# Nutrient Contribution

Assessment of contributions based on estimated assumptions

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## Contents



## To Do

- **Permutations**
- **update table construction in Feeding as nutrient source**

# Data import

| File |
|---|
| Feed composition APO-SUB-2.xlsx |
| Water quality APO-SUB-2.xlsx |
| IAFFD FICD.xlsx |

# Data wrangling

# Results

## Feed(-ing) as nutrient source

### Aquaponics feeds

### Experimental feeds

### Sources and Extent of Variability

## Water as Nutrient Source

### Data origin

### Tap water

### Rain water

- extreme outliers at the upper end –> NEED TO BE REMOVED!

Table 2: Summary statistics of rainwater composition data (n = 18). Analytes with less than 5 dataset records were removed. Outliers were identified by calculating the interquartile range (IQR). Values > 1.5 x IQR were removed from the dataset.

| analyte | unit | n | min | mean | sd | cv | max |
|---|---|---|---|---|---|---|---|
| Ca | mgL | 13 | 0.3600 | 0.3600 | 1.4659796 | 4.0721656 | 5.0024 |
| Cl | mgL | 11 | 0.7140 | 0.7140 | 1.1908863 | 1.6679079 | 4.0460 |
| K | mgL | 11 | 0.3822 | 0.3822 | 0.2792302 | 0.7305865 | 1.2000 |

| analyte | unit | n | min | mean | sd | cv | max |
|---|---|---|---|---|---|---|---|
| Mg | mgL | 7 | 0.1116 | 0.1116 | 0.0591581 | 0.5300904 | 0.2880 |
| NH4 | mgL | 12 | 0.0100 | 0.0100 | 0.6609724 | 66.0972372 | 2.2140 |
| NO3 | mgL | 11 | 0.9920 | 0.9920 | 0.3663933 | 0.3693481 | 2.1638 |
| Na | mgL | 14 | 0.3588 | 0.3588 | 1.2621411 | 3.5176731 | 4.5172 |
| SO4 | mgL | 12 | 1.7280 | 1.7280 | 1.6864556 | 0.9759581 | 6.1440 |

**Combined**

# Nutrient contribution

## Initial assumptions

We assume a recirculation aquaculture system (RAS) has a total volume of $m^3$ of which $m^3$ are used as rearing volume for the stock. Furthermore, we assume a stocking density of $kg\,m^{-3}$, referred to the rearing volume of the system. The feeding rate shall be set to $\%\,d^{-1}$ of the total biomass and a water exchange rate of $\%\,d^{-1}$ of the total system volume shall be maintained.

Based on these inputs, a biomass of kg, a total weight of kg feed fed per day, a daily exchanged volume of $m^3\,d^{-1}$ freshwater and $L\,kg^{-1}$ exchanged water per weight unit feed fed is calculated.

## Contribution

To estimate the mass contribution of source water and feed to the total amount of nutrients that are entering the system, it is assumed that the RAS operator is using tap water as freshwater source and analysis results from water treatment plants are thus taken as data input. Furthermore, the average of the nutrient profile of a number of commercial fish feeds is used.

**Feed**

**To Do** - Check average water quality data - Check for more commercial feeds - Group commercial feeds by fish species (is there a pattern?)

#### Water

### Permutation

## Save data