



NTNU

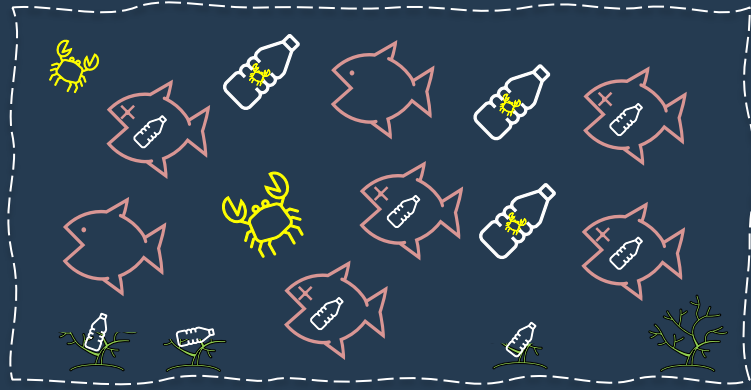
| Kunnskap for en bedre verden

Plastforurensning Kilder og Miljøpåvirkninger

Vitenskapsbaserte verktøy for å måle bærekraften til plast

Ahmed Marhoon | Stipendiat på Program for industriell økologi (IndEcol)

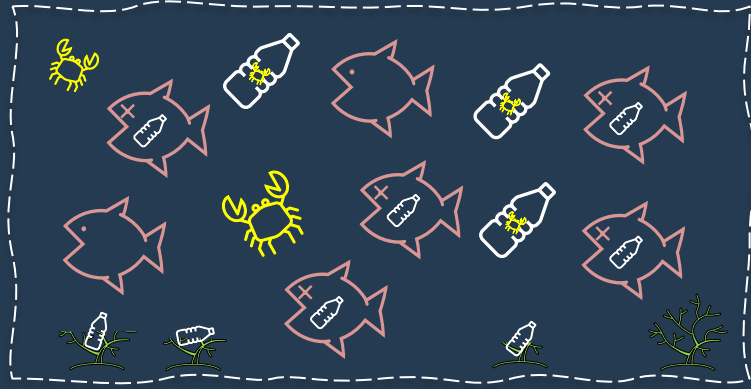
Environmental Impacts



Plastic Cycle



Environmental Impacts

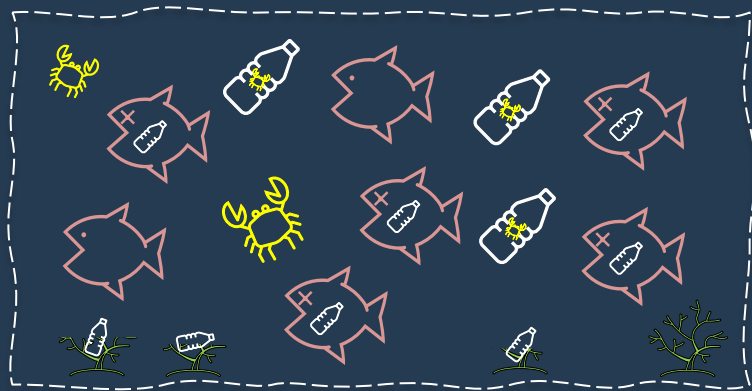


We need
to do
something!

Plastic Cycle



Environmental Impacts



We need
to do
something!

Plastic Cycle



Production

Use

Collection

Treatment





Plastic Cycle





Plastic Cycle





Plastic Cycle





Plastic Cycle

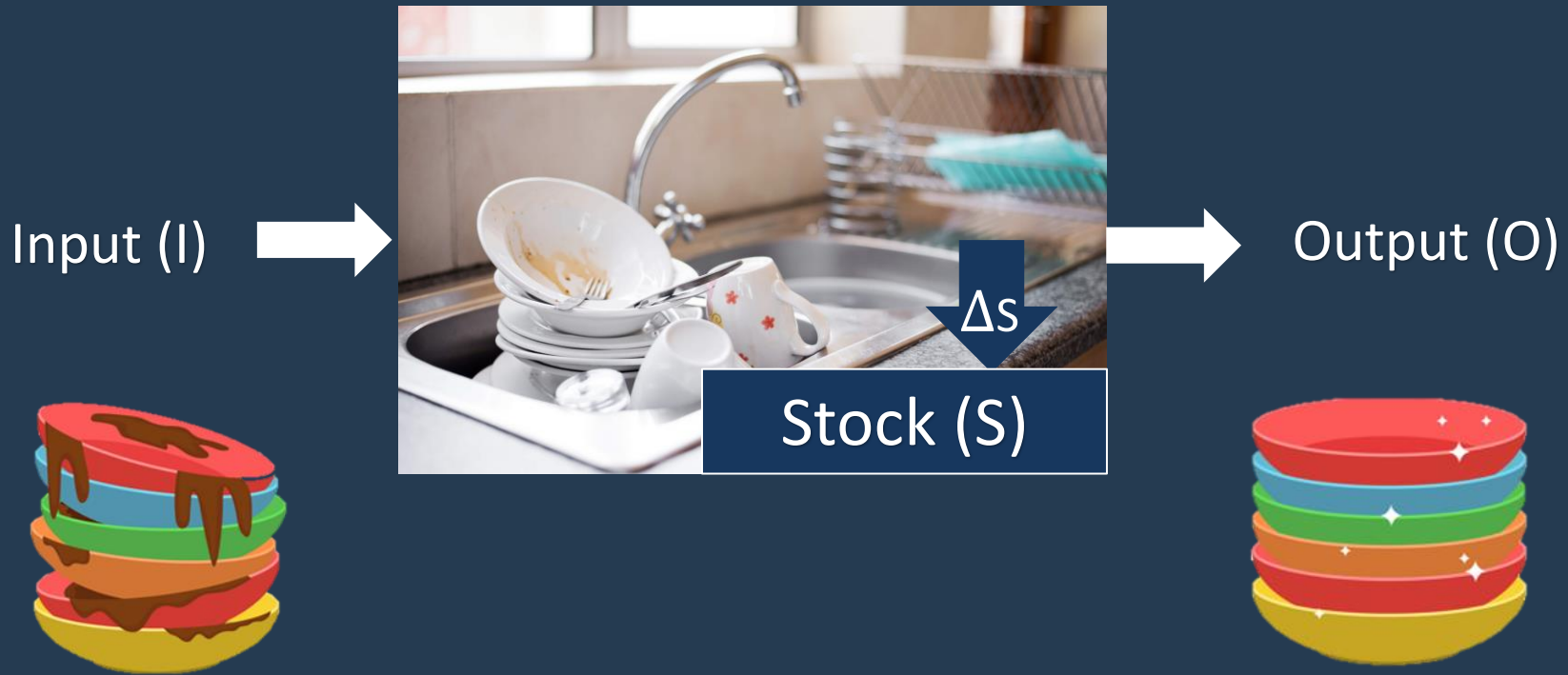


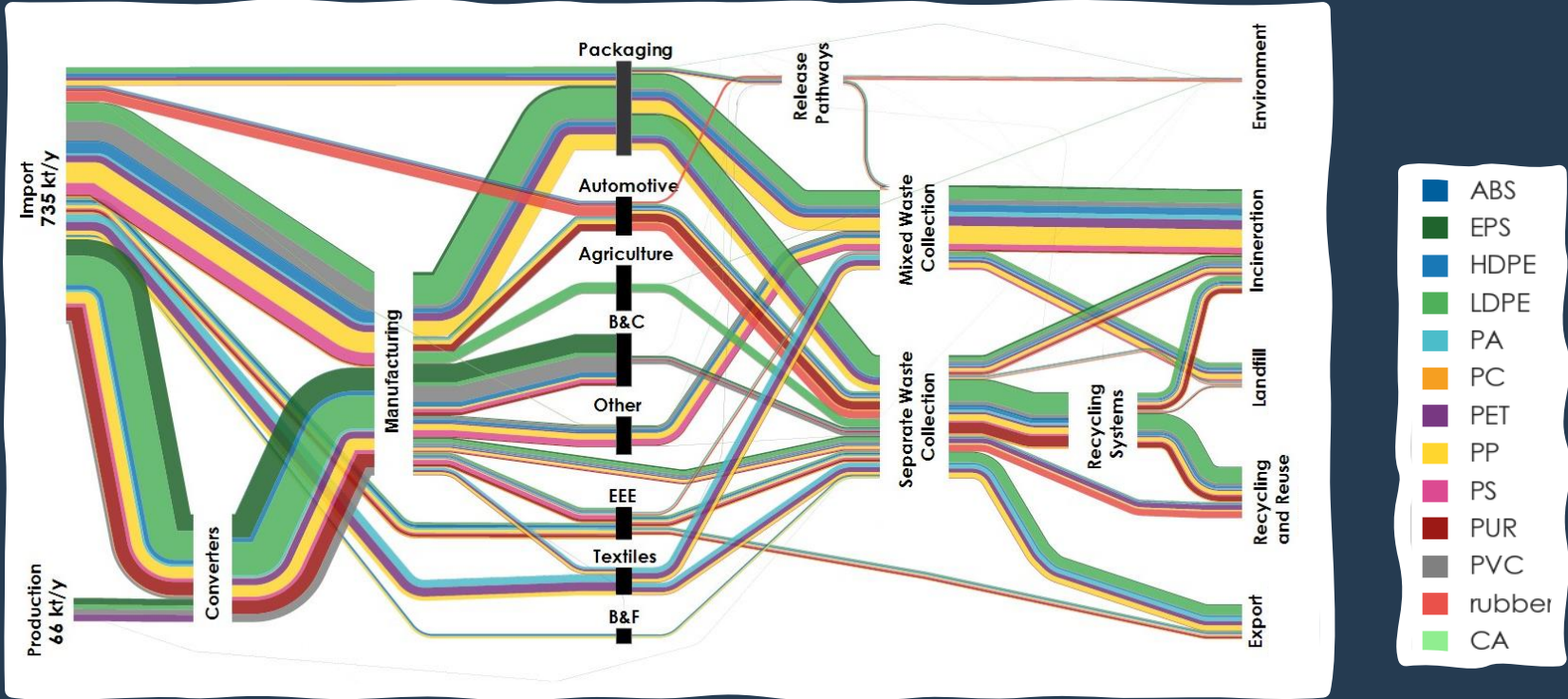


Plastic Cycle



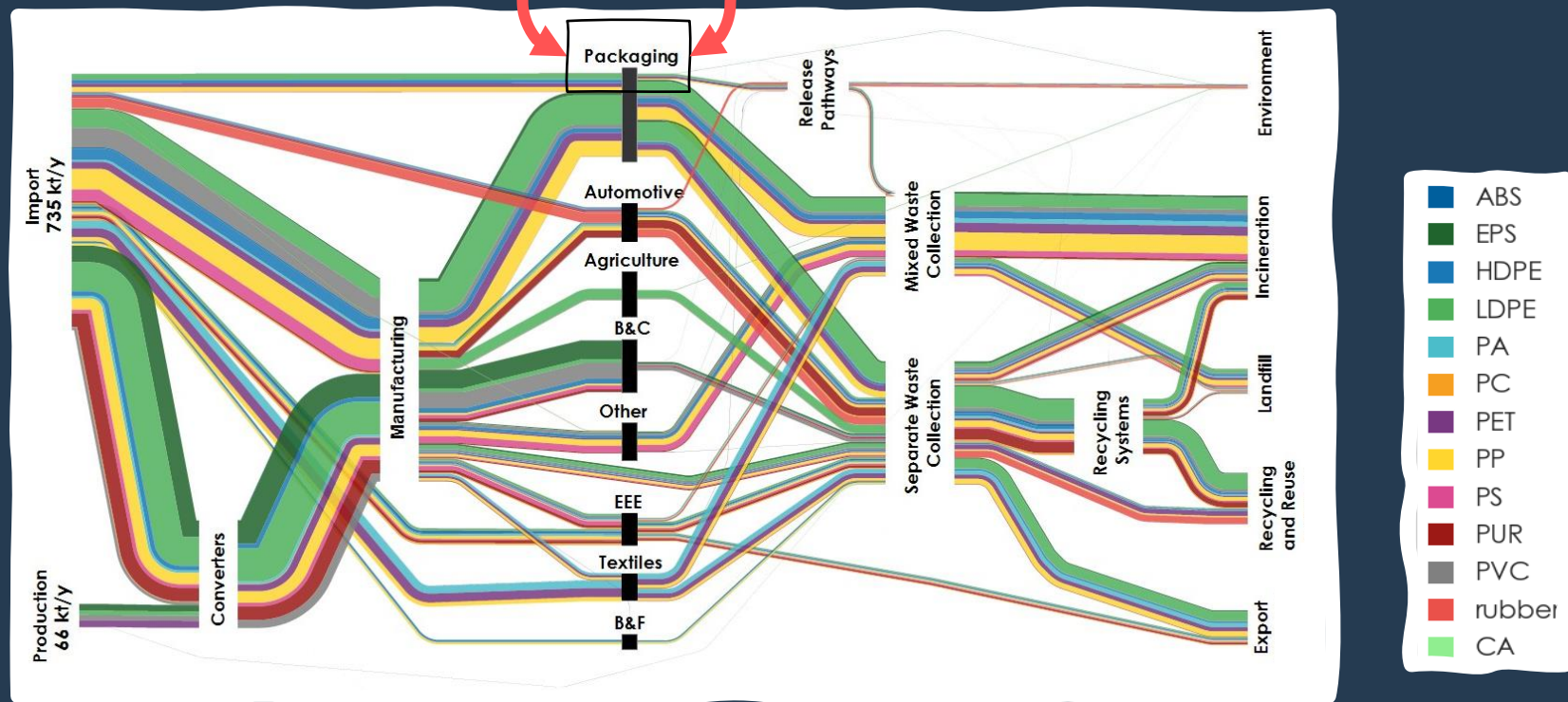
MATERIAL FLOW ANALYSIS (MFA)





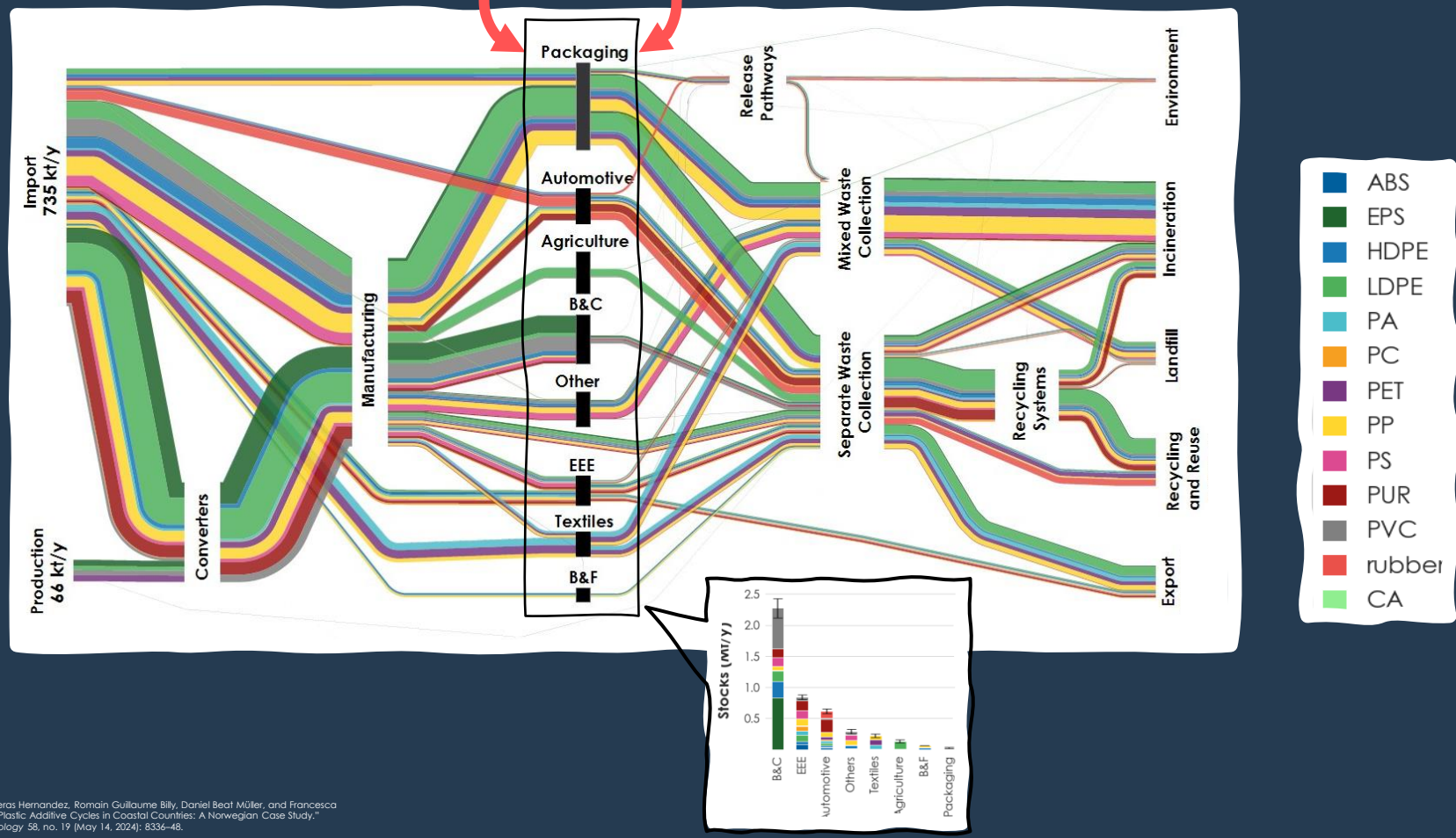
30% of total consumption

40% of total waste



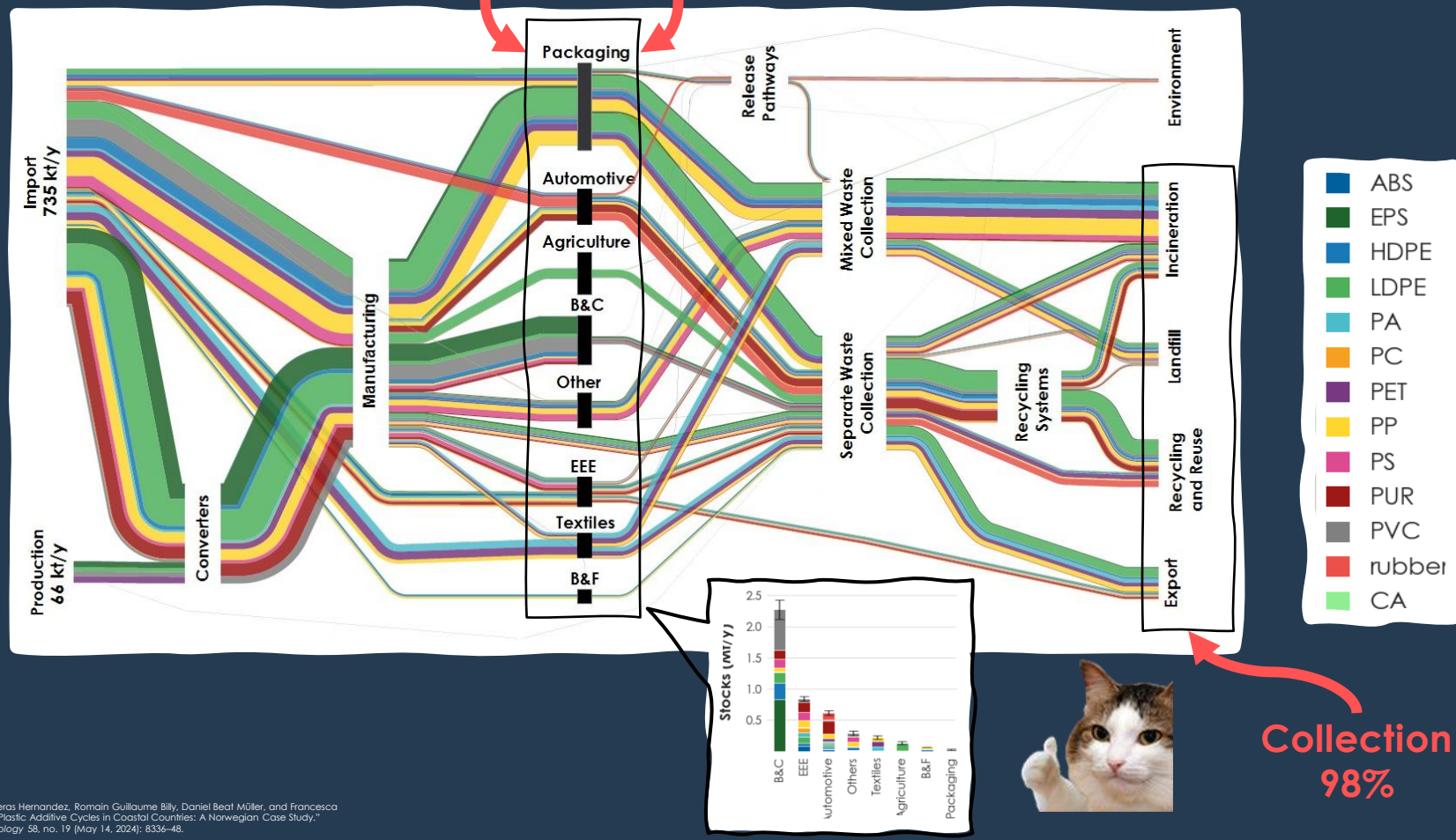
30% of total consumption

40% of total waste



30% of total consumption

40% of total waste



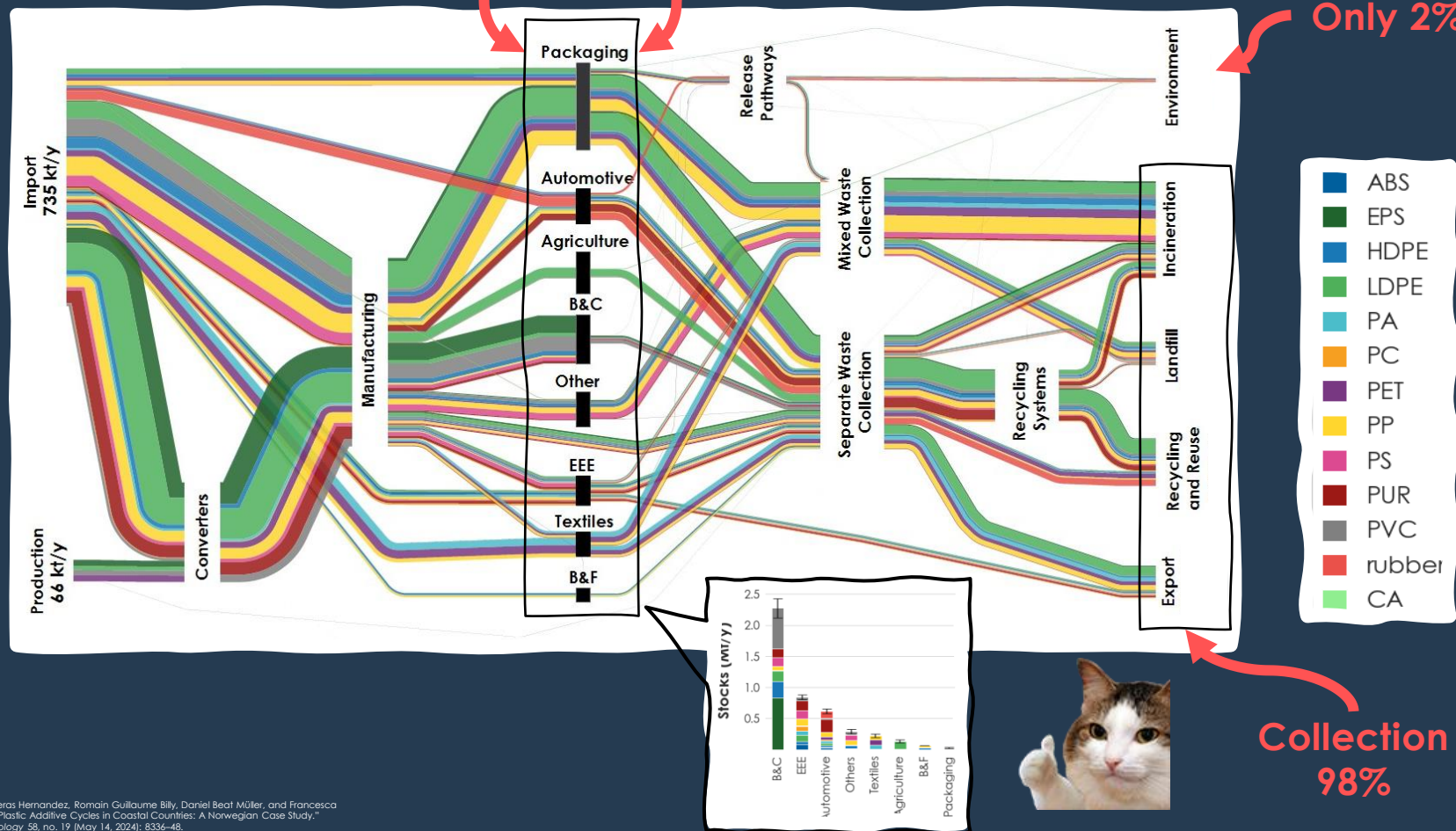
Collection
98%



30% of total consumption

40% of total waste

Only 2%



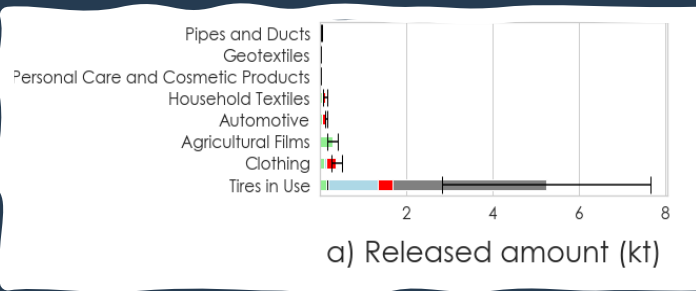


15 kilo tonnes

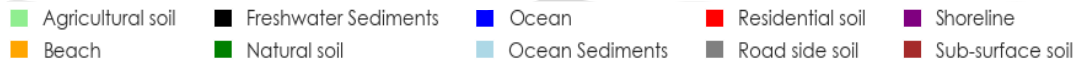


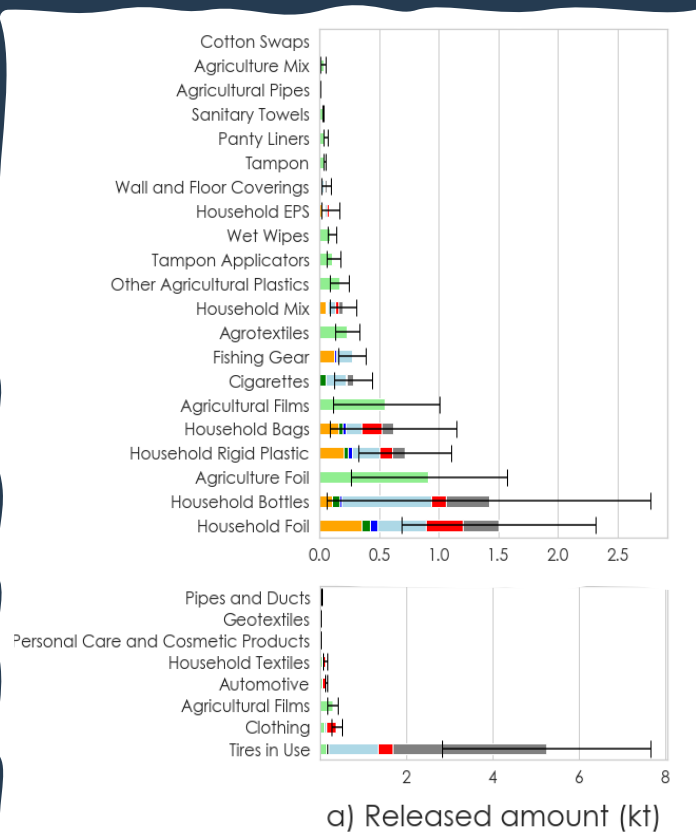
15 kilo tonnes ~ 1.5 billion

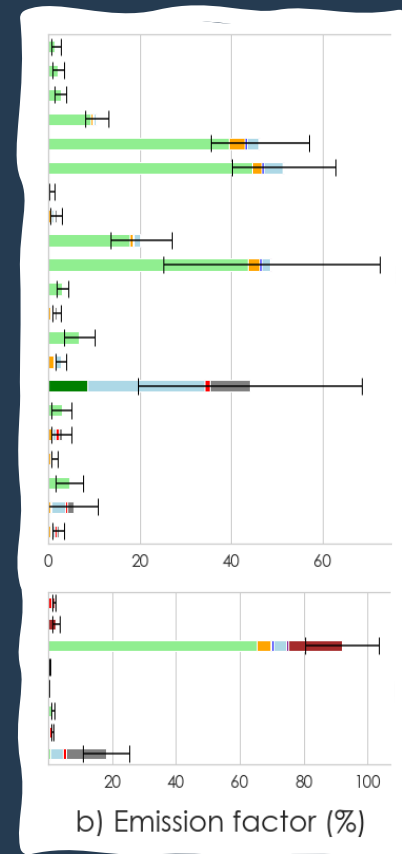
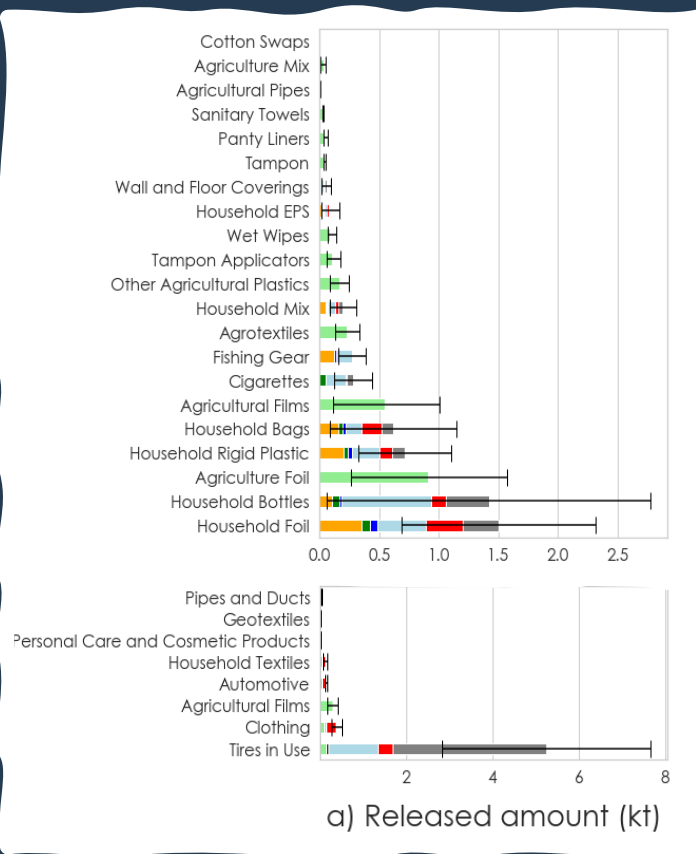




Microplastics

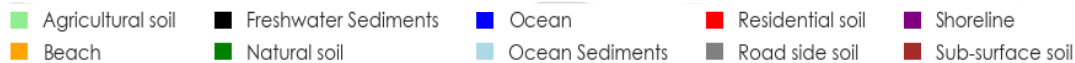


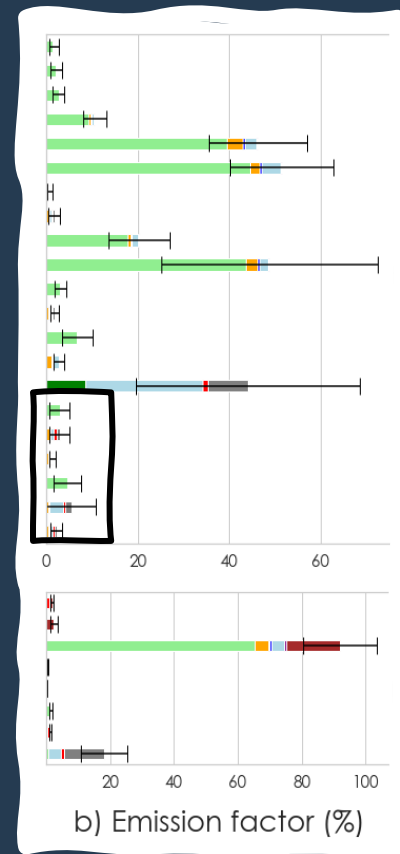
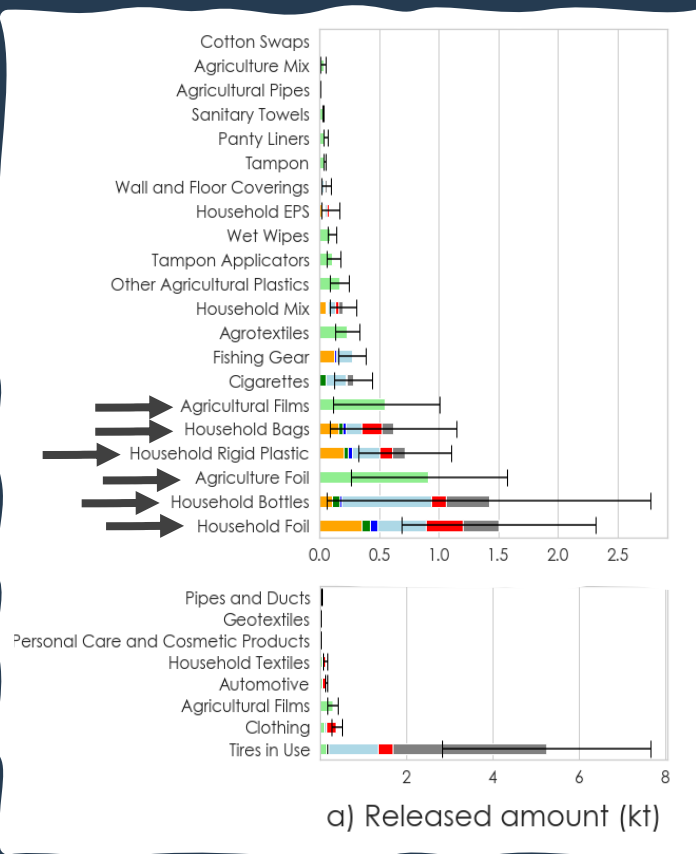




Macroplastics

Microplastics



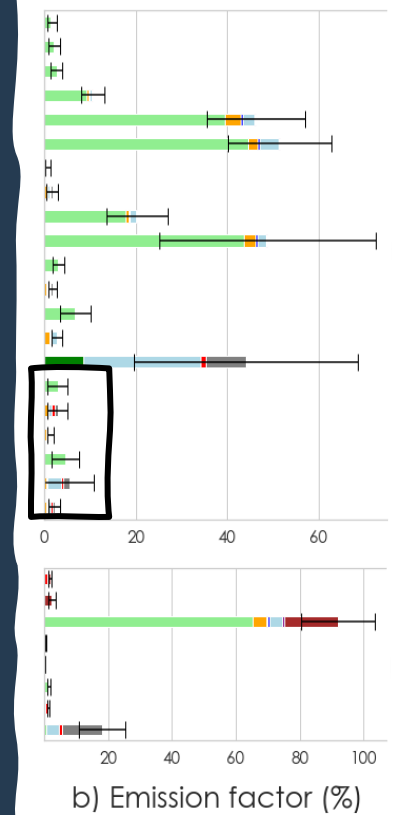
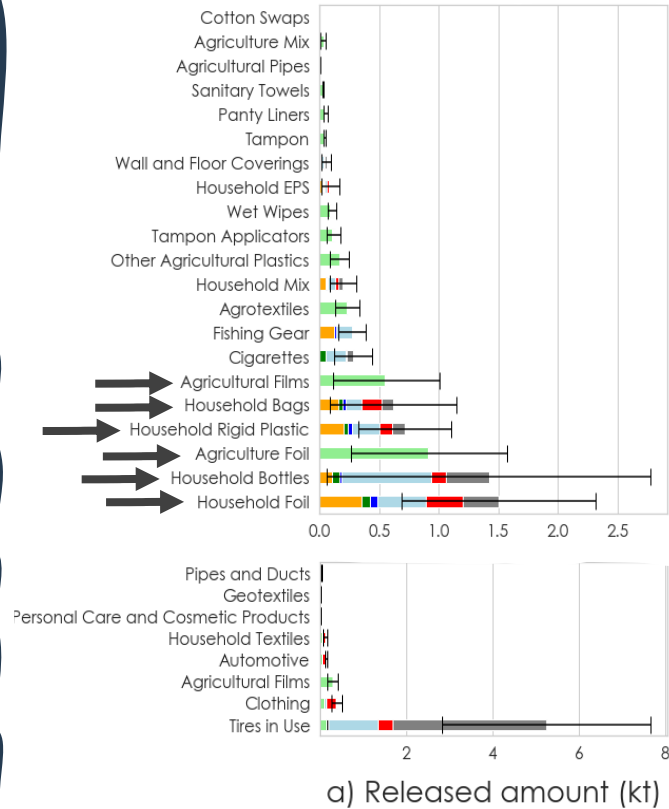


Macroplastics

Microplastics

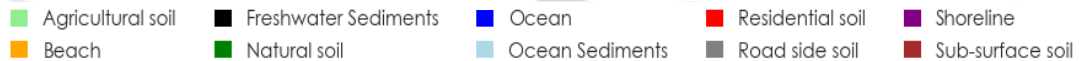


HIGH CONSUMPTION!



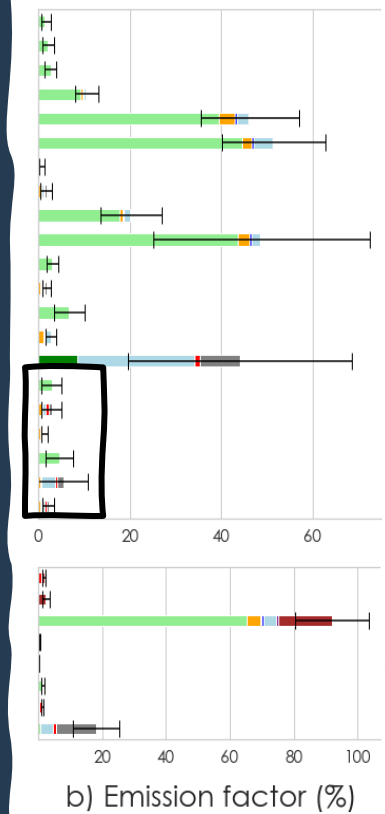
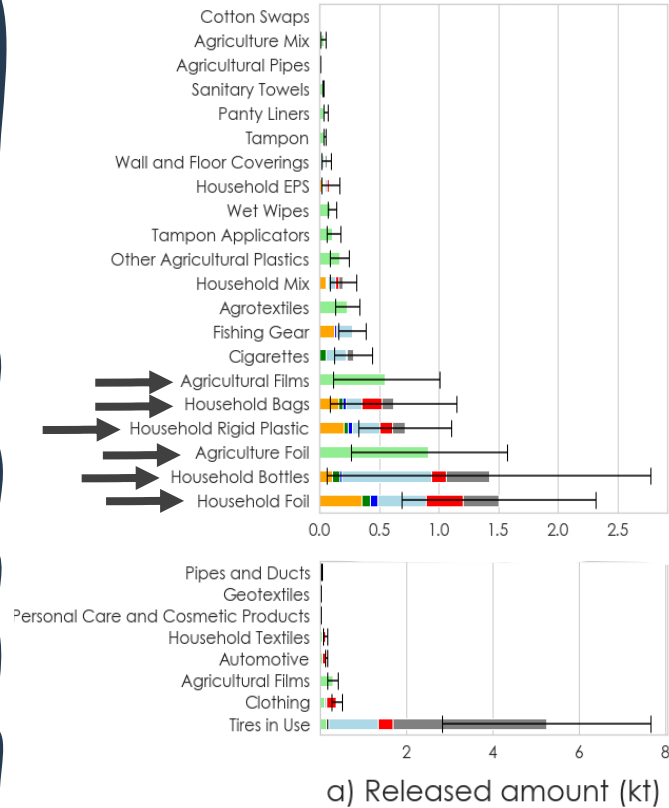
Macroplastics

Microplastics



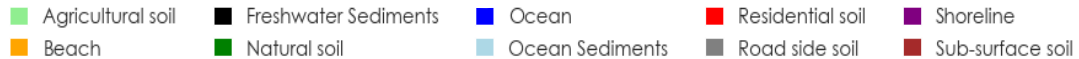
**HIGH
CONSUMPTION!**

**CONSUME 18%
ABOVE THE
EUROPEAN AVERAGE**



Macroplastics

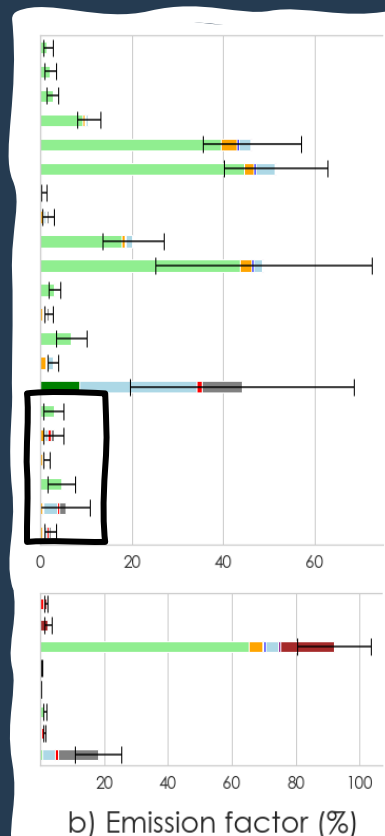
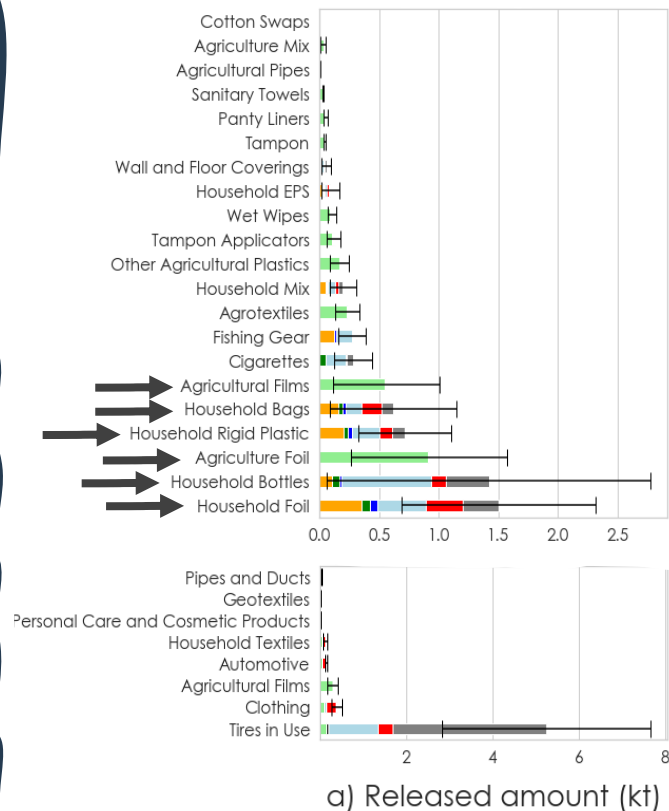
Microplastics



**HIGH
CONSUMPTION!**

**CONSUME 18%
ABOVE THE
EUROPEAN AVERAGE**

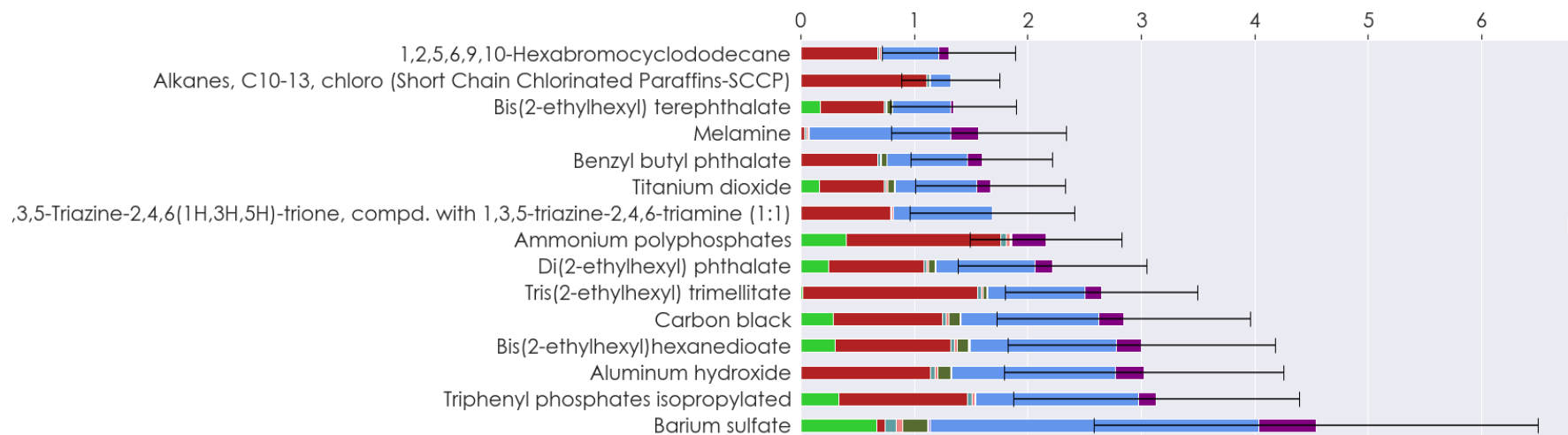
**RELEASE DOUBLE THE
AMOUNTS COMPARED
TO THE AVERAGE
SWISS**



Macroplastics

Microplastics

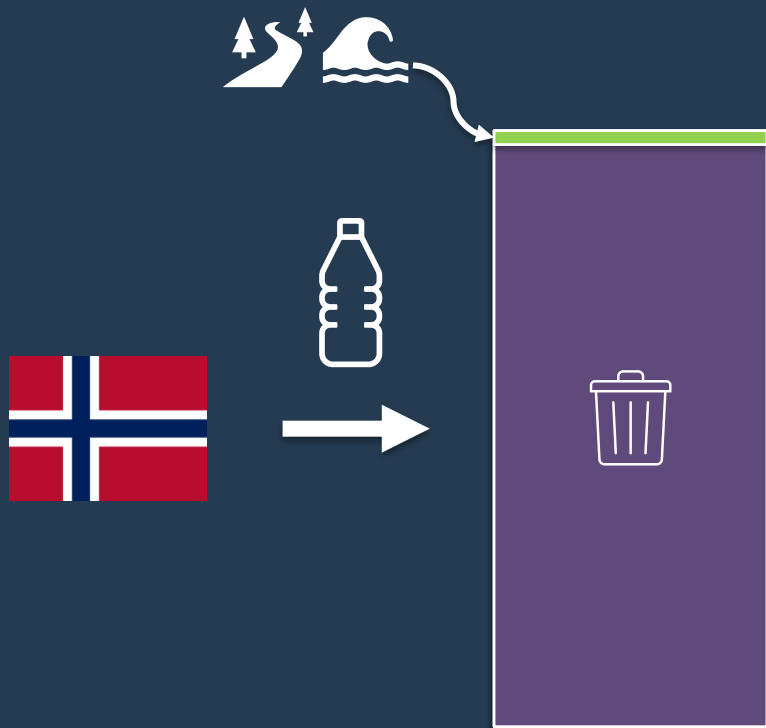


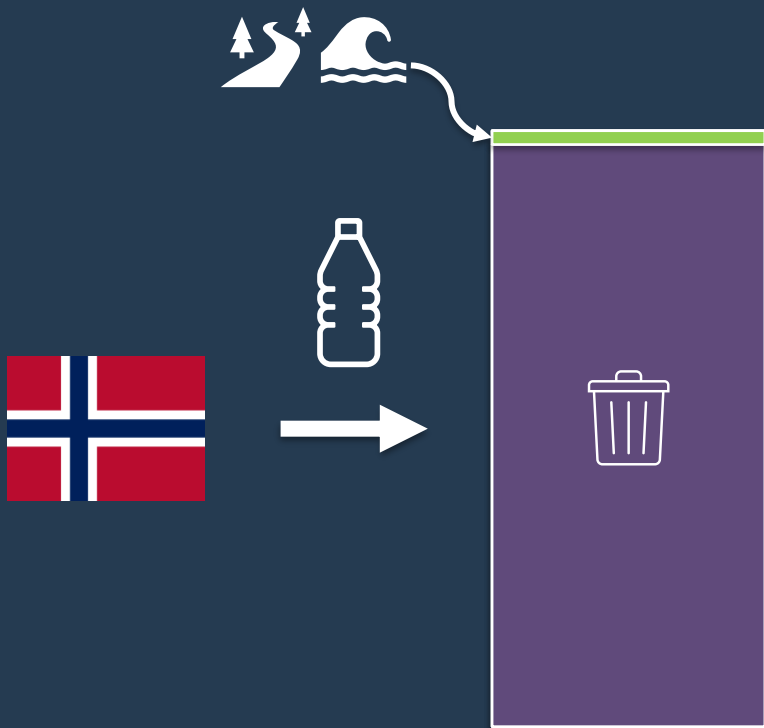


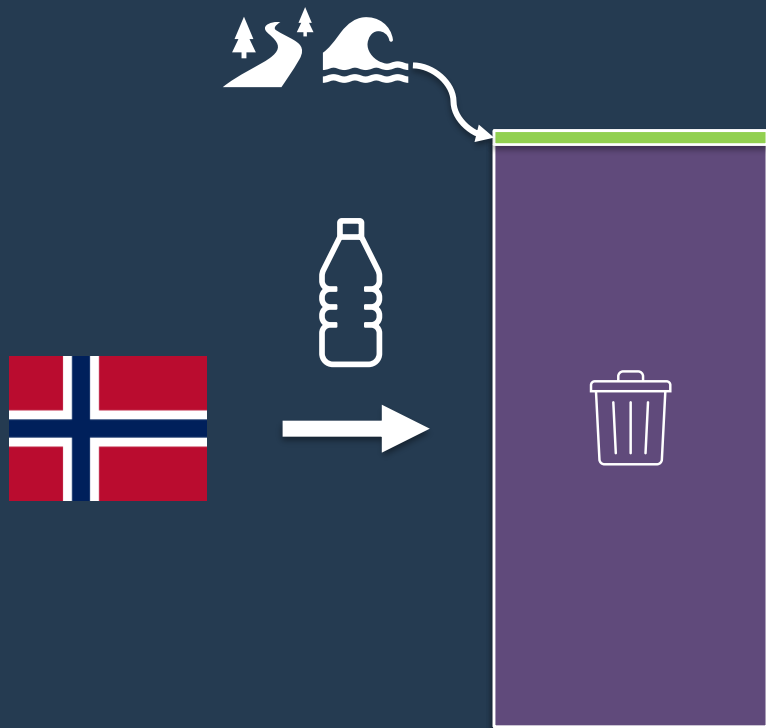
TOXIC!

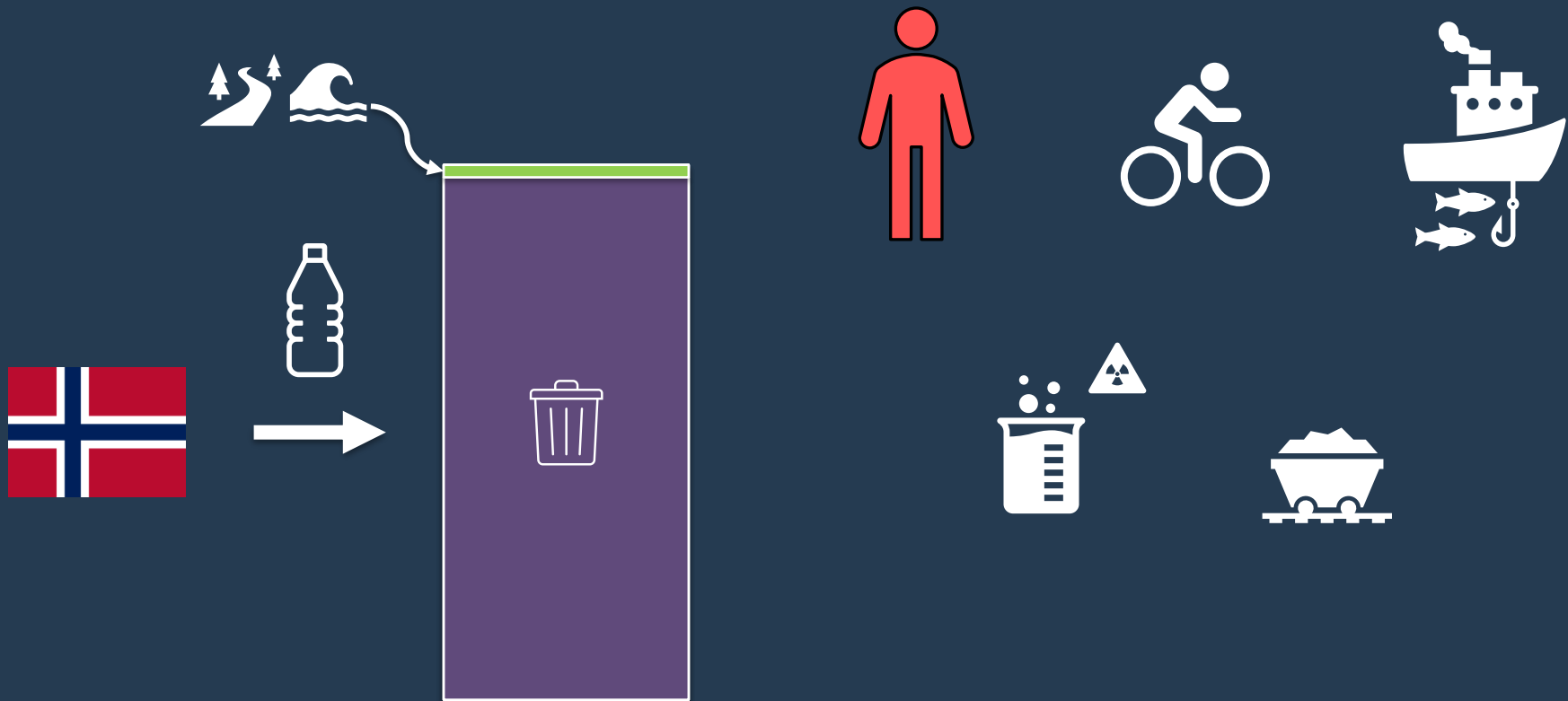






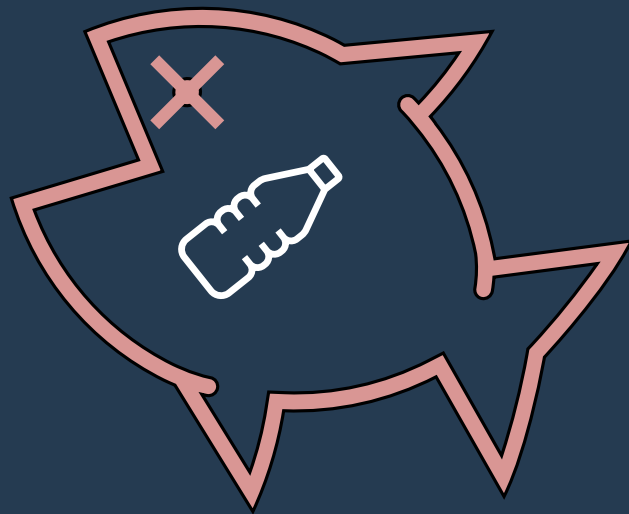






WHAT IS THE PROBLEM OF PLASTICS IN LCA?

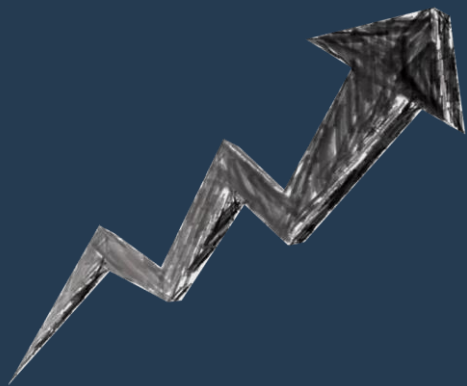




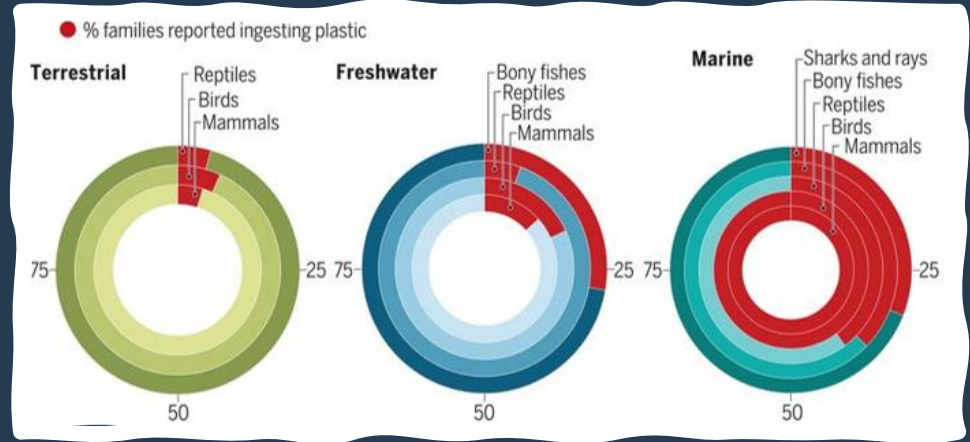
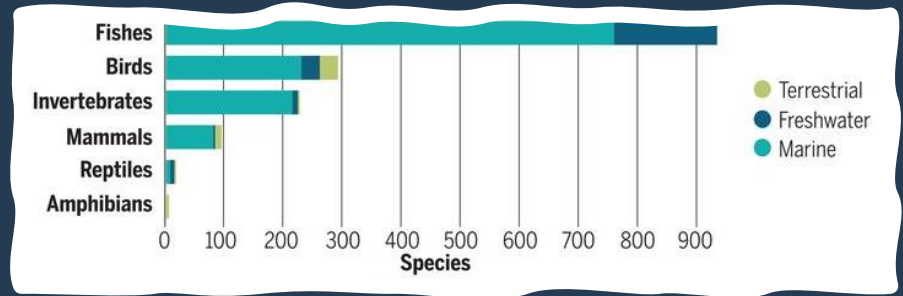
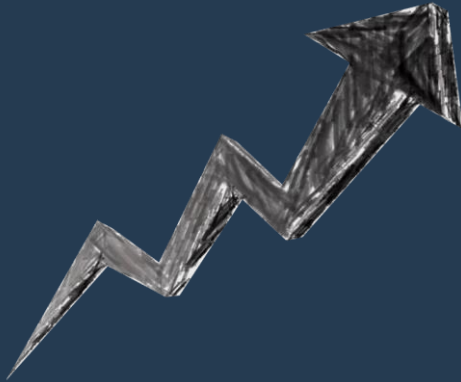
FIRST PLASTIC INGESTION BY MARINE SPECIES IN RECORDS: 1960S



RAPIDLY INCREASING



A RAPIDLY INCREASING WIDESPREAD PROBLEM



WHAT PHYSICAL IMPACTS?



**BLOCKAGE OF THE
GASTROINTESTINAL TRACT**



**GASTRIC IMPACTION AND
RUPTURE**

døde etter sykdom:

**Sjelden hval ble funnet med
over 30 plastposer inne i
magen**

Gåsenebbhvalen som ble funnet utenfor norskekysten ble trolig syk etter å ha spist store mengder plast.



WHAT PHYSICAL IMPACTS?



Model



$$\begin{aligned}\frac{\partial}{\partial a} \ln f_{a,\sigma^2}(\xi_1) &= \frac{(\xi_1 - a)}{\sigma^2} f_{a,\sigma^2}(\xi_1) = \frac{1}{\sqrt{2\pi\sigma^2}} \exp\left(-\frac{(\xi_1 - a)^2}{2\sigma^2}\right) \\ \int_{\mathcal{X}_n} T(x) \cdot \frac{\partial}{\partial \theta} f(x, \theta) dx &= M\left(T(\xi) \cdot \frac{\partial}{\partial \theta} \ln L(\xi, \theta)\right) \int_{\mathcal{X}_n} \frac{\partial}{\partial \theta} f(x, \theta) \\ \int_{\mathcal{X}_n} T(x) \cdot \left(\frac{\partial}{\partial \theta} \ln L(x, \theta)\right) \cdot f(x, \theta) dx &= \int_{\mathcal{X}_n} T(x) \cdot \left(\frac{\partial}{\partial \theta} \ln f(x, \theta)\right) \cdot f(x, \theta) \\ \frac{\partial}{\partial \theta} \ln T(x) &= \frac{\partial}{\partial \theta} \int_{\mathcal{X}_n} T(x) f(x, \theta) dx = \int_{\mathcal{X}_n} T(x) \frac{\partial}{\partial \theta} f(x, \theta) dx\end{aligned}$$



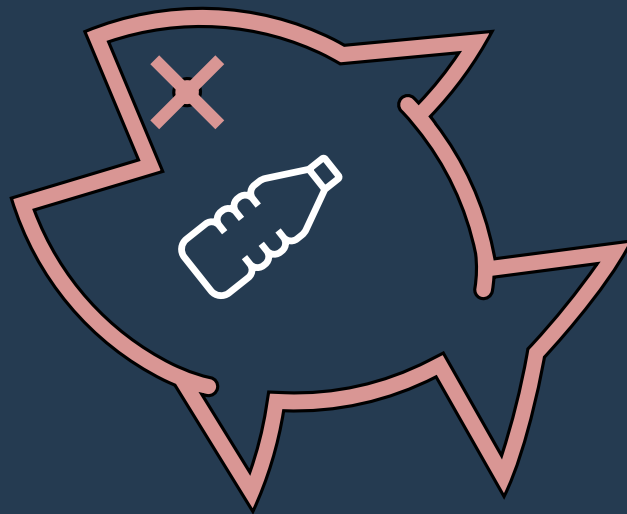
døde etter sykdom:

Sjelden hval ble funnet med over 30 plastposer inne i magen

Gåsenebbhvalen som ble funnet utenfor norskekysten ble trolig syk etter å ha spist store mengder plast.



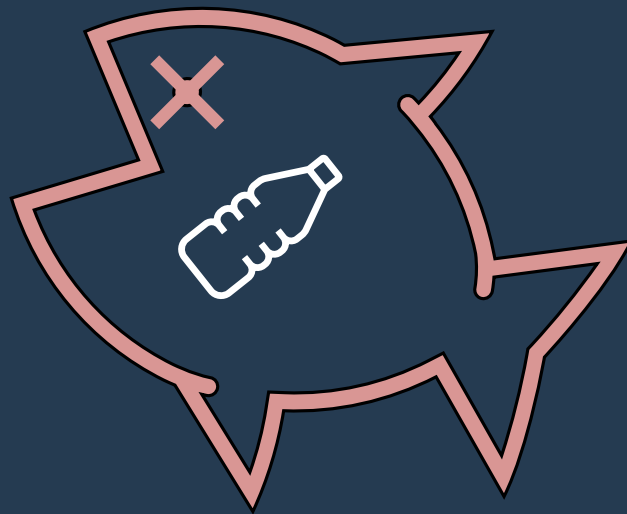
Necropsy
data

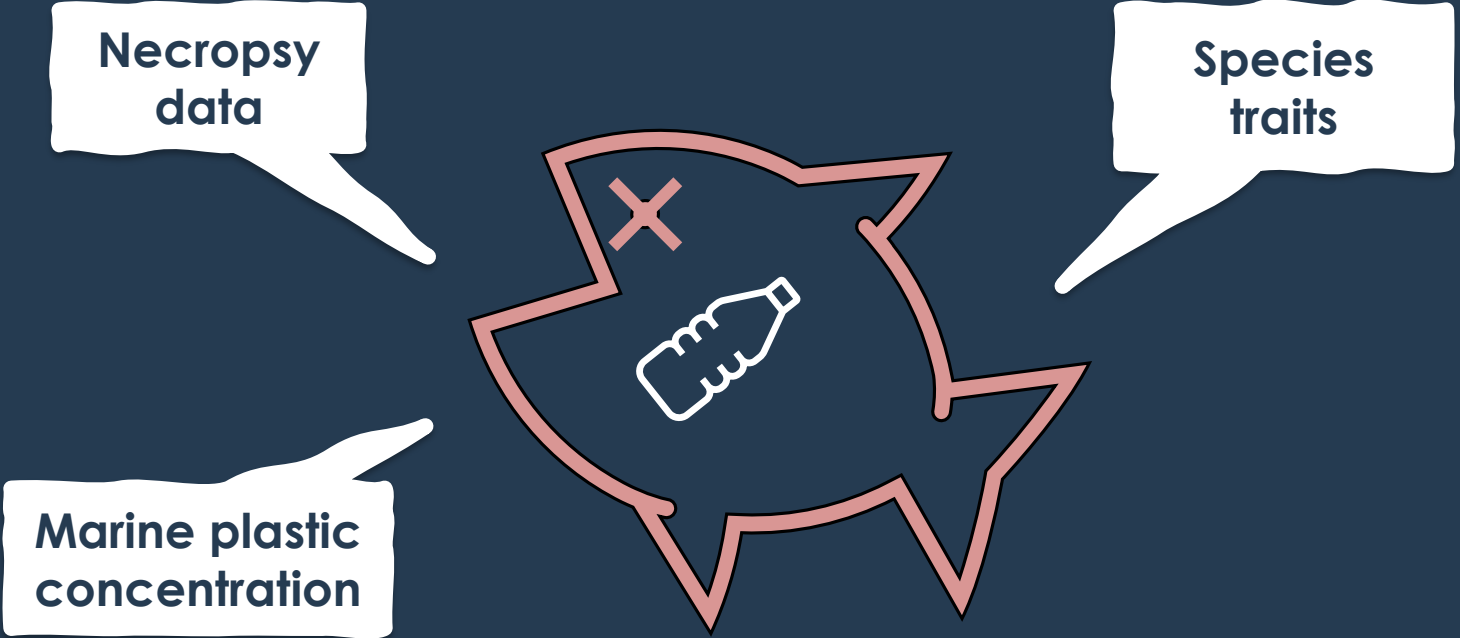




**Necropsy
data**

**Marine plastic
concentration**



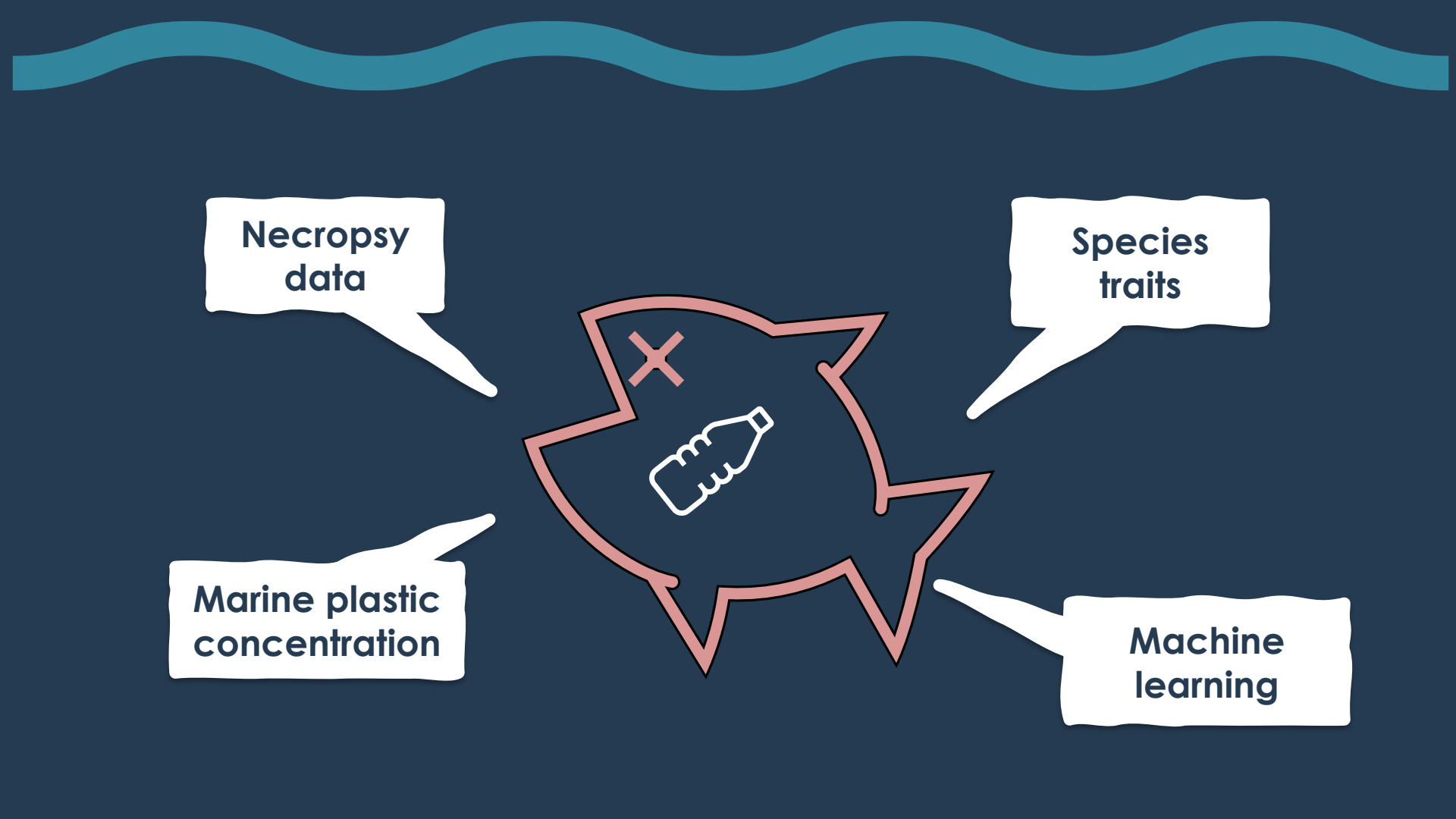


**Necropsy
data**

The diagram features a dark blue background with a wavy teal line at the top representing the water surface. In the center is a red-outlined, irregular shape representing a marine animal, containing a white plastic bottle and a red 'X'. Three white speech bubbles point towards this central shape: one from the top-left labeled 'Necropsy data', one from the top-right labeled 'Species traits', and one from the bottom-left labeled 'Marine plastic concentration'.

**Species
traits**

**Marine plastic
concentration**

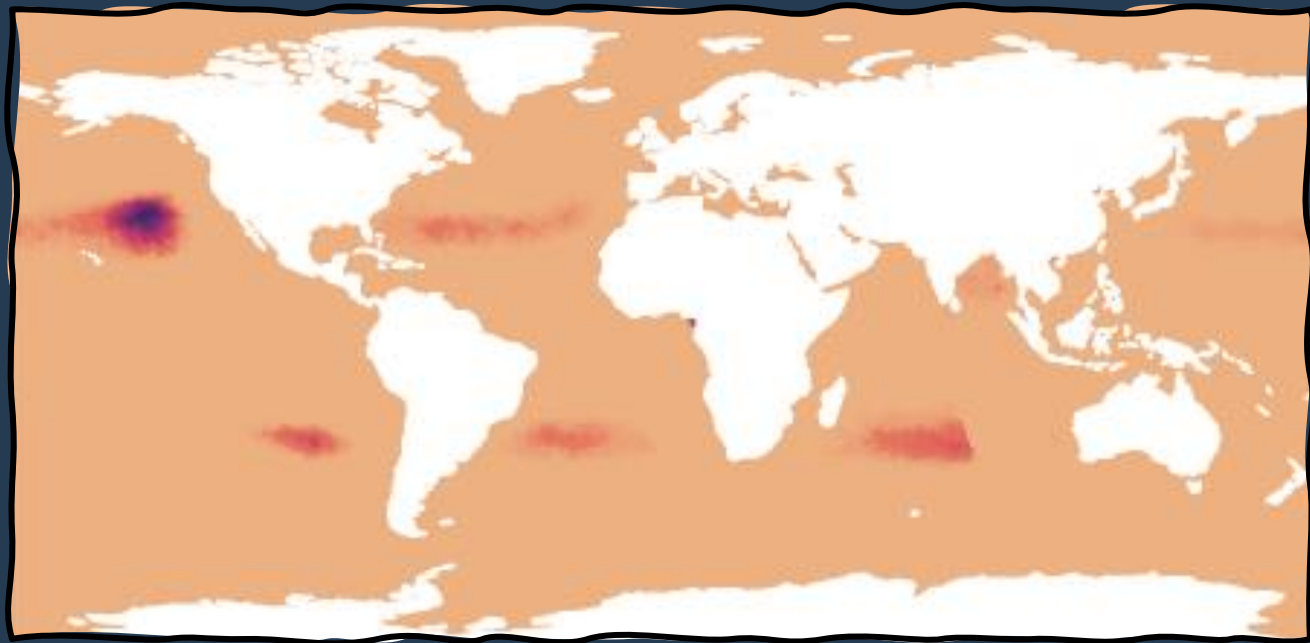


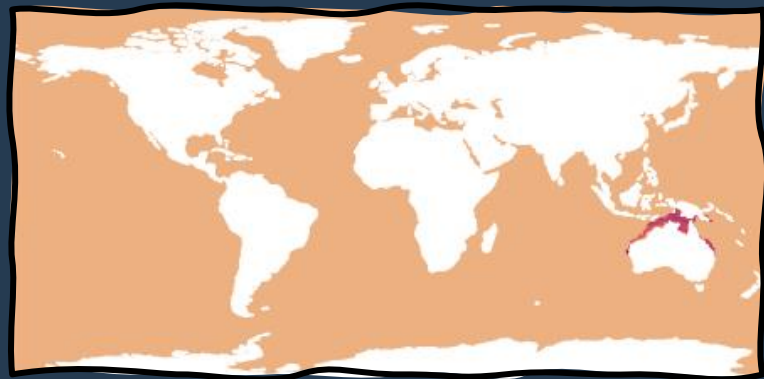
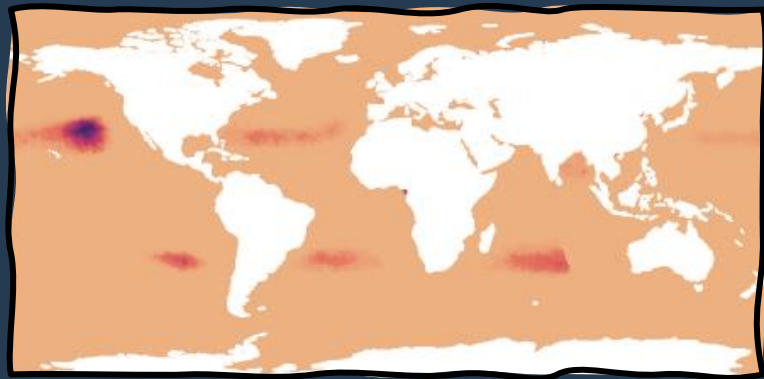
**Necropsy
data**

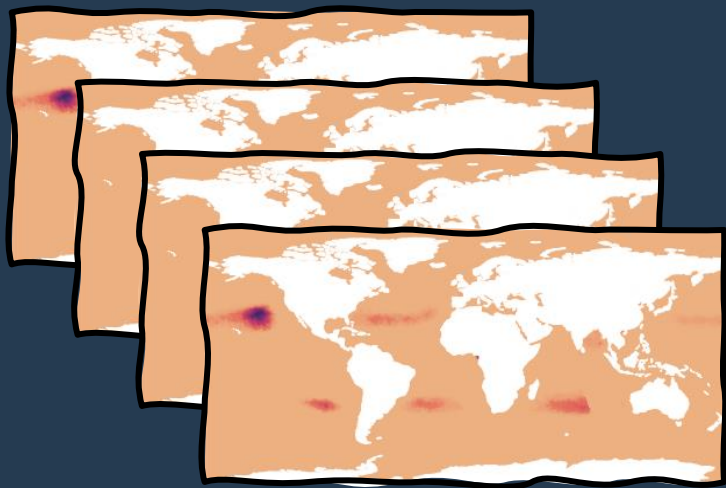
**Species
traits**

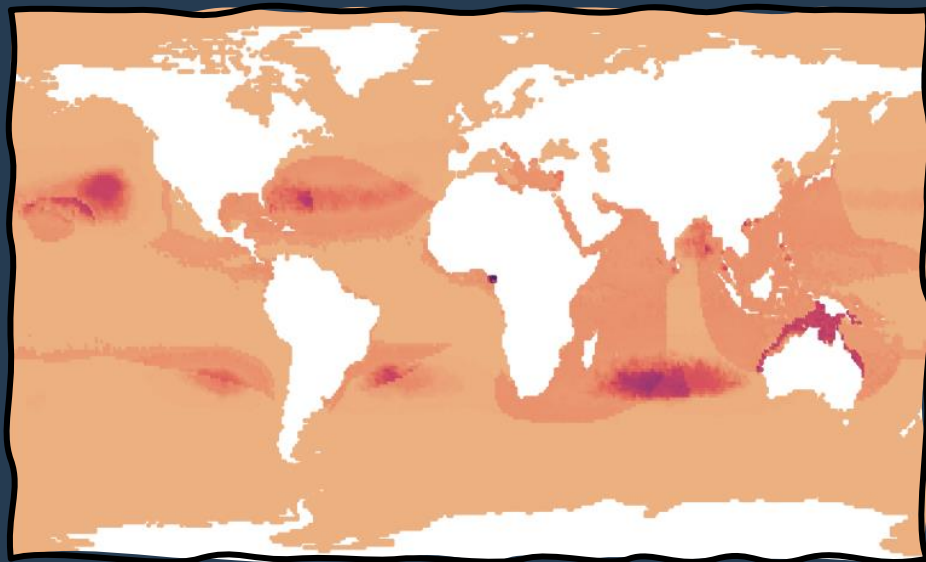
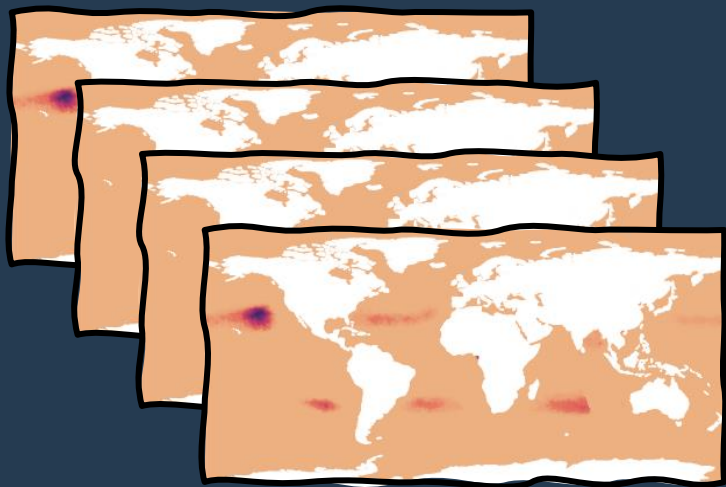
**Marine plastic
concentration**

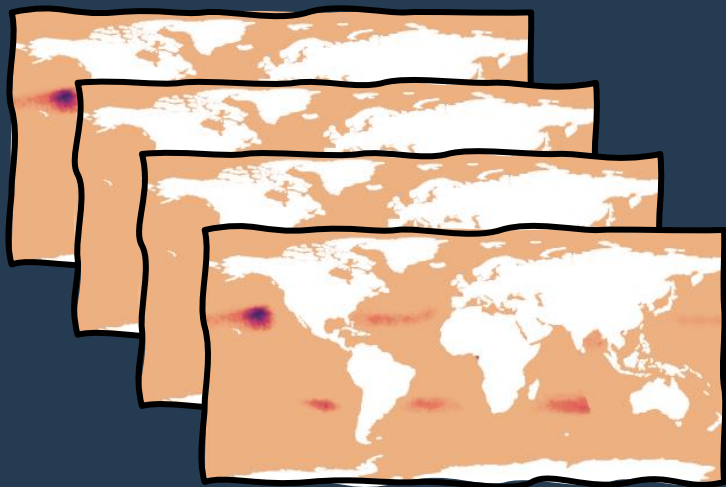
**Machine
learning**





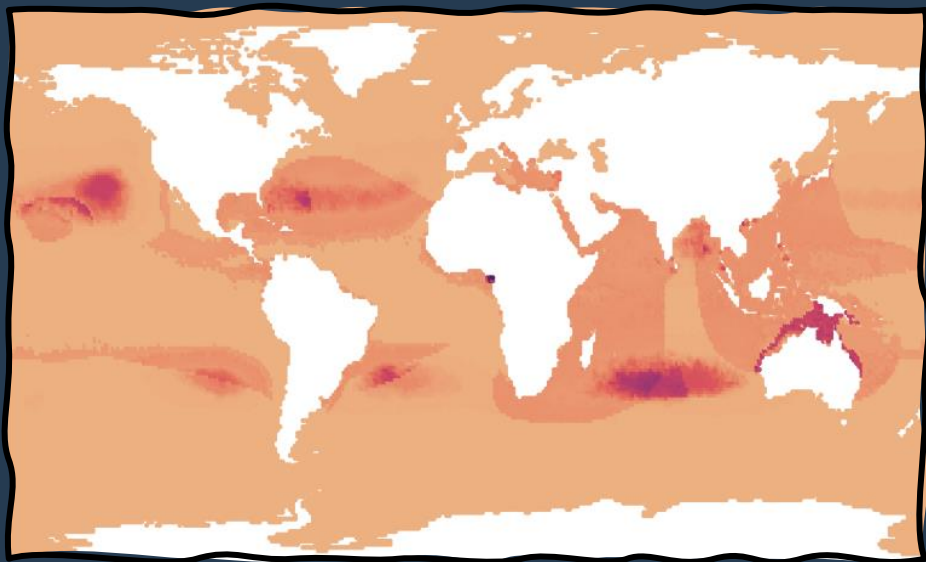


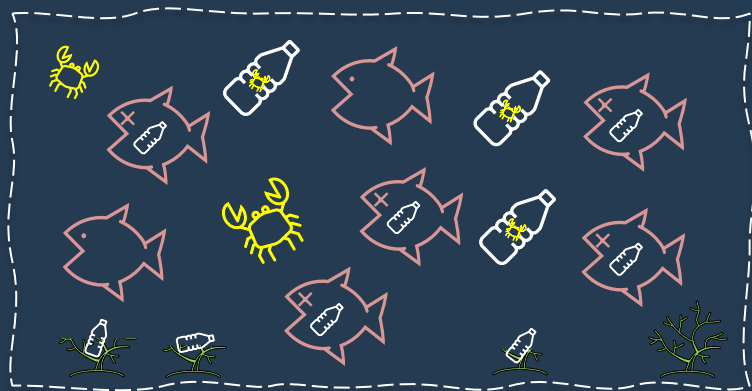


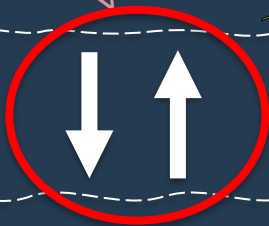
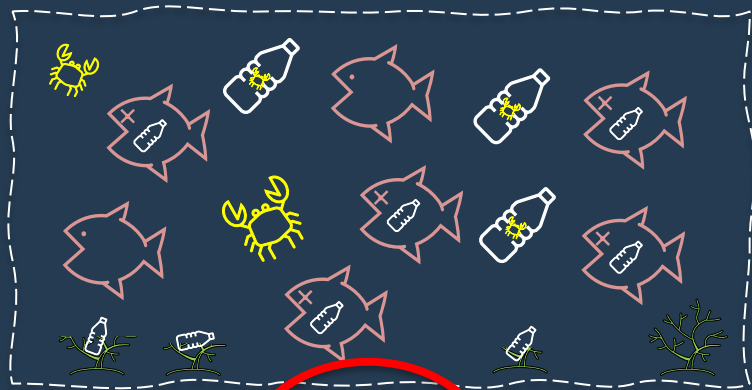


$$\text{Bottle} = \times \text{Star}$$

The equation shows a white bottle icon followed by an equals sign, then a large 'X' symbol, and finally a blue star icon with a white bottle inside and a red 'X' above it. This likely represents a mathematical operation or a relationship between the two icons.







The status quo



Sustainable society



The status quo



Sustainable society



The status quo



Life Cycle Assessment

Sustainable society



The status quo



Life Cycle Assessment

