Fish and Wildlife Management Merit Badge

Troop 344 and 9344

Pemberville, OH

Fish and Wildlife Management Merit Badge Requirements

1. Describe the meaning and purposes of fish and wildlife conservation and management.
2. List and discuss at least three major problems that continue to threaten your state's fish and wildlife resources.
3. Describe some ways in which everyone can help with fish and wildlife conservation.
4. List and describe five major fish and wildlife management practices used by managers in your state.

Fish and Wildlife Management Merit Badge Requirements

5. Do ONE of the following:
   a. Construct, erect, and check regularly at least two artificial nest boxes (wood duck, bluebird, squirrel, etc.) and keep written records for one nesting season.
   b. Construct, erect, and check regularly bird feeders and keep written records daily over a two-week period of the kinds of birds visiting the feeders.
   c. Develop and implement a fishery improvement project or a backyard wildlife habitat improvement project. Share the results with your counselor.
   d. Design and construct a wildlife blind near a game trail, water hole, salt lick, bird feeder, or birdbath and take good photographs or make sketches from the blind of any combination of 10 wild birds, mammals, reptiles, or amphibians.

Fish and Wildlife Management Merit Badge Requirements

6. Do ONE of the following:
    a. Observe and record 25 species of wildlife. Your list may include mammals, birds, reptiles, amphibians, and fish. Write down when and where each animal was seen.
    b. List the wildlife species in your state that are classified as endangered, threatened, exotic, non-native, game species, furbearers, or migratory game birds. Discuss with your counselor management practices in place or being developed for at least three of these species.
    c. Start a scrapbook of North American fish and wildlife. Insert markers to divide the book into separate parts for mammals, birds, reptiles, amphibians, and fish. Collect articles on such subjects as life histories, habitat, behavior, and feeding habits on all of the five categories and place them in your notebook accordingly. Articles and pictures may be taken from newspapers or science, nature, and outdoor magazines, or from other sources including the internet (with your parent's or guardian’s permission). Enter at least five articles on mammals, five on birds, five on reptiles, five on amphibians, and five on fish. Put each animal on a separate sheet in alphabetical order. Include pictures whenever possible.

Fish and Wildlife Management Merit Badge Requirements

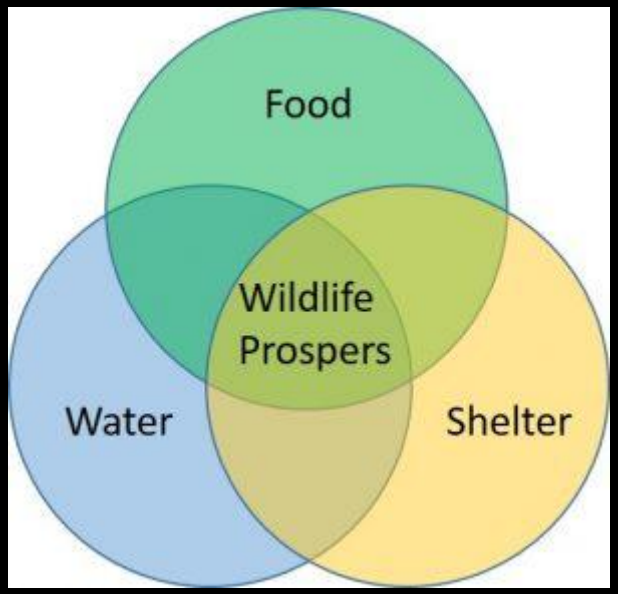
7. Do ONE of the following:
    a. Determine the age of five species of fish from scale samples or identify various age classes of one species in a lake and report the results.
    b. Conduct a creel census on a small lake to estimate catch per unit effort and report the results to your counselor.
    c. Examine the stomach contents of three species of fish and record the findings. It is not necessary to catch any fish for this option.
    d. Make a freshwater aquarium. Include at least four species of native plants and four species of animal life, such as whirligig beetles, freshwater shrimp, tadpoles, water snails, and golden shiners. After 60 days or observation, discuss with your counselor the life cycles, food chains, and management needs you have recognized. Before completing this requirement, check local laws on releasing these organisms back into the wild, and follow your counselor's direction in disposing of these organisms humanly and safely.
8. Identify three career opportunities that would use skills and knowledge by fish and wildlife professionals. Pick one and research the training, education, certification requirements, experience, and expenses associated with entering the field. Research the prospects for employment, starting salary, advancement opportunities and career goals associated with this career. Discuss what you learned with your counselor and whether you might be interested in this career.

Requirement 1

Describe the meaning and purposes of fish and wildlife conservation and management.

Meaning

- Wildlife management is the science and art of managing the wildlife—both animals and fish—with which we share our planet.
  - Maintaining the proper balance and the dynamics that go with it requires humankind's attention.
  - This includes managing and maintaining wildlife habitats of all kinds.
  - We use this stewardship tool to help minimize or eradicate the possibility of extinction of any given species.

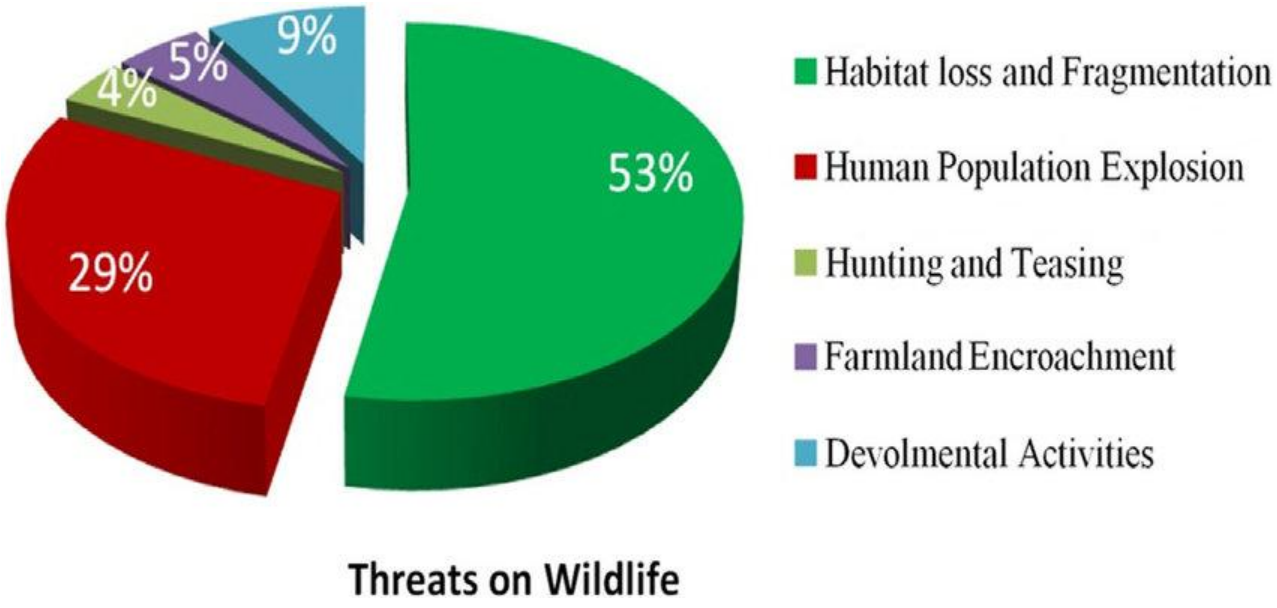


Purpose

- The purpose of fish and wildlife management is to encourage healthy fish and wildlife populations and their associated habitats while preventing lost populations and additional extinction of plants and animals.
  - To accomplish this goal, a manager must first understand and address individual species habitat requirements.
  - Healthy populations are part of healthy communities and key to the success of one often relies on productive and viable habitats.
  - A second purpose is to have sustainable fish and wildlife populations that can provide for human appreciation, recreation, and harvest for millions of Americans.
  - The economic benefit of the above interests represents billions of dollars annually and many thousands of jobs for those who engage or support these activities.

Requirement 2

List and discuss at least three major problems that continue to threaten your state's fish and wildlife resources.



Threats to Fish and Wildlife

- The most common problems shared by most states are:
  - Pollution
  - Overharvest of some species
  - Overpopulation of some species
  - Habitat fractionation
  - Habitat degradation or loss due to development and encroachment by humans
  - Wildlife disease
  - The introduction of exotic or invasive species
- Fish and wildlife managers often can only address certain major issues because many states are experiencing severe funding constraints.

Requirement 3

Describe some ways in which everyone can help with fish and wildlife conservation.

What You Can Do

- The things we do in our daily lives can help improve our lands so they provide a better place for wildlife and humans to live.
  - Volunteer at a wildlife refuge
  - Organize litter cleanups and recycling drives
  - Support natural areas and nature centers.
  - Participate in habitat restoration projects.
  - Walk, ride your bike, carpool, or use public transportation. Using less fuel reduces the need to extract energy resources and prevents changing habitat that is home to fish, wildlife, and plants.
  - If you observe evidence of wildlife poaching, contact your state fish and game office
  - Follow fishing and hunting laws.

What You Can Do

- Curb the effects of invasive species. People and human activity are the major transporters of invasive species.
  - After a hike, shake out your socks and remove any weeds and seeds from your shoes before heading home.
  - When you are through boating, inspect your equipment and boat before leaving the site. You don’t want to transport any plants, water, mud, leftover bait, or fish and other living things to another area.
  - If you have caught any fish, release it back only to the area where it was caught. Never transport your catch and release it somewhere else. In addition, never release anything from your home aquarium to a lake, pond, or other body of water.
  - If you are riding a bike, motorcycle, horse, or any other transportation across long distances, be sure you don’t pick up any “hitchhikers” along the way, such as seeds, plant parts, and bugs.

Requirement 4

List and describe five major fish and wildlife management practices used by managers in your state.

Fish and Wildlife Management Practices

- Wildlife management consists of projects that affect wildlife populations and wildlife recreational users.
- These projects usually involve habitat manipulation, management of wildlife populations, land acquisition, research, or the creation of opportunities for people to enjoy wildlife.
- Examples of management practices:
  - Fires and selective burning - Controlled fires provide new growth in forests and open lands.
  - Food plots - Food plots create winter feeding areas for wildlife. These plots are small areas planted with a mixture of grasses and clovers in open areas in the woods and on old logging roads.

Fish and Wildlife Management Practices

- Examples of management practices (continued):
  - Conservation easements - Private landowners sign contracts that agree their land will not be developed, creating conservation easements that maintain habitats for wildlife.
  - Wildlife refuges and management areas - Government agencies and private landowners purchase land to preserve its natural beauty and the wildlife present in these areas.
  - Edge control - Edge control creates habitat for upland birds, small game and some big game species. Instead of cultivating right up to the edge of the woods, farmers leave a swath of land around the field to create shelter and food for the wildlife. This area is cut every two to three years.

Fish and Wildlife Management Practices

DEER BAG LIMITS Only one antlered deer may be harvested statewide, regardless of zone or method.	
ZONE 1	A hunter may harvest an unlimited number of antlerless deer in Zone 1 using the statewide deer permit and additional deer permits.
ZONE 2	A hunter may harvest no more than four deer in Zone 2.
ZONE 3	A hunter may harvest no more than four deer in Zone 3. A firearm or air gun cannot be used to take more than one antlerless deer.
ZONE 4	A hunter may harvest no more than two deer in Zone 4. Only one can be antlerless. Antlerless deer cannot be harvested during the modern gun season, the early muzzleloader season or the first six days of the late muzzleloader season. The statewide bag limit of one antlered deer still applies.

- Examples of management practices (continued):
  - Hunting - Hunting helps maintains the correct number of specific species for a given amount of habitat or area; hunting also provides wildlife biologists with valuable information on species and population numbers in a given area. Using this information, hunting regulations and daily bag limits are determined each year for the season's duration. Bag limits are the maximum number of game animals a hunter may harvest in a given day or hunting season.
  - Trapping - Trapping reduces the quantity of certain wildlife types in a given area. It is used for relocating specific game to areas that have known depleted populations.

Fish and Wildlife Management Practices

- Examples of management practices (continued):
  - Control Nonnative Invasive Species – Invasive species have been detrimental to native communities because many nonnatives outcompete native species. Thus, populations of certain wildlife species have declined as a result of nonnative invasive species. Control practices include the use of chemicals and harvesting (physically removing) nonnative species.
  - Artificial Nesting Structures - Many wildlife species nest in cavities. Natural cavities are too few and of too poor quality to provide good nesting opportunities. Artificial nesting structures benefit wildlife and provide much enjoyment to the builders.

Fish and Wildlife Management Practices

- Examples of management practices (continued):
  - Wetland Habitat Management for Wildlife - Wetlands in the United States were considered wastelands that needed to be filled or drained to be made usable and profitable. Wetlands are now viewed as valuable real estate that needs to be protected and restored. Wetlands are particularly important to wildlife. Nearly 32% of Ohio's endangered and threatened wild species live in wetland habitat. Over one-third of Ohio's wildlife depend upon wetlands for its survival.

Requirement 5

Do ONE of the following:

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Requirement 5a

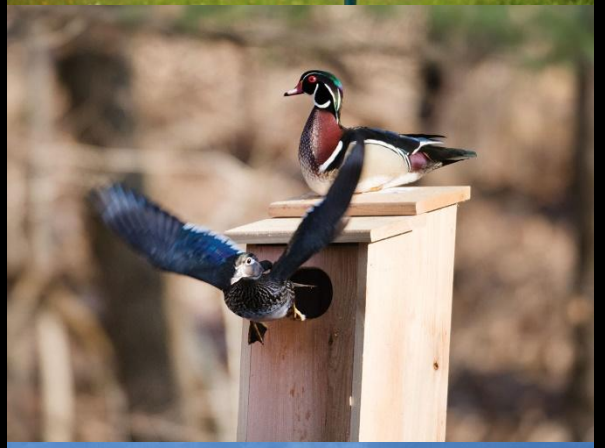
- Download Bluebird House Plans and Instructions.

or

- Download Build a Duck Nest Box.

or

- Download Bat Box Plans.



Requirement 5b

- Download How to Build a Bird Feeder with Recycled Materials

Requirement 5c

- Download Brush Piles for Wildlife

Requirement 5d

- Download Wildlife Viewing Blind Instructions

Requirement 6

Do ONE of the following:

a. Observe and record 25 species of wildlife. Your list may include mammals, birds, reptiles, amphibians, and fish. Write down when and where each animal was seen.
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Requirement 6a

Species	When Seen	Where Seen

Requirement 6b

Wildlife Species	Endangered	Threatened	Exotic	Non-native	Game Species	Furbearer	Migratory Game Bird

Management Practices for Endangered Species

- The process of developing a recovery plan is unique for each species. Factors considered include:
  - the types of factors that threaten the species
  - the magnitude of those threats
  - the degree to which the threats can reversed
  - the biology of the species
  - the current number of individuals of the species and their distributions
- Recovery plans that have been developed since 1978 are available online by clicking on the **Endangered Species Recovery Plans** link.

Requirement 6c

- Click on the following link to download Wildlife Fact Sheets

WILDLIFE FACT SHEET

Raccoon

Procyon lotor

Background

Raccoons are common throughout Connecticut. The state's expanding human population has probably benefited this opportunistic species; concentrations of people provide easy access to food sources, such as garbage, gardens, and bird feeders. Raccoons are adaptable, thriving in a large variety of habitat types. They are abundant in urban, suburban, and rural areas.

The raccoon has been an economically important furbearer in Connecticut due to its abundance and pelt value. Raccoons are harvested each year during the regulated hunting and trapping seasons, providing recreation for many Connecticut sportsmen and helping to control local raccoon populations.

Range

Raccoons range from Canada and throughout the United States (excluding the high elevations of the Rocky Mountains and much of the Southwest) into Mexico and Central America.

Description

One of the most easily recognized furbearers, the medium-sized raccoon is distinguished by a black mask across the eyes and cheeks and black rings around the bushy tail. Long, thick fur gives raccoons a typical gray-brown color, with variations ranging from skunk to silver. Other characteristics include short, slightly rounded ears bordered by white fur, and a long, pointed snout. Most adults weigh between 10 and 20 pounds, with males typically larger than females. Raccoons range in length from 23 to 38 inches, including the tail.

Habitat and Diet

Raccoons prefer wooded areas near streams, ponds, and marshes but are highly adaptable and can live in agricultural areas and in close proximity to human developments. They make their dens in tree cavities, abandoned woodchuck or fox burrows, rock crevices, brush piles, chimneys, attics, sheds, and other structures.

Opportunistic and omnivorous, the raccoon has a varied diet that includes fleshy fruits, mast (especially acorns, hickory nuts, and beechnuts), grains, invertebrates (particularly crayfish and insects), rodents, young rabbits, birds, turtles and their eggs, fish, and carrion. Raccoons are known for raiding garbage, agricultural crops, chicken coops, and pet food left outdoors.

Life History

Raccoons breed in late winter or early spring. The male does not remain with the female after breeding. The young are born in April or May after a 63-day gestation period. Females produce 1 litter per year, with an average of 4 cubs per litter. The cubs are born blind, helpless, and are covered with yellowish-gray fur. After 30 to 40 days, the cubs leave the den and will travel with the female for short distances to search for food. At 3 to 4 months, the cubs begin to forage on their own.

Interesting Facts

Raccoons are most closely related to the weasel (Mustelidae) and bear (Ursidae) families. They have keen senses of hearing, sight, and touch, but taste and smell are less well developed.

The front and hind paws of raccoons have 5 digits each. The dexterous front paws enable the raccoon to grasp and manipulate food items. Raccoons are excellent climbers, and can descend a tree head first.

Raccoons are primarily crepuscular (active at dawn and dusk) and nocturnal (active at night). They occasionally venture out in the daytime, but that does not mean that they are diseased. Raccoons often adjust their feeding schedules, especially in spring when rearing their young. They may "den up" during the coldest periods in late fall and winter; however, this is not true hibernation, and the animals will wander out during warm spells.

CONNECTICUT DEPARTMENT OF ENERGY & ENVIRONMENTAL PROTECTION • WILDLIFE DIVISION

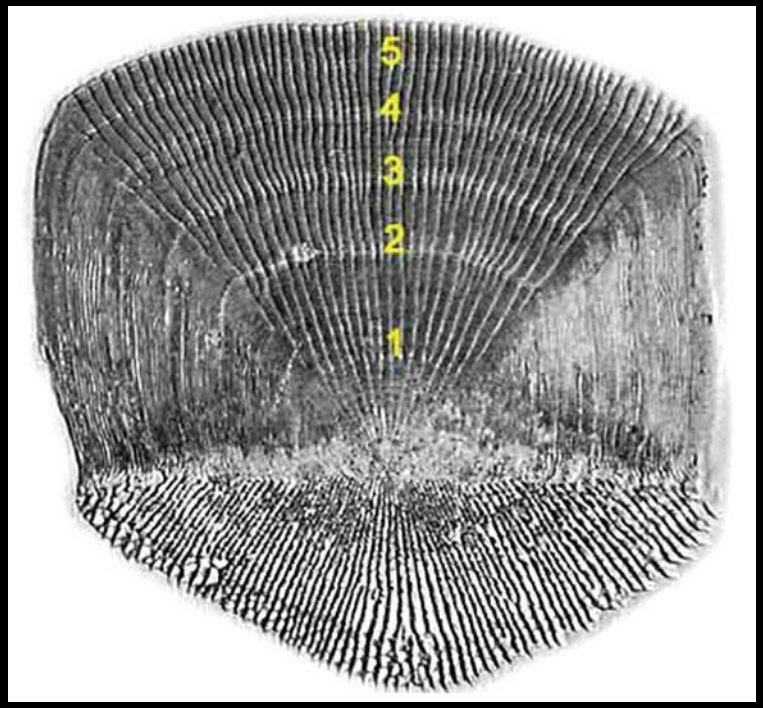
Requirement 7

Do ONE of the following:

a. Determine the age of five species of fish from scale samples or identify various age classes of one species in a lake and report the results.
b. Conduct a creel census on a small lake to estimate catch per unit effort and report the results to your counselor.
c. Examine the stomach contents of three species of fish and record the findings. It is not necessary to catch any fish for this option.
d. Make a freshwater aquarium. Include at least four species of native plants and four species of animal life, such as whirligig beetles, freshwater shrimp, tadpoles, water snails, and golden shiners. After 60 days or observation, discuss with your counselor the life cycles, food chains, and management needs you have recognized. Before completing this requirement, check local laws on releasing these organisms back into the wild, and follow your counselor's direction in disposing of these organisms humanly and safely.

7a Determine the Age of Fish from Scales

- Similar to tree rings, scales show rings that indicate the age of a fish.
- Rings that are farther apart form during the summer when food is abundant and the fish is growing quickly.
- Closely spaced rings form in winter when the fish grows slowly.
- These patterns are recorded on each individual scale (there are several rings per scale.)
- The core (region near the base of the scale where the rings originate) formed when the fish was a fry.
- Those near the edge are the most recent.



7b Conduct a Creel Census

A simple survey will help compile the data for a Creel Census.

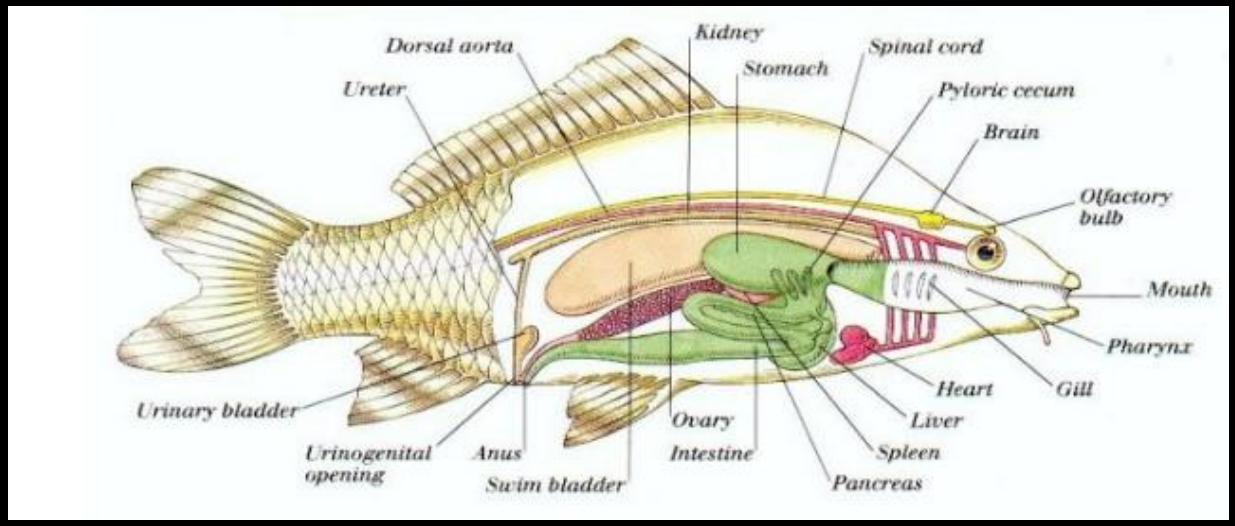
- As anglers return to the dock after a day of fishing, poll them about their catch.
  - How many hours were they out, and how many fish did they catch?
  - The more anglers you poll, the more accurate your results will be.
  - Total # of fish caught/total # of hours of fishing= # of fish caught per hour of fishing
  - # of fish caught per hour of fishing/total # of anglers = number of fish the average angler catches in an hour at one body of water.
- The results of a creel census are helpful in estimating the number of fish the average angler catches in an hour at one body of water.

7c Examining the Stomach Contents of Fish

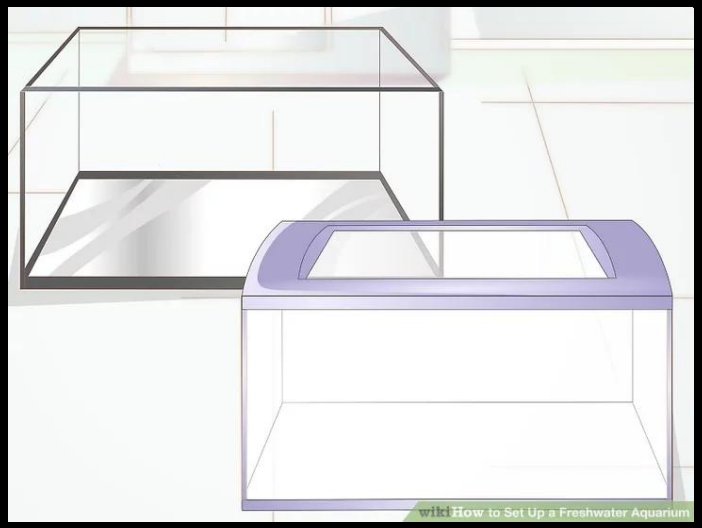
- Examining the stomach contents of fish will tell you what that species feeds on in the wild—insects, worms, smaller fish, vegetation, and so on.
  1. It will give you a good idea of the best bait or lure to use.
  2. Resource managers use this same information to help ensure that the species has access to the most appropriate food sources.

7c Examining the Stomach Contents of Fish

- If you are not able to visit a cleaning station or find a similar alternative, you may need to gut a fish yourself.
- After skinning or scaling the fish, follow these steps.
  1. Starting at the anal opening near the tail, cut through the skin from the belly to the gills. Be careful not to cut too deeply and destroy the organs.
  2. Open the belly and use your fingers to carefully remove the gills from the fish. Scrape out the kidney line (it's reddish brown) along the backbone. Detach the entrails from the fish by cutting them away from the fish's body; be careful not to burst the stomach.
  3. Carefully slice open the stomach and remove the contents. If possible, identify what the fish has been eating.



7d Make a Freshwater Aquarium



How to Set Up a Freshwater Aquarium

- **Choose a fish tank.**
  - The tank you choose needs to be large enough to hold enough water for the type and number of fish you plan to have.
  - In general, the larger the fish are, the more waste they make and the more water is needed.
  - Keep in mind that live plants and other decorations will also take up space.
- A 55 gallon (208.2 L) tank is a standard size that will allow you to have a variety of fish.
- You could also go with a 20 or 25 gallon tank for a starter tank and keep just a few hardy fish.
- It is not recommended to start out with anything less than 10 gallons because it is actually harder to maintain good water quality in a small tank.

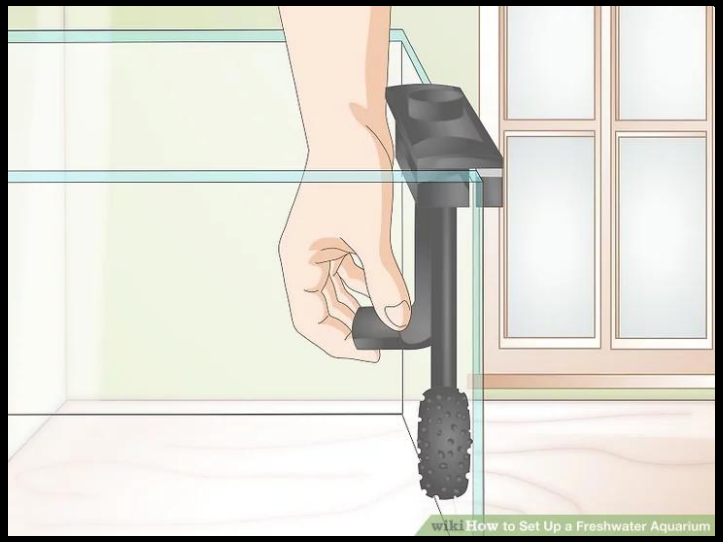
How to Set Up a Freshwater Aquarium

- **Get an aquarium stand.** Aquariums that hold 20 gallons (75.7 L) or more will need a stand no matter what.
  - Buy one that is designed for the dimensions and shape of your tank.
  - Make sure the stand is either rated for the size of your tank or that it has been custom built to be very sturdy.
  - Furniture like dressers, TV stands, end tables/buffets, or flimsy wooden desks aren't strong enough.
- Look for complete tank kits at those big box pet stores.
- Used setups from websites like Craigslist are often available for great prices, but be sure to check for leaks and clean very well before use.

Make a Freshwater Aquarium

- **Decide where to put the aquarium and stand.** Put it in a place where the temperature remains pretty consistent and the amount of light doesn't get overpowering.
  - Too much sunlight will cause excessive algae growth and a maintenance nightmare.
  - An interior wall, away from bright light, is best.
- Allow at least 5 inches (12.7 cm) between the wall and the aquarium to make room for the filter.
- Choose a location near an outlet, and keep in mind how far you will have to haul water for weekly tank maintenance!
- Set up your tank stand ideally on a wooden floor, not a rug or carpet.

Make a Freshwater Aquarium



- **Decide which filtration system you would like to use.** The most common and easiest are either under-gravel filters or power filters (recommended for first-time owners over under-gravel filters) that hang on the back of the tank.
  - If you decide to go with a power filter, select one that will circulate enough water for the size of your tank.
  - Ideally, it should filter your water 5 or more times per hour (gph), depending on your tank capacity.
  - For example, a 10-gallon tank would need a filter that circulates at least 50 gph.
- **Install the filter.**

Make a Freshwater Aquarium

- **Fill the bottom with gravel.** Having about 2 to 3 inches (5.1 to 7.6 cm) of gravel on the bottom is essential to a healthy aquarium.
  - Cheap gravel can be purchased from pet stores dealing in aquarium products.
  - Sand is optimal for fish and invertebrates that like to burrow but it needs to be stirred on a regular basis to prevent dead spots that can wreak havoc on your tank.
- Rinse the substrate in clean water before adding it to the aquarium.
  - The less dust in the water, the faster it'll clear when the filter is started up.
  - This step is especially crucial if you're using sand instead of gravel.
- Spread the rinsed substrate in an even layer across the surface of the filter.
- Put a plate on top of the substrate so it doesn't disperse when you add water.

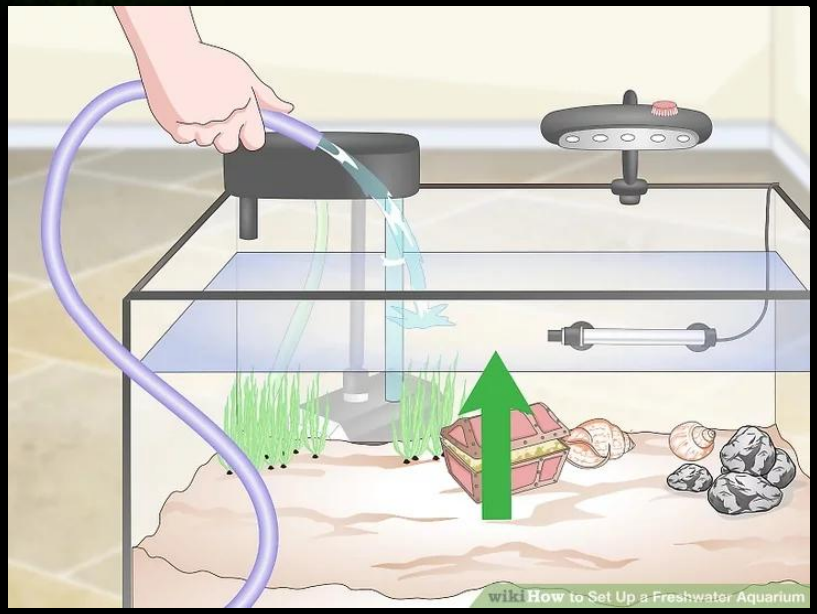
Make a Freshwater Aquarium

- **Set up chosen plants and decorations.** Make sure you arrange them how you like at this point because once the water and fish are in the tank, you'll want to have as little stress as possible—and that means no hands in the tank.
- Plants are functional decorations; it is difficult to make a mechanical filter control a plankton bloom, but live plants make it easy.
- For some fish, plants actually help them stay healthy.
- Submerge the roots in the gravel, but not the stems or leaves.

Make a Freshwater Aquarium

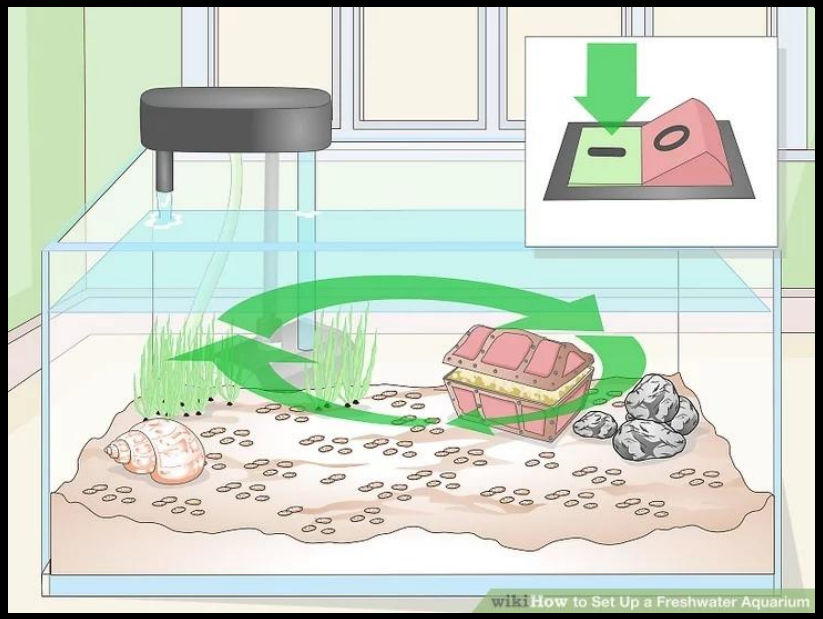
- **Look for leaks.** Fill the tank with about two inches of water, then wait for a half an hour.
- If there are any leaks, it's better they show up now, rather than when you have filled the entire thing.
- If you don't see leaks, fill up the tank about 1/3 full.
- Have sealant on hand so that you can dry the tank and start fixing it.

Make a Freshwater Aquarium



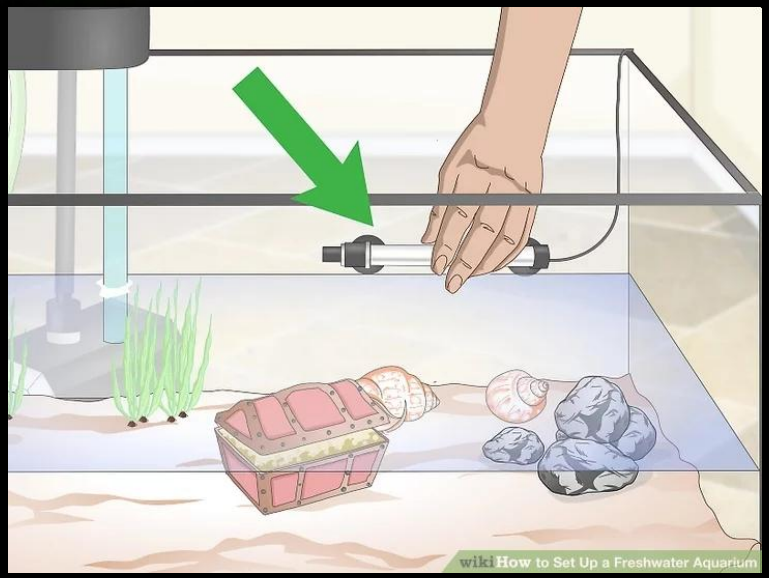
- **Fill the tank the rest of the way.** Once you are sure that all the decorations are just the way you want, fill the tank up to just under the rim of the tank, leaving a gap of 1 inch.

Make a Freshwater Aquarium



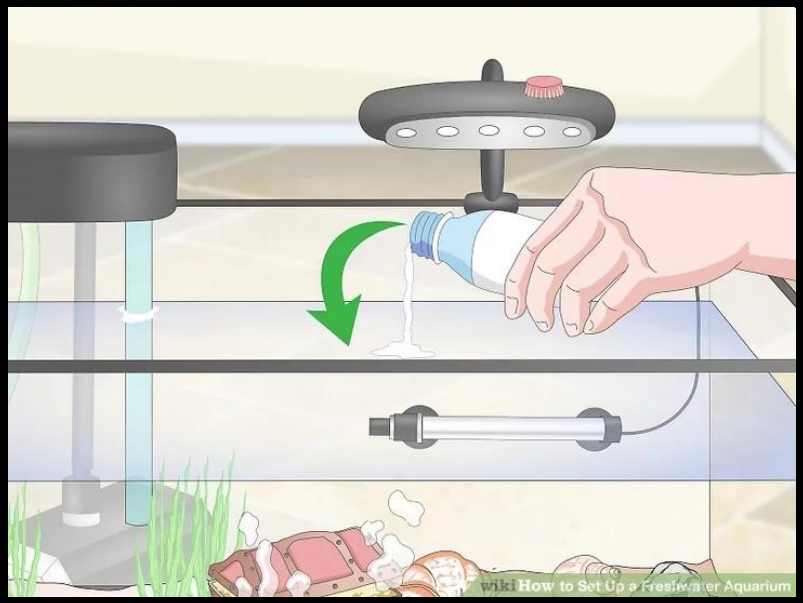
- **Start the filter.** Fill the reservoir of the filter with water, and plug it in!
  - Water should smoothly (and quietly) circulate after a couple of minutes.
- Plug in the powerhead/pump if you have an under-gravel filter.
  - Water should start moving vertically in the lift tube(s).
- Wait for an hour or two and check that the temperature is still in the safe range, that there are no leaks, and that the water is circulating properly.

Make a Freshwater Aquarium



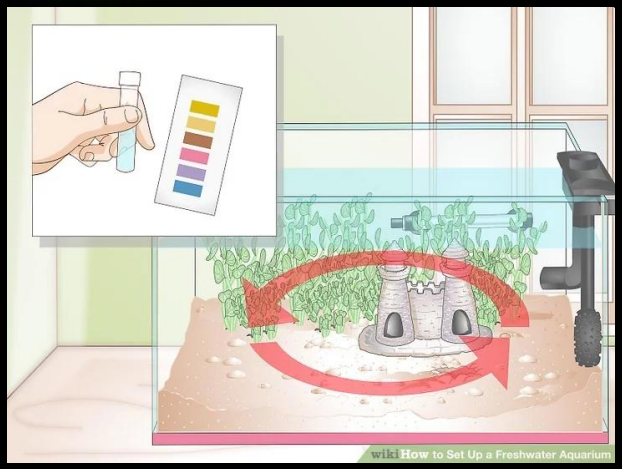
- **Install your heater on the inside of the tank.** It will attach with suction cups.
  - Try to position it near or at the mouth of the filter expelling water so that the water will be evenly heated.
- Plug in the heater and install your thermometer.
  - Do not turn it on until the tank is filled completely with water.
  - A good rule of thumb is 3-5 watts of heat per gallon of water.
  - Most fish like it between 70 and 80 degrees Fahrenheit.
- Give the heater time to adjust the temperature before cycling the tank.

Make a Freshwater Aquarium



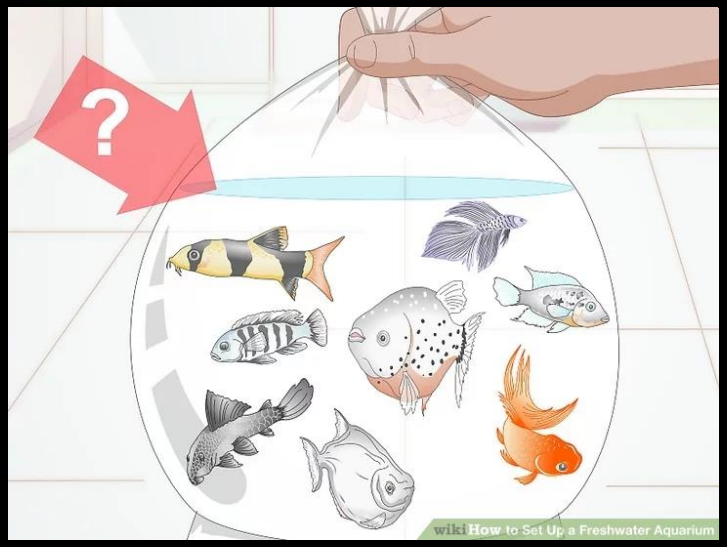
- **Add water dechlorinator.** Tap water from a municipal supply contains chlorine and other chemicals that will kill fish, so it's necessary to add a neutralizer.
  - Add the dechlorinator according to the instructions on the bottle.
- The activated carbon of your filter may need to be removed while the chemical circulates, otherwise, the filter may remove it before it has a chance to detoxify the water.

Make a Freshwater Aquarium



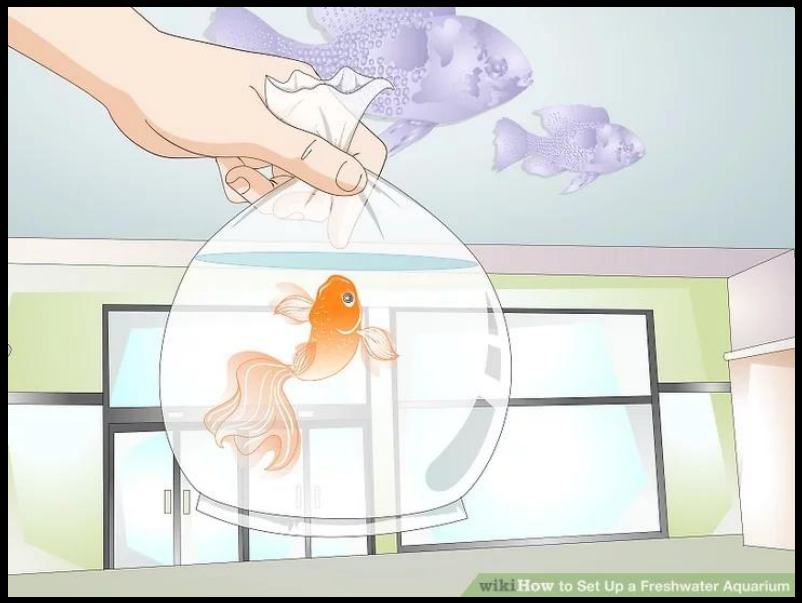
- **Cycle your tank.** For instructions on the fishless cycle (the most humane way to grow the beneficial bacteria all tanks need) see Do a Fishless Cycle.
  - The cycle must be completed before you add any fish to the tank, or they will die.
- During the cycle, you need to monitor the water parameters (pH, High pH, Ammonia, Nitrite, and Nitrate).
  - When the numbers for Ammonia, Nitrite, and then Nitrate spike and lower to 0, you have completed your initial Nitrogen Cycle and are in the clear to add fish.
  - The only way to reduce the Nitrates is to do water changes. Continue doing water tests, especially with a new tank.
  - You may need to do daily 15% water changes to keep your fish tank clean, depending on the nitrate levels.
  - Adding live plants will reduce the number of nitrates as well.

Make a Freshwater Aquarium



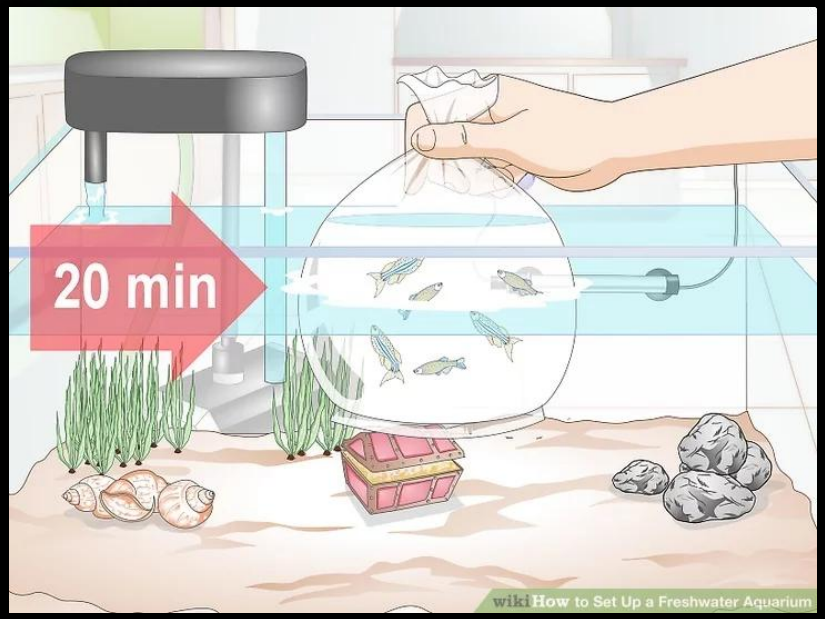
- **Choose fish.** Be aware of the size of the adult fish (not the baby you're getting) and do not get a fish you won't be able to handle down the line.
- Do lots of research before adding any fish to your tank.

Make a Freshwater Aquarium



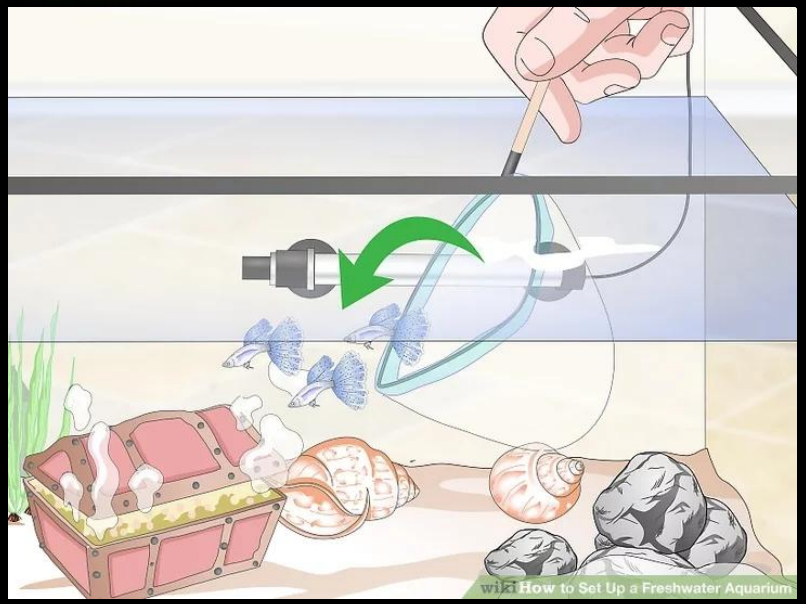
- **Don't add all of your fish at once.**
- Know all the fish you hope to eventually have in your fish tank and add two of the smallest (this goes for all types except for schooling fish, which should be bought in groups of 4 (ideally 6+).
- You can introduce a new group of fish every 2 weeks.
- Add the largest fish last.

Make a Freshwater Aquarium



- **Acclimate your fish.**
- Set the bag in your tank and let it sit there for about 20 or 30 minutes.
- Then open the bag and let some of the water from the tank in.
- Let it sit for another 20 or 30 minutes before gently releasing the fish into tank.

Make a Freshwater Aquarium



- **Introduce the fish to your aquarium.**
- Start with two or three fish the first ten days, then get two or three more, wait another ten days, etc.
- If you put too many fish at once into a new tank, the water will not be able to adequately cycle, and will quickly turn toxic.
- Patience is the key for the first six to eight weeks.
- That said, a big mistake people make is to add only 1 or 2 schooling fish.
  - This is stressful and cruel for the fish.
  - A school means that a group of 5 is the minimum.

Requirement 8

Identify three career opportunities that would use skills and knowledge by fish and wildlife professionals. Pick one and research the training, education, certification requirements, experience, and expenses associated with entering the field. Research the prospects for employment, starting salary, advancement opportunities and career goals associated with this career. Discuss what you learned with your counselor and whether you might be interested in this career.

Careers in Fish and Wildlife Management

- Competition for positions is stiff in the field of fish and wildlife management.
- This makes getting good grades in school and a solid college education essential.
- Begin by pursuing a broad-based education that strengthens your understanding of natural resources as well as the social, economic, and political forces that affect how decisions are made.
- Introductory courses in subjects such as wildlife, zoology, math, statistics, computer science, English composition, and botany all are practical.
- Starting early with volunteer work also is a great way to gain valuable experience while making friends and contacts in the profession.
  - Contact your local fish and wildlife service to inquire about volunteer opportunities.

Careers in Fish and Wildlife Management

- Wildlife biologist
- Zoologist
- Fish hatchery superintendent
- Oceanographer
- Fish and game warden
- Watershed manager
- Forest or park ranger
- Environmental analyst
- Soil conservationist
- Fisheries officer
- Conservation educator
- Park naturalist
- Fisheries biologist
- Marine resources technician
- Ornithologist
- Parks planning technician
- Resource manager
- Refuge manager
- Forester
- Park superintendent
- Environmental educator
- Zookeeper/curator

Wildlife Biologist

- Education/Training:
  - Bachelor’s degree in wildlife biology, ecology, or a related field (required).
  - Master’s or PhD for research or higher-level roles (optional but beneficial).
- Certifications:
  - Certification from The Wildlife Society (optional, boosts credentials).
- Experience:
  - Internships, fieldwork, or volunteer experience helpful during or after college.
- Cost/Education Expenses:
  - Public university bachelor’s degree: ~$40,000–$100,000 total.
  - Graduate degree: Additional ~$30,000–$60,000.
- Job Outlook:
  - Average growth (5–8%); more opportunities with federal or state agencies.
- Starting Salary:
  - ~$45,000–$55,000/year; higher with advanced degrees.
- Advancement:
  - Senior biologist, project leader, or academic/research roles.
- Career Goal:
  - Study wildlife behavior, conservation, and ecosystem health.

Game Warden / Conservation Officer

- Education/Training:
  - Bachelor’s degree in criminal justice, biology, or natural resource management.
- Certifications:
  - Must complete state or federal law enforcement academy.
- Experience:
  - Law enforcement or outdoor experience is a plus.
- Cost/Education Expenses:
  - Degree: ~$30,000–$100,000
  - Academy training: Usually covered if hired by agency.
- Job Outlook:
  - Competitive, but steady; positions limited by state/federal budgets.
- Starting Salary:
  - ~$45,000–$60,000/year; varies by state.
- Advancement:
  - Senior officer, regional supervisor, or agency trainer.
- Career Goal:
  - Enforce laws protecting fish and wildlife and educate the public.

Marine Biologist

- Education/Training:
  - Bachelor's in marine biology, oceanography, or biology.
  - Master's/PhD for advanced research roles.
- Certifications:
  - SCUBA, boating safety, or research diving certification (often required).
- Experience:
  - Lab or field research during college is crucial.
- Cost/Education Expenses:
  - $40,000–$120,000+ depending on degree level and school.
- Job Outlook:
  - Competitive; more opportunities in research and government.
- Starting Salary:
  - ~$50,000/year; up to $90,000+ with advanced degrees.
- Advancement:
  - Research leader, professor, or government scientist.
- Career Goal:
  - Study ocean ecosystems and the creatures that live in them.

Environmental Educator / Interpreter

- Education/Training:
  - Bachelor’s in environmental science, education, or biology.
- Certifications:
  - Interpretation Certification (NAAEE or NAI) optional.
  - Teaching certification (for school-based roles).
- Experience:
  - Volunteering or seasonal work at parks/museums.
- Cost/Education Expenses:
  - ~$25,000–$80,000 for a bachelor’s degree.
- Job Outlook:
  - Good for those willing to relocate or work seasonally.
- Starting Salary:
  - ~$30,000–$45,000/year.
- Advancement:
  - Program manager, director of education.
- Career Goal:
  - Teach the public about fish, wildlife, and conservation.

Fisheries Biologist

- Education/Training:
  - Bachelor’s in fisheries biology, environmental science, or marine biology.
  - Master’s often preferred.
- Certifications:
  - American Fisheries Society certification (optional but valued).
- Experience:
  - Seasonal fieldwork, internships, or research assistant roles.
- Cost/Education Expenses:
  - ~$30,000–$100,000 depending on education level.
- Job Outlook:
  - Positive, especially in government and tribal organizations.
- Starting Salary:
  - ~$45,000–$60,000/year.
- Advancement:
  - Senior scientist, policy advisor, or fisheries program lead.
- Career Goal:
  - Manage fish populations, study aquatic ecosystems, and advise on policy.