# Essential Skills 17 and 18: Fish biological sampling, and water quality

- In case you did your biology class a while ago these are few resources that can refresh your memory and help you remember what is DNA and how it works: https://www.jax.org/news-and-insights/minute-to-understanding/what-is-dna, https://www.youtube.com/watch?v=zwibgNGe4aY, https://www.genome.gov/genetics-glossary/Deoxyribonucleic-Acid
- Instructions for Sampling Salmon Tissues for DNA Stock Identification: https://npafc.org/sampling-for-dna-3/
- The most common preservative solutions used to preserve tissues for later DNA extraction are Isopropanol, Methanol, Ethanol (EtOH).
- The best part of fish to sample for DNA are the part that contain capillaries with good amounts of blood.
- Other parts of fish used for DNA analysis:
    - Axillary "spine" process https://www.adfg.alaska.gov/static/fishing/PDFs/research/geneconservation/Nonlethalsamplinginbulkbottles.pdf
    - Muscle and heart tissue biopsy https://genidaqs.com/wp-content/uploads/2019/12/Genetic_tissue_collection_protocol_with-Finclip-and-Biopsy_2016_confirmGVL.pdf
- Lever and gills are the most common location to sample for heavy metal and pollution detection, while muscle and skin are good locations to investigate worms and pest infections.
- eDNA: Animals also naturally shed DNA through their feces, skin, and hair as they move throughout their environment. By sampling soil, water, snow, or even air, we can access this environmental DNA (or eDNA). https://www.worldwildlife.org/projects/environmental-dna#:~:text=A%20single%20sample%20containing%20eDNA,power%20to%20revolutionize%20biodiversity%20monitoring.
- General information on how to pre prepare yourself for eDNA sampling: https://www.youtube.com/watch?v=z1Y2W_eCbIY
- Explore the power of eDNA in conservation Nature:
    - https://www.worldwildlife.org/projects/environmental-dna
    - https://techhub.wwf.ca/technology/genomics-edna-applications/#:~:text=Environmental%20DNA%20(eDNA)%20is%20crucial,used%20to%20identify%20different%20species.,
    - https://www.integratesustainability.com.au/2019/11/21/edna-how-it-is-helping-biodiversity-conservation/,
    - https://www.naturemetrics.co.uk/2021/05/26/edna-highlighted-in-iucns-corporate-biodiversity-guidelines/

    - https://vimeo.com/623823396,
- 18 OF THE MOST COMMON FISH DISEASES: https://aquariumstoredepot.com/blogs/news/fish-diseases
- How To Spot And Treat 23 Of The Most Common Fish Diseases: https://simplyaquarium.com/fish-diseases/
- Fish of the Mississippi River:https://www.mvr.usace.army.mil/Portals/48/docs/Recreation/ODM/pdf/Fish%20of%20the%20Mississippi%20River.pdf
- Do fish get cold? How Fish Survive Winter: https://fishingbooker.com/blog/do-fish-get-cold-winter/#:~:text=Yes%2C%20fish%20are%20very%20sensitive,preferred%20range%20of%20water%20temperature.
- Why can't saltwater fish live in freshwater and vice versa?: https://www.divescotty.com/underwater-blog/why-saltwater-fish-cannot-live-in-freshwater-and-vice-versa.php#:~:text=On%20the%20other%20hand%2C%20freshwater,Both%20processes%20are%20called%20Osmosis
- Biological Sample Storage and Management: https://www.labmanager.com/laboratory-technology/biological-sample-storage-and-management-20151#:~:text=Biomatrica's%20room%2Dtemperature%20sample%20stabilization,anhydrobiosis)%20for%20%3E100%20years.
- Water quality assessment: https://archive.epa.gov/water/archive/web/html/vms50.html

- Acute vs. Chronic: https://www.oshatrain.org/courses/mods/750m3.html

| Acute | Chronic |
|---|---|
| Occurs immediately or soon after exposure (short latency). | Occurs over time or long after exposure (long latency) |
| Often involves a high exposure (large dose) over a short period. | Often involves low exposures (small doses) over a long period. |
| Often reversible after exposure stops. | Many effects are not reversible. |
| Can be minor or severe. For example, a small amount of ammonia can cause throat or eye irritation; larger amounts can be serious or even fatal. | Chronic effects are still unknown for many chemicals. For example, most chemicals have not been tested for cancer or reproductive effects. |
| Relationship between chemical exposure and symptoms is generally, although not always, obvious. | It may be difficult to establish the relationship between chemical exposure and illness because of the long time delay or latency period. |
| Knowledge often based on human exposure. | Knowledge often based on animal studies. |

- Main water quality indicators: https://atlas-scientific.com/blog/what-are-the-main-indicators-of-water-quality/
- What Is Eutrophication? - Definition, Causes & Effects: https://oceanservice.noaa.gov/facts/eutrophication.html, https://www.youtube.com/watch?v=6LAT1gLMPu4, https://www.youtube.com/watch?v=dtxD68U2E4o
- Efforts of Conservation authorities to monitor water quality https://trca.ca/conservation/environmental-monitoring/surface-water-quality/
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