

# Marine Debris and Micro Particles



# What is marine debris?

**Marine debris is defined as:**

“any persistent solid material that is manufactured or processed and directly or indirectly, intentionally or unintentionally, disposed of or abandoned into the marine environment or the Great Lakes”.

– NOAA

What are the **sources**?

How does it **move** around?

What are the **impacts**?

What are **micro particles**?

**What you can do about  
marine debris.**





# Some types of marine debris



# Where does marine debris come from?



## Ocean-based sources

- Fishing vessels
- Stationary offshore oil and gas platforms
- Cargo ships, cruise ships and container vessels
- Sewage sludge dumping ground at sea
- Sea-based aquaculture activities (major source of marine plastic debris)

## Land-based sources



- Debris generated on land
- Littering, dumping, and poor waste management practices
- Storm water
- Extreme natural event (hurricanes, tornadoes, tsunamis, floods and mudslides)
- Illegal dumping of domestic and industrial waste
- Inadequately covered waste containers and waste container vehicles



# How does the marine debris move around in the ocean?



**Once items that float enter the ocean, they can move by ocean currents and winds.**

**Marine debris can be carried far from its origin making it difficult to determine exactly where an item came from.**

# What are some impacts of marine debris?

## Ecological impacts:



Ghost fishing



Ingestion



Habitat damage alters benthic community structure

### Release of associated chemicals



Invasive species transport

### Wildlife entanglement





# What are some impacts of marine debris?

## Economic impacts:

- Cost to tourism
- Navigational hazard
- Losses to fishery operations
- Cleaning costs



# What are some impacts of marine debris?

## Social impacts:

- Reduction to aesthetics
- Human health and safety





# Micro particles – What are they?

**Degradation = the wearing down by disintegration. Degradation takes longer in the marine environment because of lower temperatures.**

**Mineralization = the total degradation of plastics into carbon dioxide, water and inorganic molecules. Most commonly used plastics do not mineralize in the marine environment – they break down into smaller and smaller pieces.**

**Rate of plastic degradation in the marine environment depends upon:**

- chemical composition
- size
- molecular weight
- additives
- environmental conditions
- temperature
- wave action
- exposure to sunlight and
- location

*National Oceanic and Atmospheric Administration's definition:*  
**micro particles = any particle 5 mm or less in size**

# What are some sources of plastic micro particles?

## **Primary Sources:**

- Accidental loss of industrial raw materials while transporting

## **Secondary Sources:**

- Degradation of larger plastic fragments from UV radiation, mechanical forces in the marine environment (wave action, or through biological activity of organisms (boring, tearing, shredding).
- Release of micro particles (facial scrubs and personal care products) into the environment by urban wastewater treatment.
- Discharge of sewage sludge.



# Abundance and distribution of micro plastics depends upon a number of factors:


**Surface currents**

**Surface winds**

**Density of the plastic**

**Color and shape of the plastic**

**Proximity to human development**

Density (g/cm <sup>3</sup> )	Plastic type	
0.89 - 0.91	PP	#5
0.91 - 0.925	LDPE	#4
0.94 - 0.965	HDPE	#2
1.0 - 1.1	PS	#6
1.15		#7
1.16 - 1.45	PVC	#3
1.35	PETE	#1

Seawater density = 1.03 g/cm<sup>3</sup>

*Scientists have documented the harmful effects of macro plastic debris on organisms like sea turtles and whales, but there is little known about the harmful effects of micro plastics.*

## **Potential harmful effects of micro plastics:**

- **Physical harm from ingestion**
- **Leaching of toxic chemicals**
- **Desorption of persistent, bio-accumulative and toxic chemicals which are highly toxic, long-lasting substances that can build up in the food chain to levels that are harmful to human and ecosystem health (mercury, chlordane, DDT, PCB's)**



**Studies show that micro plastics  
have been ingested by a number of  
organisms including:**

## **Zooplankton**

**(copepods, larval fish and medusae)**

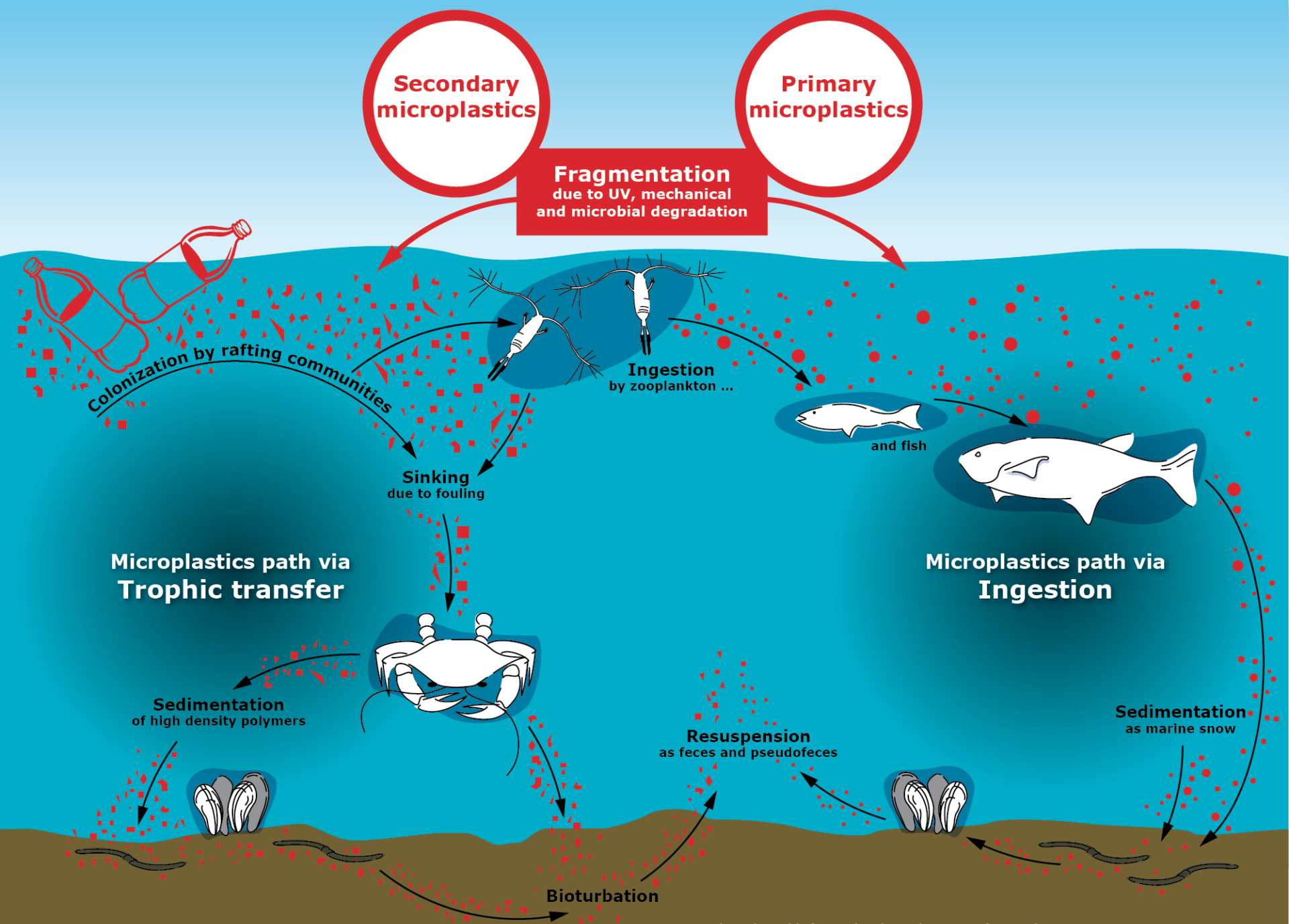
## **Benthic invertebrates**

**(polychaetes, crustaceans, echinoderms,  
bryozoans and bivalves)**

## **Vertebrates**

**(fish, seabirds, marine mammals)**







## June 2014

Illinois Gov. Pat Quinn signed legislation banning the manufacture and sale of personal care products containing synthetic plastic microbeads:

- bans the manufacture of personal care products containing microbeads by 2017.
- bans the sale of personal care products and the manufacture of over the counter drugs by end of 2018.
- bans the sale of over the counter drugs by the end of 2019.



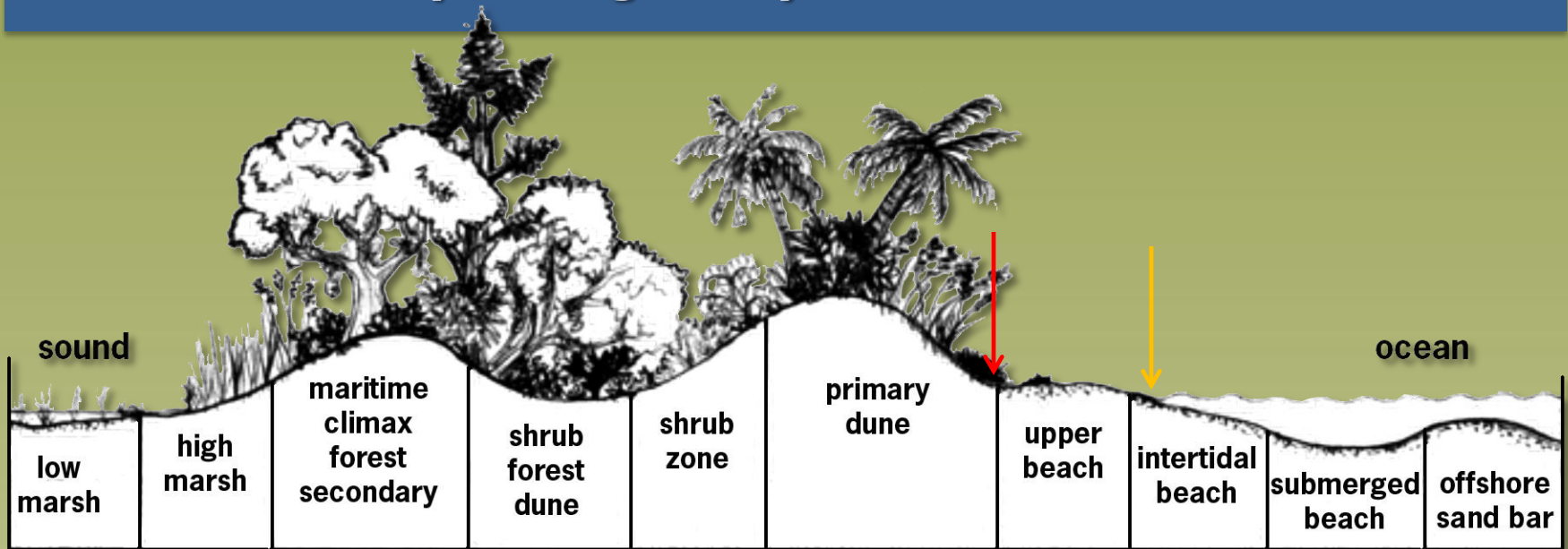
# **A micro particle study on a sandy beach using transecting:**

**You will be able to quantify changes in abundance,  
distribution and types of micro particles.**



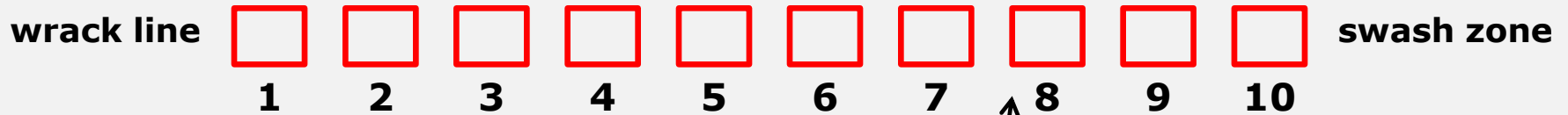


We will be exploring the abundance and distribution of micro particles on a sandy beach along the length of the upper and intertidal sections of the beach that extends from the **wrack line** (line of debris left by the high tide) to the **swash zone**.



# A micro particle study on a sandy beach using transecting:

**Transecting is a useful ecological tool designed to track changes spatially along a linear line. You will be able to quantify changes in abundance, distribution and types of micro particles.**



**quadrats**

**For each Quadrat ...**



**Extract particles using sifter**



**Separate particles into macro and micro types.**



**Count particles in each macro and micro types.**



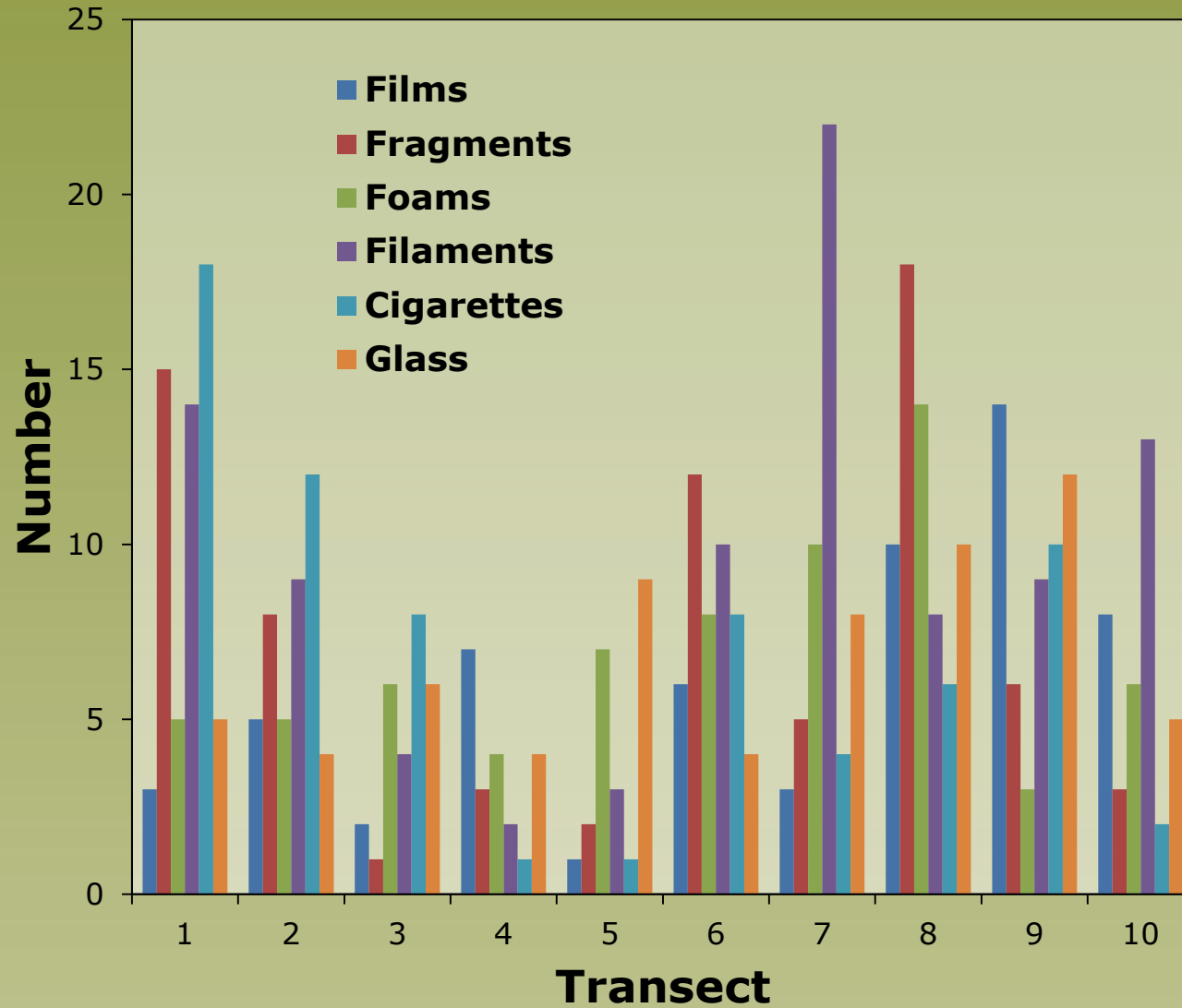
**Determine weight of each type.**



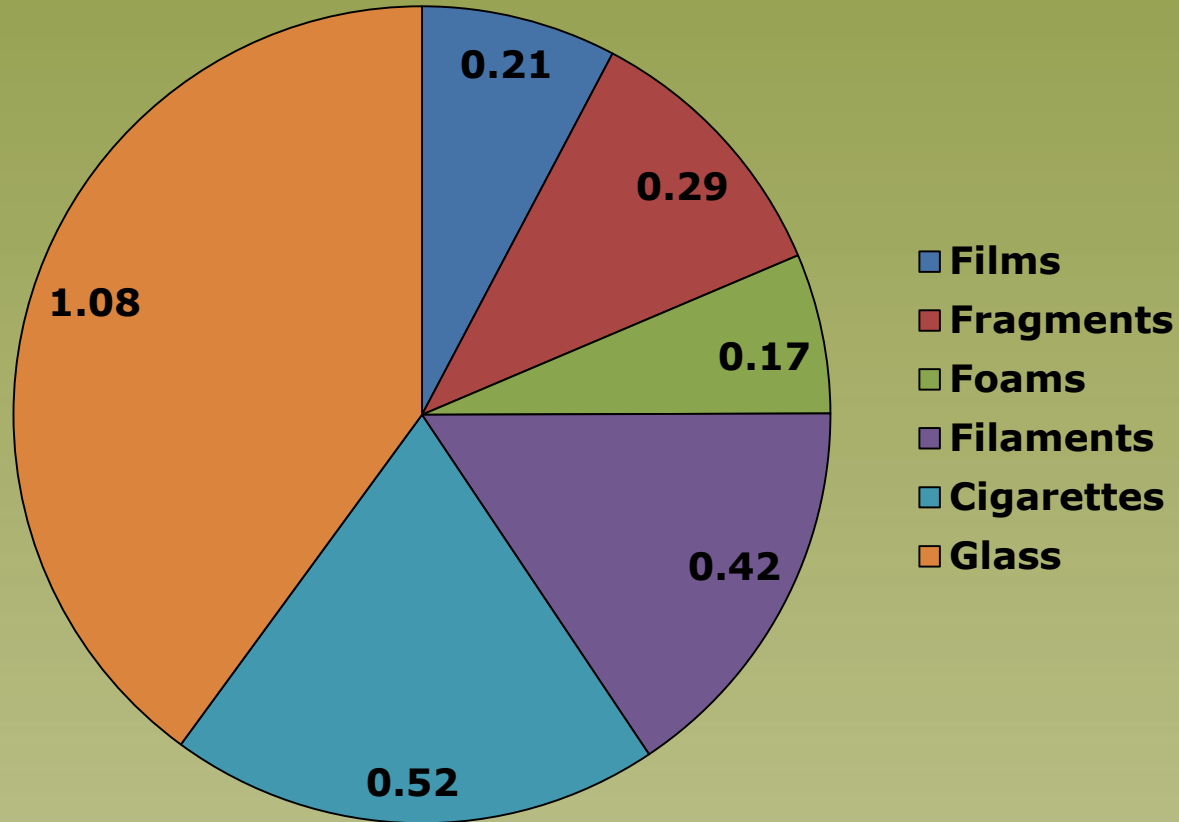
# Your data:

	Films	Fragments	Foams	Filaments	Cigarettes	Glass	Total
Number of macro particles >5 mm							
Number of micro particles 1 mm – 5 mm							
Density of micro particles (g/cm <sup>3</sup> )							
Volume of micro particles (mls)							
Weight (g) of micro particles Density (g/cm <sup>3</sup> ) x Volume (ml) = Weight (g)							

## Number of micro particles



## Average weight of micro particles (g)





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