How to Monitor

When developing your monitoring plan, you should aim to collect the same information outlined in Surveying for Mussels (page 11), including recording evidence of healthy mussel populations (Box 5) with mussels of multiple size or age classes. To help you evaluate the effectiveness of BMPs or salvage and relocation efforts, you can estimate abundance (before and after), mark mussels, and/or use grids or transects.

Marking Mussels

Marking a subset of the mussels you are monitoring will enable you to track specific mussels (especially if the unique number of each tag is noted) or generally track mussels that have been surveyed or relocated. Tagging also provides an opportunity to measure the length and height of each mussel. Mussels can be marked using small vinyl shellfish tags (Figure 16; Floy Tag and Manufacturing, Inc., Seattle, Washington) or PIT tags applied to mussel shells (Lemarié et al. 2000; Hartmann et al. 2016; Ashton et al. 2017). Tags can also provide useful information on movement of animals if animals are placed in transects or plots. PIT tags are particularly useful if mussels are dislodged or difficult to observe and can reduce the need to handle mussels.

Figure 16. Vinyl shellfish tags are easily attached to the outer shell.

Marking of mussels should be done in a shaded area out of direct sun. Monitor the mussels continuously for signs of distress. To mark mussels with a shellfish tag, briefly wipe the shell dry and clean, then gently scrub a small patch of the left shell valve along the posterior ridge extending from the beak (umbo) with a green scrubbing pad. Placing the tag toward the posterior end makes it more likely to be visible if mussels are not completely buried. While holding the tag in tweezers, apply cyanoacrylate adhesive (e.g., Loctite or Krazy Glue) to the back of the tag and then gently depress it onto the shell. You can also affix PIT tags with RFID antenna. The cyanoacrylate adhesive should cure in water as you gently depress the tag against the shell. Other types of glue are not recommended because they have not been tested to ensure they cure quickly and properly in water. However, dental cement is also effective, particularly in rocky habitat, and can dry quickly, but is more expensive.

Plots, Transects, and Grids

When mussels are relocated, they can also be placed directly into permanent plots or belt transects to improve the chances of encountering relocated animals during later surveys (Figure 17). Note the transect number and tag number, if tagged, of each mussel. Monitoring searches should take place both within and outside of the exact site of relocation to capture any mussels that may have moved short distances before settling.

Placement of a grid system over the relocation site can also pinpoint mussel locations. A grid system can be surveyed with the use of a hand-held grid constructed of PVC pipe. The grid should consist of a single row of 0.25 m^2 squares. The number of squares will depend on the size of your stream and the area in which mussels are relocated, as well as the number of surveyors. The grid can be placed

at the downstream end of the relocation site and flipped end over end, progressing upstream. Within each transect and plot, count the number of relocated mussels (live animals and shells) and note the transect number and plot number for each count. Make sure that you adequately mark locations of plots, transects, or start locations for grid systems (using rebar, GPS, flagging, or other appropriate methods).

Figure 17. A marked grid with tagged freshwater mussels.