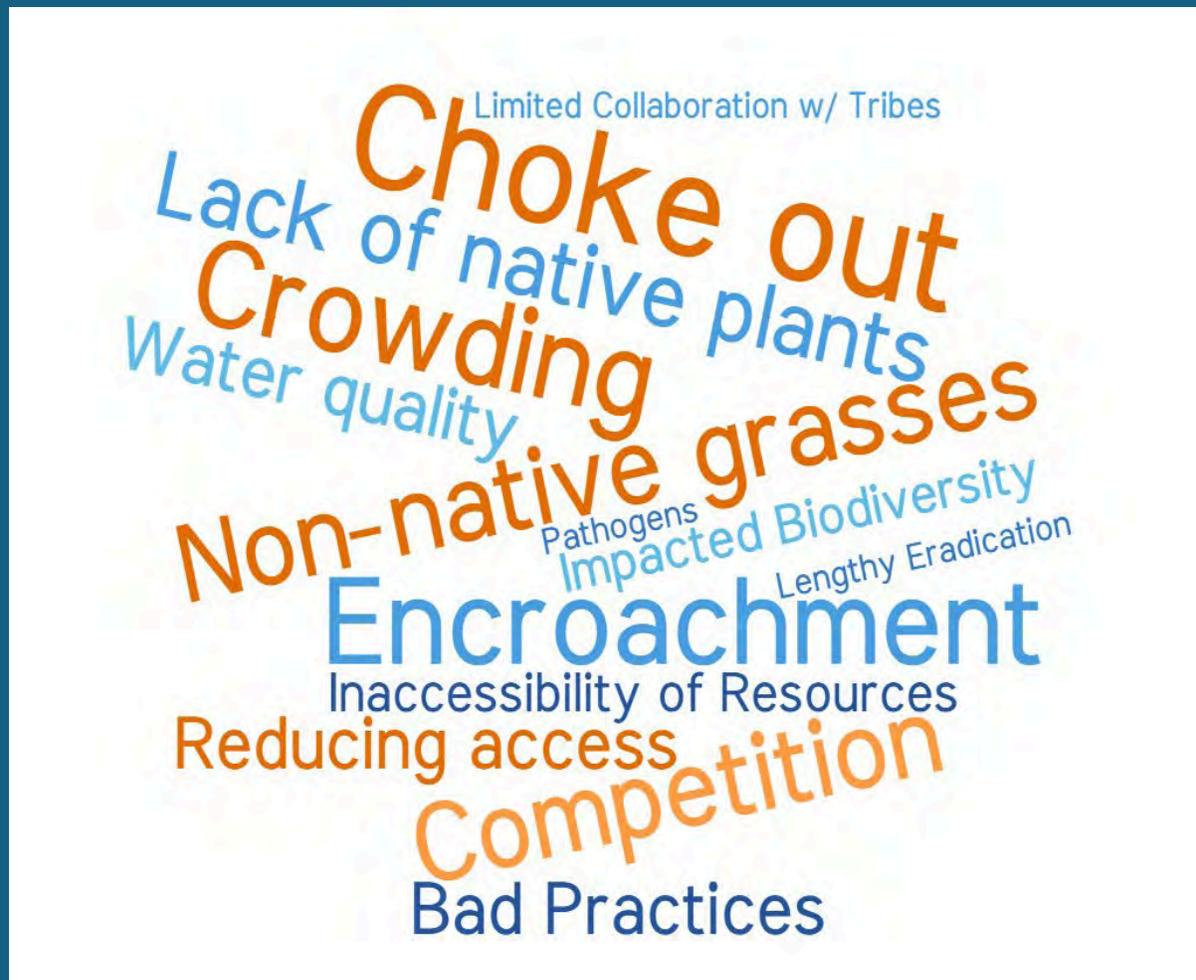


# Invasive Species Impact on Indigenous Communities



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## Introduction

This report summarizes a project to survey indigenous populations to assess the impacts of non-native species on tribal cultural resources. The project was designed and completed by the author during an internship hosted by the California State Lands Commission's Marine Invasive Species Program in partnership with the California State University's Council on Ocean Affairs, Science, and Technology (CSU COAST).

## About the California State Lands Commission

Established in 1938, the California State Lands Commission (Commission) protects and enhances 4 million acres of tide and submerged lands and the beds of natural navigable rivers, streams, lakes, bays, estuaries, inlets, and straits. These lands are public trust lands that the Commission leases for use and development while also championing public access and environmental preservation. The lands stretch from the Klamath River and Goose Lake in the north, to the Tijuana Estuary in the south, the Colorado River in the east, and from the Pacific Ocean three miles offshore to Lake Tahoe in the east. The Commission's mission is to provide the people of California with effective stewardship of the lands, waterways, and resources entrusted to its care based on the principles of equity, sustainability, and resiliency, through preservation, restoration, enhancement, responsible economic development, and the promotion of public access.

The Commission's Marine Invasive Species Program (MISP) aims to minimize the introduction of aquatic nonindigenous species to California waters by implementing and enforcing vessel ballast water and biofouling management requirements (Thompson et. al, 2023). The program began in 2000 after the adoption of California's Ballast Water Management for Control of Nonindigenous Species Act the prior year and was reauthorized and expanded by the 2003 Marine Invasive Species Act. Along with the Commission, the MISP includes three other entities: California Department of Fish and Wildlife - Office of Spill Prevention and Response, California Department of Tax and Fee Administration, and the California State Water Resources Control Board.

## Invasive Species and their Importance

Nonindigenous species, also commonly called non-native species, are organisms that have been transported from their native habitat to a new habitat via human activities either intentionally or by accident (Thompson et al., 2023). They can pose risks to human health, the environment, and the economy. Once a nonindigenous species has become established in its new location, has started to spread, and is causing a form of harm, it is considered invasive. Environmentally, these species significantly impact community

structure, food web interactions, and biodiversity within the invaded habitat. Economically, these species not only carry a significant cost to prevent/manage/eradicate, but they can outcompete and eliminate other species that are economically important. Because control and prevention are a never-ending process, the cost continues. These species can also impact human health by acting as vectors (i.e. transfer mechanisms) for human pathogens or being pathogens themselves (Thompson et al., 2023).

## Impact of Invasive Species on the General Public

To look at the impacts of invasive species on the public, we can look at the green crab (*Carcinus maenas*). First discovered in 1989 in San Francisco Bay, the crab has since traveled up and down the west coast (Fofonoff, 2018). Environmentally, these crabs negatively influence populations of a native shore crab (*Hemigrapsus oregonensis*) and result in the loss of eelgrass beds. Eelgrass beds are an important habitat for young fish. Green crabs use the same resources as Dungeness crab (*Megacarcinus magister*), which is commercially important, and can impact other commercially important species, resulting in large costs to control or eradicate (Thompson et. al, 2023). A second, more recent, example of an invasive species introduction is *Caulerpa prolifera*, an alga species that can grow quickly and outgrow native species where it is introduced. First discovered in Newport Bay, California, in March 2021, a significant eradication effort was immediately implemented because this alga species can spread via fragmentation. Recent surveys in late 2024 found no new growth (C. Scianni, pers. comm.), so the eradication methods appear to be working. The species was also found in San Diego in September 2023, and there is an eradication plan in place. The species is not a viable food source for native herbivorous fish and invertebrates, so an expansive *C. prolifera* population would limit food sources and may cause these animals to move to areas with appropriate food resources (California Department of Fish and Wildlife, 2023).

# California Native American Tribes

## California State Lands Commission 2016 Tribal Consultation Policy

In August 2016, the Commission adopted a Tribal Consultation Policy (CSLC 2018) to ensure effective, meaningful, and mutually beneficial coordination and communication between the Commission and California Native American Tribes. Created with the Governor's Tribal Advisor and other governmental entities, the policy reflects input from California Native American tribes. The Commission recognizes that Tribes have used many of the lands, waterways, and resources under the Commission's current jurisdiction, to support their culture and ways of life since time immemorial. The Tribes have a unique perspective and valuable knowledge regarding the conservation and sustainability of these lands. This policy was created to invite Tribes to participate in consultations regarding proposed activities on lands and waterways that are under the Commission's jurisdiction and to facilitate a positive, cooperative process with Tribes for engaging in government-to-government consultations. The policy also seeks to encourage collaborative working relationships with Tribes on issues, programs, and other projects at the staff level that do not require formal consultation. The 2016 Policy outlines five aspects of these working relationships:

- **Education: A combination of both Tribal knowledge of the resources and the Commission's skills in balancing opposing uses will be more effective for preserving Tribal Interests than either one alone.**

The Commission is committed to sharing information and perspectives to foster mutual understanding of each other's role in managing and providing stewardship of the land now under the Commission's jurisdiction.

- **Respect: For formal consultation to be successful, parties must respect one another.**

The Commission recognizes Tribes and Tribal communities as sovereign governments with legitimate interests and respects each Tribe's unique interests in the State's land and resources. The policy outlines several best practices for engaging with Tribes to foster mutual respect.

- **Confidentiality: Consulting parties will need to protect culturally significant places and objects.**

To avoid threats to those objects and places, the confidentiality of information regarding the locations of various sacred artifacts and sites, and other sensitive information will need to be maintained. The Commission will ask Tribes proactively if confidentiality is needed, and Tribes should also inform the Commission staff of the need to maintain confidentiality if necessary.

- **Communication: Open communication between the Commission and Tribes is essential and for that, the Commission will remain flexible.**

Meetings may be scheduled at times and locations that are most convenient for the Tribe, if it is feasible. The Commission believes face-to-face communication is most ideal but will accommodate Tribes otherwise. This part of the policy continues regarding pre-consultation meetings and joint consultations.

- **Timeliness: Commission staff will ensure that Tribes have timely notice of projects that are under consideration and responses to consultation requests.**

The policy outlines “timely notice” based on the various project types including emergencies.

## A Brief Look into the Colonization History in California

We want to take a moment to honor the California Native American communities all across the state for persisting, carrying on diverse cultural and linguistic traditions, and sustainably managing the land that we now share. Native people have maintained a constant presence on the landscape for many thousands of years, and they are essential stewardship partners whether along the coast, along our rivers and valleys, or in our fragile deserts. Specifically, this section serves to highlight this history and summarizes the educational resources available on the California Native American Heritage Commission website (Castillo, 2024).

In the 17<sup>th</sup> century, massive revolts among the indigenous communities against Spanish colonial settlers near the Rio Grande gave way to the Franciscan padres separating from the colonial settlers and establishing missions in California. Set up in 1769, the first coastal mission appeared in San Diego and would become one of 21 missions that functioned as labor camps created to benefit the colonizers and force religion on indigenous communities. During this time, the colonizers began to introduce stock animals that decimated native foods (see following subsection).

The Tribes attempted to remain independent from the colonizers, but due to overwhelming European originating disease, Tribes with sick children and elders sought help from the

settlers. The inhumane conditions and labor demands resulted in resistance from the indigenous people, which grew over time. The missions collapsed in 1836, but by that time, almost a third of the indigenous populations had died as a direct result of the missions.

When the Mexican Republic came into the picture with their new Constitution in 1824, they claimed that Native Americans would be citizens, have the right to vote, and hold public office. Despite the missions being gone, the treatment did not change. The communities did not get their land back, and land continued to trade hands while being transformed due to the introduction of various herds of stock brought over with the settlers (see following subsection). During this time, epidemics took hold of the various populations, and more people perished, resulting in another 50% decline of the native population.

With the arrival in the area of the U.S. Army, Navy, and Marine forces in 1847, Mexican resistance was replaced, and the U.S. oversaw the appointment of newly created Indian Affairs leaders as the gold rush era began. Within the first two years of the gold rush, another 100,000 indigenous people were killed. In 1849, two emissaries were sent to California to report on how Mexico recognized Indian land titles. The emissaries did not speak to any Tribes and drafted an inaccurate report which led to more misinformation. The U.S. Congress sent three federal officials to make treaties with California Indigenous Tribes. This resulted in 18 negotiated treaties that made promises to benefit the indigenous communities; however, in 1852, the U.S. Senate refused to ratify them. At this point, most Tribes tried to withdraw from the unfolding events. Once California became a state, the state Legislature rapidly enacted a series of laws that legalized indigenous slavery and indigenous Tribes were denied citizenship, voting rights, and the right to testify in court.

The first semblance of a reservation in California was created by the Superintendent of Indian Affairs for California, Edward Beale, in 1854. After Beale's removal from office in 1856, Col. T.J. Henely replaced him and established a few more reservations. These reservations offered little to the indigenous people, as they became overrun with white settlers and lacked game or sustainable land. Multiple Tribes were forced to live on the same reservations which did not always work. For example, the Modoc War of 1872 resulted from several attempts to deport the Modoc Tribe to the Klamath Reservation in Oregon.

In 1905, the Northern California Indian Association got the federal Bureau of Indian Affairs to enumerate landless indigenous people. Their efforts resulted in federal actions creating 36 new reservations and Rancherias in northern California. With the passage of the Jurisdictional Act of 1928, indigenous Tribes could sue the federal government and later saw the creation of the Indian Claims Commission in 1948. But with the Termination policy

established under a U.S. House Concurrent Resolution and put into motion in 1951, the authority over reservations was handed over to the State, allowing the state to tax their land. Termination became law in California under the authority of the U.S. Rancheria Act of 1958. Between 1958 and 1970, 23 reservations and rancherias were terminated under authority of this federal law. To date, 17 of the reservations and rancherias have reversed the termination process.

## Colonization and the Introduction of Non-Native Species

As mentioned above, when settlers and missionaries came to what is now California, they brought various new species including types of livestock, new agricultural stock, horses and other terrestrial mammals for various purposes such as travel, and pathogens that were unknown to the area and the Native American Tribes.

For example, the California Central Valley is one of the areas in which invasive species impacts can be traced back to the Spanish missions specifically. There is evidence of invasive plant species found in old bricks of the Spanish missions along the California coastline (Hendry, 1931). Invasive plants truly became an issue for California during the gold rush with large numbers of people immigrating in search of gold. During this time, the likely vectors included imported forage, packing materials, and contaminated seed lots. The California native plants that remained were damaged and displaced due to the amount of predation/trampling from livestock and the other non-native species that were introduced deliberately for the livestock to forage (Poland et al., 2021). By 1880, the vegetation in Central California had been transformed by introduced vegetation brought by settlers as well as drought, flooding, competition with non-native species, and cultivation of native vegetation (Mack, 1989).

Not only were non-native plants brought over by colonizers, but non-native livestock were also brought over (CDFW (2)). Domestic hogs (*Sus scrofa*) were introduced to North America by the Spanish settlers in the sixteenth century and again later by other settlers. They were introduced so that the settlers could have a constant and familiar food supply. The Eurasian wild boar (also *Sus scrofa* and derived from the domestic pig) has a native range including North Africa and Eurasia. Feral swine, which includes wild boar, feral hogs, and combinations of the two, are now in at least 38 states. It is likely that there are no records of the impacts other than a reduction in species diversity caused by the non-native livestock. But in more recent history, feral swine have caused contamination of agricultural crops, massive agricultural damage, and contamination of potable water with *E. coli* and other disease pathogens (Jay, 2007; Bevins, 2014; Poland, et al., 2021). In the time of the

Spanish settlers of the gold rush era, feral swine and other introduced livestock may have had devastating effects due to the lack of effective containment/prevention practices.

## Survey

While we have some understanding of the impacts of non-native species on settlers in California, little is known about how non-native species impacted and continue to impact indigenous populations.

This project was designed to better understand the cultural impact of invasive species on California Native American communities. This includes invasive species that may currently be invading or may invade in the future. To gain a baseline understanding of invasive species awareness and cultural impacts from invasive species, Commission staff working on this project developed and sent a survey to 53 Tribes across northern California. Although the MISP mainly focuses on aquatic non-native species, the survey encouraged responses on all non-native species.

This survey will be an important tool for many reasons. First, there is very little literature on the topic of invasive species and impacts on indigenous communities. The published literature that is available ranges from Tribal communities' general beliefs on invasive species, to how they prevent and mitigate these species, to how these species impact their ancestral land, culture, and livelihood. Second, this survey aims to build a collaborative working relationship between Commission staff and indigenous communities throughout California. Tribal communities have unique sets of knowledge, skill sets, and beliefs that Commission staff can learn from, and this survey acts as a starting point to understand current measures, concerns, and impacts related to non-native species. Finally, this project may act as a way of identifying non-native species in areas down waterways adjacent to the coast. Many of these communities are situated near coastal or estuarine waters that remain vital to indigenous lifestyles and livelihoods.

## Survey Creation and Distribution

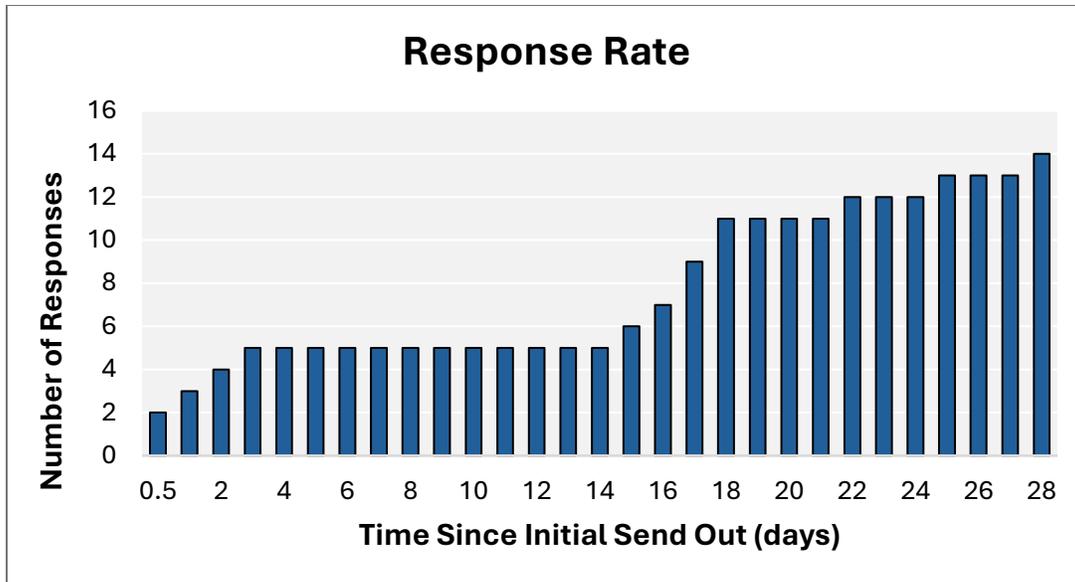
The survey questions were created after reviewing various pieces of literature regarding the cultural impacts of invasive species (Reo et al., 2017; Hoard et al., 2020; Poland et al., 2021). The questions revolved around current and future concerns, preventative actions and current measures, the barriers to developing and implementing effective measures, and community interactions with aquatic and terrestrial invasive species.

Microsoft Forms was used to create the survey which was sent to the 53 Tribes. Participation in the survey was voluntary, and questions could be left unanswered because

the main goal of the survey was to assess the cultural impacts of invasive species on communities. The survey contained twenty questions, including one for the Tribe's name, to keep track of how many different Tribes responded, and had an estimated completion time of 10-15 minutes. Tribes were told that a report would be created from the results of the survey (i.e., this report) and then made available on the Commission's website for future use.

The Native American Heritage Commission sent a contact list of Tribes that the survey could be sent to. The list contained both federally and non-federally recognized Tribes. The Tribes that the survey was sent to have ancestral land in the following California counties: Humboldt, Siskiyou, Trinity, Mendocino, Del Norte, and Modoc counties. Those Tribes may have ancestral land that continues outside of those counties, but these counties were of interest based on their proximity to areas of invasive species concern. Most of the Tribes on the contact list had at least one point of contact. For those with more than one point of contact, all the contacts were emailed except the Chairperson. For those without more than one point of contact, we searched the website for general emails or emails that would go directly to the environmental department, and for those that had neither, the survey was sent to the mailing address.

The survey was first sent on June 24, 2024, and had a requested response date of Wednesday, July 10, 2024. In total, we emailed the survey to 70 contacts from 45 Tribes and mailed copies to 8 Tribes. A reminder email was sent out on July 8, 2024, and phone calls to each Tribe with a general or department number took place in the week that followed (July 8-July 10) resulting in either leaving a voicemail, leaving a note with a receptionist, or speaking to the correct department. From those phone calls, we received new email addresses and added them to the mailing list for the next email reminder. On July 12, we sent an email extending the deadline to July 19, 2024. Although we set the deadline at the 25-day mark, we received another response on the 28<sup>th</sup> day, or at 4 weeks, and decided to include it as well. The final responses came from 14 Tribes (Figure 1) with ancestral lands in all the counties of interest: Del Norte, Humboldt, Siskiyou, Mendocino, Trinity, Modoc.



**Figure 1.** The response rates of the survey over four weeks.

## Results

Because all the questions of the survey were voluntary, not all questions had the same number of responses. The following results were dependent on the responses to each question.

### General Questions

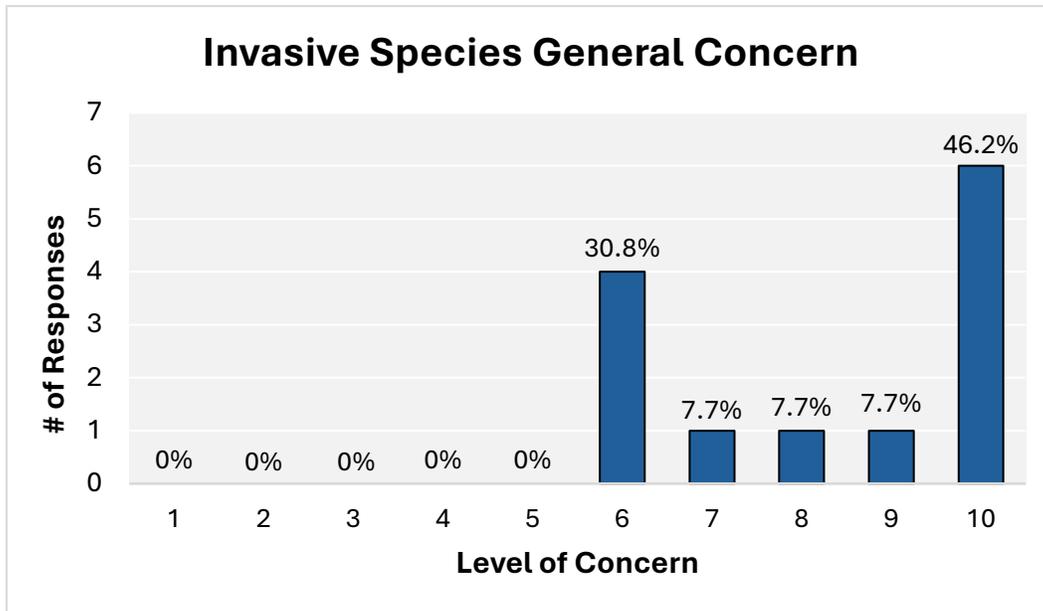
*Question 1: “How concerned are you about the impact of invasive species on a scale of 1 to 10?”*

This question contained a detailed scale of 1 being that the Tribe has no awareness of the issue at all and 10 being that the Tribe is extremely concerned and needs to allocate more than the current measures being done. All the Tribes who responded were aware of the issue and responded with an average of level 8 (Figure 2). The following results were recorded:

- 30.8 percent of the respondents rated their concern as a level 6, meaning the Tribe is mildly concerned enough that they have a plan in mind but not enough resources or knowledge to execute it.
- 7.7 percent rated their concern at level 7 meaning they are concerned, have a plan in place, and have begun implementation.
- 7.7 percent rated their concern at level 8, meaning that they are concerned, have a plan in place, and there is a strong effort to implement it.

- 7.7 percent rated their concern at level 9, indicating that they are very concerned and everything that can be done is being done.
- Finally, 46.2 percent rated their concern at level 10, which indicated extreme concern as mentioned previously.

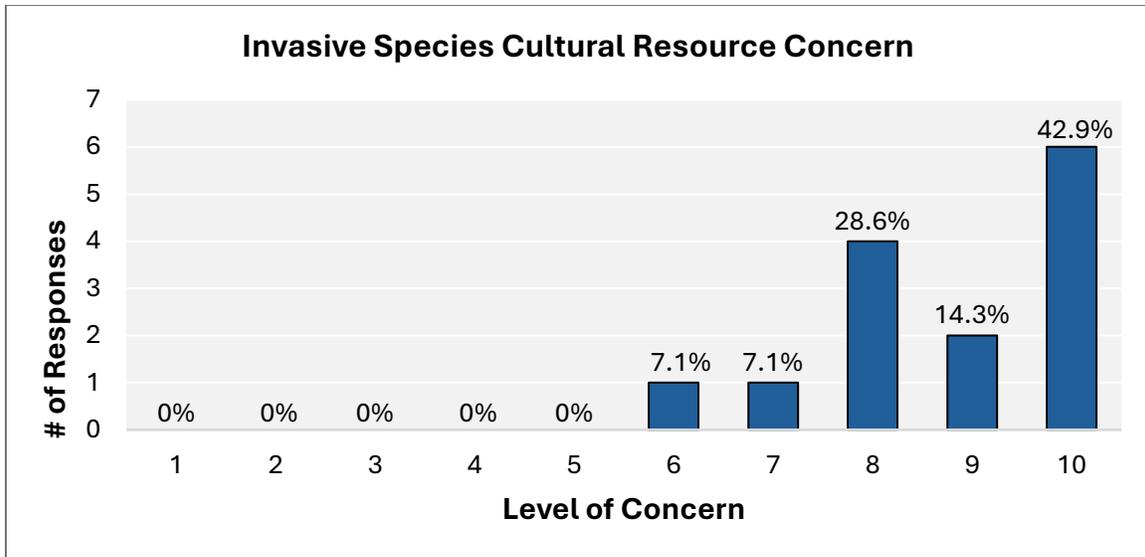
These data show that the responding Tribes are aware of the invasive species issue and are concerned about it.



**Figure 2.** General concern about invasive species. The responses to question one of the survey asked Tribes to rate their level of concern regarding invasive species. The percentages above each bar indicate the percentage of respondents that chose each option (i.e., 30.8 percent of Tribes that responded to this question rated their concern of invasive species to be a level 6, mildly concerned enough to have a plan in mind but not enough resources or knowledge to execute it.)

*Question 2: How concerned are you about the impact of invasive species on Tribal cultural resources of your Tribe, on a scale of 1 to 10? In this case, 1 is no concern and 10 being the most concern possible.*

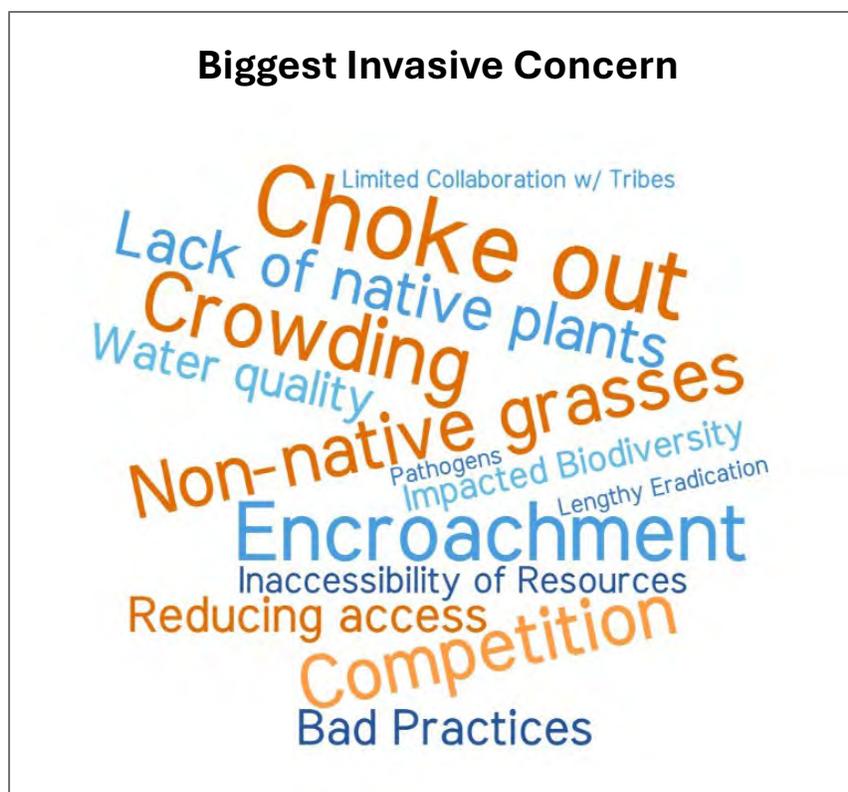
The Tribes all rated their concern about impacts of invasive species on tribal cultural resources as level 6 or higher, with an average rating of 8.79, which indicates a high level of concern across all the responding Tribes. Out of the responding Tribes, 42.9 percent indicated a level 10 concern about the impact on cultural resources from invasive species (Figure 3).



**Figure 3.** Level of concern about invasive species impacts on cultural resources. The responses for question two of the survey asked Tribes to rate their level of concern regarding invasive species and their impact on cultural resources. The percentages above each bar indicate the percentage of respondents that chose each option (i.e., 7.1 percent of respondents to this question rated their concern for cultural impact to be at a level 6).

*Question 3: What is your Tribe’s biggest concern about invasive species on your ancestral land?*

The question asked for short open text answer to avoid limiting possible concerns, and although voluntary, all Tribes answered this question. Due to the many responses, we created a word cloud using the responses from the survey (Figure 4). The larger the words, the more often the concern was brought up in the survey responses (i.e., competition was mentioned more often than water quality). The most common answers included choking out of native plants and encroachment.



**Figure 4.** Largest concern about invasive species. Survey results from question three in the form of a word cloud due to the nature of the short answer form of the question. The larger the words, the more common the answer. The smaller the font, the less common the answer.

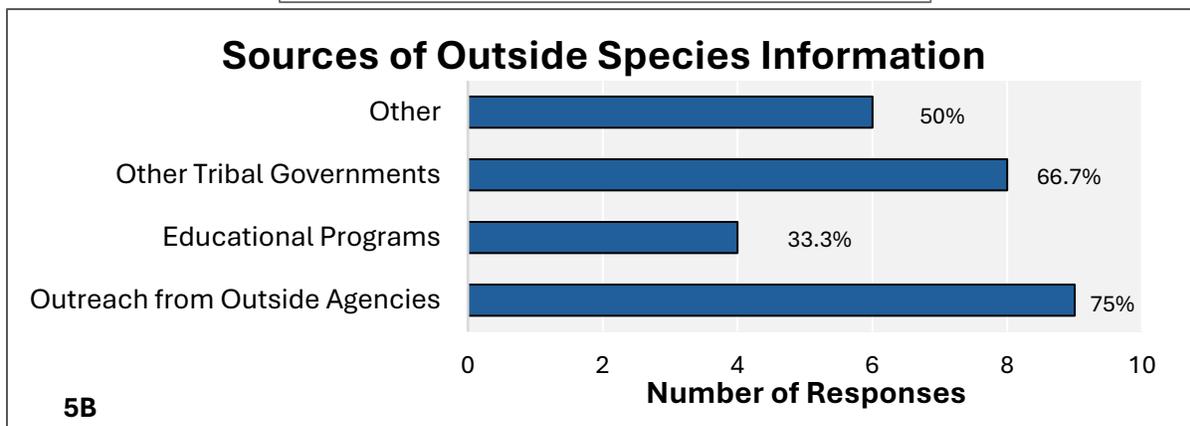
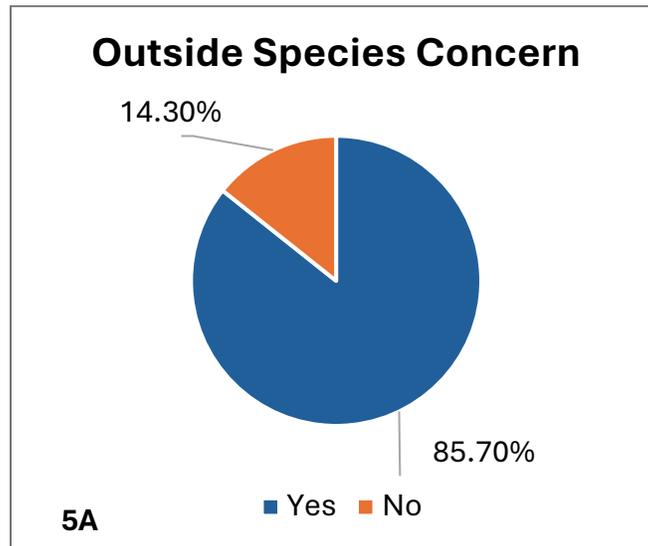
*Question 4: Is your Tribe concerned about invasive species that are not within your Tribe's ancestral land?*

This question was designed as a yes/no question. 85.7 percent of the respondents said they do have concerns about species not within their Tribes' ancestral land, and 14.3 percent said no (Figure 5A).

*Question 5: If the Tribe is concerned about invasive species outside your ancestral land, how did you find out about them?*

Question five acted as a follow-up to question four, and allowed the Tribes to choose all the answers that apply to their Tribe (i.e., more than one option was allowed), including a choice to write in any other options. Out of all the responding Tribes, 75 percent of Tribes indicated they learned about invasive species via outreach from outside agencies, 33.3 percent of Tribes learned from educational programs, 66.7 percent of Tribes learned from other Tribal governments, and 50 percent indicated they learned from "other" forms

including academic partners, personal observation, career experience, and Tribal knowledge on traditional plant species of California (Figure 5B).



**Figure 5.** The responses to question 4 (Figure 5A) and question 5 (Figure 5B) regarding species that are not currently within the Tribe’s ancestral land. The percentages next to each bar indicate the percentage of respondents that chose each option (i.e., 75 percent of Tribes that have a concern about species not on ancestral land learned about those threats from outreach from outside agencies).

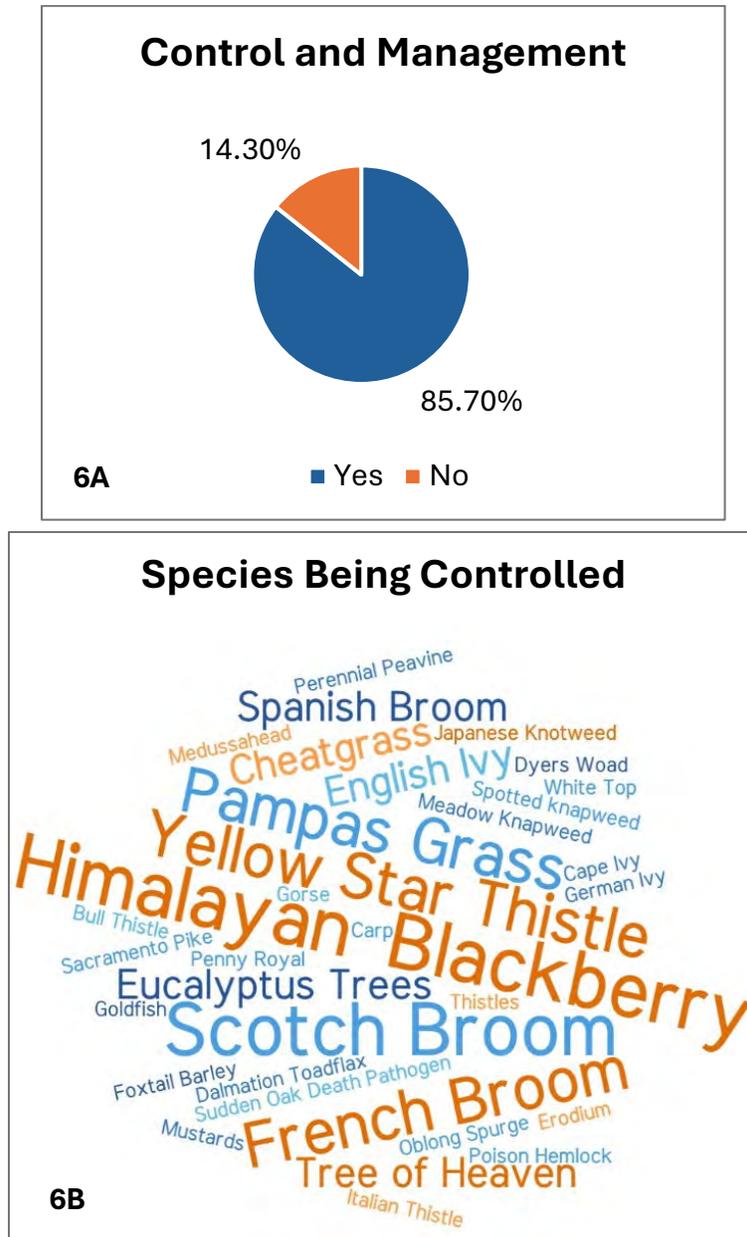
### Current Measures and Preventative Action

*Question 6: Is the Tribe working on any invasive species control and management?*

Set up as a yes/no question, 85.7 percent of responding Tribes said yes, and 14.3 percent of Tribes said no (Figure 6A).

Question 7: If the Tribe is working on any invasive species control/management, please list the species?

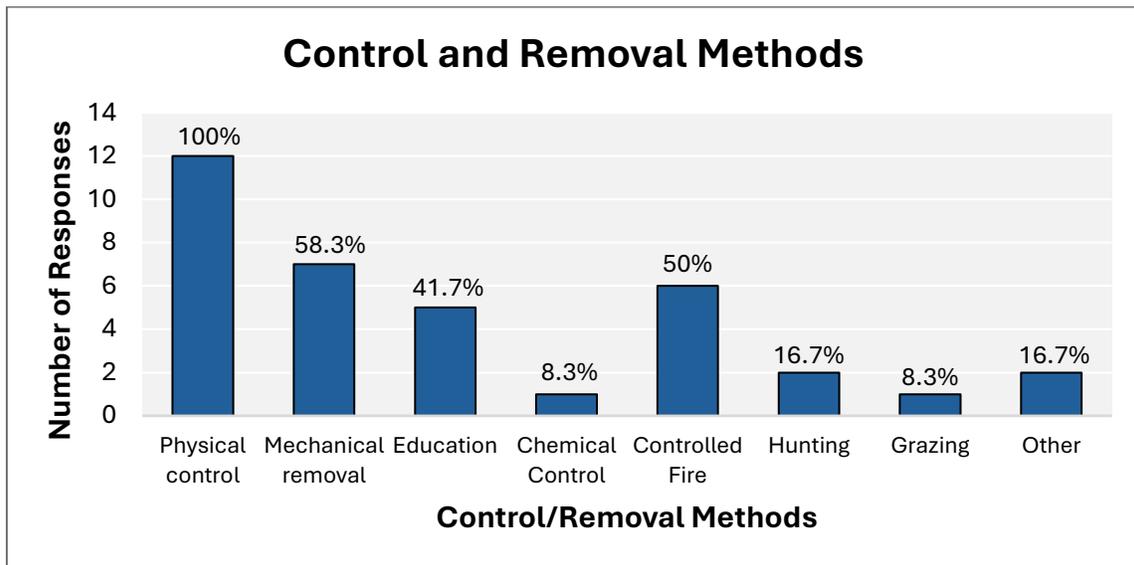
Question seven was set up as a follow-up to question six and used a short answer format. To display this question, we created another word cloud. The most common answers included Himalayan Blackberry and Scotch Broom (Figure 6B). Most responses included terrestrial plant species.



**Figure 6.** The survey responses to question 6 (Figure 6A) and question 7 (Figure 6B). Question 6 asked if there is any invasive species control and management while question seven asked what species specifically.

*Question 8: If you are working on invasive species control and management, what control/removal methods are being used?*

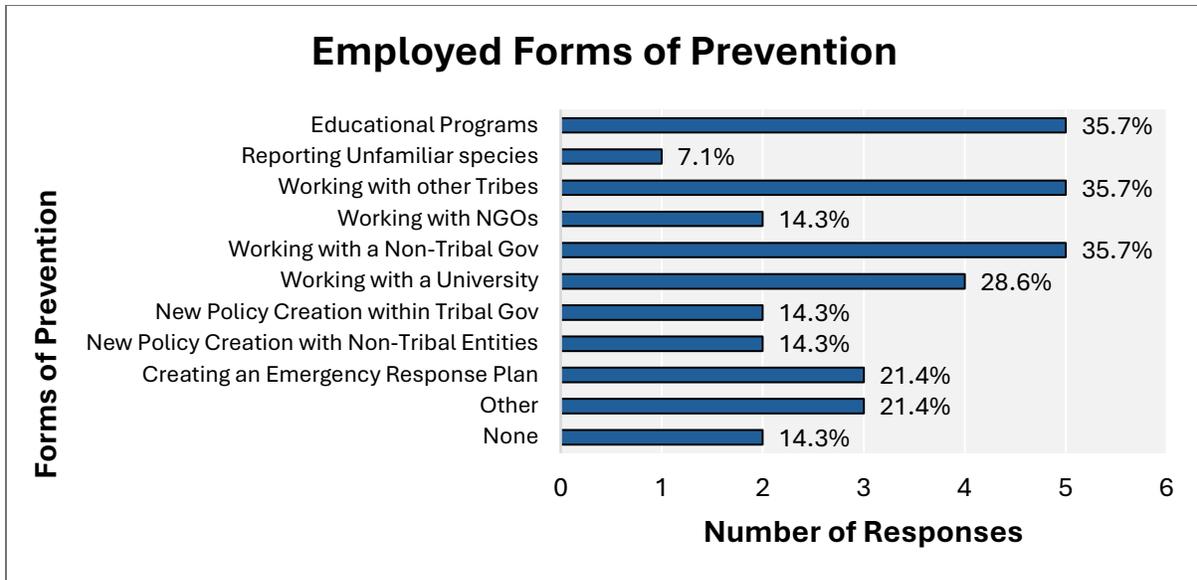
This question also allowed the survey participants to choose all that apply to them and had a write-in choice for any other unmentioned options. Due to the number of options, Figure 7 shows how many respondents used each of the prevention methods. Physical control, including hand pulling, digging, flooding, and removal of early life stages, had the most response, with 100 percent of respondents indicating they use this method. Some options were not selected at all, including biocontrol and ceremony. Two respondents chose “other” and specified methods including “goat herd” and “tools only.”



**Figure 7.** The responses to question eight, that asks what control methods are being used currently, if any, to help with invasive species on the Tribe’s ancestral land. The percentages above each bar indicate the percentage of respondents that chose each option (i.e., 100 percent of responding Tribes indicate they use physical control as a control method).

*Question 9: Does your Tribe have measures to prevent new invasive species?*

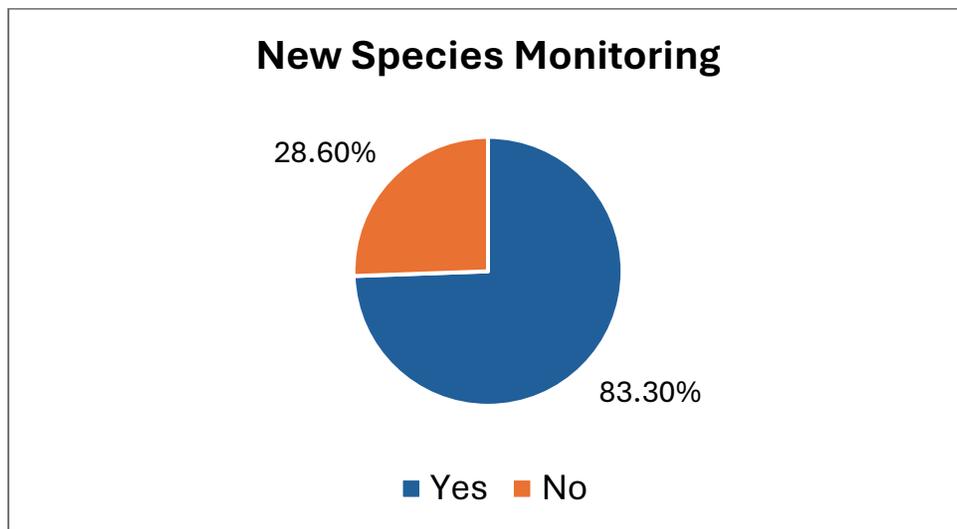
This question offered 11 options, including an “other,” so tribes could write in any other measures that were not on the list. The respondents were asked to choose all that apply. Both educational programs and working with a non-Tribal government entity are being employed by 41.7 percent of responding Tribes (Figure 8). However, none of the responding Tribes indicated that they clean their boats and gear before moving locations. In the other option, the responses included limited activities with the Bureau of Indian Affairs and United States Environmental Protection Agency, regular monitoring and vegetation management, and use of noxious weed management plans. 16.7 percent of the respondents indicated no measures to prevent new invasive species.



**Figure 8.** The results of question nine from the survey asked what forms of prevention the Tribes employ, if any, to prevent new invasive species. The percentages next to each bar indicate the percentage of respondents that chose each option (i.e., 35.7 percent of responding Tribes indicate that educational programs are one form of prevention they employ).

*Question 10: Is your Tribe monitoring for new or existing non-native species?*

The last question in this section was set up as a yes/no question. Of the respondents, 71.4 percent indicated yes while 28.6 percent indicated no (Figure 9).

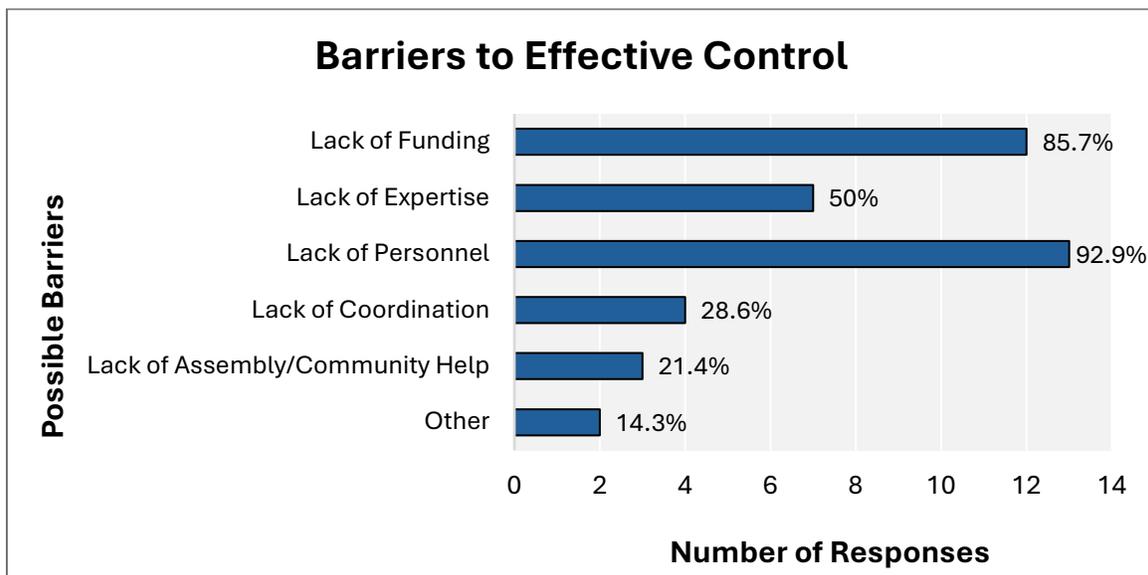


**Figure 9.** The results from survey question ten asked if the Tribe monitors for new or existing non-native species.

## Barriers to Effective Invasive Species Measures

*Question 11: What are some of the biggest barriers to effective identification and/or a timely response to invasive species?*

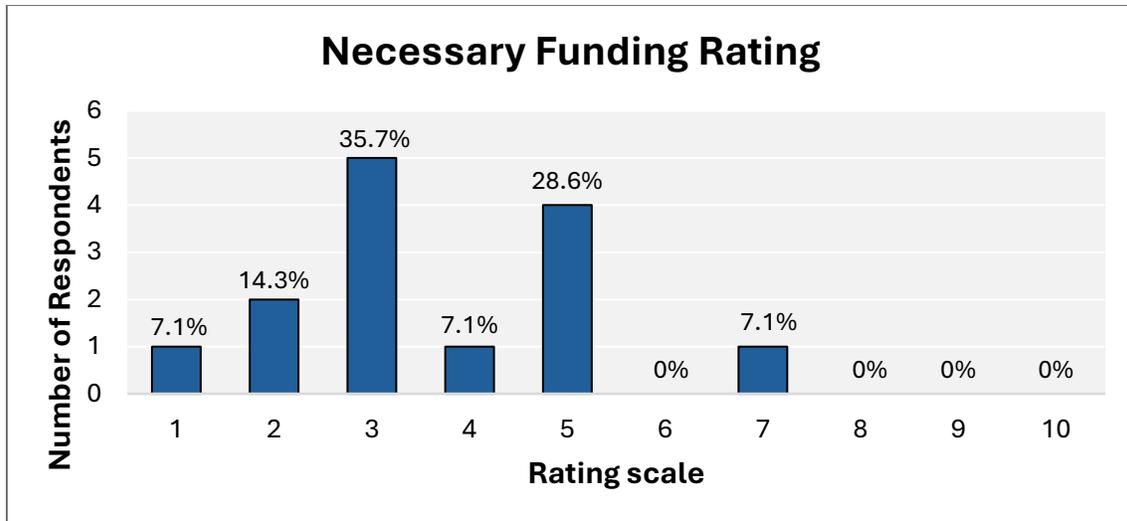
Question 11 allowed Tribes to select all that apply and/or fill in the “other” box. The two most common answers are lack of funding, selected by 85.7 percent of responding Tribes, and lack of personnel, selected by 92.9 percent of responding Tribes (Figure 10). The answers listed in “other” included “hard to decide where to begin” and “overbearing power of grazers and resistance to more sustainable practices.”



**Figure 10.** The responses to question 11 which asked about the possible barriers to effective prevention and control of invasive species. The percentages next to each bar indicate the percentage of respondents that chose each option (i.e., 85.7 percent of responding Tribes indicated lack of funding is a barrier).

*Question 12: On a scale of 1 to 10, do you feel that your Tribe has the necessary funding to meet the objectives regarding preventing and controlling invasive species?*

For this question, level one meant having none of the funding needed and 10 meant having plenty of funding to meet objectives. Tribal respondents averaged a rating of 3.64. The responses ranged from level one (7.1 percent) to level 7 (7.1 percent). Of the responding Tribes, 53.7 percent of Tribes indicated a level of 3 (Figure 11).

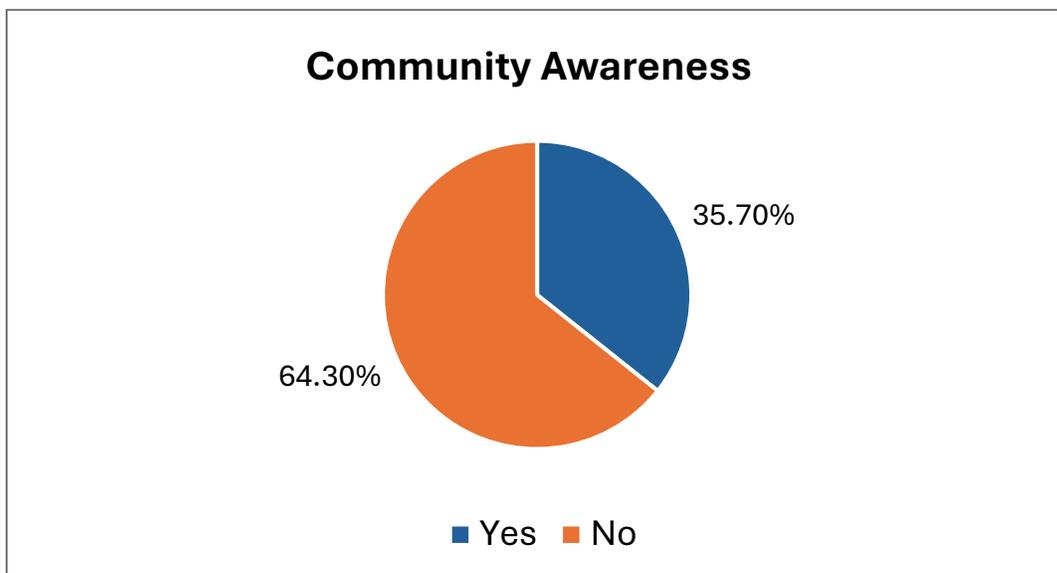


**Figure 11.** The survey answers for question 12 which asked the Tribes to rate the amount of funding they currently have to deal with invasive species. The average rating is 3.64. The percentages above each bar indicate the percentage of respondents that chose each option (i.e., 7.1 percent of responding Tribes rate their level of funding at 1).

### Community Interaction with Invasives

*Question 13: Are those whose jobs/livelihoods are directly impacted by invasive species aware of them and the consequences?*

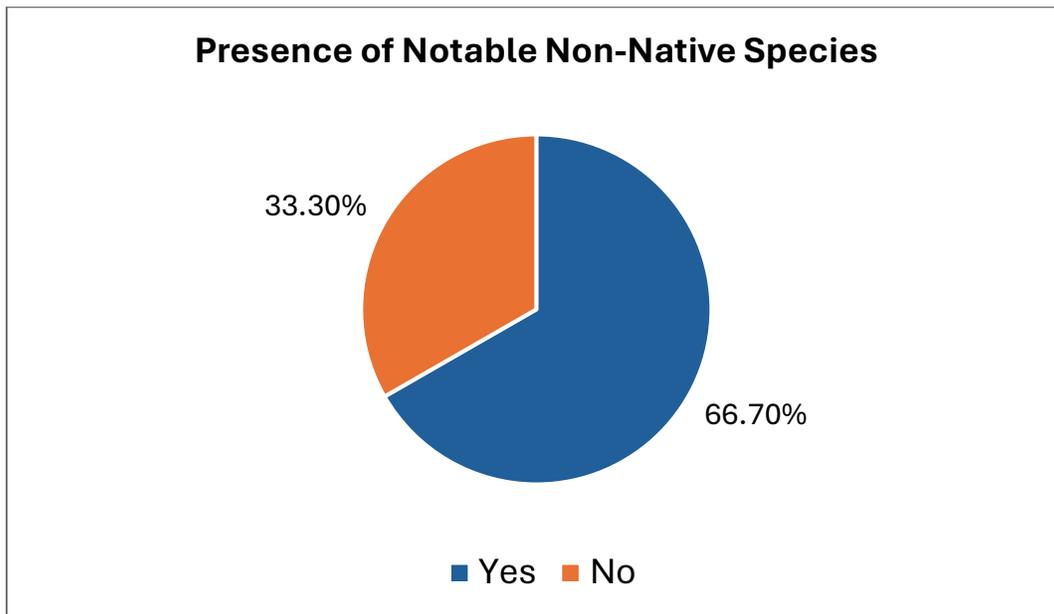
This question was asked in a yes/no format. Figure 12 shows that 35.7 percent of Tribes said yes, while 64.3 percent indicated that those who are impacted are not aware.



**Figure 12.** Shows the responses from question 13, which asked if those who have jobs that are directly impacted by the invasive species are aware of them.

*Question 14: Are any non-native species notable to your Tribe?*

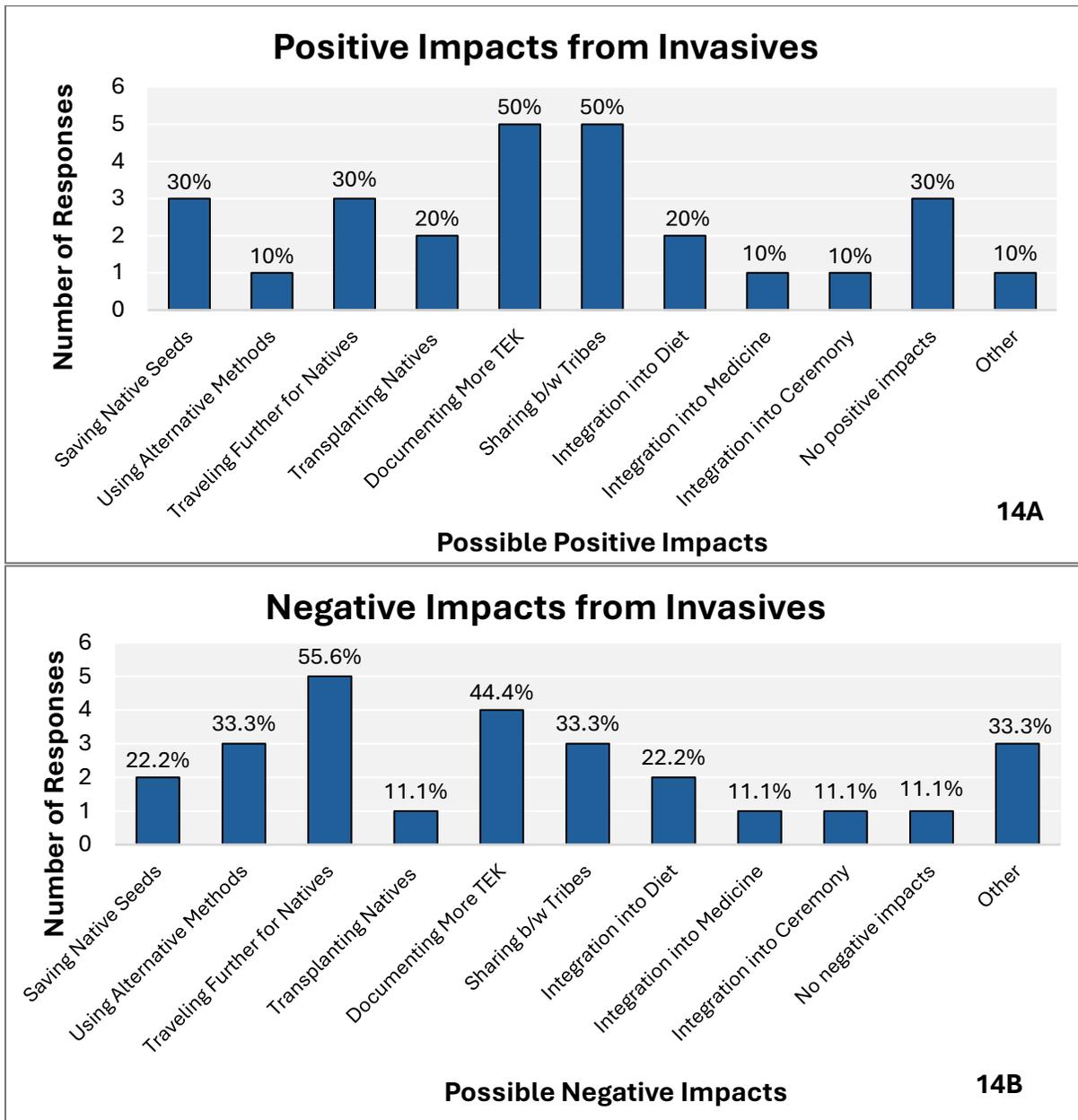
The question was asked in a yes/no format and indicates that 66.7 percent of Tribes stated that at least one non-native species was notable to them while 33.3 percent said there were none (Figure 13).



**Figure 13.** Shows the results from question 14 which asked if any non-native species are notable to the Tribe.

*Question 15 and 16: If there are notable non-native species, in which ways have they positively/negatively influenced the culture of your Tribe?*

Questions 15 and 16 asked about non-native species and their positive or negative impacts on the Tribe. Both contain the same answer choices, but the questions allowed the respondents to decide, if those impacts occur in their Tribe, whether they are positive or negative (Figures 14A and 14B). From question 15, the “other” positive response included “cover crops and forage.” In question 16, the other negative responses included “higher vegetation and removal costs,” “ecological impacts to wildlife,” “degraded gathering area,” and “impacted traditional fire regimes.”



**Figure 14.** Shows the survey results from questions 15 (Figure 14A) and 16 (Figure 14B) which asked about the positive and negative impacts on the Tribes from their experience with invasive species. The percentages above each bar indicate the percentage of respondents that chose each option (i.e., in Figure 13B, 22.2 percent of Tribes that responded indicated that saving native seeds is a negative impact from invasive species).

*Question 17: Additional comments, questions, or concerns.*

The last question asked the Tribes to provide us with any feedback regarding the survey. The main comments included the following:

- The use of “invasive” is inappropriate but “aboriginal” or “exotic” would be a better term. The term indigenous is too vague, need to specify the type of indigenous organism we are asking about.
- A few comments asked if there was an alert system to notify Tribes of the introduction of invasives or possible funding opportunities for invasive species programs.
- Finally, a few comments mention that this survey “interrelates” to their efforts.

## Conclusions

### Expectations vs Results

When sending out the survey, especially to Tribes in specific coastal counties such as Humboldt, we had assumed more of the answers would address marine invasive species. Working with MISP, we were curious to see if marine invasive species, possibly introduced by vectors such as ballast water or biofouling, would be of concern. For example, Table 1 shows various types of marine invasive species and how many have arrived in the Humboldt Bay area via ballast water, biofouling, or both (Fofonoff et. al, 2018).

Type of Species	Number species
Algae	3
Annelids - Polychaetas	9
Bryozoans	7
Cnidarians - Anthozoans	4
Cnidarians - Hydrozoans	2
Crustaceans-Amphipods	15
Crustaceans-Barnacles	1
Crustaceans-Copepods	1
Crustaceans-Crabs	1
Crustaceans-Isopods	4
Crustaceans-Shrimp	1
Crustaceans-Tanaids	1
Entoprocts	1
Mollusks-Bivalves	3
Mollusks-Gastropods	3
Protozoans	2
Sponges	3
Tunicates	10
Total Introduced Species	71

**Table 1.** Table of introduced species into Humboldt Bay (bio region p130) that have been introduced by ballast water, biofouling, or both (Fofonoff et. al, 2018).

However, based on answers to question seven about possible invasive species management, almost all of the species mentioned are terrestrial plants. The mention of

goldfish, carp, and Sacramento pike came up as answers to the question, but that is only 3 species out of the 35 listed by the Tribes, or 8.6 percent. From prior research, we expected species such as the American shad, the New Zealand mudsnail, or the signal crayfish to pop up (Fofonoff et. al, 2018; USGS NAS Database). Because the survey acted as a baseline for knowledge and impacts of invasive species, and because we wanted to encourage as many responses as possible, we did not have space to add questions specifically regarding marine invasive species.

From the results, we would like to highlight a few of the most mentioned terrestrial species that were brought up. First, the Himalayan blackberry (*Rubus armeniacus*) which is a strong competitor native to Eurasia. In California, it is found in the coastal ranges, the central valley, and the Sierra Nevada mountains. The plant can reduce soil moisture and rapidly displace native plants. It can create a dense canopy over plants that severely reduces the light getting to plants underneath and limits the growth of those plants. The Himalayan blackberry is very difficult to remove (CAL-IPC; Fryer, 2021; National Park Service, 2015; UCSD, 2022).

The second species to highlight is Scotch broom (*Cytisus scoparius*), otherwise known as the common broom, that is native to northern Africa and parts of Europe. It is found in California from the coast to the Sierra foothills and is known to spread rapidly through pastures, borders, forests, and roadsides. It was introduced as an ornamental and was frequently planted in gardens. It later became used for erosion control along highway cuts and fills. Scotch broom crowds out native species, diminishes habitat for grazing animals, is unpalatable to livestock, and is slightly toxic. It has many different factors for its success including, but not limited to, the fact that it can grow year-round due to its photosynthetic tissues, its roots can host nitrogen fixing bacteria that help it to establish itself in nutrient poor soils, and it can create seeds to produce a seedbank that can remain dormant for up to 80 years. Scotch broom also creates an increased risk for wildland fires (CAL-IPC; National Park Service, 2016; UC Davis, 2022).

Finally, the yellow starthistle (*Centaurea solstitialis*), which is native to the Mediterranean region in Europe and has invaded over 12 million acres in California. It inhabits open hills, grasslands, roadsides, fields, and rangelands. It is known to be one of the most serious rangeland weeds in the state and spreads by seed. It is a very competitive weed and has sharp spines on seed heads which dissuades livestock grazing. If allowed, animals avoid this plant, but if forced to eat it, they can develop a neurological disorder called “chewing disease” (CAL-IPC; FS USDA, 2014; National Park Service, 2020; UC Davis, 2022).

## Key Take-Homes

We have learned that the majority of responding Tribes are aware of invasive species and are concerned about invasive species impacts on Tribal cultural resources. The respondents were open about their concerns, as shown in Figure 4. Over 85 percent of the responding Tribes have taken note of invasive species, have current control/removal methods, and have specific species they are controlling. Over 70 percent of responding Tribes are looking to the future regarding species that are not yet on their ancestral land and have some form of prevention of new species introductions. We have learned that many responding Tribes feel they do not have the necessary funding for their invasive species programs.

## Recommendations

This survey was sent to Tribes in five of the 58 counties in California, all of which are in northern California. If a survey like this were to be sent to the entire state, we would be able to get a statewide baseline on invasive species and Tribe's current knowledge, methods of control and prevention, and their concerns about invasive species in general and impacts to Tribal cultural resources.

To get more targeted answers about concerns related to invasive species in certain habitats, including the marine environment, we recommend either including more specific questions or creating and sending a separate survey. This would help Commission staff understand that baseline and strengthen and promote working relationships with Tribes with respect to invasive species management in coordination with regional bodies like the Western Regional Panel on Aquatic Nuisance Species.

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