Adaptive Management Aquarium/Ecosystem Glossary (required detail/specificity)

Sun: The star at the centre of our solar system. The sun has a massive output of energy that directly affects the inner planets, including Earth. This solar radiation (sunlight) drives terrestrial weather, climate and biological systems.

Radiation: Energy transmitted through space in the form of waves. In biological systems, thermal radiation (heat) drives all biochemical reactions. Within a critical limit, heat determines the speed of reactions. Too little heat, and these reactions will stop; too much heat damages proteins, enzymes and DNA. Energy also drives the flow of matter. In the abiotic environment, prime examples include wind (air) and turbidity/currents (water).

Gravity: The primary physical force on earth that allows molecules such as air and water to move and change positions. Gravity allows fluids to flow e.g. water in rivers and air as wind.

Wind: The flow of air heated by solar radiation, or under the influence of gravity. Wind is an important factor in nutrient flow; and gas and water exchange. Surface winds move and displace surface water. Deeper, usually nutrient rich, water is able to move closer to sunlight. The combination of solar radiation and nutrients provide the start of a food chain. Aerated surface water is moved to deeper regimes of the water column.

Water movement: Movement of water powered by solar radiation or wind. This motion allows the redistribution of nutrients, energy and organisms.

Bacteria: The simplest organic life on earth. Bacteria underpin all ecosystems and are responsible for the majority of energy and nutrient conversions.

Wetland: An ecosystem with a terrestrial-aquatic interface. Examples include estuaries, lakes, swamps, pans and vleis. They have a suite of uniquely adapted vegetation, animals and micro-organisms. Wetlands are amongst the most productive eco-systems on the planet. These function to recycle and store nutrients, serve as fish nurseries, and provide refuges during period when terrestrial eco-systems are in change.

Trophic levels: Levels within a food chain. A food chain is a succession of organisms absorbing and accumulating energy. These organisms are consumed by other organisms on a higher trophic level. Except for a few rare examples, all food chains start with solar radiation.

Primary producers: Organisms of the first trophic level of a food chain. They combine solar radiation and nutrients (inorganic and organic) to produce complex biological molecules, crucial for higher trophic levels. Important examples are bacteria, algae and plants. Collectively they are known as autotrophs (“Self-feeders”).

Primary consumers: Organisms that accumulate energy and nutrients through the consumption of autotrophs. Organisms in this group are known as heterotrophs (“Other feeders”).

Secondary consumers: Organisms that predated organisms that feed primarily on photosynthetic organisms

Tertiary consumers: Organisms that occupy the highest trophic level. They consume secondary consumers.

Scavengers: Organisms that feed on dead/decaying organisms

Decomposers: Organisms engage primarily in catabolic reactions. They break down complex organic molecules into simpler inorganic and organic molecules. In this process they release nutrients and energy back into an environment. They products are used by autotrophs.

Filter feeders: Organisms that feed by filtering organic particles, bacteria, algae and multi-cellular organisms out of water. They are characterised by adaptations such as sieves or bristles to efficiently feed in this manner.

Single-celled organisms: Organisms that able to conduct all biological functions within a single cell. The functions include reproduction, respiration and metabolism. They differ from multi-cellular organisms that conduct these

same processes in specialised cells within their bodies. Examples of single cell organisms include bacteria and single-celled members of the algae, fungi and animal kingdoms.

Temperature: The primary energy into an aquarium. A substitute for the input of solar radiation. The temperature is important in driving the supply of nutrients and respiratory gases available to the tank occupants.

Dissolved oxygen: The primary respiratory gas needed by tank inhabitants. The lack of wind requires oxygen to be added by aeration devices (air stones) or living plants.

Biological filtration: Utilising living organisms to degrade, accumulate and recycle excess nutrients or organic molecules in an aquarium. Examples include living plants and nitrogen-loving bacteria.

Chemical filtration: The process of removing or degrading unwanted organic molecules by abiotic chemical processes in an aquarium. Examples are activated charcoal and zeolite.

Mechanical filtration: The use of physical means (filters) to remove unwanted organic materials in an aquarium. Examples include filter wool or sand traps.

Nitrosomas: Bacteria that convert ammonia, a toxic waste product from protein metabolism to nitrite (NO_2)

Nitrobacteria: Bacteria that convert nitrite to nitrates. The nitrates are able to be used by autotrophs, especially aquatic plants as nutrients.

Aquatic vegetation: Plants and algae adapted to living partially or fully submerged in water. In aquarium they function as shelter for tank inhabitants and as biological filtration.

Water chemistry: The organic and inorganic chemicals and physical properties of aquarium/pond water. These chemicals include toxic waste products and essential biological electrolytes. The balance of these substances is important to allow a healthy tank environment. This balance is achieved through filtration, aeration and temperature control.

Nitrogen cycle: The flow of nitrogen ions within an aquarium. It enters the tank as protein (in fish food). It is used and degraded to ammonia within the fish and excreted as ammonia. Bacteria successively detoxify it to nitrites and nitrates. The nitrates are used as a nutrient by plants and bacteria.

Ammonia: The toxic breakdown product (metabolite) of protein metabolism. Enters into the water via urine and faces, or by protein decay including that from food and dying plants/animals.

Nitrite: The initial product of ammonia metabolism by nitrosomas bacteria. It is less toxic than ammonia, but still needs to be present in low concentration in a healthy aquarium.

Nitrate: The product of nitrite metabolism by nictrobacter. Relatively safe in moderate concentrations but toxic at higher concentrations. Is an important nutrient for bacteria, algae and living plants.

ρH: A measure of the amount of free protons or hydroxyl ions in a system. Commonly thought of as the “acidic” or “basic” nature of a system. The ρH scale runs from 0 (acid) to 7 (neutral) to 14 (basic). The ρH is an important value as it has a crucial impact on the rate of many biochemical reactions.

Zeolite: A method of chemical filtration using natural and manufactured compounds to reduce ammonia from the water in an aquarium. Often, also softens the water.

Pumps: Replace the natural flow of air and water under the influence of gravity in an aquarium/fish pond.

Heaters: Provides thermal energy; a substitute for the sun in an aquarium.