1. Describe the difference between the dilution paradigm and the boomerang paradigm, and place this in historical context.

Historically the dilution paradigm was common practice. This paradigm can be summed up as: the solution to pollution can be found in dilution. In other words, if we contaminate a large body of water (e.g. with POPs), or the atmosphere (e.g. with greenhouse gases) the self-regulatory principles of our planet will dissolve any potential harm. Due to the increasing public understanding of pollution (including the work of Rachel Carson, Earth Rise and the Minamata disease), a new paradigm emerged: the boomerang paradigm. Within this paradigm the pollutant does not disappear when we emit or discharge it into the environment. It will at some point, and at some time resurface, just like a boomerang.

1. Define biomagnification and bioaccumulation and explain the difference between the two concepts.

Bioaccumulation refers to the accumulation of a xenobiotic compound within an organism, and is a net result of uptake and elimination. In specific cases biomagnification can occur. This is caused by the inability of organisms to eliminate compounds from their bodies. Organisms at the base of the food pyramid accumulate xenobiotic compounds from the environment. Animals at next trophic feed on these organisms, and thereby also accumulate the compound in their bodies. However, they are unable to excrete the compound, and as a result they concentrate or magnify the compound. When these organisms are subsequently consumed by another predator higher in the food chain, the concentration increases even further. This results in biomagnification across trophic levels: the increase of the concentration of the contaminant with an increase in trophic level.

1. Explain how dead zones develop in estuaries.

* Fertilizers run-off into aquatic system, which is an interconnected system
* Watersheds (drainage basins) drain huge quantities of water, and accompanying nutrients and nutrients end-up in estuaries
* Results in increased algal growth due to the increased availability of nutrients
* Bacteria move in to decompose, but remove the oxygen from the water
* Results in hypoxic and anoxic zones: other animals die: dead zone

1. Endocrine disruptors are a group of environmental pollutants of emerging concern. Explain what they are, and how they affect the endocrine system of organisms.

Endocrine disruptors are chemicals which have the ability to affect the endocrine system and thereby disrupt homeostasis (the steady-state) in organisms. And, as hormones are signalling substances, even small amounts of pesticides in the environment can cause serious impacts on organisms, including humans. Impacts include reduced fertility, growth and developmental deformities, to name a few.

1. Environmental risk assessment is a process in which the risk of pesticides is quantified. Explain how this data is used by risk managers, and what additional data they use to decide on whether the use of pesticides should be allowed, banned or restricted.

Scientific research on impacts forms the foundation of an **Environmental Risk Assessment** (or Ecological Risk Assessment)**:** a structured approach to quantitatively or qualitatively estimating the risk related to a specific (mix of) pollutant(s). This information is subsequently used by risk managers in a process called **Environmental Risk Management** to determine the course of action. Importantly, the decision does not only depend on the environmental risk, but other factors are also taken into account. Economic, social, or legal constraints are important factors which are also considered by risk managers to determine the course of action, and whether or not the use of a chemical, such as a pesticide, should be banned or restricted.