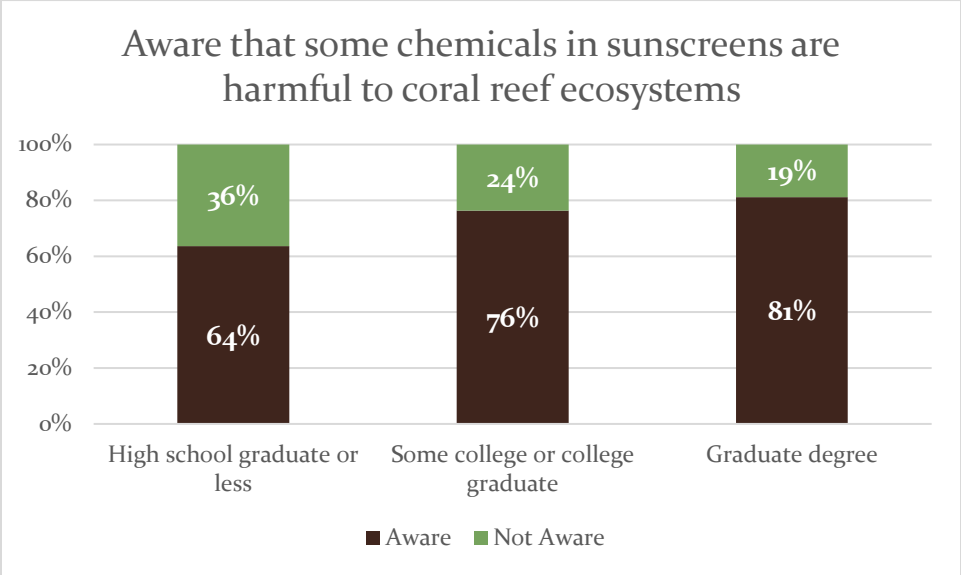

Figure 7: Respondents' stated awareness that certain chemicals in some sunscreens (such as oxybenzone and octinoxate) are harmful to coral reefs, fish, and other ocean life, based on education attainment.

Women were slightly more likely to be aware of the sunscreen chemical issue (77%) than men (73%) (x^2 (1, N=1308) = 95.44, $p < 0.001$), as well as more likely to state that they were wearing, or planned to wear, sunscreen (89% of women vs. 79% of men; x^2 (1, N=1318) = 22.56, $p < 0.001$). However, for those wearing sunscreen (and for whom sunscreen

ingredients could be verified) men and women were equally likely to be using sunscreen that contained either oxybenzone or octinoxate.

INFORMATION SOURCES

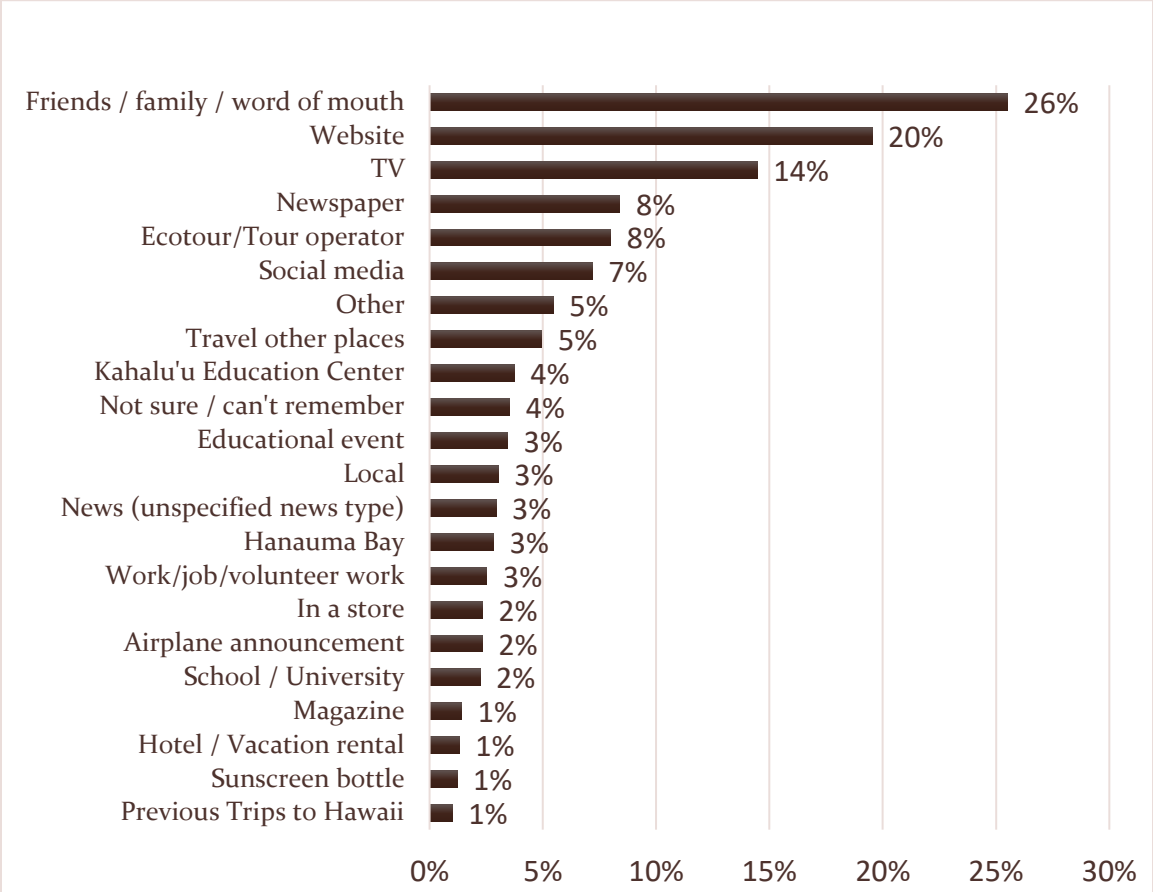

Figure 8: Top information sources for information about harmful effects of sunscreen on coral reef ecosystems (total sample, respondents could cite more than one information source)

When asked where they learned about the issue of toxic chemicals in sunscreens, respondents cited a wide range of sources (Fig. 8). The most common source of information given by respondents was through word of mouth or through friends and family. Websites were also a common source of information; visitors often read about the upcoming sunscreen ban online or while they were researching their trip prior to coming to Hawaii. Television was another common information source, as were newspapers, tour operators, and social media. Information sources varied based on the respondent's place of residence (Fig. 9). Hawaii residents were most likely to learn about the issue from friends/family/word of mouth, visitors from other U.S. states learned about the sunscreen issue primarily by word of mouth, as well as websites, and international visitors were most

likely to learn from TV and websites. Of note, many visitors to Hanauma Bay (8%) and Kahaluu (12%) stated that they learned about the sunscreen issue from educational information at those sites, either through signage or outreach from site-based volunteers.

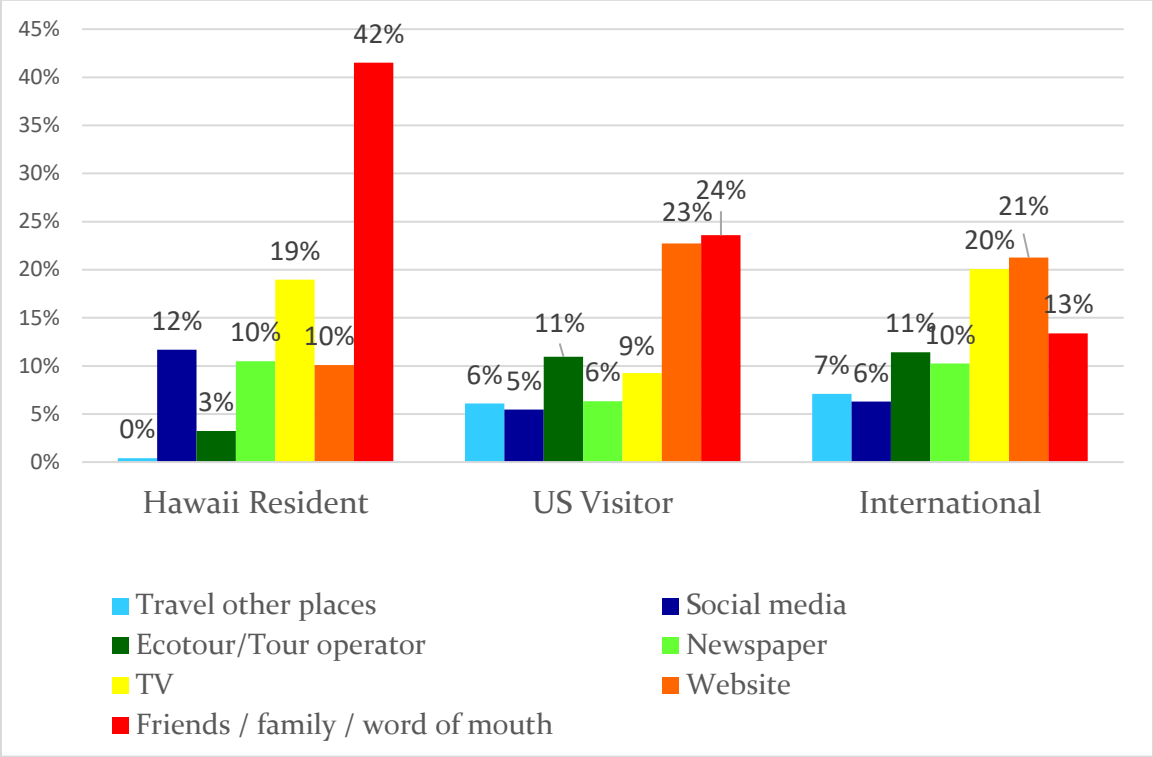

Figure 9: Top information sources for information about harmful effects of sunscreen on coral reef ecosystems by place of residence (respondents could cite more than one information source)

PRESENCE OF OXYBENZONE AND/OR OCTINOXATE IN SUNSCREENS

In order to verify whether or not oxybenzone and/or octinoxate were present in the sunscreens respondents were using at the time of the survey, surveyors asked respondents if they could look at the ingredient list on their sunscreen bottles. Seventeen percent of respondents' sunscreens were not able to be verified, either because the ingredients were not available in English, or because they did not have their sunscreen readily available for the surveyor to examine (often sunscreens were left it in respondents' cars or at their hotel/place of residence). Fifteen percent of respondents were not wearing sunscreen. Twenty-two percent of respondents were using sunscreens that were verified to have oxybenzone and/or octinoxate present in the ingredient list, while 46 percent of respondents were using sunscreens that were verified not to contain these ingredients (Figure 10). In total, of the respondents using sunscreen, for whom ingredients could be verified, 32% were using sunscreens containing at least one of the two chemicals subject to the ban, and 68% were using sunscreens that did not contain these chemicals.

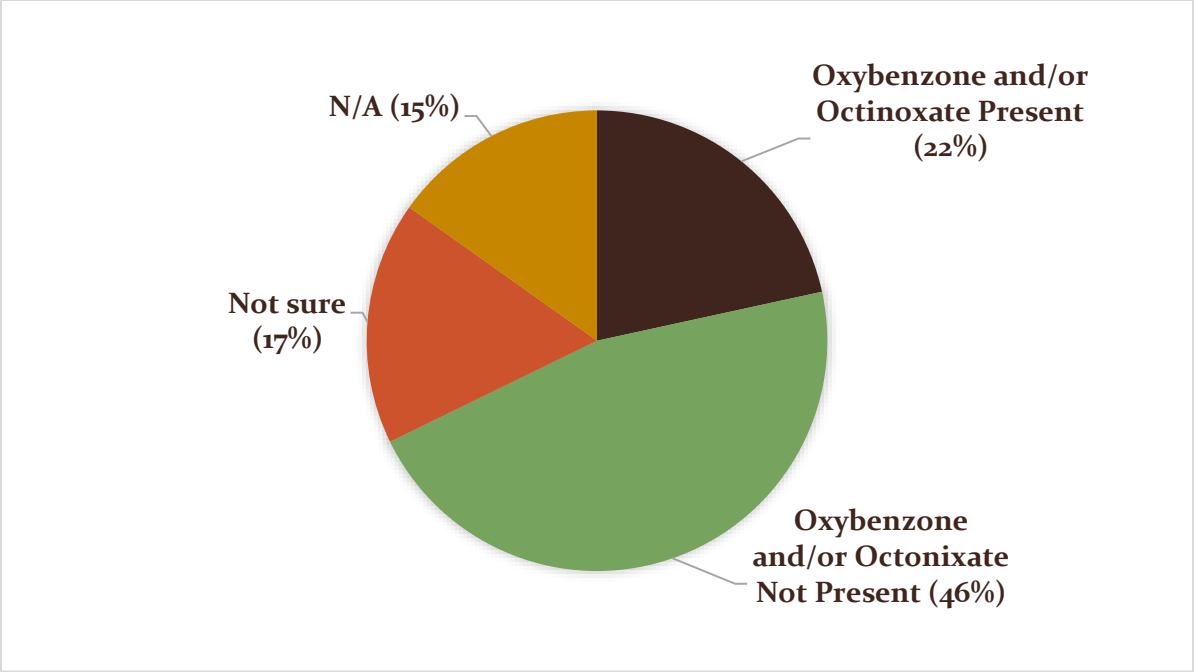

Figure 10: Percent of respondents using sunscreen containing oxybenzone and/or octinoxate. N/A indicates that the respondent was not wearing sunscreen. Not sure indicates that the sunscreen was unavailable for verification, or that the ingredient list was not available in English.

When examined by place of residence, U.S. visitors were the most likely to be wearing sunscreen containing the banned chemicals (32% of respondents), and Hawaii residents were least likely to be wearing sunscreen containing the banned chemicals (20%). Hawaii residents also had the highest proportion of respondents not wearing sunscreens (29%) (Fig. 11). Survey respondents at Hanauma Bay were the most likely to be using sunscreen that contained oxybenzone or octinoxate, while respondents at Waialea Bay / Puako were least likely to be using sunscreen containing those chemicals (Fig. 12).

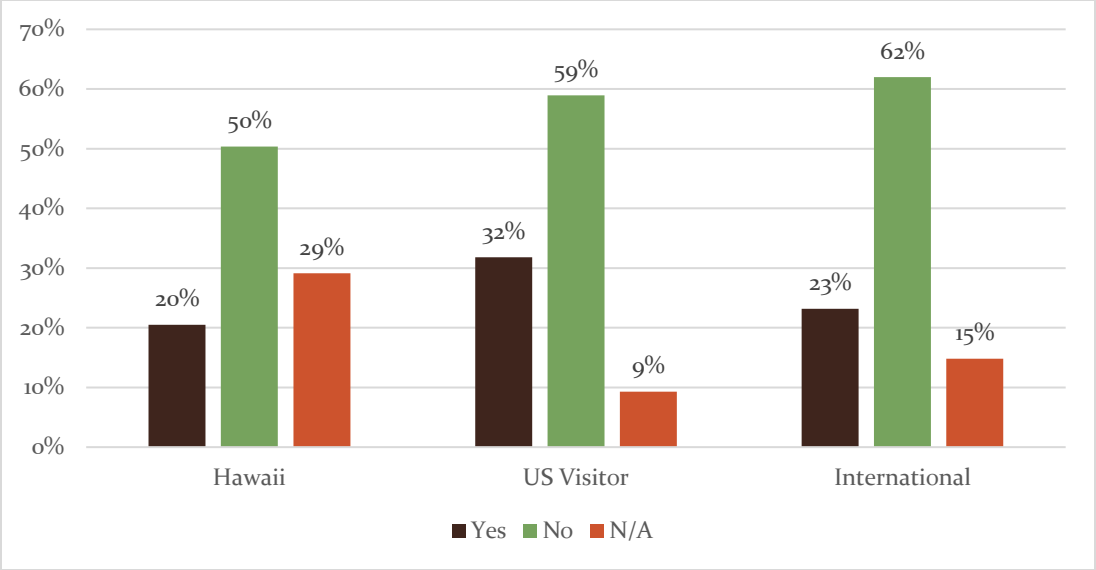

Figure 11: Percent of respondents using sunscreen containing oxybenzone and/or octinoxate by place of residence. "Yes" indicates that respondent was wearing sunscreen that contains at least one of the two banned chemicals, "no" indicates that the respondent was wearing sunscreen that does not contain the banned chemicals, and "N/A" indicates that the respondent was not wearing sunscreen. Note, the total from those who answered "not sure" is distributed across "yes" and "no" categories proportionately to the verified sample.

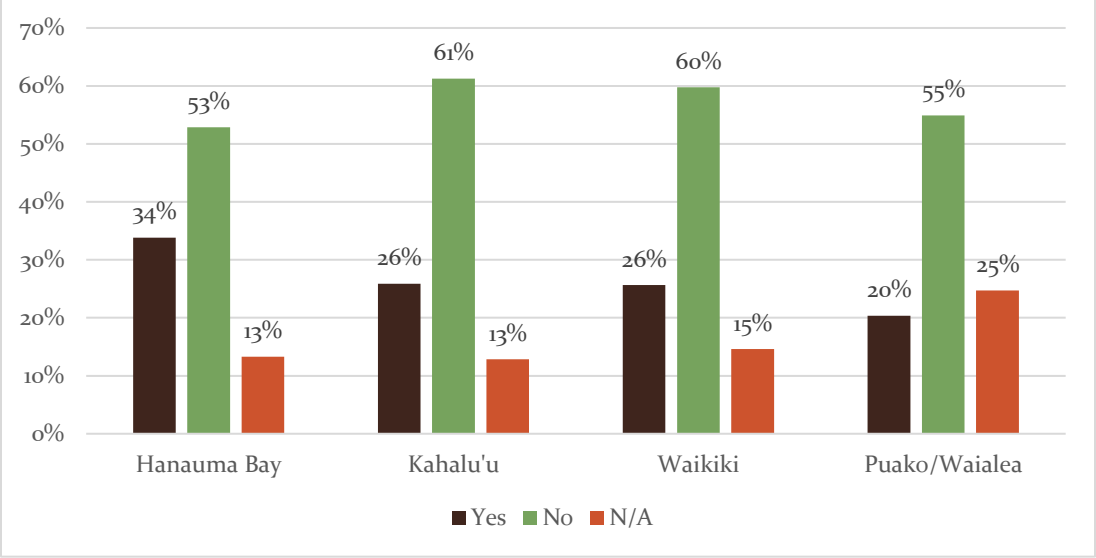

Figure 12: Percent of respondents using sunscreen containing oxybenzone and/or octinoxate by survey location. "Yes" indicates that respondent was wearing sunscreen that contains at least one of the two banned chemicals, "no" indicates that the respondent was wearing sunscreen that does not contain the banned chemicals, and "N/A" indicates that the respondent was not wearing sunscreen. Note, the total from those who answered "not sure" is distributed across "yes" and "no" categories proportionately to the verified sample.

Sunscreen users who stated that they were aware of the dangers that certain chemicals in sunscreen posed to coral reef ecosystems were slightly less likely to be wearing sunscreens that contained oxybenzone and/or octinoxate (x^2 (1, N=890) = 30.91, $p < 0.001$). The two chemicals were present in 30% of sunscreens used by respondents who stated that they were aware of the chemical issue, versus present in 37% of sunscreens used by individuals who stated that they were not aware of the chemical issue (Figure 13).

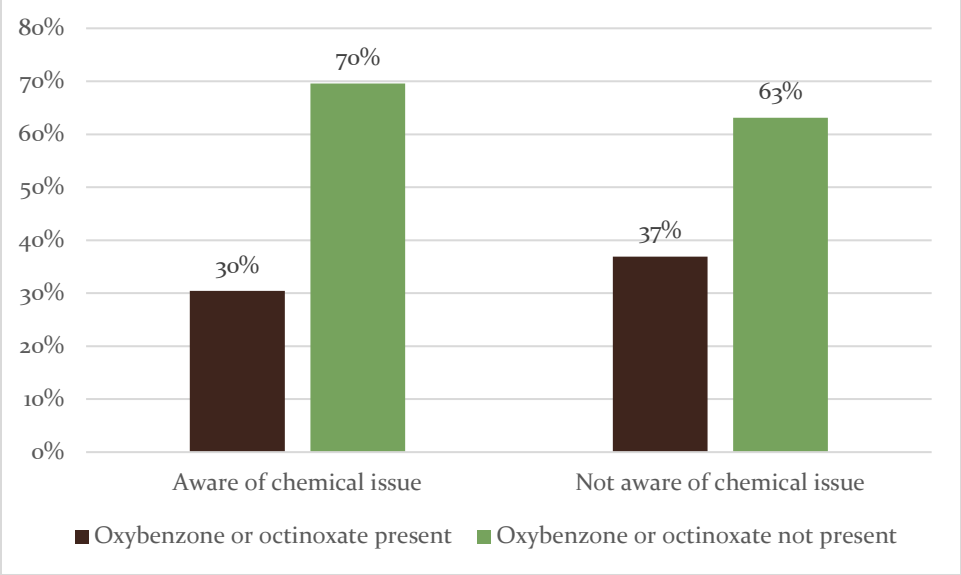

Figure 13: Presence of oxybenzone or octinoxate in sunscreens worn by respondents based on whether or not the sunscreen user was aware of the fact that some chemicals in sunscreens are harmful to coral reef ecosystems. Note: data from respondents who were wearing sunscreen and for whom sunscreen ingredients could be verified.

SUNSCREEN PURCHASE LOCATION

Because the ban on sunscreens containing oxybenzone and octinoxate only applies to sunscreens sold in the state of Hawaii, it is important to assess what percent of beach-goers use sunscreens that were purchased in Hawaii and will thus be subject to these restrictions. Of the survey respondents using sunscreen, 54% purchased their sunscreen in Hawaii and 46% purchased their sunscreen out of the state of Hawaii. This varied by respondents' place of residence (Figure 14). Beach-goers from Hawaii largely purchased their sunscreen in-state (87%). Just over half of U.S. and international visitors purchased their sunscreen outside of Hawaii.

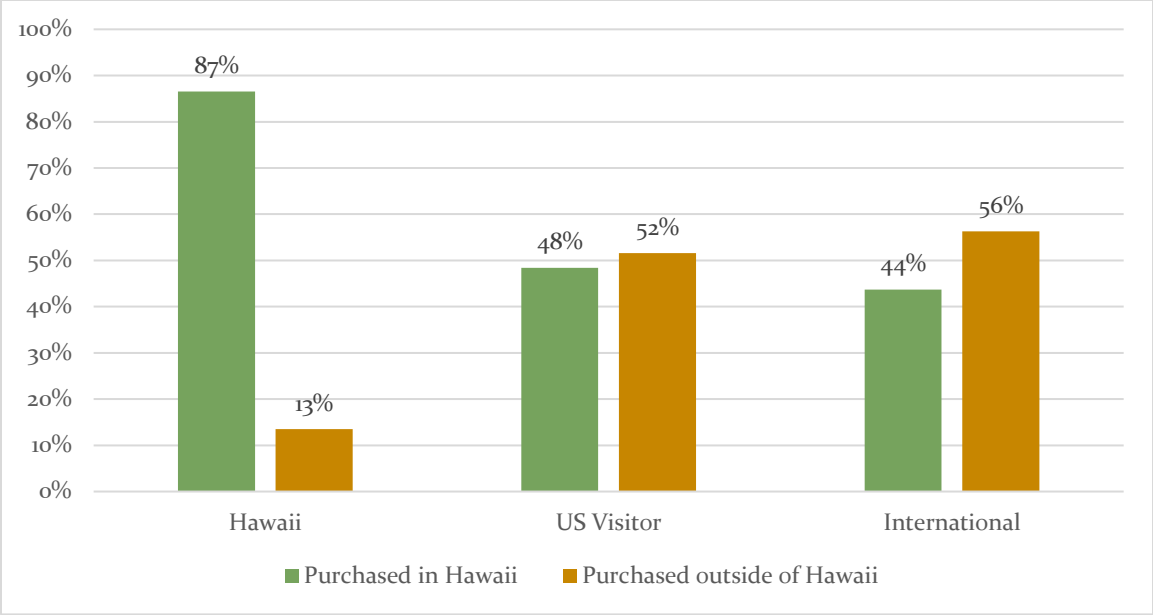

Figure 14: Where respondents purchased their sunscreen

REASONS FOR SUNSCREEN SELECTION

When asked what factors contributed to their choice of sun protection, visitors cited a variety of reasons for their sunscreen selection (Fig. 15). High SPF was the most frequently cited reason for sunscreen choice (42%). Twenty-five percent of respondents stated that the sunscreen being non-toxic to the environment was a factor that they considered when selecting sunscreen, although this did not necessarily mean that the sunscreen they were using did not contain the chemicals subject to the upcoming ban. Many respondents also favored sunscreens that were waterproof (20%), as well as sunscreens that they considered easy to apply (17%), a response generally given for spray sunscreens. Other factors frequently cited for sunscreen selection included: convenience (either they had the sunscreen on hand, or were given the sunscreen by a friend or family member), inexpensive, and non-greasy feel.

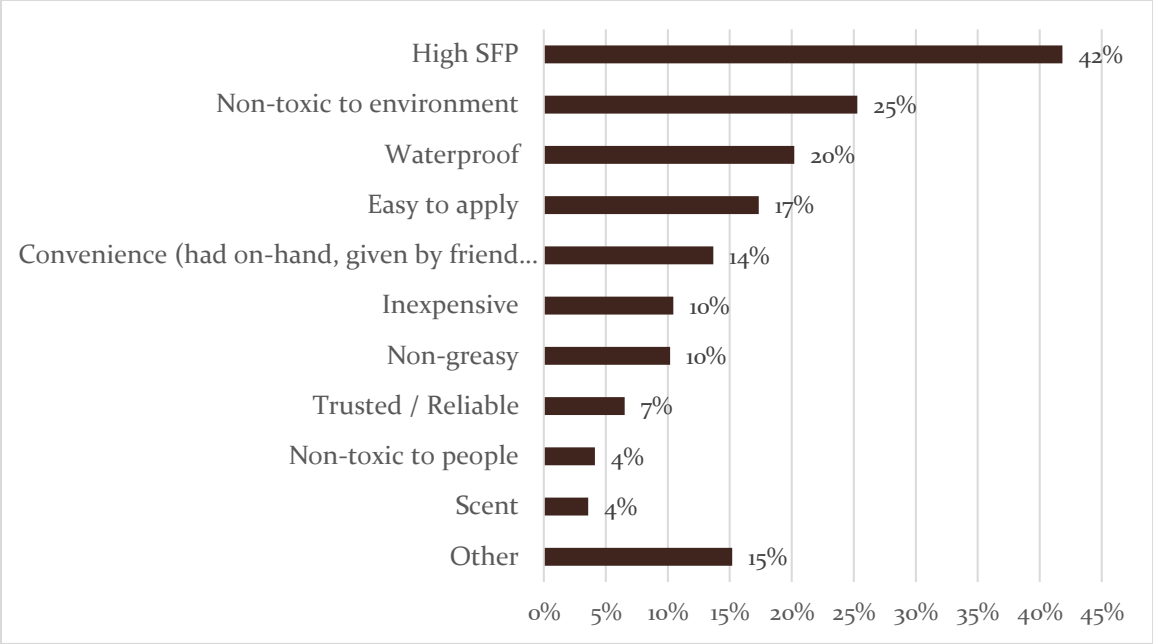

Figure 15: Reasons respondents cited for their choice of sun-protection (respondents often cited more than one reason for their selection of sunscreen).

WILLINGNESS TO SWITCH TO "REEF SAFE" SUNSCREEN ALTERNATIVES

Respondents who were using sunscreens that contained chemicals considered harmful to coral reef ecosystems were asked whether they would be willing to switch to "reef safe" forms of sunscreen protection (Fig. 16). The vast majority (85%) of respondents stated that they would be willing to switch, providing no qualifications. Only 1% of respondents stated that they were not willing to use alternative forms of sun protection. Twelve percent of respondents stated that they would be willing to switch to sunscreens containing non-toxic ingredients, providing that certain criteria were met (Figure 17), primarily that the alternative form of sun protection must be effective, affordable, and clearly labelled.

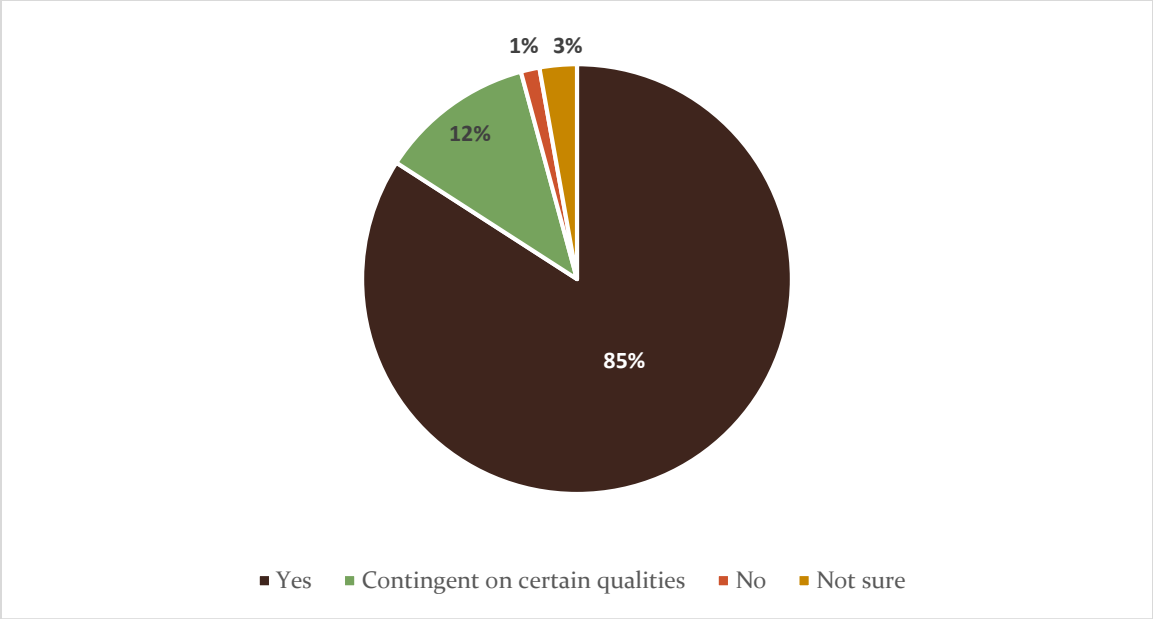

Figure 16: Respondents' stated willingness to switch to "reef safe" sunscreen alternatives

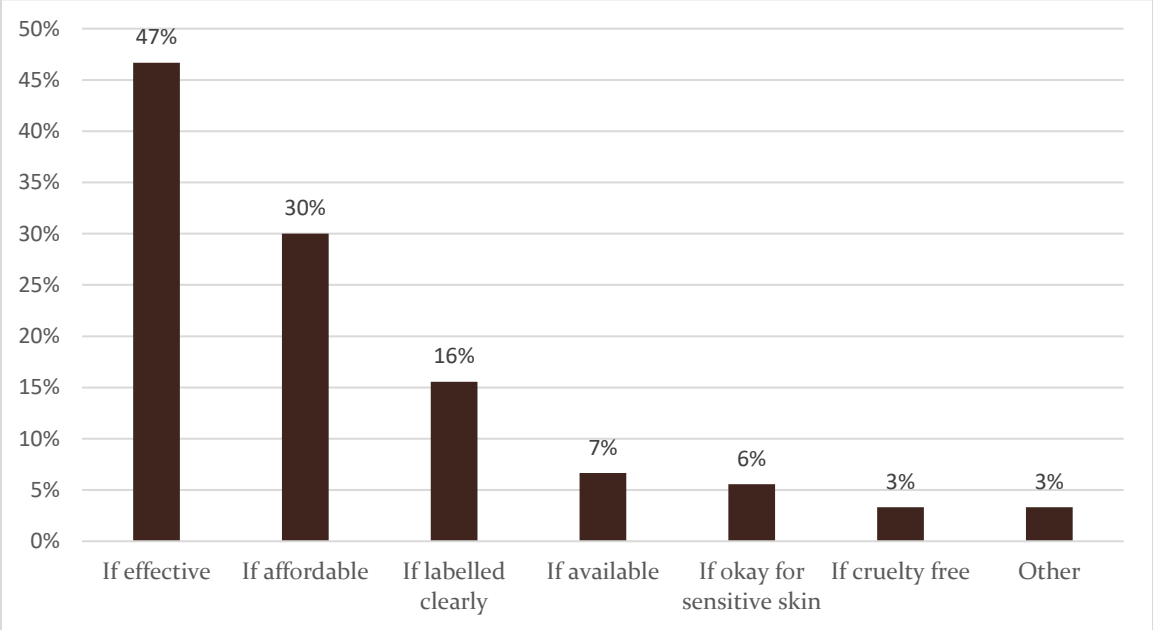

Figure 17: Factors potentially limiting respondents' willingness to switch to alternative forms of sun protection (for respondents who stated that they might be willing to switch, contingent on the sunscreen having certain qualities).

Discussion

Just over half of respondents purchased their sunscreens in the state of Hawaii, meaning the ban's impact on sunscreen use will be substantial, but there will still be a large proportion of people going into Hawaii waters whose sunscreen use will not be affected by the chemical ban. During surveys, some respondents mentioned that they waited to purchase their sunscreen until after they arrived in Hawaii because they had heard about the ban on sunscreen chemicals and assumed that any sunscreen they purchased in Hawaii would be "reef safe". While this was not actually the case, as the chemical ban does not go into effect until 2021, it indicates that knowledge of the chemical ban may be changing the purchasing behavior of some visitors so that a larger proportion of people are purchasing their sunscreen after they arrive in Hawaii. Another factor mentioned by respondents that contributed to visitors' decision to purchase sunscreen in Hawaii was TSA regulations on liquid size in carry-on luggage.

Outreach regarding the effects of sunscreen chemicals on coral reef ecosystems in Hawaii has been extremely successful. The vast majority of Hawaii residents at the survey sites were aware of the issue, as were the majority of visitors to the islands at the time of the survey. It should be noted, however, that many visitors learned of the chemical issue after they arrived in Hawaii. For example, of beach-goers surveyed in Kahaluu Bay, 12% of those who were aware of the harmful effects of sunscreen chemicals stated that they had learned about the issue from the Kahaluu Bay Education Center, an organization that is engaged in daily outreach activities at that location. Additionally, 8% of those who were aware of the issue at Hanauma Bay stated that they learned about the issue at Hanauma Bay. While this demonstrates that education and outreach at beach sites is increasing visitor awareness, in many cases visitors are becoming aware of the issue after they have already purchased and applied sunscreen.

Survey respondents are learning about the sunscreen chemical issue from very diverse sources. The prevalence of the issue in the news, both in Hawaii as well as nationally and internationally, has likely contributed to high levels of awareness. People are also learning about the issue through social networks, as friends/family/word of mouth was the most commonly cited information source about the topic. Many visitors are also learning about the issue while researching their trip to Hawaii, often reading about the sunscreen chemical ban online as they try to learn more about the islands as a vacation destination. While these high levels of awareness are encouraging, it will be important to continue outreach efforts once the sunscreen ban is no longer "newsworthy" and the topic becomes less prevalent in diverse information sources.

However, those who were aware of the effects of sunscreen chemicals on coral reef ecosystems did not always avoid using sunscreens that contained these chemicals, consistent with other studies that have found that environmental awareness does not always translate into environmental behavior (Schultz 2011). While people who were aware of chemical effects were less likely to use sunscreens containing oxybenzone or octinoxate, 30% of people who were aware of the issue (and wearing sunscreen where ingredients

could be verified) were still using sunscreens containing the banned ingredients. In some cases this was because people had learned about the chemical issue after making their sunscreen purchase. In other cases, people were broadly aware of concerns about sunscreen chemical effects on coral, but they did not know the names of the chemicals that they should avoid, or they assumed that any sunscreens they purchased in Hawaii were already subject to the chemical ban.

It is important to note that surveyors only documented the presence or absence of oxybenzone or octinoxate, the two chemical ingredients subject to the 2021 ban, when reviewing sunscreen ingredients. Other UV blocking chemical ingredients of possible concern to coral reef ecosystem health (such as octocrylene, avabenzone, homosalate, and octisalate) were frequently present in sunscreens that did not contain the two chemicals subject to the ban[1]. In many cases, these sunscreens were labelled with "reef safe" stickers as a marketing strategy. Because we did not document ingredients other than oxybenzone and octinoxate, we are unable to assess the proportion of sunscreens used that would be considered truly "reef safe," that is, sunscreens that did not contain chemicals of concern and whose active ingredients were non-nano zinc oxide or titanium dioxide. However, surveyors noted that sunscreens using non-nano zinc oxide and titanium dioxide represented a minority of the 68% of sunscreens that did not contain the chemicals subject to the upcoming ban.

An encouraging outcome of the survey was that the vast majority of people surveyed expressed a willingness to use reef safe sunscreen, and many respondents were already taking environmental considerations into account in their decision-making when purchasing sunscreen. Survey respondents often expressed a desire to learn more about the sunscreen issue and wanted to know how they could best make reef-safe purchasing decisions. In order to enable people to more easily make reef-safe purchasing decisions, it is important that sunscreens are clearly labelled. As of now, there are no labelling standards for claiming that a sunscreen is "reef safe." Several sunscreen brands are already capitalizing on the media attention from the chemical ban by placing "reef safe" stickers on sunscreens sold in Hawaii. For the most part, sunscreens bearing these labels do not contain oxybenzone or octinoxate, but most contain other chemicals of concern. While the state ban on oxybenzone and octinoxate will likely reduce the prevalence of those chemicals in the ocean, clear and consistent labelling standards could be an additional tool to help reduce the prevalence of other chemicals of concern, as well as to help individuals make more informed sunscreen purchasing decisions before the chemical ban goes into effect in 2021.

[1] For instance, during a sunscreen swap sponsored by the Kahaluu Bay Education Program on July 6, 2019, 107 sunscreens that contained chemicals of concern (anything other than non-nano zinc oxide or titanium dioxide) were collected from beach goers. Thirty-six percent of these sunscreens collected contained oxybenzone, while 63% did not contain oxybenzone but contained oxtocrylene (1% were foreign sunscreens where ingredients could not be verified) (Cindi Punihaole, personal communication).

Acknowledgements

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Appendix A: Sunscreen Survey

Beach Location: _____ *Surveyor:* _____ *Date:* _____

Weather conditions: *Time of day:*

☐ *Sunny* ☐ *Partly Cloudy* ☐ *Cloudy* ☐ *Before 9am* ☐ *9am – 3pm* ☐ *After 3pm*

Please begin here:

1. Do you plan to go into the ocean here today? ☐ a. Yes ☐ b. No

2. Are you wearing (or do you plan to apply) sun protection today? ☐ a. Yes ☐ b. No

(If no, skip to Q. 5)

3. What type of sun protection are you wearing today (brand and type)?

_____

3a. Purchased in Hawaii? ☐ a. Hawaii ☐ b. Not purchased in Hawaii

4. What factors contributed to your selection of this sun protection (check all that apply)?

☐ a. High SPF ☐ b. Easy to apply ☐ c. Non-greasy ☐ d. Waterproof

☐ e. Non-toxic to people ☐ f. Non-toxic to environment ☐ g. Inexpensive

☐ h. No reason / not sure ☐ g. Other: _____

5. Are you aware that certain chemicals in some sunscreens (such as oxybenzone and octinoxate) are harmful to coral reefs, fish, and other ocean life?

☐ a. Yes ☐ b. No

6. *(If yes)* Where did you learn this information (check all that apply)?

☐ a. In a store ☐ b. Newspaper ☐ c. TV ☐ d. Radio ☐ e. Website: _____

☐ f. Educational event: _____ ☐ g. Sunscreen trade-in: _____

☐ h. Social media: _____ ☐ i. Airplane announcement

☐ j. Hotel/Vacation rental: _____ ☐ k. Farmer's Market: _____

☐ l. Family / friends / word of mouth ☐ m. Other: _____

7. Would you be willing to switch to alternative forms of sun-protection that does not contain these chemicals?

☐ a. Yes ☐ b. No ☐ c. Not sure ☐ d. Already using reef-safe sun protection

Elaborate (why/why not): _____

Appendix A: Sunscreen Survey

Demographics:

8. Gender (check one): ☐ a. Male ☐ b. Female

9. May I ask what age category you fall into?

☐ a. 18-25 ☐ b. 26-35 ☐ c. 36-45 ☐ d. 46-55 ☐ e. 56-65 ☐ f. over 65

10. What is your place of residence?

☐ a. Hawaii ☐ b. US (specify state _____) ☐ c. International (specify country _____)

If Hawaii resident:

10a. Are you a full time resident? ☐ a. Full time ☐ b. Part time

10b. How long have you lived in Hawaii?

☐ a. Entire life ☐ b. > 10 years (but not entire life) ☐ c. 5-10 yrs ☐ d. 1-4 years ☐ e. < 1 year

10c. Island of residence: _____

11. What is your ethnicity? (mark all that apply)

☐ a. Asian ☐ b. Black / African American ☐ c. Hispanic / Latino

☐ d. Native Hawaiian ☐ e. Other Pacific Islander ☐ g. White / Caucasian

☐ g. Other: _____

12. What is the highest level of education you have attained?

☐ a. Some high school or less ☐ b. High school diploma or equivalent ☐ c. Some college, no degree

☐ d. Two year degree or technical school ☐ e. College graduate (BA, BS) ☐ f. Graduate degree (MA, MS, PhD, JD, MD, etc.)

Thank you for your time. Please allow the surveyor to look at the sunscreen that you are currently using when he or she collects your survey.

Surveyor check:

13a. Surveyor check: Oxybenzone and/or octinoxate present? ☐ a. Yes ☐ b. No ☐ c. Not Sure

13b. Surveyor check: Using sun-protective clothing? ☐ a. Yes ☐ b. No ☐ c. Not Sure

Appendix B: Sunscreen Survey - Japanese Translation

1. 今日、あなたは海に入る予定ですか？ ☐ a. はい ☐ b. いいえ

2. 今日、あなたは日焼け止めを使用していますか？もしくは、使用する予定ですか？

☐ a. はい ☐ b. いいえ

（“いいえ”を選択した場合は質問 5 へ進んで下さい。）

3. 今日使用している、もしくは使用する予定の日焼け止めのブランド名と商品名を記入してください。

_____

4. 今日使用している、もしくは使用する予定の日焼け止めを選んだ理由にあてはまるものをすべてチェックしてください。

☐ a. 高い日焼け止め効果（SPF が高い） ☐ b. 使い方が簡単である ☐ c. べたべたしない

☐ d. 水や汗に強い・ウォータープルーフ ☐ e. 人に対して安全・害がない

☐ f. 海の環境に対して安全・害がない ☐ g. 価格が高くない

☐ h. 特に理由がない・わからない

☐ g. その他の理由: _____

5. あなたは、日焼け止めの種類によっては、特定の化学成分（例：オキシベンゾン（oxybenzone）、オクティノクセイト（octinoxate））がサンゴ礁、魚、その他の海の生物に害があることを知っていますか？

☐ a. はい ☐ b. いいえ

6.（質問 5 に“はい”と答えた方のみ回答してください）どこで、そのことを知りましたか？あてはまるものをすべてチェックしてください。

☐ a. 店 ☐ b. 新聞 ☐ c. テレビ ☐ d. ラジオ ☐ e. ウェブサイト: _____

☐ f. 教育関連のイベント: _____

☐ g. 海の環境に害のない日焼け止めに交換するイベントもしくは施設: _____

☐ h. ソーシャルメディア: _____ ☐ i. 飛行機 機内アナウンス

☐ j. ホテル・観光宿泊施設: _____

☐ k. ファーマーズマーケット・農産物直売所: _____

☐ l. 家族・友達・その他口伝え

☐ m. その他: _____

7. あなたは、今後、海の環境に害のない（害を与える特定の化学成分を含まない）日焼け止めを積極的に使用したい、もしくは、使用するつもりですか？

☐ a. はい ☐ b. いいえ ☐ c. わからない

☐ d. すでに海の環境に害のない日焼け止めを使用している。

はい、もしくは、いいえの理由を詳しく教えてください。

_____

8. あなたの性別を教えてください。 ☐ a. 男 ☐ b. 女

9. あなたの年代を教えてください。

☐ a. 18-25 歳 ☐ b. 26-35 歳 ☐ c. 36-45 歳 ☐ d. 46-55 歳 ☐ e. 56-65 歳 ☐ f. 65 歳以上

10. あなたの出身国を教えてください。 _____

11. あなたの最終学歴を教えてください。

☐ a. 中学 ☐ b. 高校 ☐ c. 大学等中退

☐ d. 短大・専門学校 ☐ e. 大学 ☐ f. 大学院

以上で、質問は終わりです。最後に、アンケート用紙を渡す際に、使用している、もしくは、使用する予定の日焼け止めを調査員に見せてください。アンケートにご協力いただき、ありがとうございました。

Surveyor check:

13a. Surveyor check: Oxybenzone and/or octinoxate present? ☐ a. Yes ☐ b. No ☐ c. Not Sure

13b. Surveyor check: Using sun-protective clothing? ☐ a. Yes ☐ b. No ☐ c. Not Sure

Beach Location: _____ Surveyor: _____ Date: _____

Weather conditions: Time of day:

☐ Sunny ☐ Partly Cloudy ☐ Cloudy ☐ Before 9am ☐ 9am – 3pm ☐ After 3pm