Supplemental Information:AIS Explorer 5 Step User Guide

Supp.1. Stage 1 – Selecting species and lakes of interest

The user first specifies which species they would like to develop an intervention scenario for by selecting from a drop-down menu. At the time of publication, these choices include zebra mussel (*Dreissena polymorpha*), starry stonewort (*Nitellopsis obtusa*), or 'all' species (both zebra mussel and starry stonewort).

The user will then select a list of lakes of interest by picking individual lakes and/or groups of lakes from a data table of potential lakes within the selected jurisdiction(s). A total of 8,315 lakes are selectable. Each entry in the table contains relevant details about the lake, including the division of waters (DOW) lake identifier, the county or counties that the lake resides in, and invasive species present in that lake (zebra mussels and/or starry stonewort). The selected lakes for inspection will be carried over into Stage 2.

Supp.2. Stage 2 – Define effort

The user sets an overall effort percentage for each of the three intervention categories – watercraft inspections, hot water decontamination and education and outreach. We define effort as the proportion of total boats visiting that lake yearly that are subjected to the intervention. For example, if 1000 boats come through a lake and 200 are inspected, the inspection effort is 20%. The total number of boats coming through each lake was determined by an adjacency matrix from Kao et al. (2021).

The selectors for effort are populated by default percentages that yield the following approximate numbers of boats intervened upon across all chosen lakes: 1) watercraft inspections: 20,000 across all chosen lakes or 15% effort, whichever is lower; 2) hot water decontaminations: 140 across all chosen lakes or 0.1% effort, whichever is lower; 3) education and outreach: 40,000 boaters reached across all chosen lakes or 50% effort, whichever is lower.

These values were chosen to keep effort levels realistic. However, users can apply these default values to their entire selection of lakes, set their own values, or edit the effort for each lake and/or intervention type individually within the data table view on the lower half of the tab. In real-time, the total number of boats to be intervened upon is displayed for reference. The selected intervention effort percentages are then carried through into Stage 3.

Supp.3. Stage 3 – Define effectiveness

The user sets an effectiveness percentage for each of the three interventions. We define effectiveness for a given intervention as the proportion of risky boats intervened upon that are rendered harmless by that intervention. For example, if 200 risky boats are inspected and the effectiveness is 80%, 160 boats fewer boats will be risky when they enter their next lake. We acknowledge that, in reality, an intervention's effectiveness should be measured per boat (e.g., an individual boat's risk is reduced by 80% following inspection rather than reduced to 0%), not as a proportion of all boat movements (e.g., 80% of boats now have 0% risk and 20% of boats have 100% risk following inspection). Regardless, the outcomes would be the same mathematically and our approach is more intuitive for estimating effectiveness values for end users.

A range of default effectiveness estimates are provided for each intervention method, but these default values can be modified. Default values were obtained from a study completed by Angell et al. (2024) wherein researchers observed boaters and trained AIS professionals as they attempted to remove AIS from a boat that had been staged with AIS. The study estimated that, on average, watercraft inspectors were 79% effective, hot water decontaminators were 84% effective, and boaters were 56% effective in AIS removal; these values were set as the "medium" effectiveness default values in the tool. The "low" and "high" effectiveness levels are set to the lower and upper 95% confidence interval bounds of the estimates from Angell et al. (2024).

Users can apply these default values to their entire selection of lakes, set their own custom values, or edit the effectiveness for each lake and/or intervention type individually within the data table view on the lower half of the tab. The selected intervention effectiveness percentages are then carried through into Stage 4.

Supp.4. Stage 4 – Define cost

The user sets a cost estimate for each of the three intervention categories on a per-intervention basis. Default values are provided but can be modified. The default cost values per AIS intervention were determined using spending data obtained through interviews with county AIS managers. We prioritized county-level AIS managers given the availability of the annual Minnesota AIS Prevention Aid funding ($10 million) shared between counties (n = 87) with individual autonomy to make spending decisions (Minnesota Department

of Revenue 2024). County managers were selected based on the completeness of summary data provided to the MN DNR describing their AIS spread prevention plans to ensure we captured a variety of prevention strategies, budget amounts, and geographic location (Minnesota Department of Natural Resources 2023c). County managers were emailed using a standardized email template asking for voluntary participation in this study and informing them of what monetary information we would be collecting (Angell et al. 2024a). Cost estimates were collected for watercraft inspection, hot water decontamination, and boater education.

Interviews lasted approximately one hour, with email conversations following the interview, if needed. During the interviews, itemized spending information was obtained for each prevention method of interest (Table 1). Funds spent on multi-year equipment were divided by the expected lifespan of the equipment to obtain an annual equipment expense. For example, if the expected life of a tablet is 2 years and the cost is $500, the annualized cost would be $250.

To estimate the average cost per intervention, we first determined the total cost of watercraft inspection, hot water decontamination, and boater education for each interviewed county. The total cost was then divided by the number of interventions conducted. For example, if $10,000 was spent on watercraft inspection and the county manager reported doing 500 inspections, the result would be $20/inspection. The cost-per-intervention values were then averaged across counties to obtain one cost-per-intervention value for each of the three prevention types.

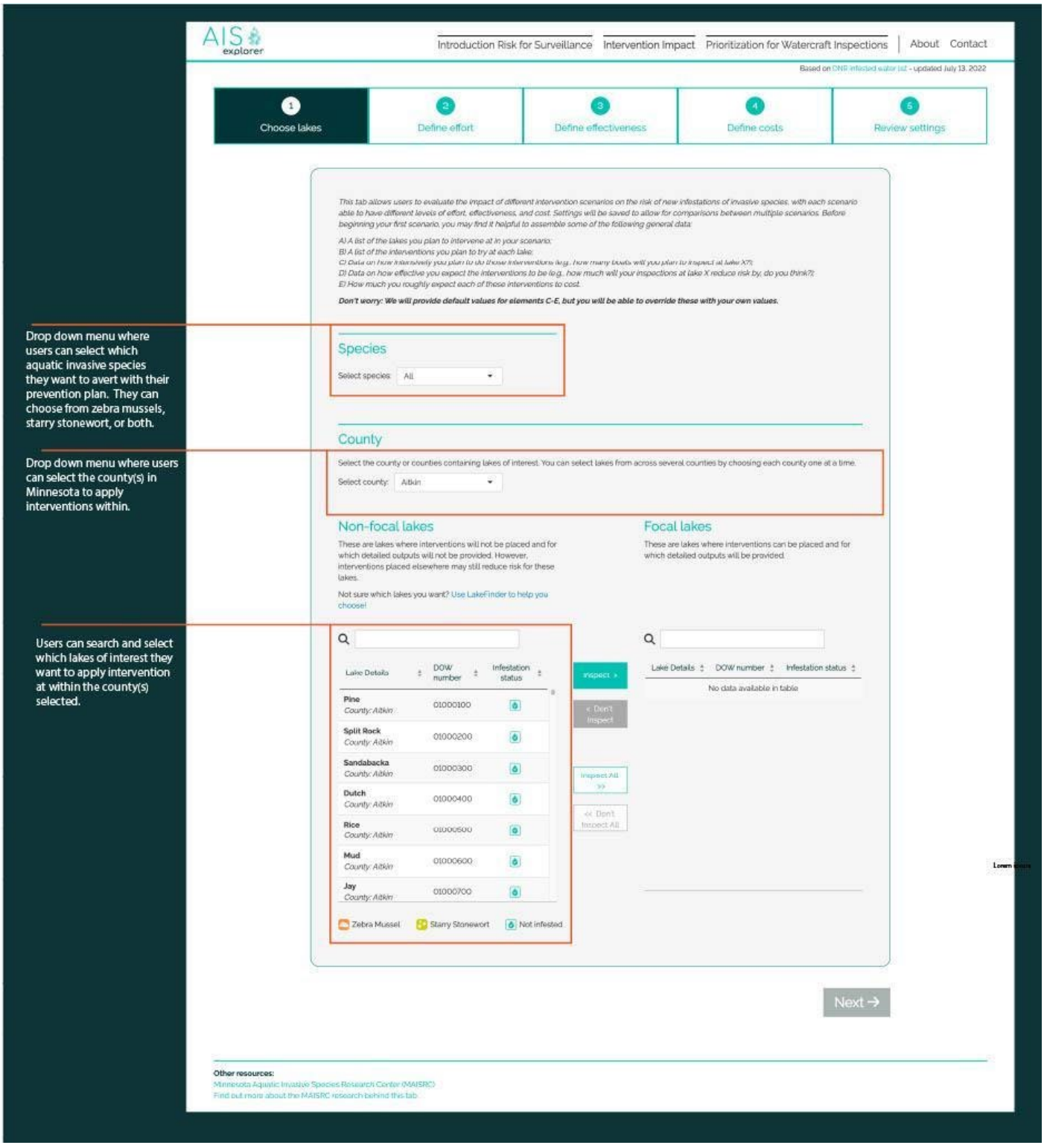
The user can apply these default values to the entire selection, set their own custom values, or edit the total yearly cost for each lake and/or intervention type manually. The default ‘total yearly cost’ for each lake is determined by multiplying the cost per intervention by the number of those interventions performed at each lake. The user can also see an overview of the overall costs as well as total costs for each intervention category. The total yearly costs per lake are then carried through into Stage 5.

Supp.5. Stage 5 – Summary

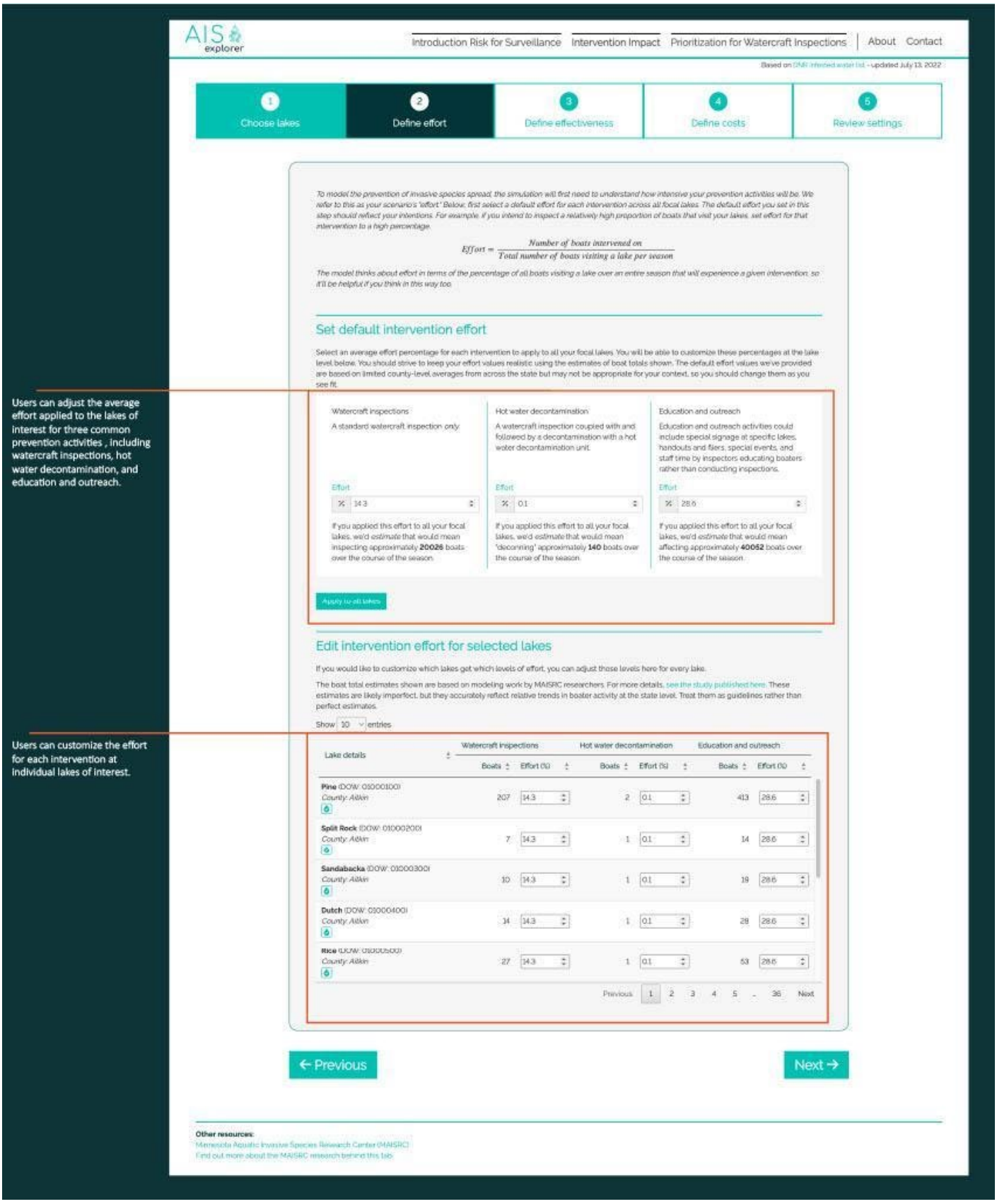
Here, the user can view a summary table of the settings they have specified in the preceding four stages. The table includes the lakes they have selected, lake details, effort and effectiveness percentages, and total yearly cost for each intervention category.

Once the user is satisfied with their settings, clicking ‘Submit’ will allow them to enter a name for the model run, along with their email address, before clicking ‘Run’ to send the model run to the AIS Explorer OpenCPU API for later processing. At this point, the user is free to continue using the AIS Explorer dashboard – the *Intervention Impact* simulation model will run in the background and the user will receive an email with a link to their results once the model is complete.

Supp.1. Stage 1 – Selecting species and lakes of interest



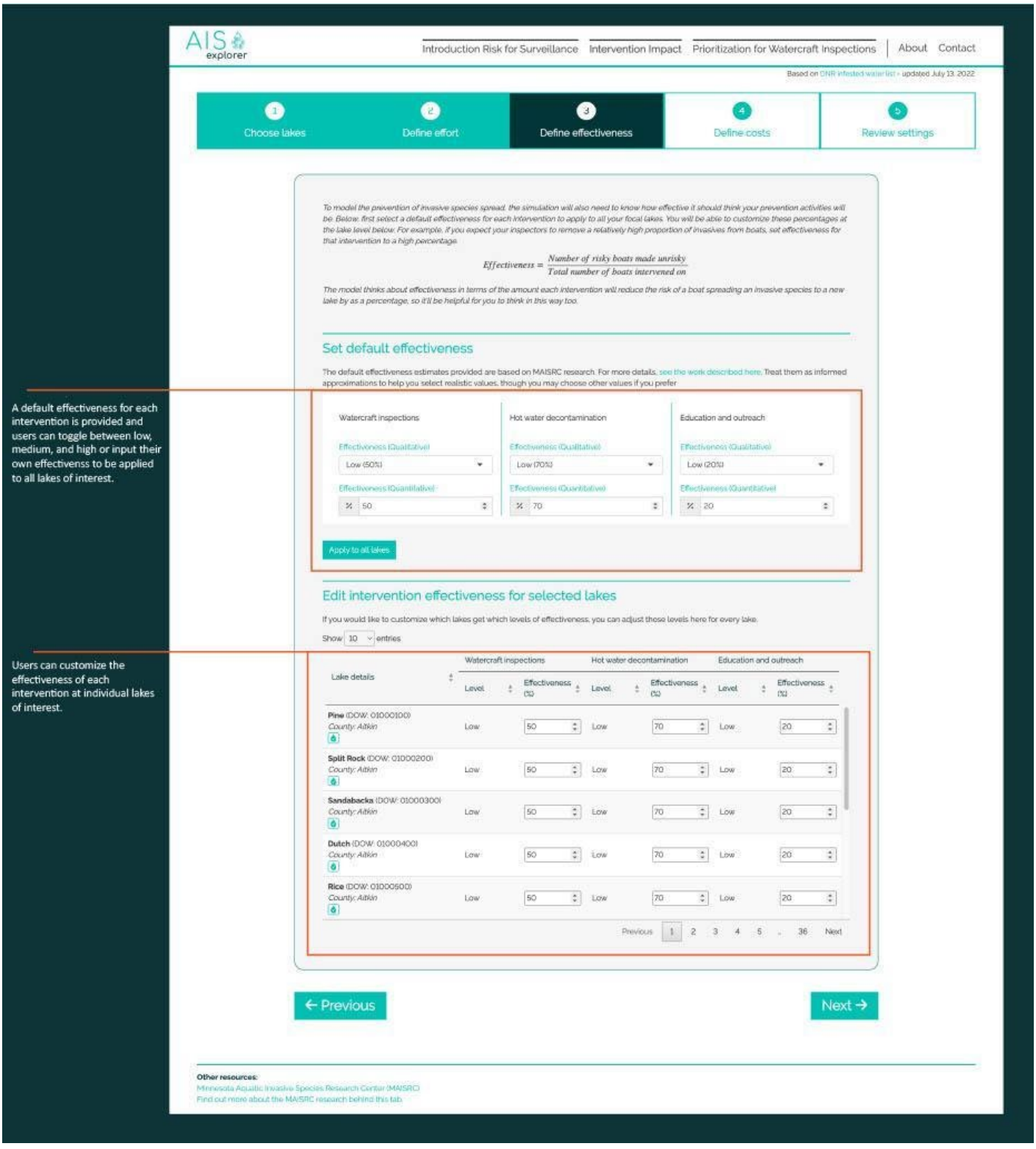
Supp.2. Stage 2 – Define effort



Users can adjust the average effort applied to the lakes of interest for three common prevention activities , including watercraft inspections, hot water decontamination, and education and outreach.

Users can customize the effort for each intervention at individual lakes of interest.

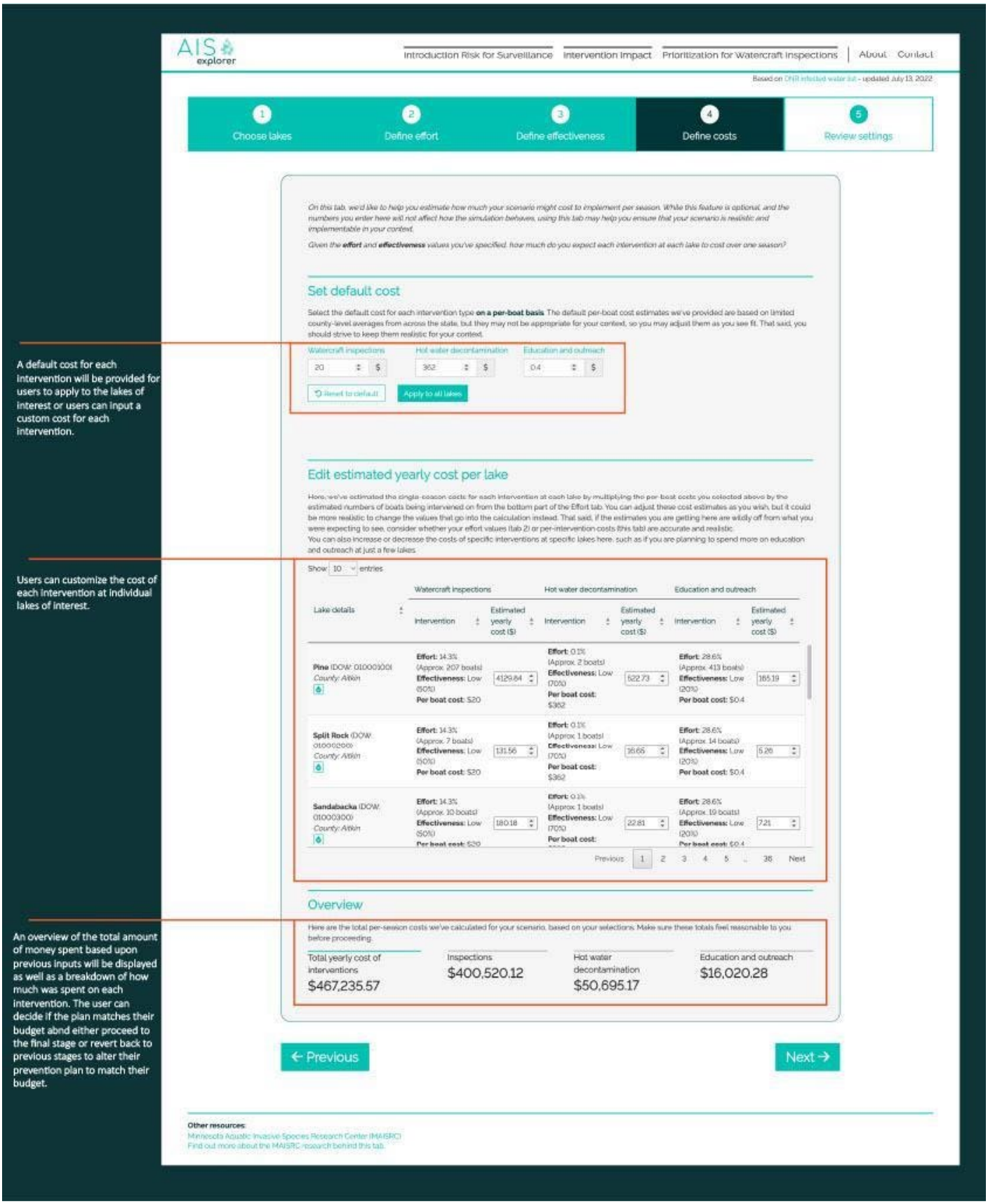
Supp.3. Stage 3 – Define effectiveness



A default effectiveness for each intervention is provided and users can toggle between low, medium, and high or input their own effectivenss to be applied to all lakes of interest.

Users can customize the effectiveness of each intervention at individual lakes of interest.

Supp.4. Stage 4 – Define cost



Supp.5. Stage 5 – Summary