RACC

Research on Adaptation to Climate Change

2013 Water Quality Survey

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NSF

The University of Vermont

Vermont EPSCoR

I. Summary

Oriented toward the policy and governance implications of climate change on water quality of the Lake Champlain Region, the 2013 RACC Water Quality Survey seeks to understand Vermonters' attitudes toward, and awareness of, water quality, climate change, and individual and social responsibility for both. These are its key findings:

1. Vermonters are deeply concerned about water quality, more so than any other surveyed policy issue.
2. Vermonters believe that water is a public good, and that we ought to focus on the maintenance of recreational opportunities, high quality of life, and economic health as the primary impacts of water quality policy.
3. Vermonters show a strong preference for state-level responsibility for water quality, and also believe that responsibility ought to be clearly designated.
4. Vermonters are convinced that adequate funding ought to be dedicated to water quality in Vermont.
5. Vermonters are largely *unwilling* to allow tax increases or fees in order to fund water quality initiatives and enforcement.
6. Vermonters show the highest level of acceptance of one-time development fees, increased stormwater fees, and excise taxes, with the greatest acceptance being for fees or taxes that are directly related to water usage to fund water quality initiatives and enforcement.
7. Vermonters' recreational habits are significantly impacted by water quality.
8. Socioeconomic, cultural, and life stage factors influence Vermonters' perception of water quality-related legal and economic issues.
9. Vermonters have a fairly high level of confidence in experts on climate change.

The following sections go into detail on these points, as well as providing an assessment of the implications of these results for policymakers in Vermont.

This study was funded through a grant from the National Science Foundation to Research on Adaptation to Climate Change (RACC) Initiative of the Vermont Experimental Program to Stimulate Competitive Research (EPSCoR). RACC's central research question asks how "the interaction of climate change and land use alter hydrological processes and nutrient transport from the landscape, internal processing and eutrophic state within the lake," as well as what the implications are for adaptive management strategies.[1]

[1] http://www.uvm.edu/~epscor/new02/?q=node/30

This research project was conducted by Dr. Steve Scheinert in his capacity as a postdoctoral associate with RACC's Policy & Governance Team, and under the supervision of Drs. Christopher Koliba and Asim Zia. Completion of this report was undertaken by Katherine Logan, MPA candidate and Research Assistant in the Department of Community Development and Applied Economics at the University of Vermont.

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II. Scope of Study and Methods Employed

As part of its efforts to understand the links between the state of water quality in the Lake Champlain Basin and public policy decision, the Policy & Governance Team polled the population of Vermont seeking to gain a greater understanding of their opinions regarding public action to improve water quality in the Lake Champlain Basin, as well as the rest of Vermont. Our survey instrument included questions on the use of water-based recreation and resources to gain a basic understanding of the extent of public use of water bodies. We queried respondents on their level of concern about water quality both in absolute terms and relative to their level of concern for a range of other issues currently facing Vermont. This included jobs and employment, general environmental conditions, public safety, quality of life, and public spending. Relatedly, we asked about whom respondents believe bears responsibility for promoting and supporting water quality and the acceptability of certain public actions both in constructing programs and raising funds to support water quality. These last three sets of questions aimed at establishing the Vermont public's opinions regarding tradeoffs between tax levels and targets, the issues facing Vermont, including water quality, and the focus of public spending.

Previous surveys had indicated that Vermonters viewed pollution in the lake as a problem.[2] Despite decades of concern for this matter, water quality remains an important issue in Vermont. This study is designed to update these results and to place the level of public concern for water quality in a context with other issues. Rather than simply asking about the level of concern, this study includes other issues facing Vermont in an effort to understand how the Vermont public ranks the relative importance of water quality and what trade-offs the Vermont public is willing and unwilling to make to improve water quality.

A paper survey was mailed to an initial sample of 5,000 individuals. From the initial sample, we received 422 usable responses, giving an 8.44% response rate. This gives a generalized

[2] Lake Champlain Recreation Management Program, Lake Champlain Basin Program. 1995. *Developing a Recreation Plan for Lake Champlain: The Lake Champlain Recreational User Surveys*. Albany, NY: New York Office of Parks, Recreation and Historic Preservation and Vermont Department of Forests, Parks and Recreation.

confidence interval of ±4.77%, assuming 50% proportion values and a 95% confidence level (α = 0.05). This is lower than the desired response rate of 20% (n=1000), yet the set of usable responses supports general analysis. Confidence intervals for individual responses are calculated using the reported percentages of the response such that each confidence interval uses the percentage of the sample that chose that value on that question as opposed to choosing all other possible responses on that question. Among other demographic information, respondents provided a year of birth, allowing age on this year's birthday to be calculated:

$$age = 2013 - year\ of\ birth$$

Significant features of the sample

Figures 1 and 2 show the relative distribution of the survey respondents against the relevant population of Vermonters (those aged 15 and up). They indicate that the responses to the survey skew towards elderly respondents, relative to the general population of Vermont. For example, residents aged 60 and up comprise 51.6% of the respondent sample, whereas this same demographic makes up only 29.3% of the Vermont population.

Figure 1: Age distribution of respondents (n=422)

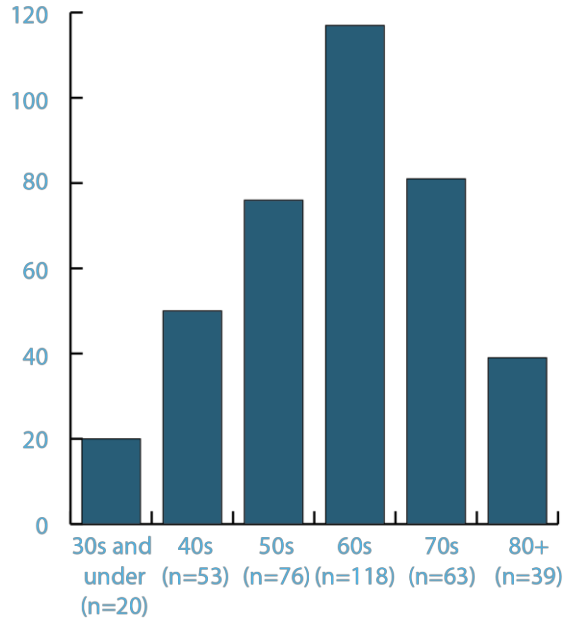
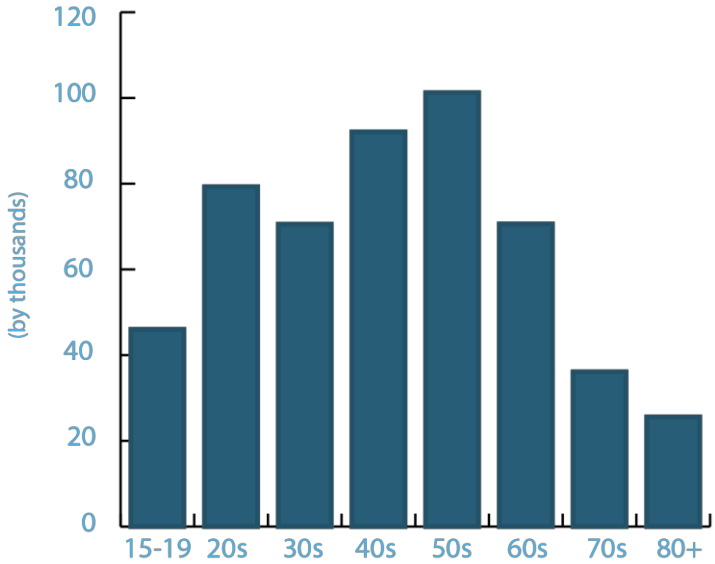


Figure 2: Actual age distribution of Vermonters (2010 Census)

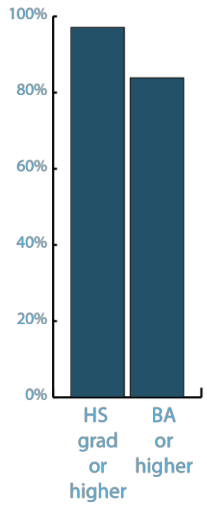


As a result of the skew of the data toward those who are older and more educated than the relevant Vermont population, more detailed data analysis will need to be performed in order to generalize all survey results in a manner that is consistent with standards for publication in a peer-reviewed research forum. *Nevertheless*, the survey results are immediately useful with respect to those issues where there is a fair amount of symmetry in the data across age and

educational background. However, where differences in education and age make a difference in relation to water quality policy, these will be noted in the following section.

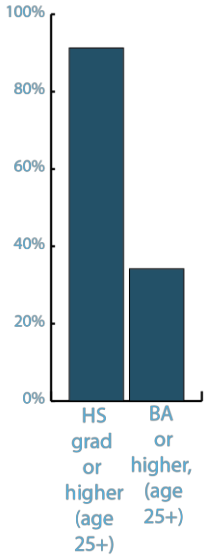
Likewise, respondents under 40 years old make up only 4.7% of the sample, but 43.4% of the Vermont population. There is slightly less underrepresentation for those in their 40s and 50s. Respondents in their 40s make up 12.6% of the sample, compared to 20.4% of the population of Vermont, while respondents in their 50s make up 18.0% of the sample and 22.5% of the population of Vermont.

Figure 3: Education distribution of respondents (n=422)



The sample also skews towards highly educated respondents. Nearly 30% of respondents report holding graduate or professional degrees, more even than bachelors' degrees. Further, as seen in Figure 3, those with bachelor's degrees comprise 83.9% of the sample, while only representing 34.2% of the Vermont population (aged 25 and up).

Figure 4: Actual education distribution of Vermonters (2010 Census)

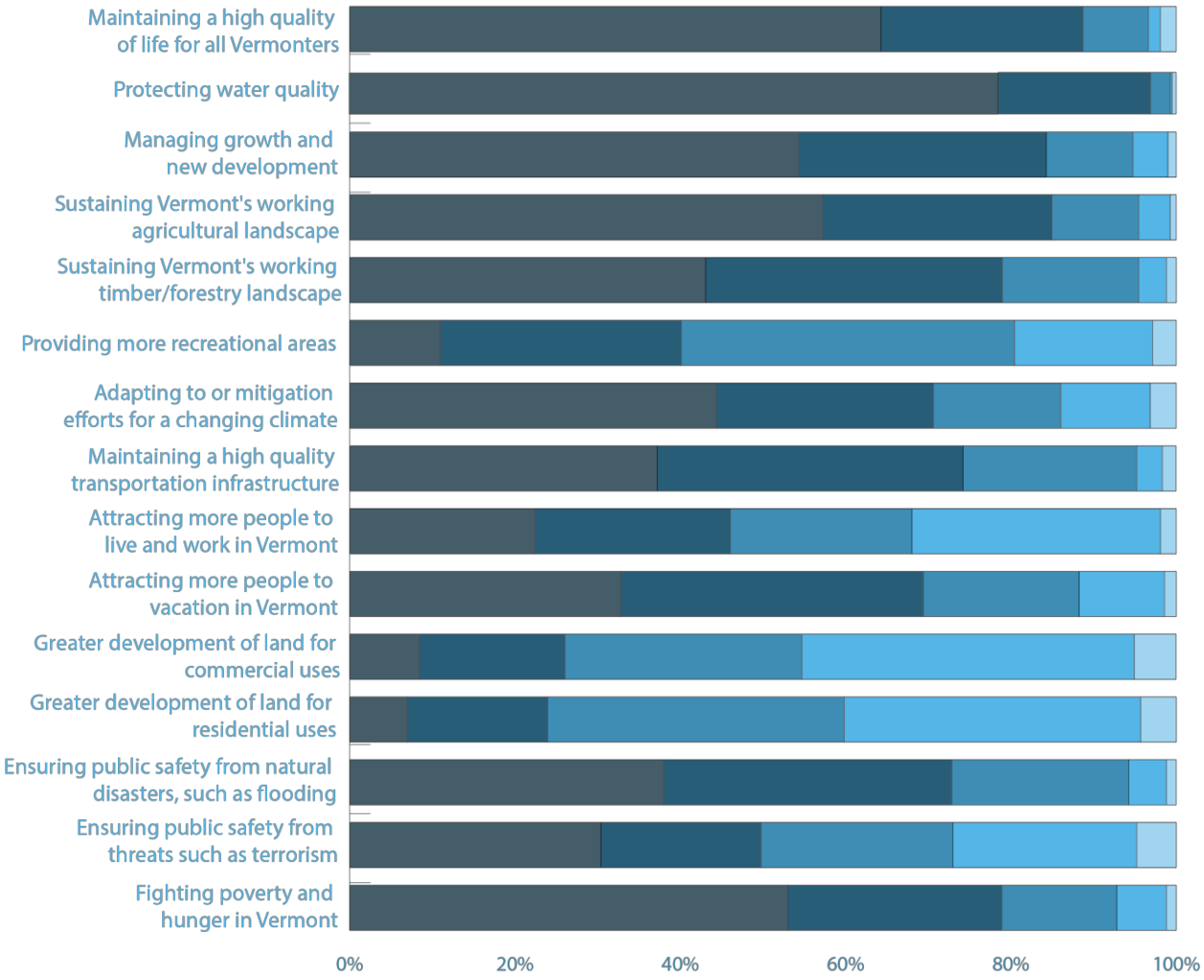


III. Vermonters' Attitudes towards Water Quality and Climate Change

1. Vermonters are deeply concerned about water quality, more so than any other surveyed policy issue

The survey asked what importance Vermonters would assign to various policy issues. Figure 5 below provides a listing of those policy issues and the corresponding results. Respondents find water quality a particularly important issue, more so than any other surveyed policy issue.

Figure 5: Vermonters' Policy Priorites (n=422)



Issues that are "very important" to Vermonters

As seen in the figure above, survey respondents are more concerned about water quality than any other surveyed policy issue.[3] Fully 96.9% of respondents ranked water quality as "moderately important" or better, with 78.5% of respondents ranking water quality as "very important." See Section III.2, below, for more detail regarding Vermonters' particular concerns regarding water quality.

[3] This may demonstrate somewhat of a response bias: those who care about water quality might have been more likely to take the time to respond to the survey.

Likewise, there are a few other policy issues around which almost all respondents had a general consensus: quality of life; economic growth and development; agriculture; and social welfare. For each of these issues, over half of all respondents ranked them as "very important."

As a result, it might be possible to see a close link between Vermonters' concerns about water quality and their concerns about the well-being of *all* Vermonters. For example, 88.73% of respondents considered the maintenance of high quality of life for all Vermonters as "moderately important" or better. Likewise, 78.9% of respondents believe that there is a need for increased attention to poverty and hunger in Vermont. Related to these are respondents' concerns regarding the need for increased economic growth and development, as well as the need to sustain Vermont's "working agricultural landscape" and timber industry with 84.3%, 85.0%, and 79.0% of respondents, respectively, ranking these issues as "moderately important" or better, indicating that these issues are of significant importance to Vermonters.

Issues that are "moderately important" to Vermonters

In the mid-range, several issues surfaced as holding significant but moderate importance to the majority of respondents: transportation; natural disaster response; climate change response; and tourism. While less than half of respondents ranked these issues as "very important," a significant majority ranked them as "moderately important" or better. Responses are nearly evenly split between "very important" and "moderately important," and approximately 70% of respondents rank these issues as "moderately important" or better.

Issues that are less or not important to Vermonters

There are a few issues to which Vermonters assign less importance: providing for more recreational areas; attracting more people to live and work in Vermont; ensuring public safety from threats such as terrorism; and development of land for either commercial or residential use.

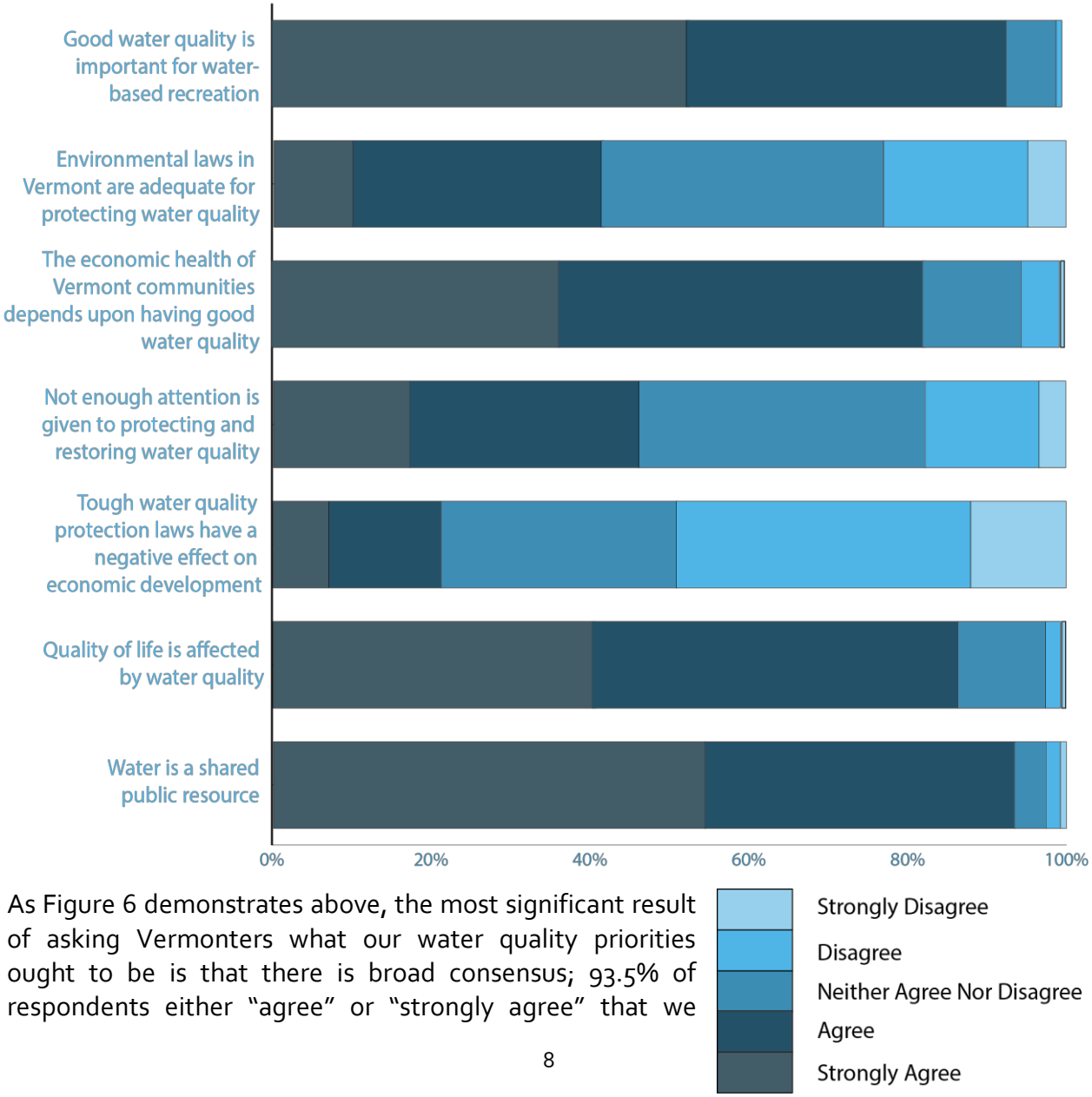
The most significant result at the low end is that Vermonters show a marked lack of interest in the development of Vermont land for either commercial or residential use. 68.9% and 71.8% of respondents, respectively, ranked these issues as either "not important" or only "slightly important." While this survey was designed primarily to indicate policy priorities regarding water quality, this result suggests that Vermonters prefer redevelopment of already developed areas over the development of new commercial and residential areas.

In the more moderate range, respondents assigned moderate to slight importance to recreational areas, public safety, and attracting new Vermonters. With respect to the first, 69.5% of respondents ranked this issue as either "slightly important" or "moderately important," with 40.3% ranking it as only "slightly important."

By contrast, respondents showed higher overall support for the need to attract new Vermonters and ensure public safety. Respectively, 68.0% and 73.0% of respondents ranked these two issues as "slightly important" or better, with the responses fairly evenly split among "slightly important," "moderately important," and "very important." While the majority of respondents did not offer moderate to high support for these issues, they remain relevant, though of lesser importance to Vermonters.

2. Vermonters believe that water is a public good, and that we ought to focus on the maintenance of recreational opportunities, high quality of life, and economic health as the primary impacts of water quality policy

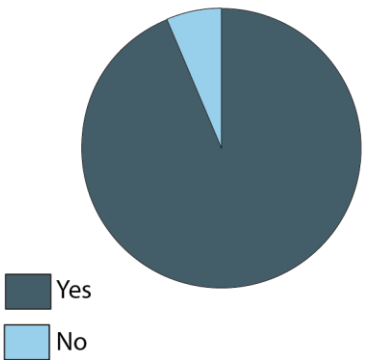
Figure 6: Vermonters' Water Quality Priorities (n=399)



As Figure 6 demonstrates above, the most significant result of asking Vermonters what our water quality priorities ought to be is that there is broad consensus; 93.5% of respondents either "agree" or "strongly agree" that we

ought to consider water a public good. In addition, three areas emerged as the most important policy priorities for Vermont's water quality agenda: water-based recreation (92.3%); quality of life (86.6%); and economic health (82.3%). Section III.7 has more details on the impacts of water quality on Vermonters' recreation habits and, thus, on their quality of life.

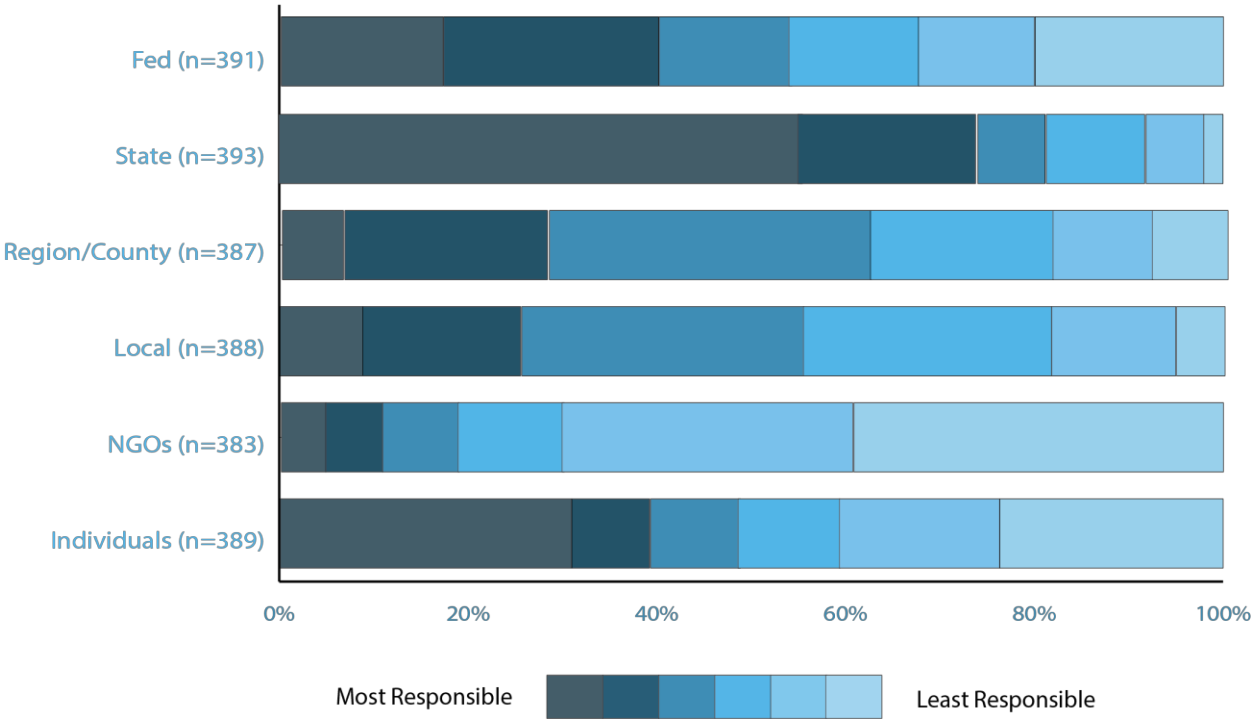
Figure 7: Should responsibility for water quality oversight be designated? (n=422)



3. Vermonters show a strong preference for state-level responsibility for water quality, and also believe that responsibility ought to be clearly delegated

As is made very clear in Figure 7 to the right, Vermonters express an almost universal preference for the clear designation of oversight control regarding water quality issues. 93.8% of Vermonters support clear designation of oversight.

Figure 8: Where does the responsibility lie for ensuring water quality?



As Figure 8 shows, there is high support for the designation of state-level responsibility for water quality. 55.5% of respondents assign the highest level of responsibility to the state, and a

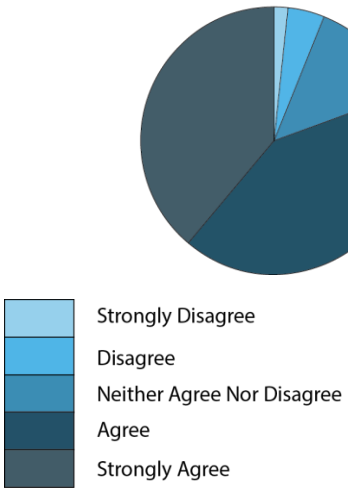
full 81.4% of respondents assign a rank of 1, 2, or 3[4] for the state, Including the full range of rankings regarding the state results in a mean responsibility score of 2, a full 1.27 points lower than the next highest. Regional or county responsibility scored a moderate 3.27, with local, federal, and individual responsibility falling close behind at 3.31, 3.41, and 3.44, respectively. Only NGOs were scored as having virtually no significant responsibility, at an average of 4.75.

4. Vermonters are convinced that adequate funding ought to be dedicated to water quality in Vermont

Consistent with the above findings, that Vermonters are broadly convinced that the responsibility for water quality lies at the state level, it ought to be no surprise that survey respondents also place a high level of importance on the need to adequately fund water quality initiatives at the state level.

As seen in the Figure 9 to the right, 80.4% of respondents agree or strongly agree that the state has an obligation to raise sufficient funds to for water quality. However, as will be shown in the following, there is far less support for any tax raises associated with the need to maintain or increase water quality standards.

Figure 9: It is important that the State of Vermont raise adequate funds to manage, protect and restore water quality (n=418)

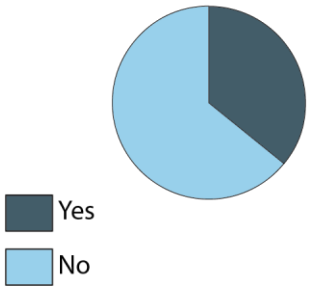


5. Vermonters are largely unwilling *to allow tax increases or fees in order to fund water quality initiatives*

Although Vermonters think that water quality is a top priority concern, and despite the fact that they largely agree that the state government ought to accept responsibility and ensure adequate funding for water quality initiatives, there is far less enthusiastic support for raising taxes to cover the expense of these initiatives.

As can be seen in Figure, 62.8% of respondents reject an increase in taxes. In another survey question, respondents were equally split as to whether or not the kind of tax makes a difference in whether or not they would support

Figure 10: Is a raise in taxes for water quality acceptable? (n=414)

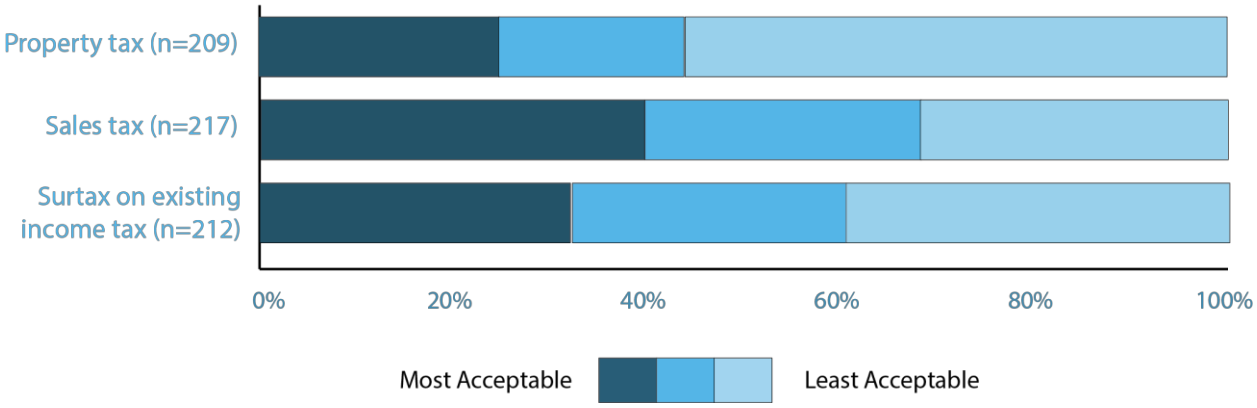


[4] 1=most responsible, 6=least responsible

its use for funding water quality initiatives. This fact turns out to be significant, because even though there is general lack of support for a variety of kinds of taxes, the next section will show where respondents are willing to fund spending increases. Before that, however, it is worth showing the survey results regarding other kinds of taxes and fees.

As Figure 10 shows, respondents were hesitant to accept additional taxes. Figure 11 clarifies their opinions. Respondents were asked to state their acceptance of different kinds of general taxes on scale of 1 to 3, with 1 as "most acceptable" and 3 as "least acceptable." Respondents

Figure 11: Acceptability of different kinds of taxes



gave relatively high average scores to all three options. Sales tax scored the lowest, meaning that it was regarded as the most acceptable, with an average score of 2.0. Additional property tax and a surtax on existing income tax were deemed slightly less acceptable on average, with scores of 2.3 and 2.1, respectively.

Figure 12: Acceptability of different sizes of tax increase

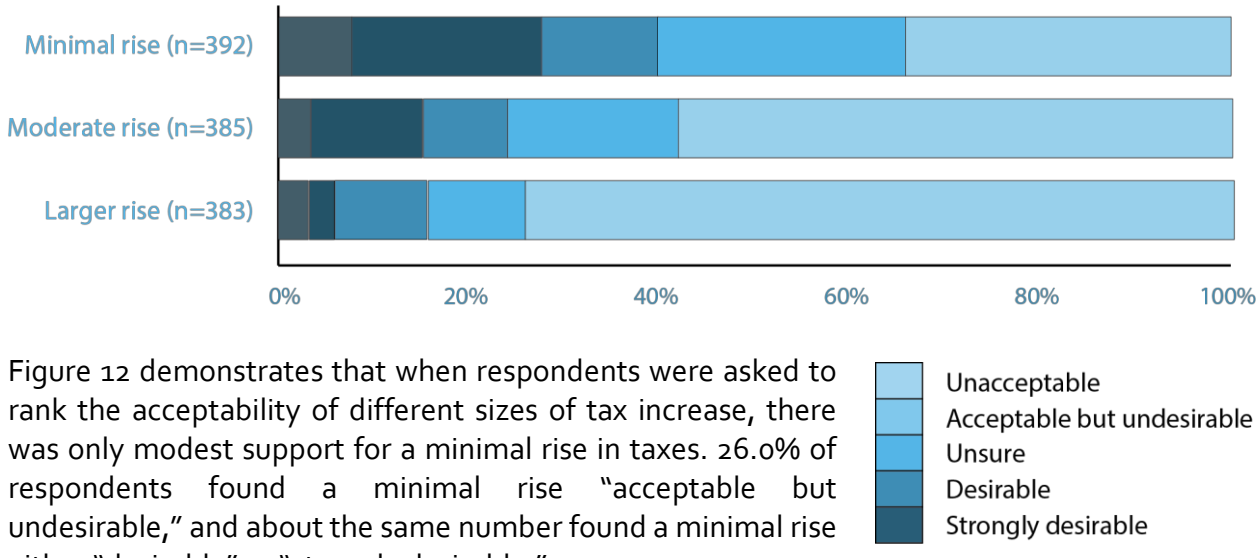
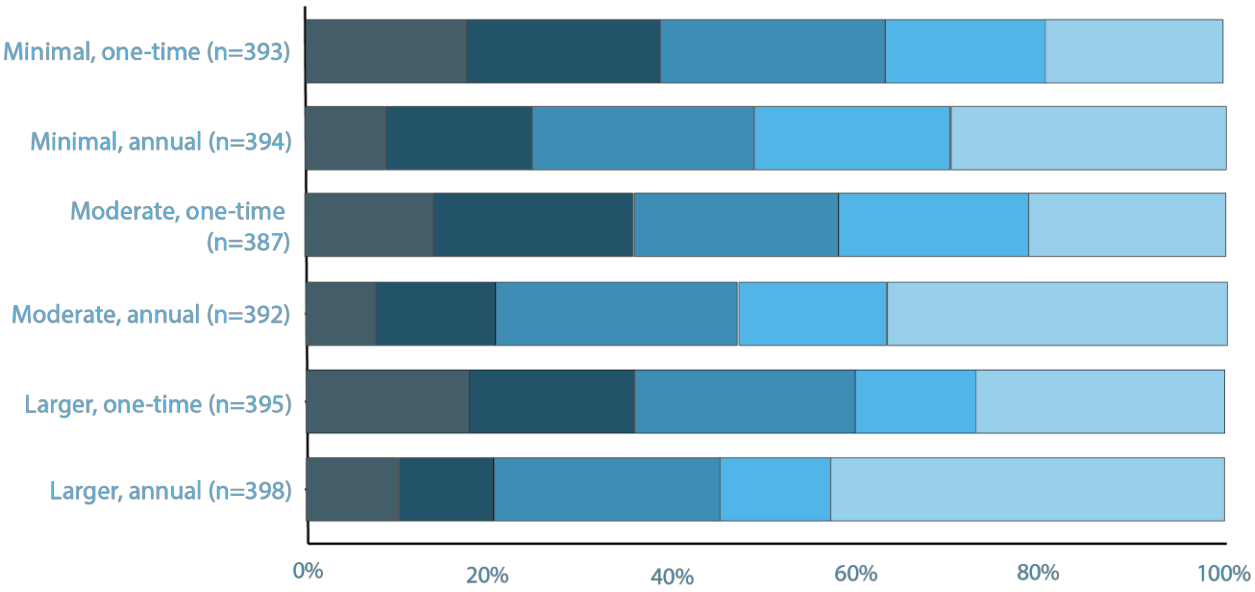


Figure 12 demonstrates that when respondents were asked to rank the acceptability of different sizes of tax increase, there was only modest support for a minimal rise in taxes. 26.0% of respondents found a minimal rise "acceptable but undesirable," and about the same number found a minimal rise either "desirable" or "strongly desirable."

6. Vermonters show the highest level of acceptance of one-time development fees, increased stormwater fees, and excise taxes

Development fees

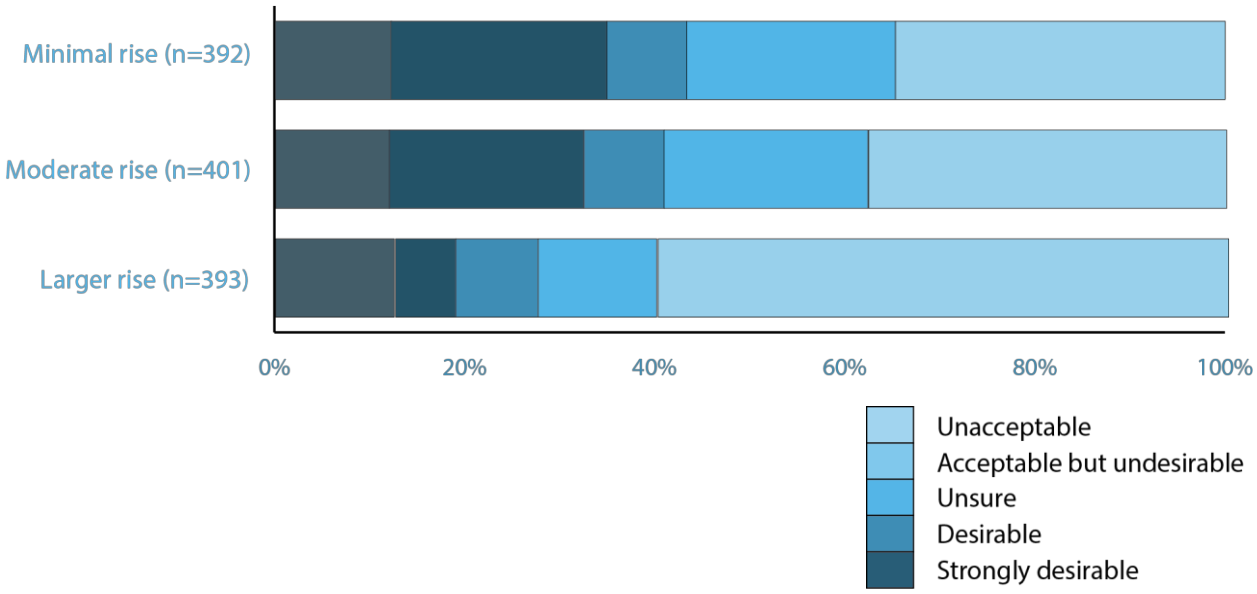
Figure 13: Acceptability of development fees



Regarding development fees, annual fees were found "acceptable but undesirable" or better by less than half of all respondents for each level of funding. This is demonstrated in Figure 13 (below). The same was not true for one-time development fees. Over half of respondents found minimal and moderate one-time fees "acceptable but undesirable" or better (56.2% and 56.3%, respectively), while almost half (48.9%) found a larger, one-time development fee "acceptable but undesirable" or better. Of those who found a fee "desirable," a moderate one-time development fee was considered the most desirable, at 20.7% of respondents. Of those who found a fee "strongly desirable," a minimal one-time development fee was considered most desirable, at 19.34% of respondents. Thus, while there is not overwhelming support for the implementation of development fees, Vermonters do consider these kinds of fees more acceptable than traditional tax increases.

Stormwater fees

Figure 14: Stormwater fee



The majority of respondents (56.9%) would support a minimal rise in stormwater fees, though 21.9% still find this "acceptable but undesirable" (see Figure 14). About the same number would support a moderate rise (54.0%), but very few would support a larger rise (31.3%). This indicates that stormwater fees have roughly the same level of acceptability as minimal or moderate one-time development fees.

Excise taxes

One exception in the level of acceptability of taxes are the implementation of excise taxes in general and on motor fuels specifically. As Figure 15 to the right shows, the majority of respondents (58.3%) indicate that excise taxes are acceptable for this purpose.

Thus, of all of the alternatives to traditional tax increases, excise taxes are regarded as the most acceptable means for funding water quality initiatives.

Figure 15: Are excise taxes for water quality acceptable? (n=402)

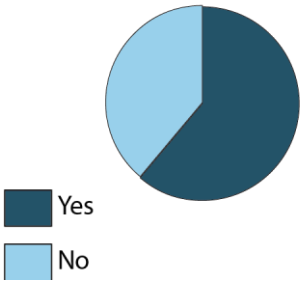


Figure 16: Acceptability of different kinds of excise tax

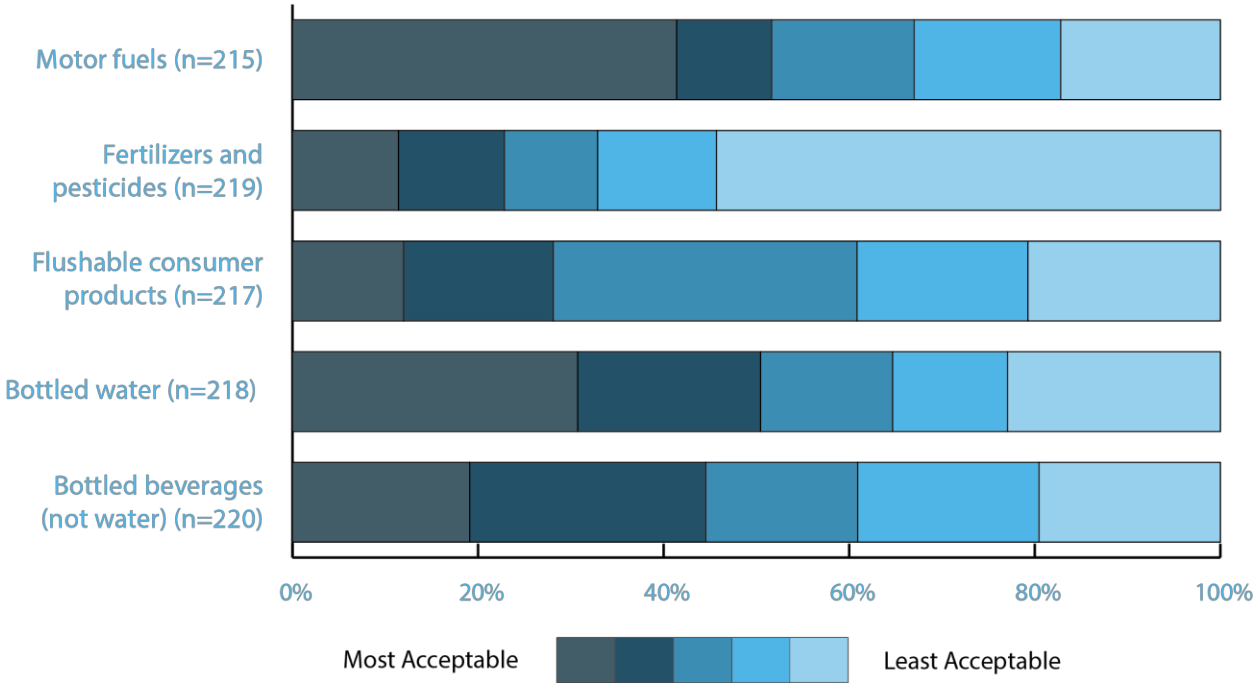
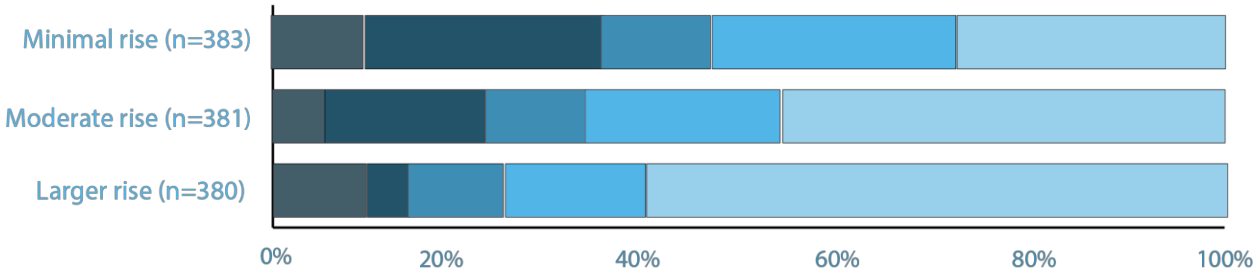


Figure 16 demonstrates that among those who expressed varying levels of acceptance for excise taxes on a variety of products, motor fuels emerged as the most acceptable and the only for which the data shows a high level of tax acceptability. On a scale of 1 to 5, with 1 as "most acceptable" and 5 as "least acceptable, 67.0% of respondents ranked motor fuels as acceptable (3) or better, with a mean score of 2.6. A tax on bottled water was the next most acceptable, with a mean score of 2.8. Other options were deemed increasingly less acceptable, in this order: tax on bottled beverages (3.0); tax on flushable consumer products (3.2); and a tax on fertilizers and pesticides (3.9).

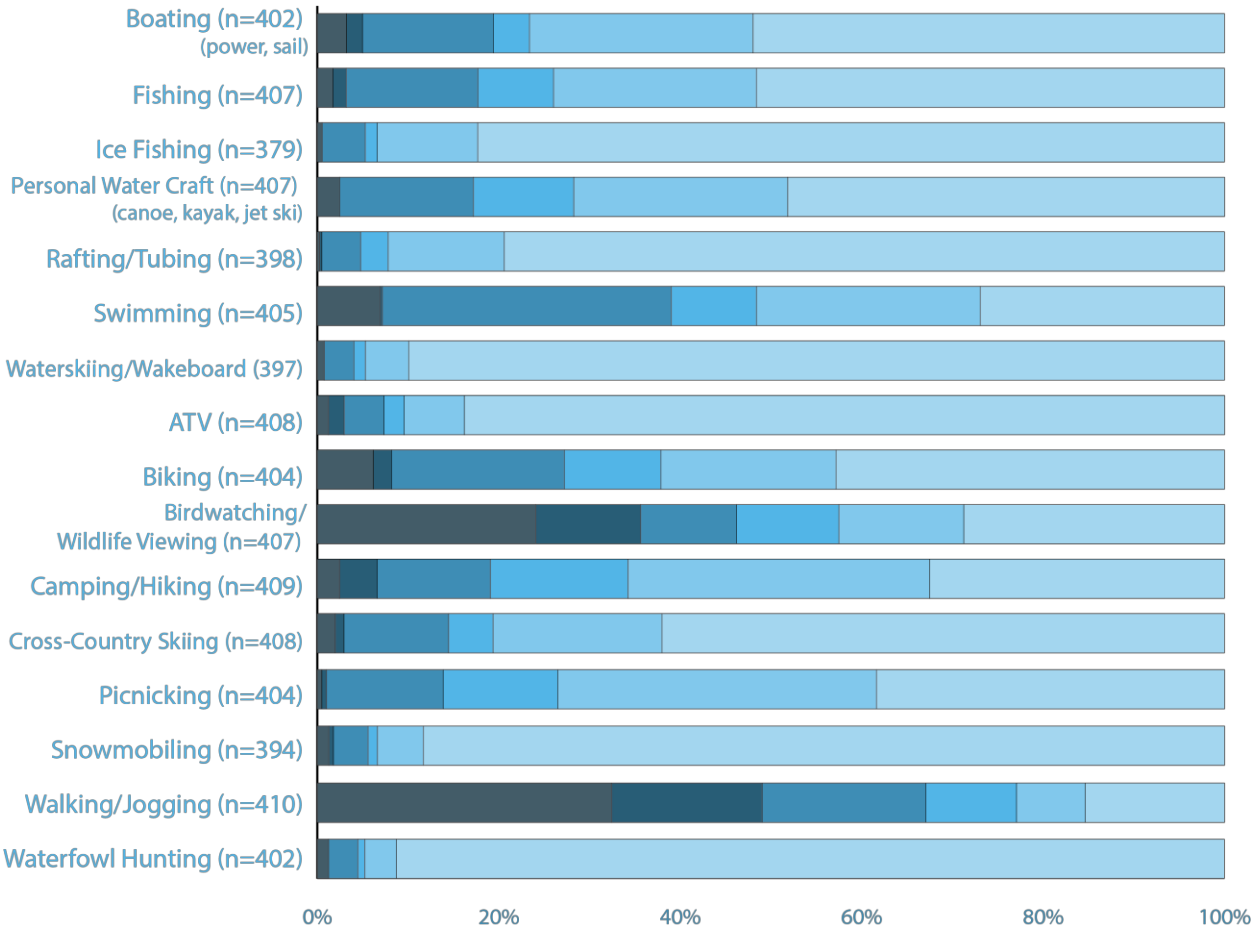
Regarding the level of excise tax that respondents would consider acceptable, figure 15 (below) shows that a minimal rise is deemed the only acceptable option, where 60.3% of respondents rank a minimal rise in excise taxes as "acceptable but undesirable" or better. A moderate rise fell far short of a majority, at 42.8%, and a larger rise garnered a ranking of "acceptable but undesirable" or better from only of 28.7% of respondents.

Figure 17: Acceptability of different sizes of excise tax increase



7. Vermonters' recreational habits are significantly impacted by water quality

Figure 18: Vermonters' Outdoor Recreational Habits

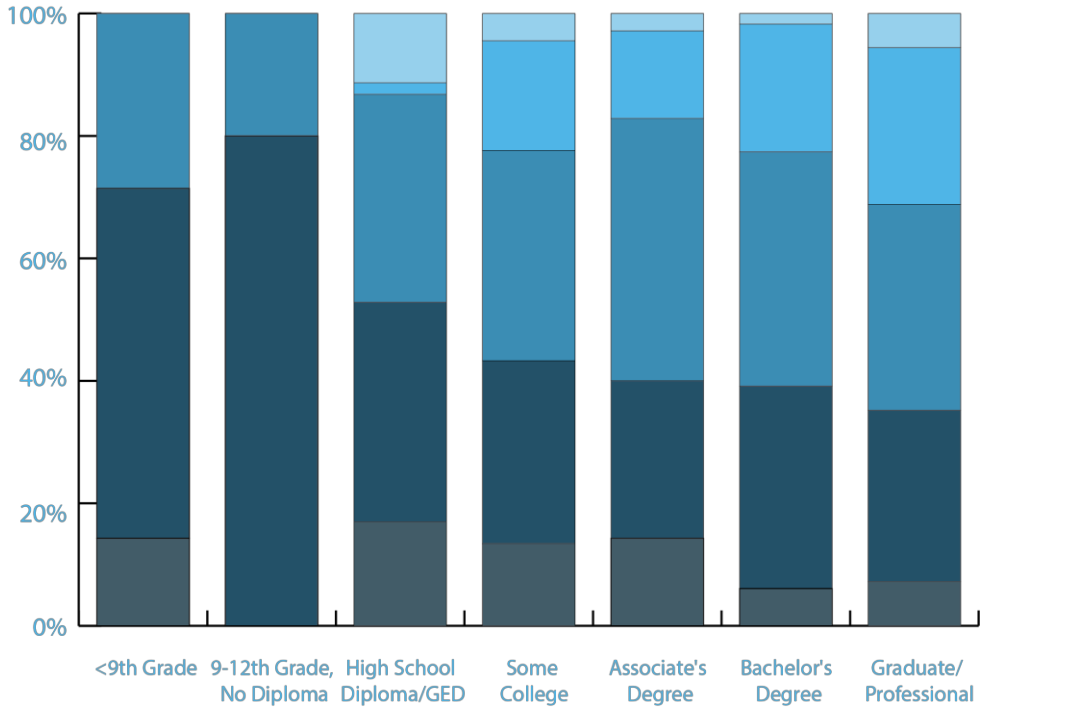


Despite their reticence to support the financial means necessary to fund water quality initiatives, the survey results suggest that respondents' quality of life is deeply tied to water quality issues. As seen in Figure 18, the most common recreational habit for survey respondents was walking and jogging, an activity that is not necessarily immediately impacted by water quality issues. However, the next most common activities—swimming and birdwatching/wildlife viewing—would be significantly impacted by decreased water quality. In the case of swimming, this impact would be felt in a direct manner. In the case of birdwatching/wildlife viewing, this impact would be felt indirectly. As riparian zones and wildlife habitats degrade through decreased water quality, the accessibility of natural spaces suitable for these activities will decrease for Vermont residents.

Further, there are small populations of regular recreational watersports participants—boaters, fishermen, ice fishermen, personal water craft users, rafters/tubers, water-skiers and wake boarders, and waterfowl hunters—who would likely form a significant water quality advocacy coalition if organized around recreational watersports. This is especially true if swimmers and birdwatchers/wildlife viewers were considered as part of this coalition. In other words, the survey as designed does not immediately indicate the scale of impact that decreased water quality would have on the outdoor recreation habits of Vermonters, but combining their results reveals a significant coalition that could be organized as defenders of Vermont's waterways.

8. Socioeconomic, cultural, and life stage factors influence Vermonters' perception of water quality-related legal and economic issues

Figure 19: Adequacy of Vermont's environmental laws for protecting water quality (by level of education, n=407)



As noted in Section II, the skewed nature of the data is problematic for interpreting the results of this survey where there is inconsistency in opinion over demographic categories. In this section, we highlight one such area where a difference across demographic categories makes a significant difference in the results of the survey.

In this case, Figure 19 (above) demonstrates that a respondent's level of education shows a divergence in opinion regarding the adequacy of current laws for the protection of Vermont's water quality. While a significant portion of respondents neither agreed nor disagreed (36%),

of those who either agreed or disagreed (n=257), 41.5% believe that Vermont's laws are adequate for protecting water quality. However, of those with high school education or lower (n=44), this percentage rises to 84.0%. This suggests that education on climate change and its effects on water quality must be a public priority in moving Vermont towards a broad and effective regulatory response to challenges to water quality as a result of climate change.

Since the sample is skewed towards greater education and older Vermonters, it is important to check how these results relate to education and age, to allow for adjusting our interpretations so that they are more representative of the Vermont population. Crosstabulation of education with the acceptability of a larger rise in stormwater fees, Table 2, illustrates a pattern that was seen in many crosstabulations of education and fee acceptability. Though Table 2 clearly shows that respondents predominately found the increase unacceptable, it does show that its acceptability rises with education; those with the greatest education attainment find this increase in fees to be much more acceptable, even strongly desired, while few. These results provide some evidence to suggest that greater education does increase support for the means to pay for water quality programs. This pattern is also seen in the relationship between education and the acceptability of a minimal, one-time development fee; a minimal, annual development fee; a moderate rise in excise taxes, and a larger rise in excise taxes. No other relationship between education and a raise in fees showed a statistically significant relationship.

Table 1: Acceptability of a Larger Rise in Stormwater Fees Based on Education

Education	Unacceptable	Acceptable	Unsure	Desired	Strongly Desired	Total
<9th Grade	6	1	0	0	0	7
9-12th Grade, No Diploma	0	1	1	0	2	4
High School Diploma/GED	36	6	4	0	2	48
Some College	48	4	5	1	7	65
Associate's Degree	21	3	3	2	2	31
Bachelor's Degree	66	14	11	9	11	111
Graduate/ Professional	55	17	10	13	25	120
Total	**232**	**46**	**34**	**25**	**49**	**386**

Table 3 presents the analogous analysis for controlling for age. Despite the skew in the data, and despite the results from education, this is the case in which age has a statistically significant relationship with a survey response. The majority of respondents is still opposed to raising property taxes and finds it less acceptable than other means of tax-based funding, as included in Figure 11. However, there is a spike in acceptability where those later in life show a movement towards preferring property tax raises to other tax-based funding means. This preference peaks in for those who are in their 60s before falling back down afterward.

Table 2: Acceptability of Raising Property Taxes Based on Age (1 is Least Acceptable; 3 is Most Acceptable of Tax Options)				
Age Categories	**1**	**2**	**3**	**Total**
Age: 20s	3	0	1	4
Age: 30s	1	1	3	5
Age: 40s	13	2	11	26
Age: 50s	13	9	14	36
Age: 60s	42	10	12	64
Age: 70s	27	8	7	42
Age: 80s and older	18	10	4	32
Total	**117**	**40**	**52**	**209**

9. Vermonters have a high level of confidence in experts on climate change

Finally, one result of the survey that ought to be of interest to policymakers is that the majority of respondents have confidence in experts' assessment of climate change (see Table 3 below). This ought to empower policymakers to draw heavily from climate change science when attempting to persuade their constituents of the necessity and viability of a particular climate change policy. This is especially salient given the results of Section III. 8 above, which indicates that environmental education ought to be a priority for policymakers.

Table 3: How clearly do you think scientists understand climate change?		
	Freq.	**Percent**
Very clear understanding	60	16.13%
Clear understanding	169	45.43%
Unclear understanding	93	25%
Very unclear understanding	30	8.06%
Don't know	17	4.57%
Total	372	100%

IV. Implications

There is broad support for the idea that the state of Vermont holds the greatest responsibility for maintaining and improving water quality. This ought to give policymakers the assurance that they need to move forward with a water quality agenda. Given the relatively high level of confidence in experts on climate change among Vermonters, legislators and other policymakers may draw heavily upon the best science available in order to educate their

constituents regarding the water quality challenges that Vermonters face as a result of climate change.

The survey results show that water quality is an important issue to Vermonters, and that decreased water quality stands to disrupt the high quality of life that Vermonters value. However, funding for water quality initiatives must be carefully designed, relying upon excises taxes and fees, rather than broad-based taxes. Indeed, the survey still shows a considerable unwillingness to raise additional funds to support water quality programs, despite the greater preference among the elderly for raising property tax, the indication that greater education increases willingness to the means of raising additional funds, and the sample's skew towards both the elderly and the more educated. This underlines the result that Vermonters are concerned about water quality but will only accept limited means to raise additional funds to promote it.

V. Conclusions

This survey produced a wide range of results, each discussed in detail above. Vermonters reported that they are concerned about water quality, and that it is one of their leading policy concerns. More than any other place in the governance system, Vermonters place responsibility for maintaining water quality with state government and want to see water quality adequately funded. However, Vermonters are largely unwilling to support additional fundraising mechanisms. Nevertheless, higher levels of education link to greater support for additional fundraising. Together, this indicates that Vermonters are well-informed of the issue and its importance, while additional outreach about the state's efforts could build from that awareness to increase Vermonter's willingness to support additional fundraising. Without additional fundraising, these results indicate public support for shifting state funds towards water quality promotion.