Dumped Munitions and Warfare Materials in Wrecks as a Threat to the Ecosystem

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Situation of Baltic Sea dumped munitions

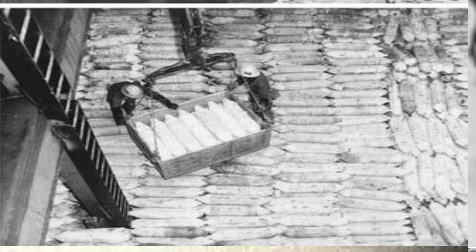
CHEMSEA
CHEMICAL MUNITIONS SEARCH & ASSESSMENT

MODUM
TOWARDS THE MONITORING OF DUMPED MUNITIONS THREAT

daimon
Decision Aid for Marine Munitions

Chemical munitions sunk at sea

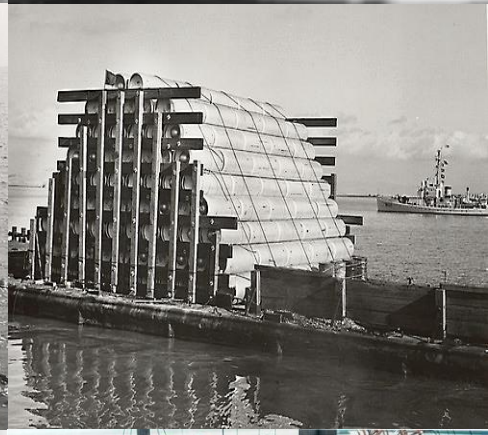
- **40 000 tonnes sunk in Baltic proper, 150 000 tonnes in Skagerrak**
- **Natural processes plus enhancing human pressure put environment at risk**



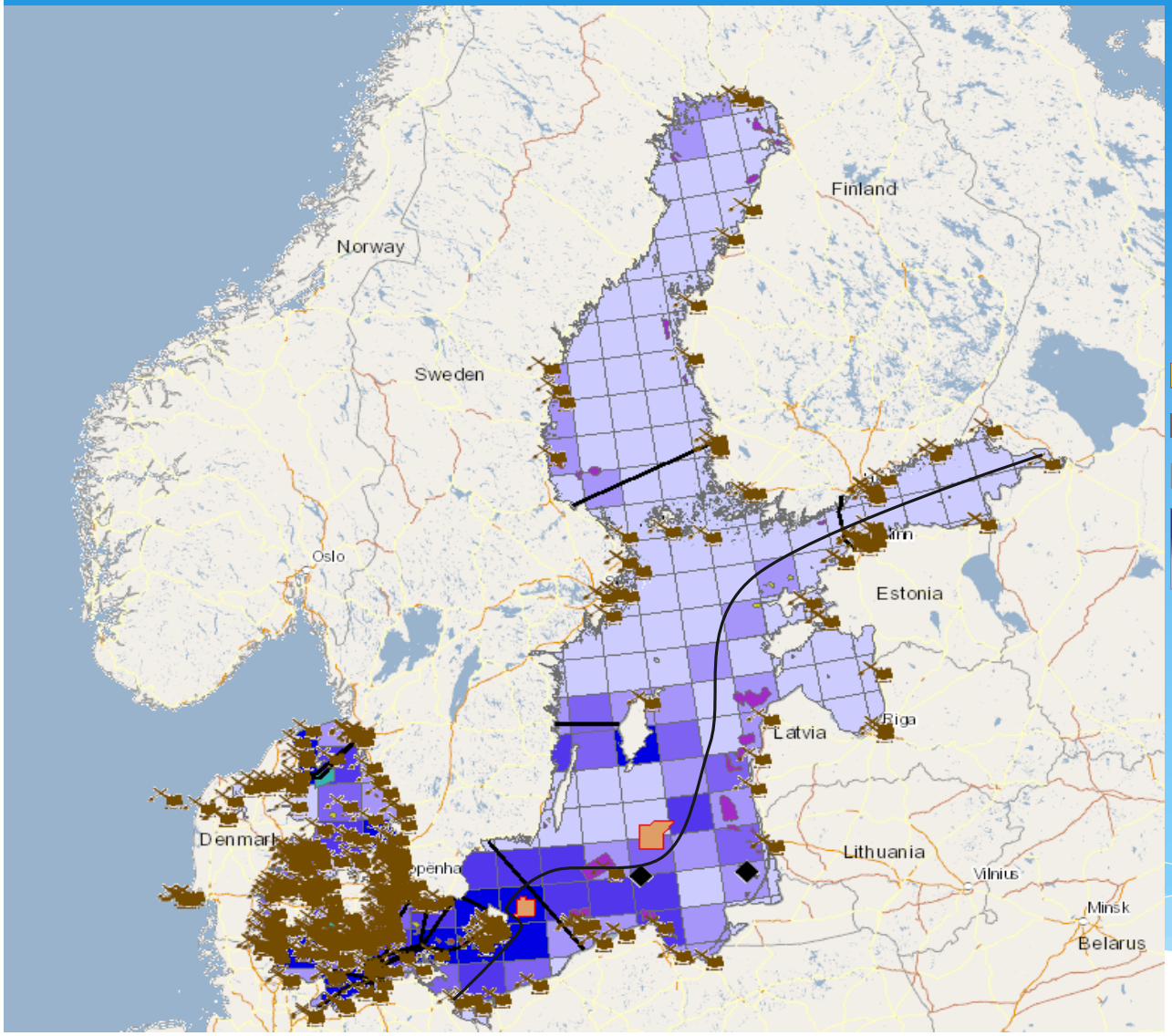







EXPLOSION OF MUNITIONS AT MAGAZINE

Human impact on the Baltic Sea



Legend:

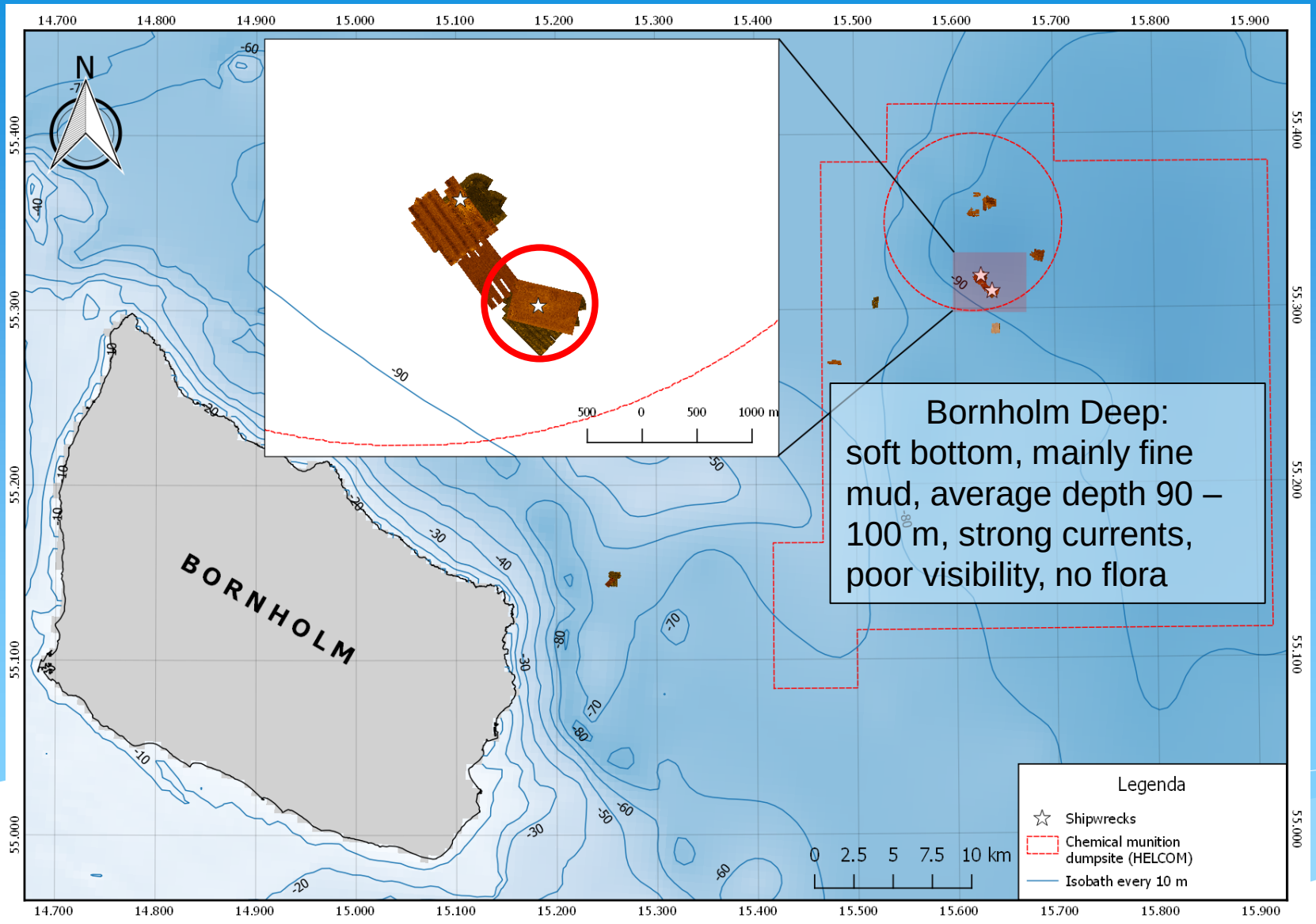
- CWA Dumps
- Dredge sites
- Offshore wind farms (planned)
- Bottom Trawling intensity
- Pipelines and Cables

(HELCOM)

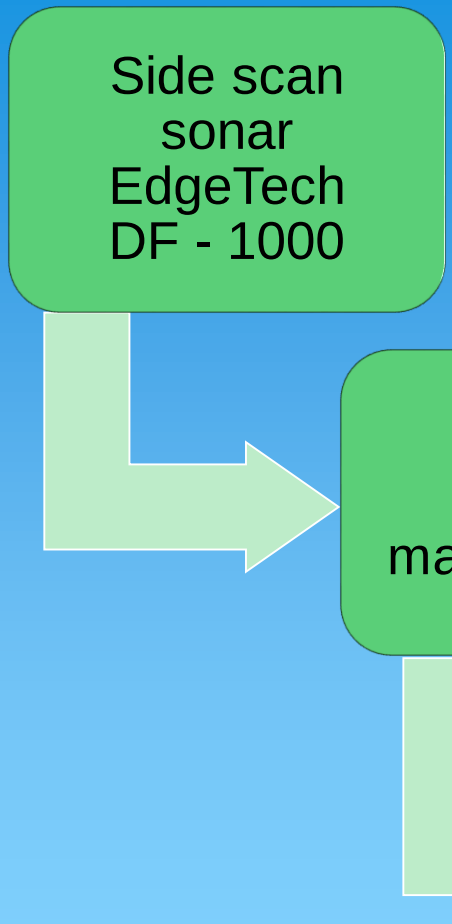
Sunken ship(s) at the Bornholm Deep

- No official records of sunken munitions ships in 1947
- In 1962 one barge filled with CW was sunk (operation „Hanno”)

Bornholm Deep dumpsite



Basic algorithm of investigation:



- preliminary survey of the selected area
- precise survey of the selected area
- visual inspection of detected targets

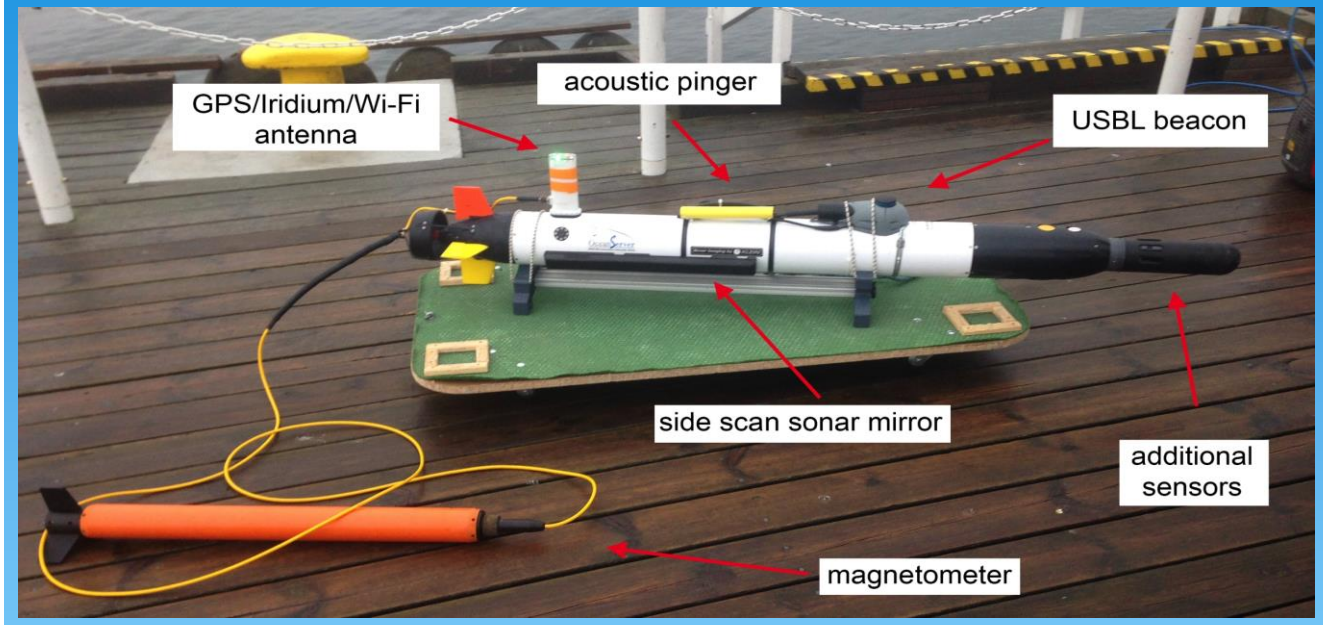
Equipment: side scan sonar Edge Tech DF-1000

Features	Description
Side Scan Sonar dual frequency	100 kHz/500 kHz
Pulse length	100 kHz – 0.1 msec, 500 kHz – 0.01 msec
Horizontal beam width	100 kHz – 1.2°, 500 kHz – 0.5°
Side scan data output	COD, XTF

Performance:

- Maximum operation depth – up to 1000 m
- Acquisition of the sonar data in two resolution (4-channel simultaneously): standard resolution – 100 ± 10 kHz, high resolution – 400 ± 20 kHz
- Detection of big object on the bottom – wrecks etc.
- Proper layback settings and undulating issue
- Precise positioning problems

Equipment: autonomous underwater vehicle – IVER2 AUV



Performance:

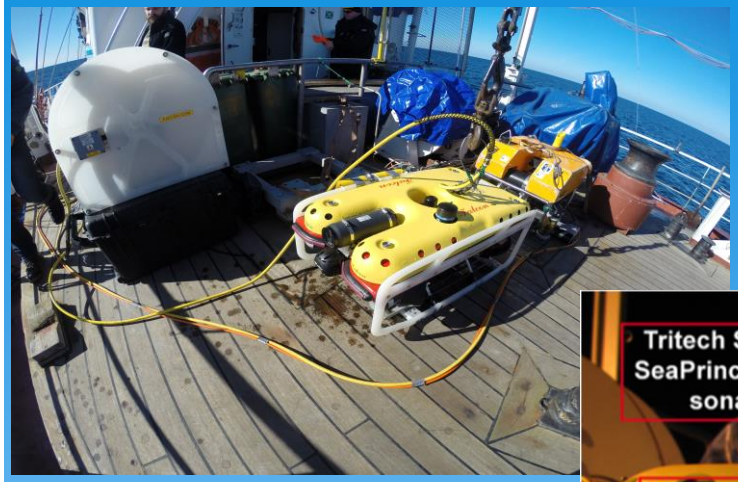
- Maximum operation depth – up to 150 m
- 2-3 missions per day
- Average mission time – 2,5 h
- Actual swath range for precise targets location:

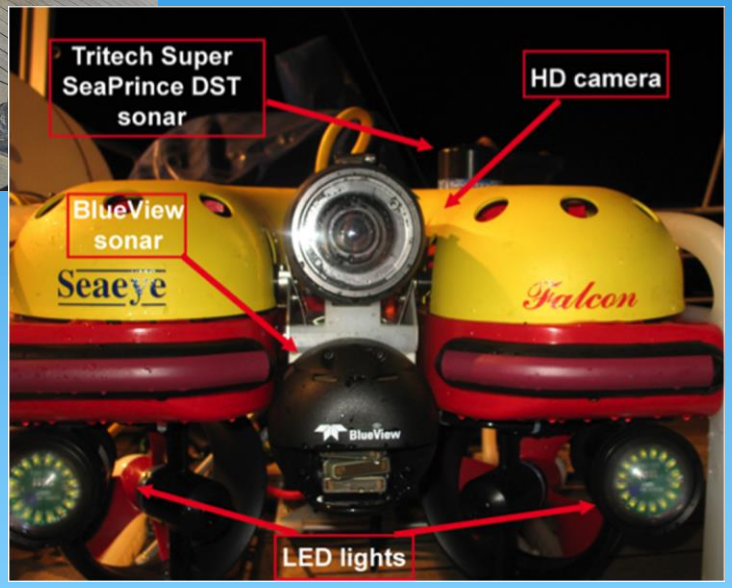
- with magnetometer 25 m per channel
- without magnetometer (only sonar missions) 50 m per channel

Hull-mounted side scan sonar: Klein L-3 UUV - 3500

Klein Features	Description
Side Scan Sonar Dual frequency	455 kHz / 900 kHz
Optional Swath Bathymetry	455 kHz
Pulse Technology	Wideband FM Chirp (1,2,4, 8 msec)
Swath Range	350m @ 455 kHz / 150m @ 900 kHz
Side Scan Data Output	SDF or XTF

Equipment: remotely operated vehicle Seaeye Falcon ROV





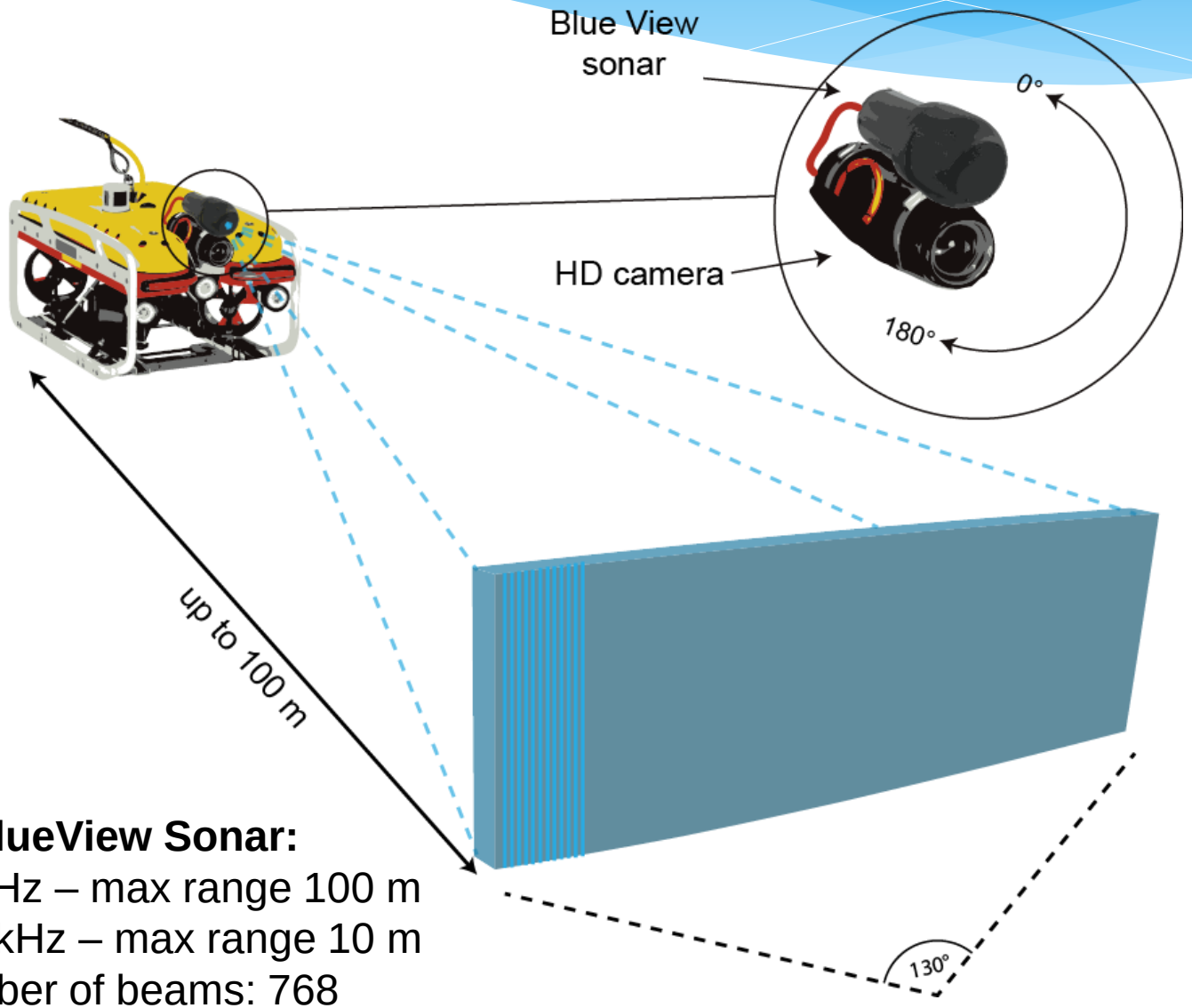
Performance:

- Maximum operation depth: 300 m
- 14 kg payload
- 3-4 missions per day
- 450 m umbilical cable
- High resolution color camera on 180° tilt platform
- Auto heading and depth
- Additional HD cameras

Additional equipment:

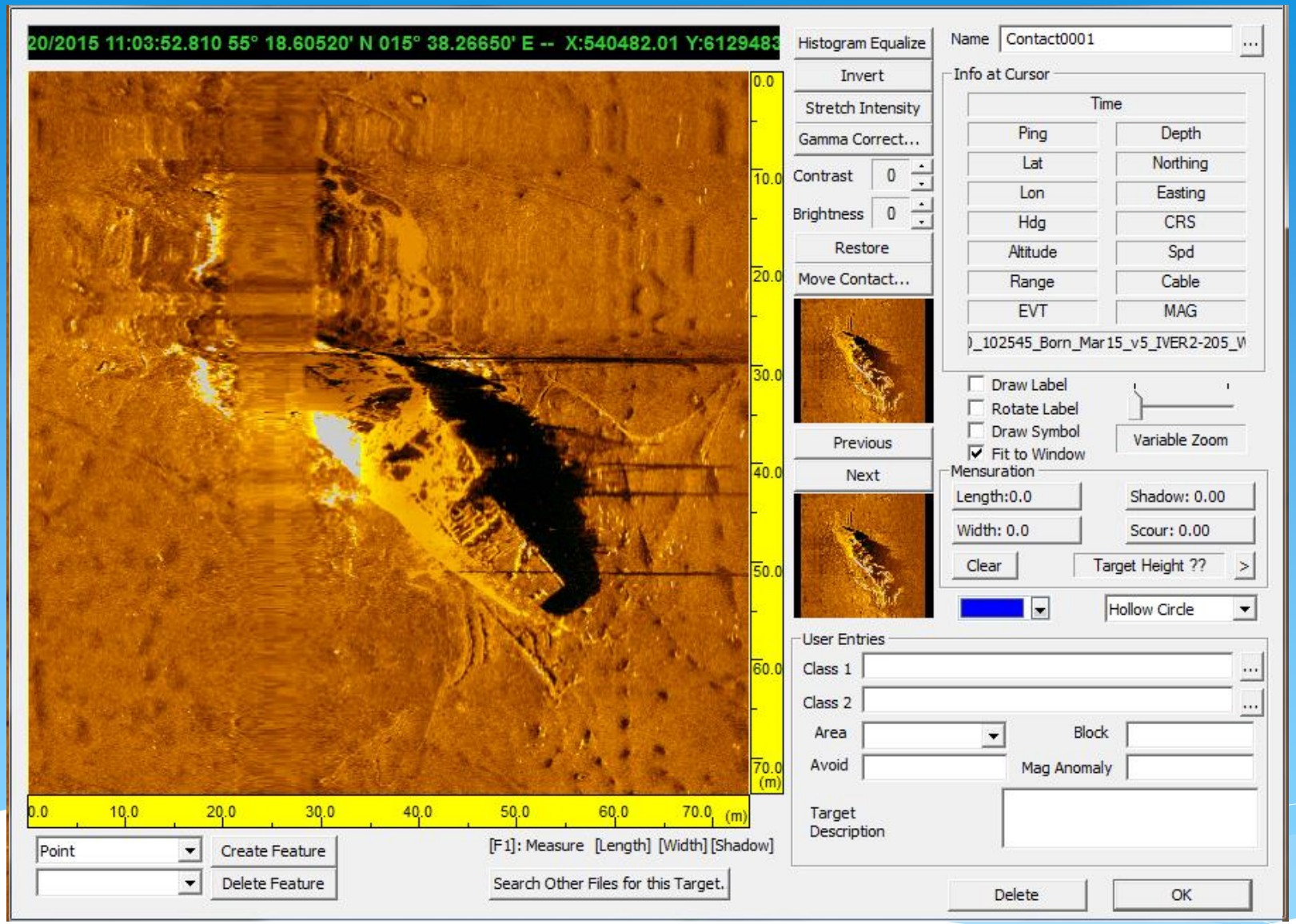
- **Teledyne BlueView Sonar:**
- **Tritech Super SeaPrince DST Sonar**

Blue View sonar – principle of working

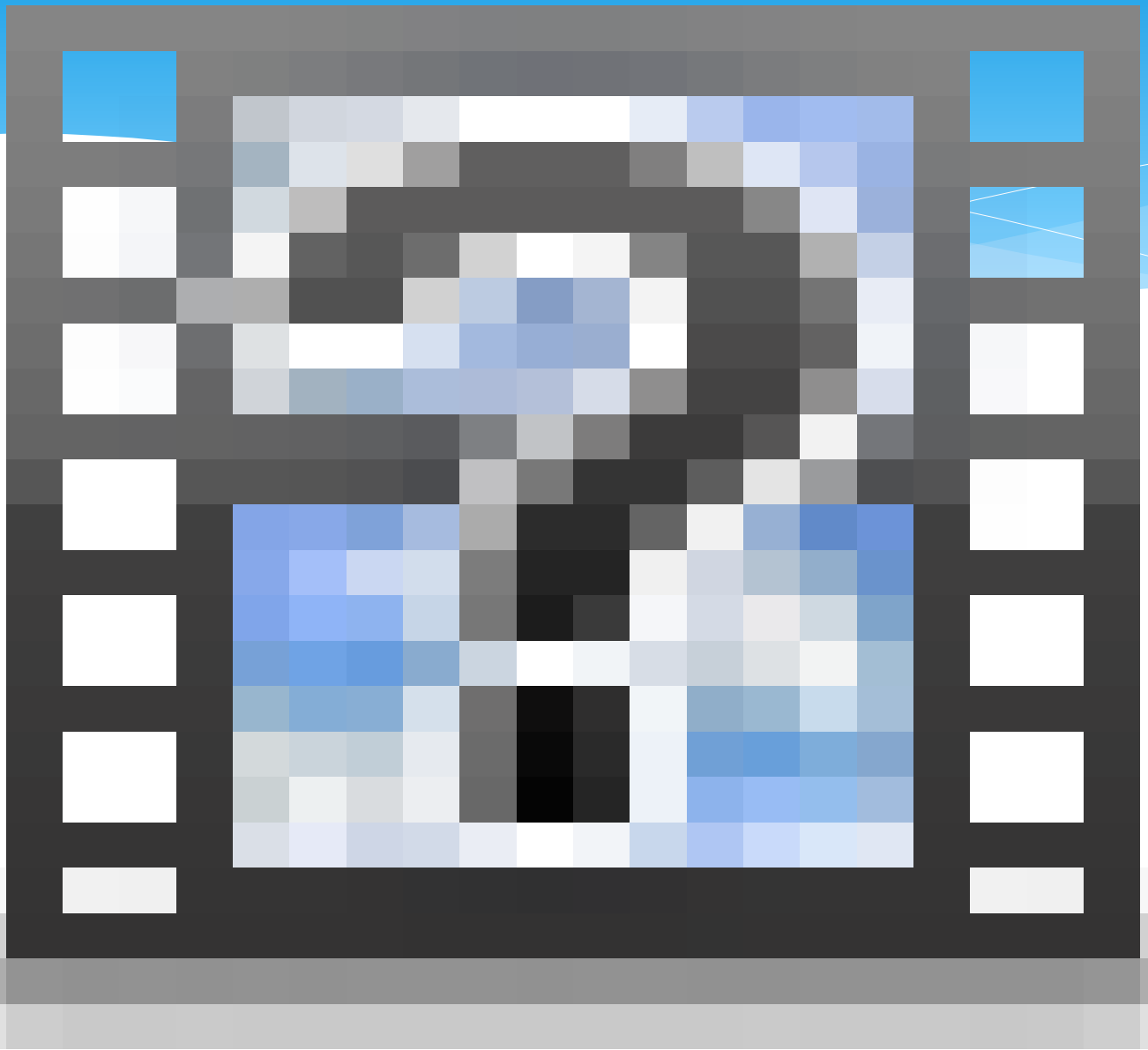


- **Teledyne BlueView Sonar:**
  900 kHz – max range 100 m
  2250 kHz – max range 10 m
  - number of beams: 768
  - field of view: 130° H, 20° V

Shipwreck in the Bornholm primary dumpsite – case study



Shipwreck in the Bornholm primary dumpsite – visual inspection



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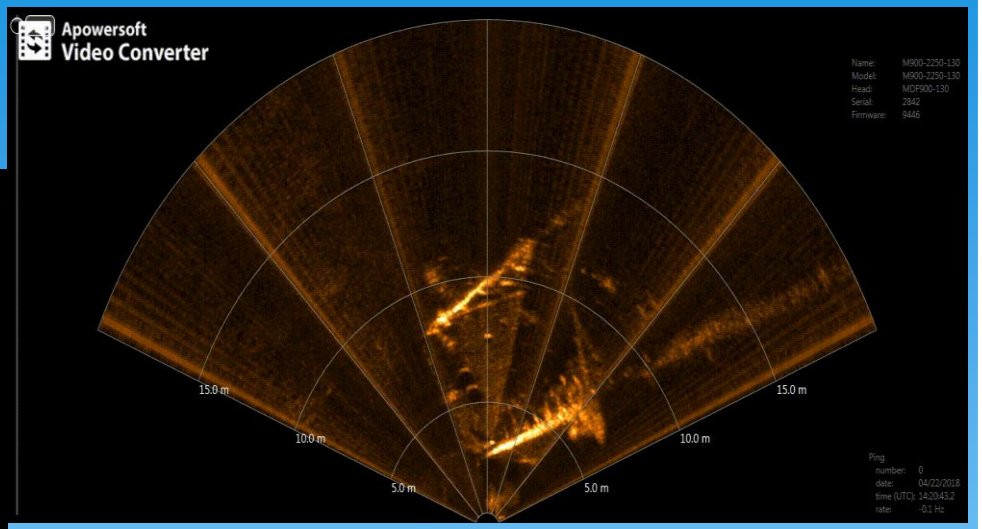
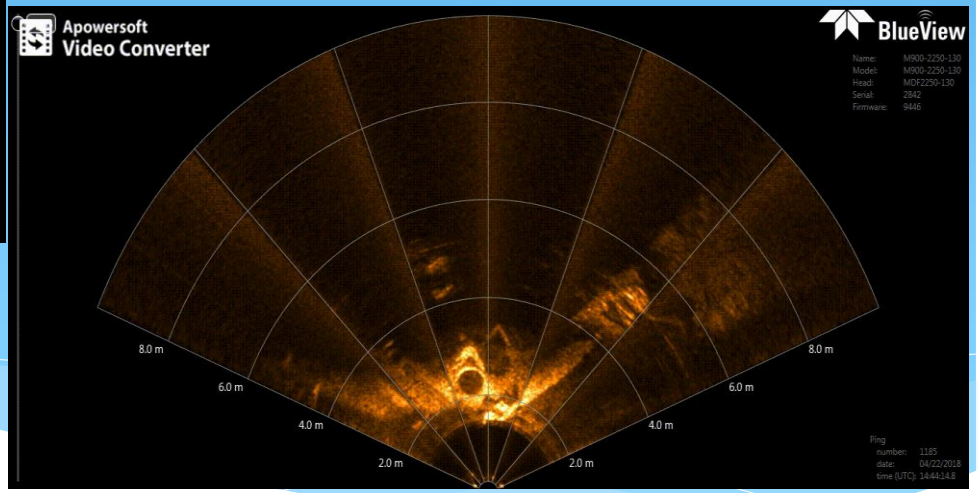
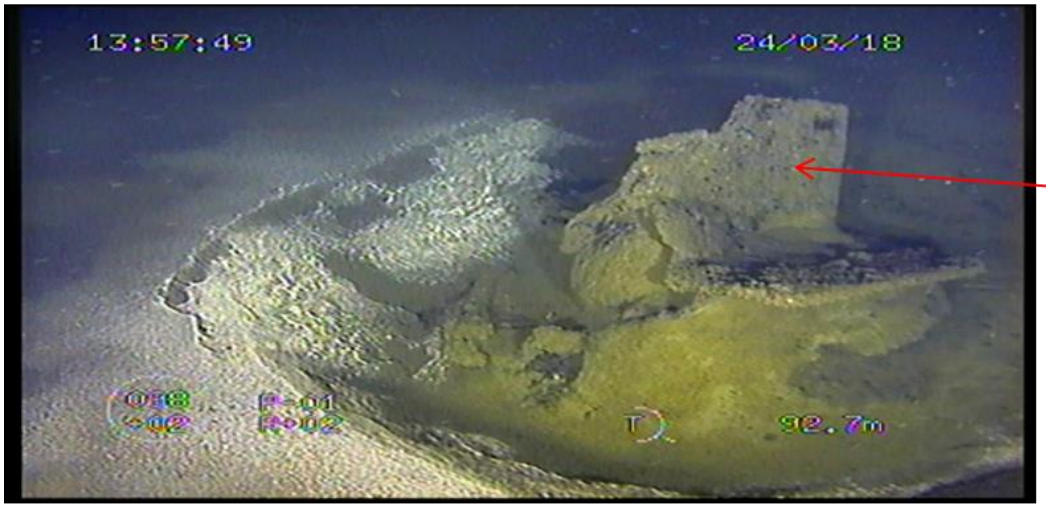
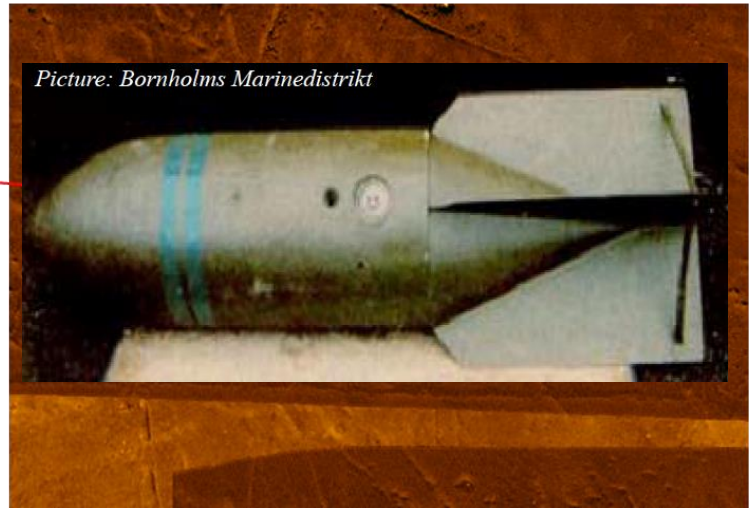




Object found less than 500 m from inspected shipwreck

KC-250 bombs detected less than 2 NM from the shipwreck





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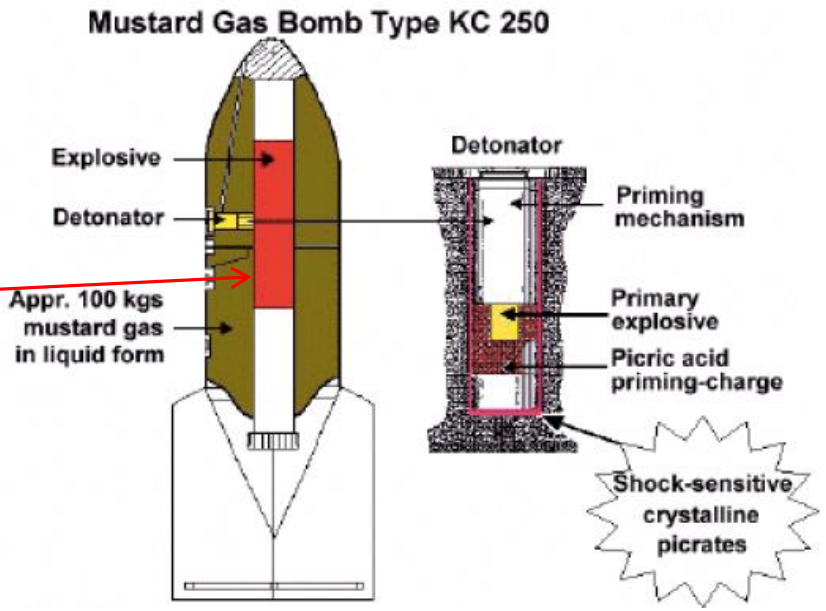

(Nord Stream ESPOO)

High concentration of Mercury Fulminate ($Hg(CNO)_2$) in the sediments!

Conclusions:

* Inspection of shipwrecks with the ROV in the Bornholm dumpsite require additional acoustic equipment
* It is hard due to high risk of losing or damaging of the ROV
* Traces of corroded chemical munitions in close proximity of shipwrecks
* Shipwrecks can be filled with chemical munitions
* Shipwrecks at the area of Bornholm dumpsite are highly corroded
* Threat of CWA leakage from the shipwrecks
* Additional survey is required

THANK YOU

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