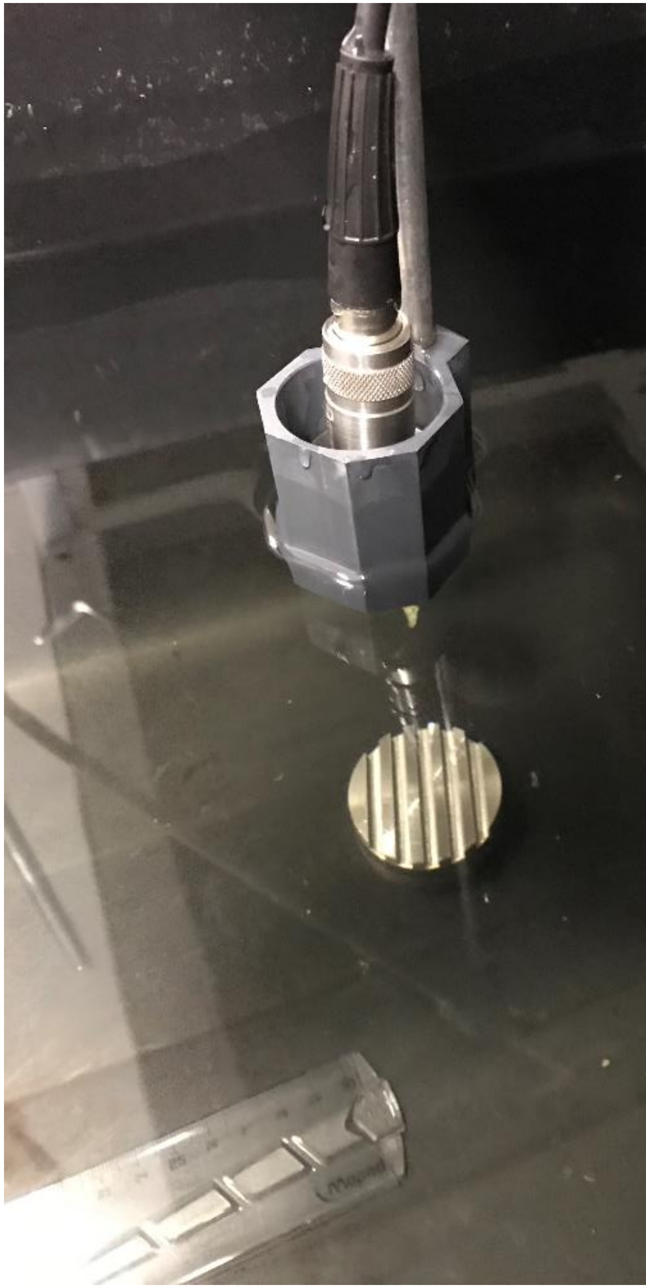
Western Norway
University of
Applied Sciences

Instrumentation in ocean acoustics
-intro to Exercise 1



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Frequency – number of oscillations per second

20 Hz – 20 kHz

› https://www.youtube.com/watch?v=qNf9nzvnd1k

Rule of thumb:

› Large objects make sound with low frequency and vice versa

Low frequency

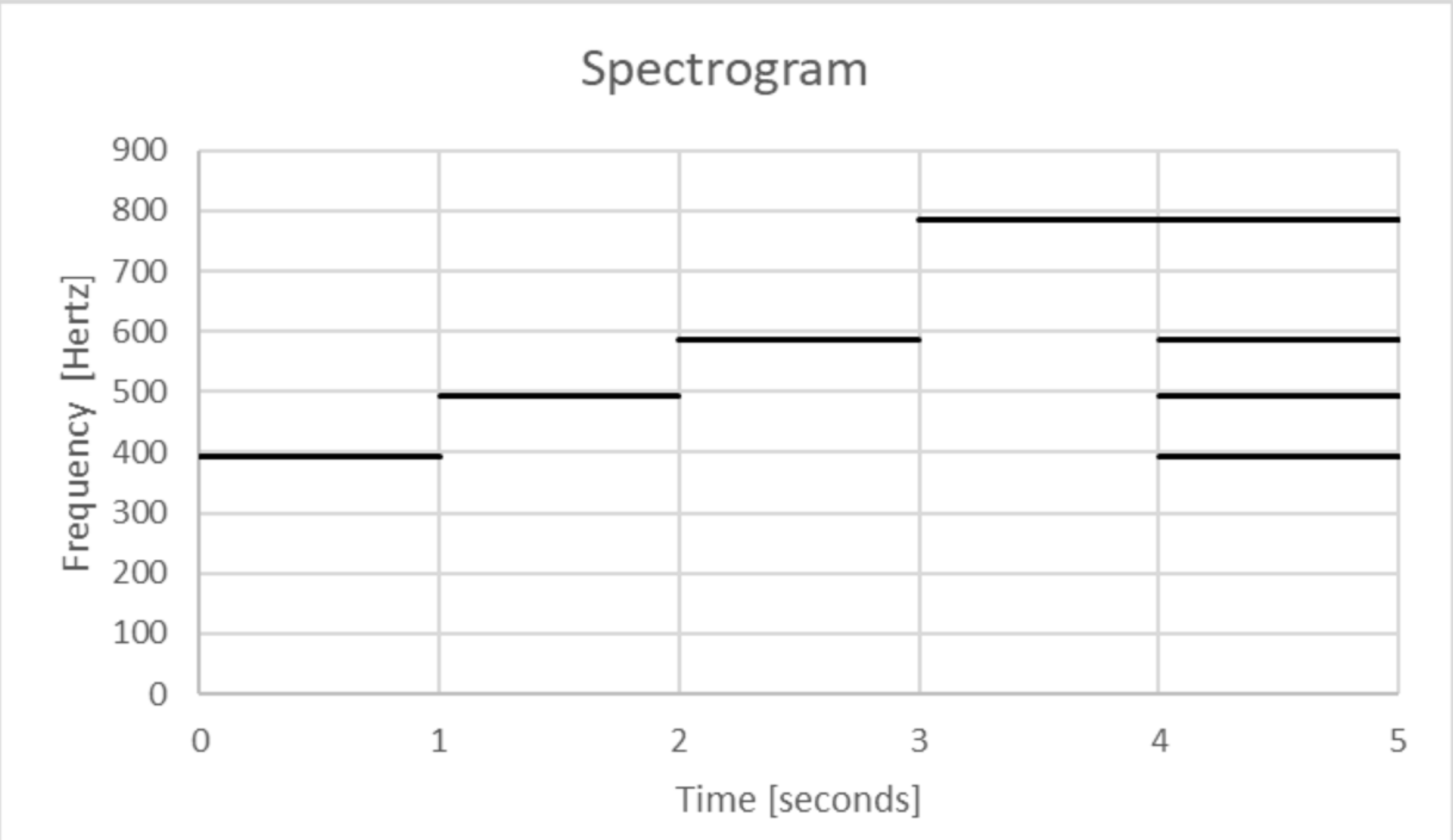
Medium frequency

High frequency

Sound example

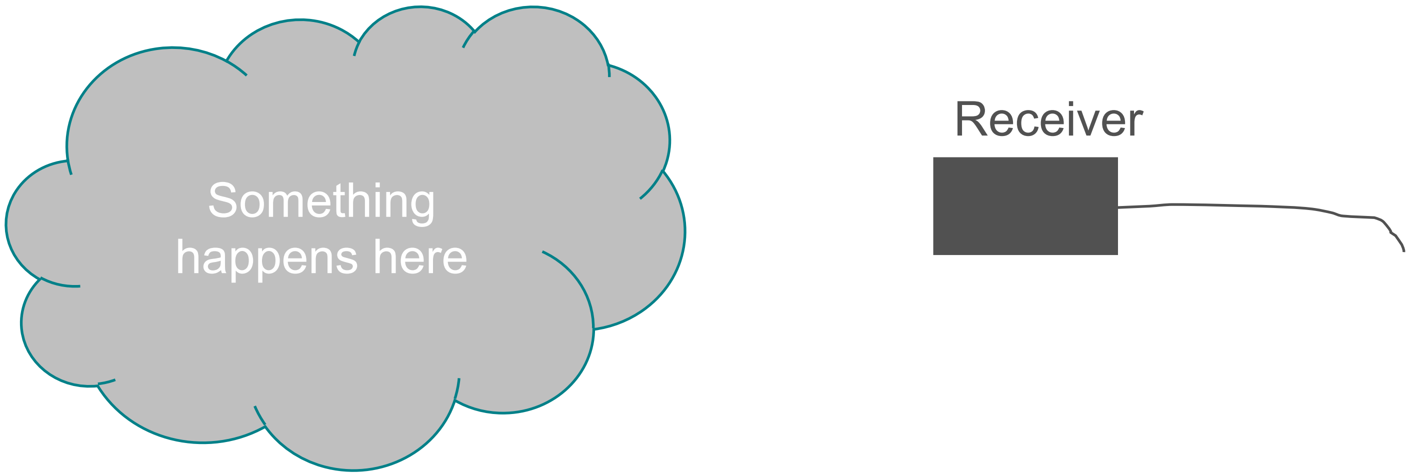
Playing:

- 1 second: 392 Hz
- 1 second: 493.88 Hz
- 1 second: 587.33 Hz
- 1 second: 784 Hz
- 1 second: All four frequencies



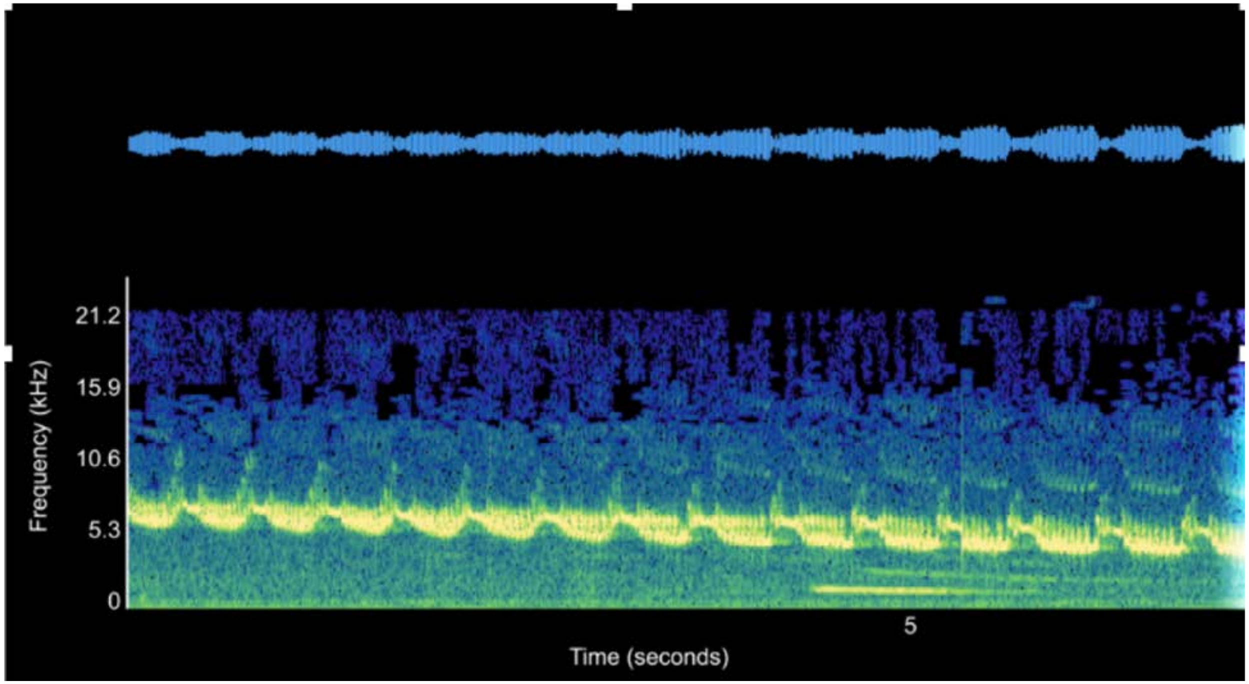
Passive acoustics

› Listen to sound that already is present in order to extract information



Passive acoustics

-possible presentation of data: Spectrogram

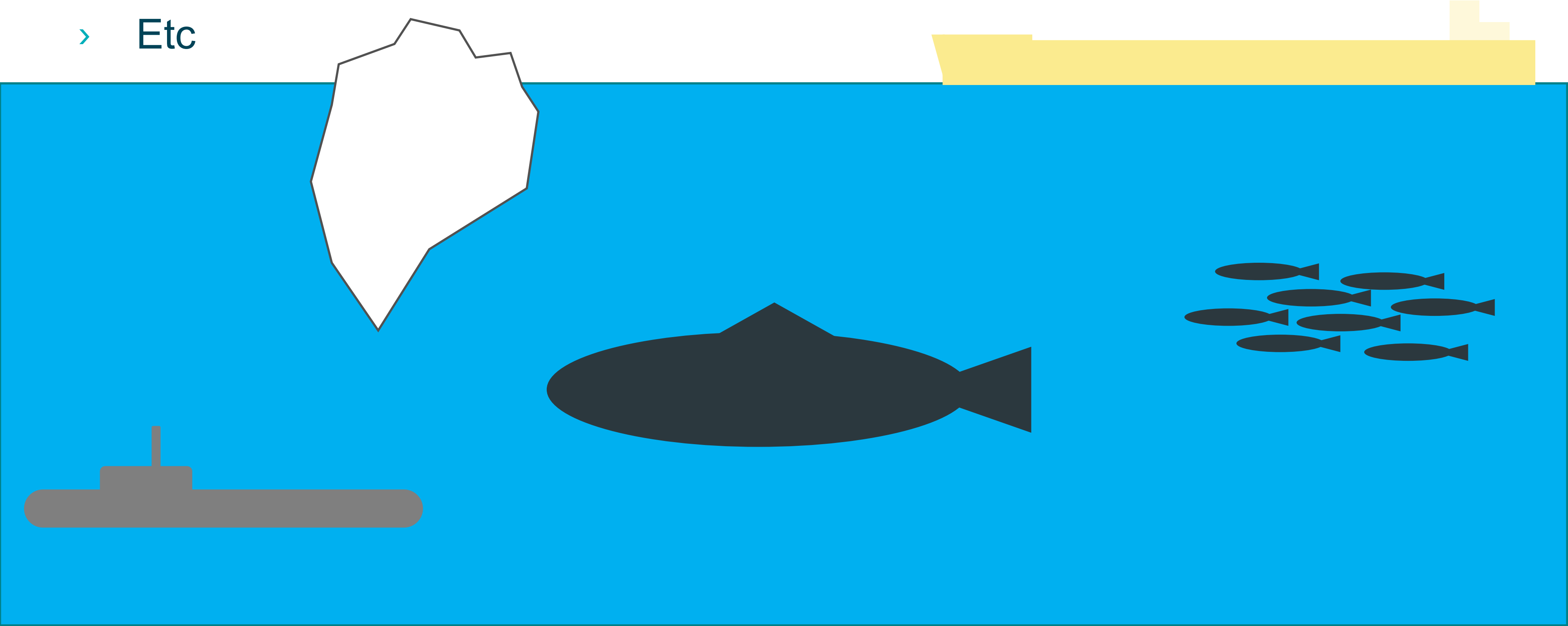


- Low frequencies can propagate long distances in water
  - 10-100 Hz can even go all the way from Antarctica to the Arctics
- 10 kHz (=10000 Hz) can propagate tens of kilometers

Example of passive acoustics in the ocean

Listen to…

- Life in ocean
- Ice bergs
- Earth quakes
- Man-made noise (ship noise, sonars, seismics, …)
- Etc



Receiving sound

- ***Microphone:*** Device for picking up sound in air

- ***Hydrophone:*** Device for picking up sound in water

How does this work?

Piezoelectric material in hydrophone:
converts a mechanical oscillation to an electrical voltage oscillation

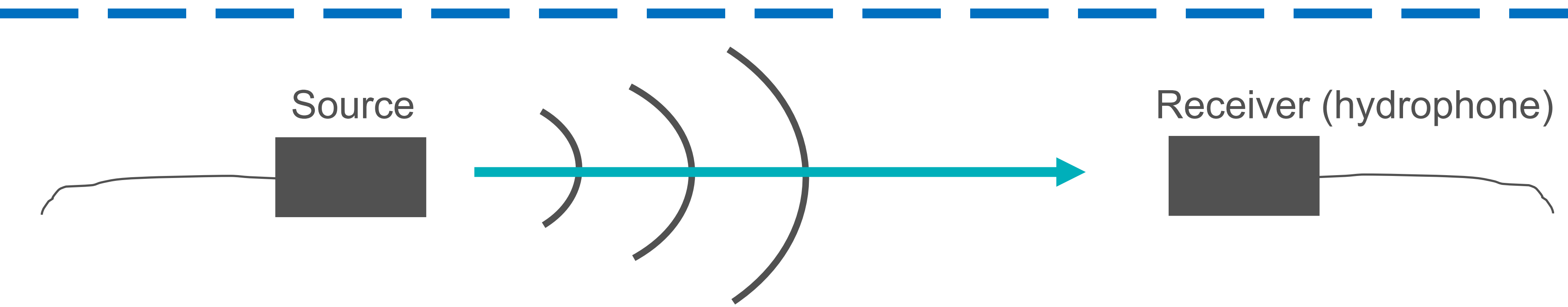
Sound wave = mechanical oscillation → **Hydrophone with piezoelectric disc** → Electrical oscillation for automatic detection

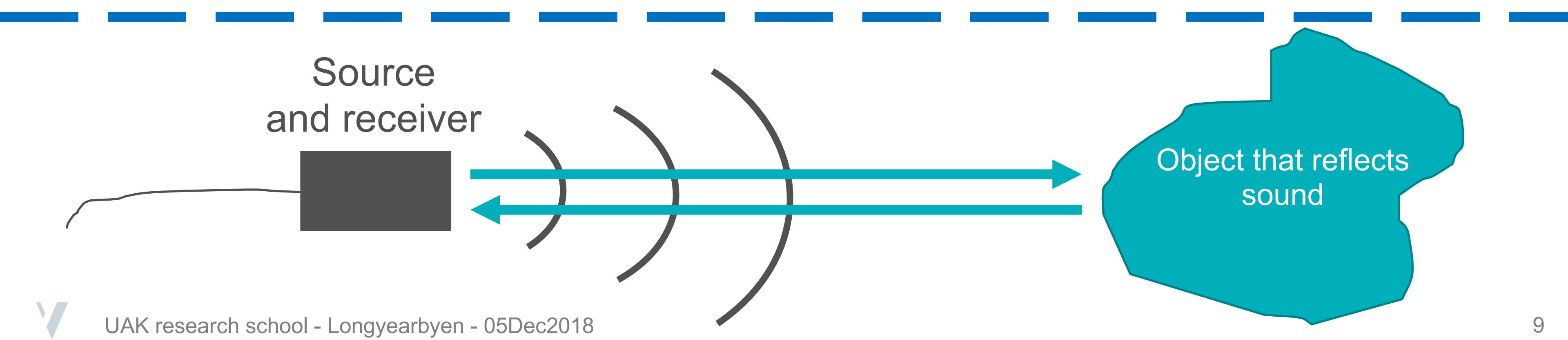
Active acoustics

Sound is

- sent out by a sound source
- received at the same position or somewhere else

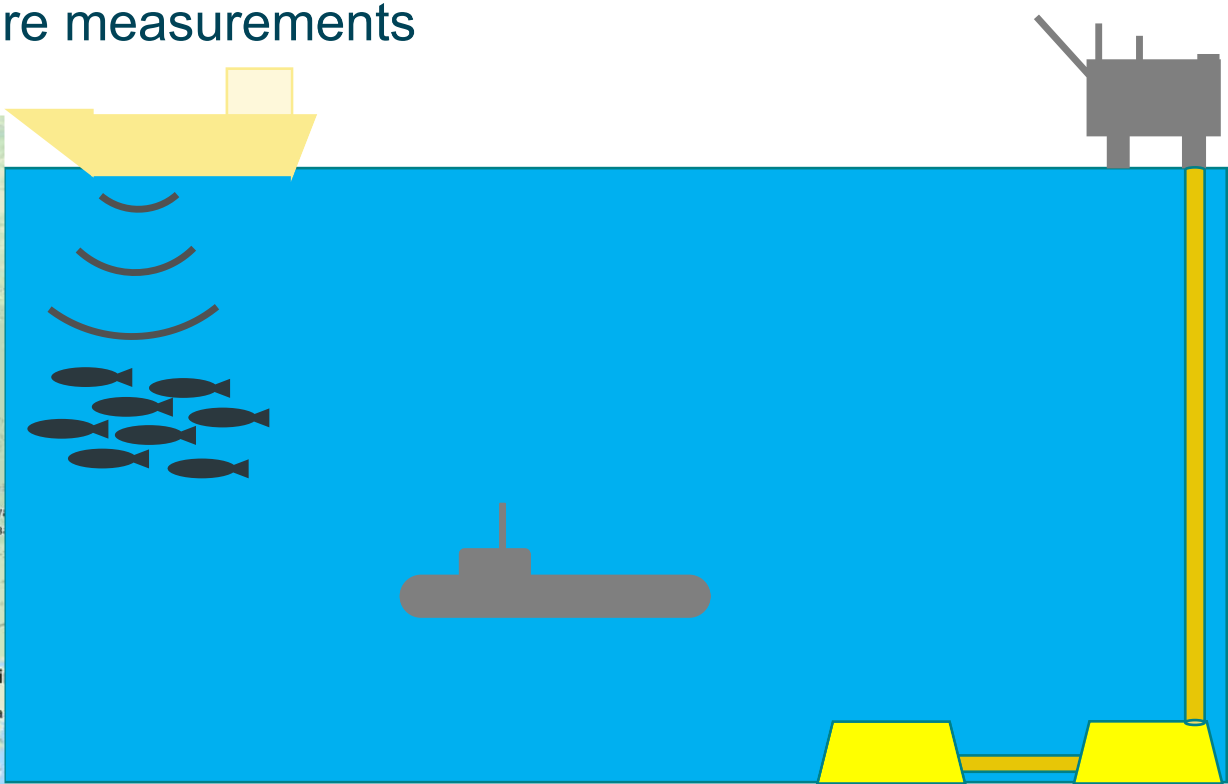
The received sound is used to get knowledge about the volume that the sound has gone through



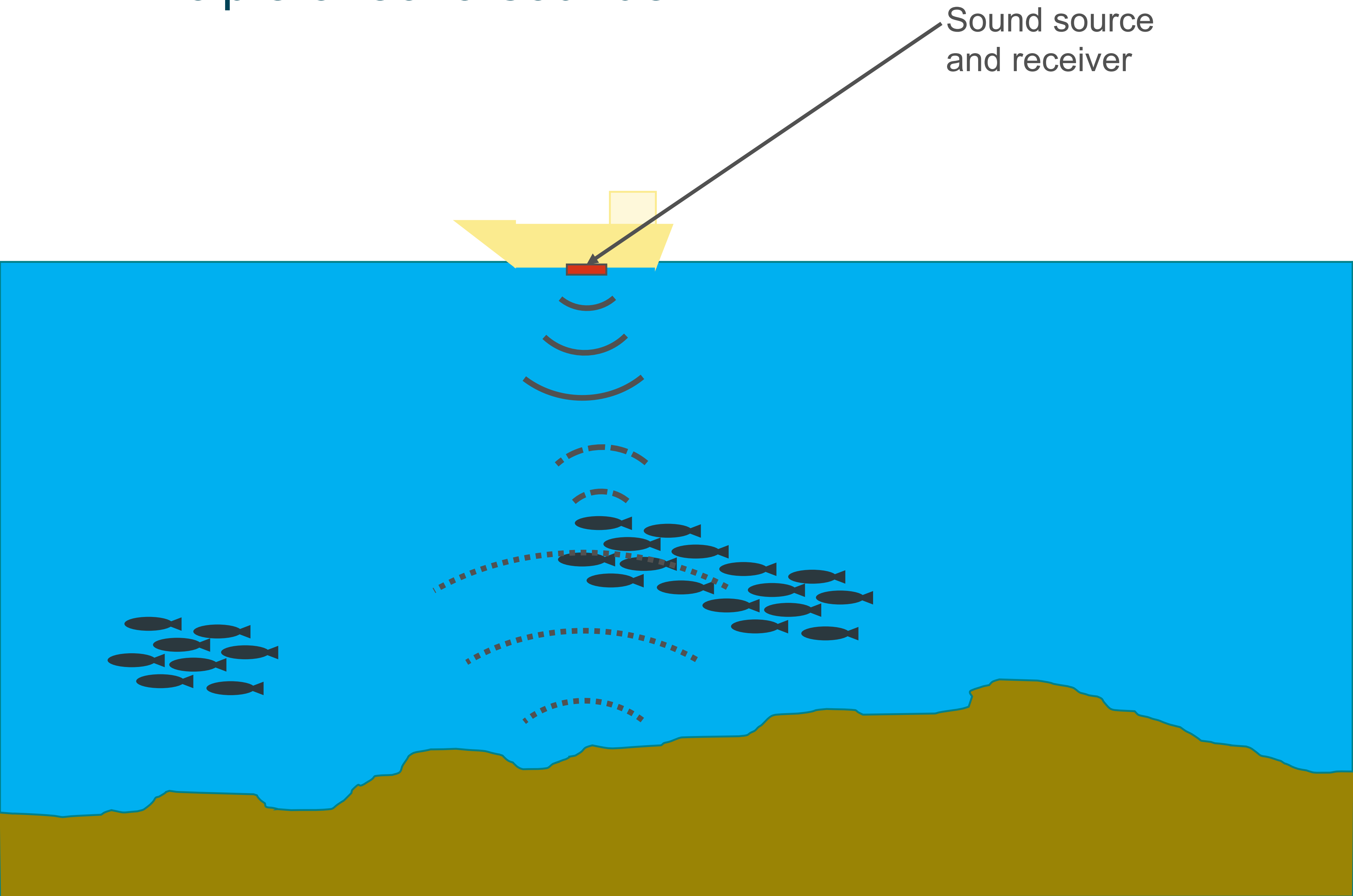


Example of active acoustics in the ocean

- Echo-sounders for fish detection
- Sonars for submarines
- Monitoring of subsea pipelines
- Seismics
- Long-range temperature measurements



Principle of echo-sounder



Principle of temperature measurement

- Sound speed = distance / time
- Sound speed depends on temperature

Exercise 1 – Speed of sound measurement

- **Purpose:** Understand how acoustics can be used for temperature measurement in the ocean
- **What:** Measure speed of sound at different temperatures, compare with model
- **How:** Use acoustic measurement system with oscilloscope, water chamber and temperature probe
- **Bonus:** Brief echo-sounder principle demonstration