HIDDEN SURVIVORS STATION WORKSHEET– TEACHER ANSWER KEY

STATION 1 QUESTIONS:

- **Which scenario will lead to healthier animals? Explain your reasoning.**
  - The full-dose treatment scenario will lead to healthier animals because it removes most of the parasite population. With fewer parasites remaining, the animals experience less infection, less stress on their bodies, and better overall health. Even though resistant parasites may still survive, the total number of parasites is much lower, making the infection easier to manage.

- **Why is it important to consider total parasite population, not just the percentage of resistant organisms?**
  - The total parasite population is important because it determines the severity of infection in the animal. A small population with a high percentage of resistant parasites may have less impact than a large population with fewer resistant ones. Larger populations cause more harm to the animal and create more opportunities for parasites to reproduce, mutate, and spread resistance over time.

- **Why is underdosing increase the risk of resistance over time?**
  - Underdosing increases the risk of resistance because it allows many parasites to survive treatment. These surviving parasites continue to reproduce, increasing both the total population and the number of resistant organisms. A larger population also creates more opportunities for new mutations to occur, which can lead to additional resistant parasites over time.

STATION 2 QUESTIONS:

- **Why did one group of bacteria (staph) survive completely in the the first scenario?**
  - In the wrong antibiotic scenario, the medication only targeted one type of bacteria. The other bacteria were not affected by the drug, so they survived entirely and continued to reproduce. This shows how using an incorrect treatment allows certain organisms to escape control and become the dominant population.

- **Why does the first treatment scenario create more opportunities for mutations to occur?**
  - New mutations are more likely to occur in the first treatment scenario because a larger number of bacteria survive and continue to reproduce. Since mutations occur randomly during reproduction, having more bacteria increases the number of chances for mutations to happen. In the second scenario, the correct antibiotic removes most of the bacteria, leaving a much smaller population with fewer opportunities for mutations to occur.

- **Which treatment would be most effective in helping the cow recover and return to health? Explain your reasoning.**
  - The correct, targeted treatment would be most effective because it removes the majority of the bacteria causing the infection. With fewer bacteria remaining, the infection is reduced, allowing the cow's body to recover more easily. In contrast, the wrong treatment allows large numbers of bacteria to survive and continue growing, which can keep the animal sick and delay or prevent recovery.

STATION 3 QUESTIONS:

- **Arguments in support of blanket treatment may include:**
  - Disease spreads quickly in crowded flocks
  - Some infected birds may not show symptoms
  - Quick treatment can protect animal health and prevent suffering

- **Arguments to limit blanket treatment may include:**
  - Increased risk of antibiotic resistance
  - Treating animals that are not sick
  - Long-term effectiveness of antibiotics

STATION 4 QUESTIONS:

- **Why did the resistant bacteria increase more in the scenario where the same drug was used repeatedly?**
  - The resistant bacteria increased more because the same drug applied the same selection pressure each time. The susceptible bacteria were removed, but the resistant bacteria survived every treatment and continued to reproduce. Over multiple rounds, this allowed the resistant bacteria to become a larger portion of the population.

- **How did rotating drug classes affect the resistant bacteria population?**
  - Rotating drug classes affected the resistant bacteria by exposing them to a different type of treatment. Because the second drug worked in a different way, it was able to remove some of the bacteria that survived the first treatment. This reduced the number of resistant bacteria and slowed their spread in the population.

- **Why is rotating drug classes an effective strategy for managing disease and slowing resistance?**
  - Rotating drug classes is effective because it prevents the same group of bacteria from surviving every treatment. Different drugs target bacteria in different ways, so bacteria that are resistant to one drug may still be susceptible to another. This helps reduce the overall population and slows the development and spread of resistance over time.

STATION 5 QUESTIONS:

- **If you were managing a herd, how would you decide whether to use a targeted topical antibiotic vs. a whole-body injectable treatment?**
  - The decision would depend on the severity and location of the infection. If the problem is mild and localized, such as pinkeye affecting only the eye, a targeted topical treatment would be appropriate because it treats the infection directly while limiting unnecessary antibiotic exposure. If the infection is severe, spreading, or affecting the whole body, an injectable treatment may be necessary to reach all affected areas and ensure the animal recovers.

- **How might cost, time, or labor influence treatment decisions?**
  - Targeted treatments often require more time and labor, since each animal must be handled individually and treated multiple times. This can be difficult in large herds. Injectable treatments are often faster and easier to apply to many animals at once, making them more practical in some situations. However, while whole-body treatments may save time in the short term, they can lead to higher long-term costs if resistance develops or treatments become less effective.

- **Who is responsible for making these decisions, and how should they balance animal health with long-term antibiotic effectiveness?**
  - Farmers and veterinarians share responsibility for making treatment decisions. They must prioritize the immediate health and welfare of the animals, while also considering the long-term effectiveness of antibiotics. This means using antibiotics only when needed, choosing the most appropriate type of treatment, and avoiding unnecessary exposure that could contribute to resistance.

STATION 6 QUESTIONS:

- **Why is it important to improve the environment before using antibiotics in a fish farm?**
  - Improving the environment is important because poor conditions—such as low oxygen, high waste, and stress—make fish more vulnerable to disease and allow bacteria to grow more quickly. Fixing these conditions can reduce the infection and help fish recover, sometimes without needing antibiotics.

- **Why might antibiotics be less effective if environmental conditions are poor?**
  - Antibiotics may be less effective because sick or stressed fish may not eat enough medicated feed to receive the treatment. Poor conditions can also allow bacteria to continue growing, making it harder for the medication to control the infection.

- **How can improving environmental conditions reduce the risk of antibiotic resistance?**
  - Improving environmental conditions reduces the number of sick animals and lowers the need for antibiotics. When fewer antibiotics are used, fewer bacteria are exposed, which reduces selection pressure and decreases the chances of resistant bacteria developing and spreading.