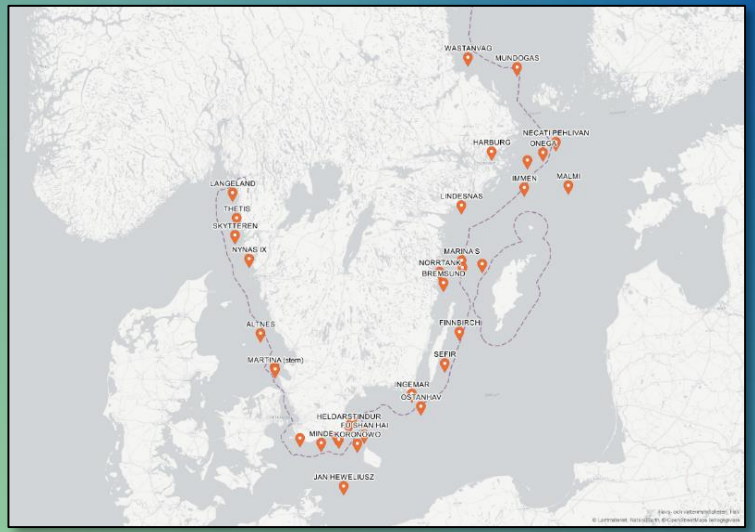
Environmentally hazardous shipwrecks

Swedish national programme

- work procedure, examples and lessons learnt



2019-02-27

Frida Åberg

frida.aberg@havochvatten.se

Swedish Agency for Marine and Water Management

Swedish Agency for Marine and Water Management

Outline

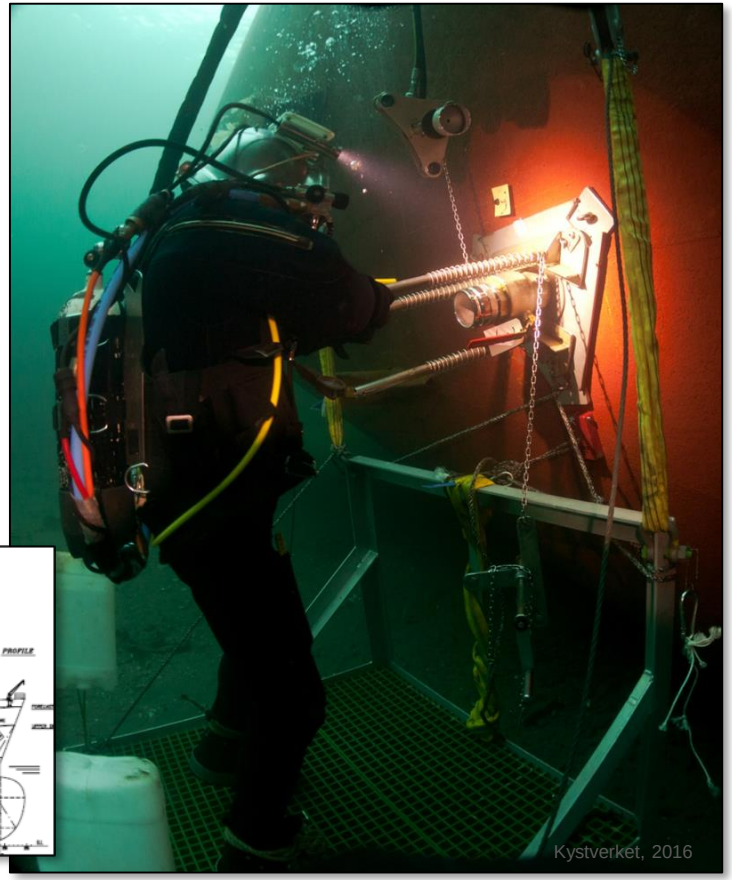
- Swedish programme
- Legal framework
- Inventory
- Methodology
- Surveys
- Risk assessment
- Remediation
- Experiences

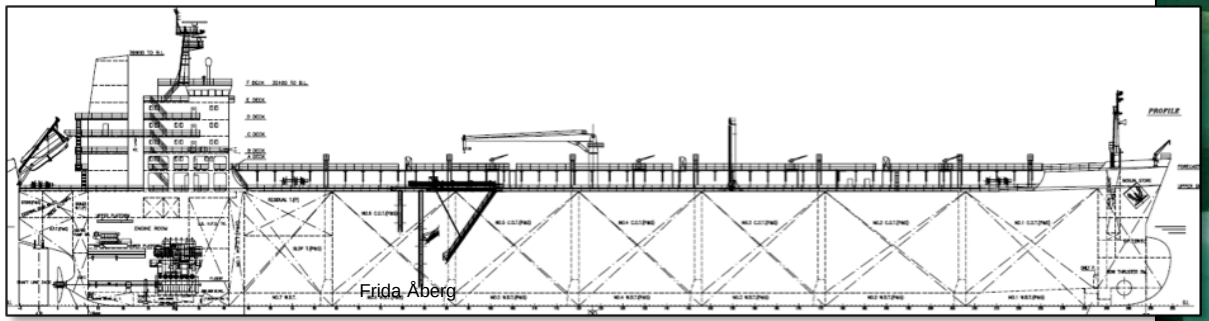
- Useful links

Swedish national programme

Swedish Agency for Marine and Water Management

- SwAM is responsible for coordination of investigations and remediation of environmentally hazardous shipwrecks
- Annual budget € 2.4 M/year, 10 years
- Decision support tool – VRAKA
- Remediate 2-3 wrecks annually


Kystverket, 2016


Frida Åberg

Swedish legal framework

Swedish Agency for Marine and Water Management

- Wrecks that constitutes an environmental hazard
  - Risk of leakage of oil and other hazardous substances
  - Imminent risk of release, ~hours.
- Wrecks that constitutes an hazard in respect to navigation
  - Wrecked ship in a fairway or in an area with important commercial fishing.
  - In a public port if it hinders the usage of the port, e.g. other ships cannot enter the port.
- Wrecks that constitutes cultural heritages
- Nairobi International Convention on the Removal of Wrecks

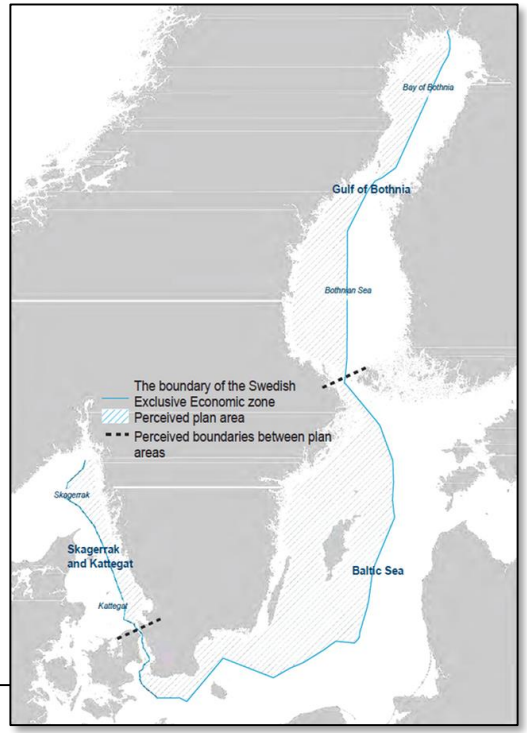

Photo: Swedish Coast Guard


Photo: Swedish Coast Guard

Swedish legal framework, cont.

Swedish Agency for Marine and Water Management

- Nairobi International Convention on the Removal of Wrecks
  - Shipowner responsible to remove hazard that occur after a wreckage
    - Wreck
    - Hazardous substance
    - State can intervene after a deadline
      - shipowner responsible for state´s costs
    - Shipowner (300gt)
      - compulsory insurance
      - other financial security to cover liability
  - EEZ, option expand to territorial waters
  - Sweden ratification 3 February 2018.
    - Expand application to Swedish territorial waters and inner waters.
  - The convention is not applicable on ships that have wrecked prior to the states ratification of the convention.

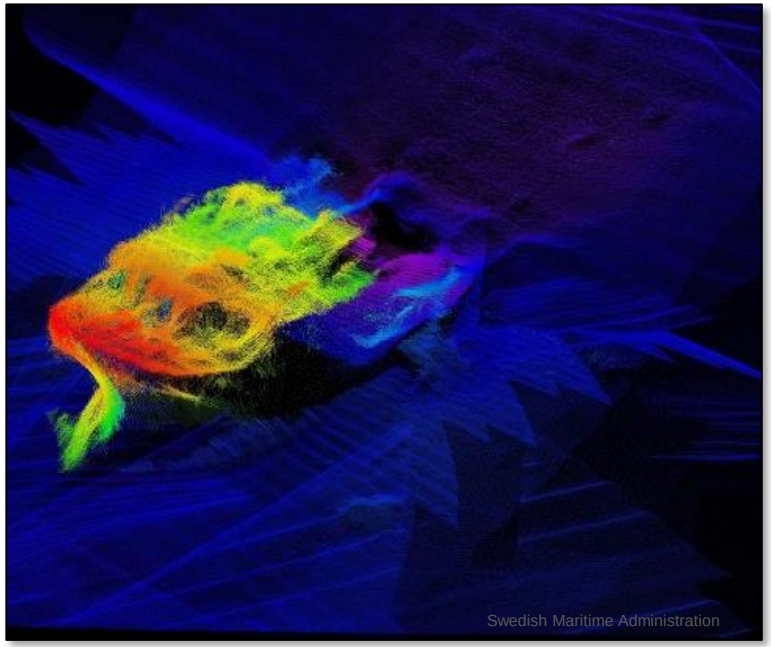


Legal considerations prior to a oil removal operation

Swedish Agency for Marine and Water Management

- 1850-2018
- No owner, insurance
- Not in a fairway or public port
- Potentially polluting

- No law applicable (most likely)
- Cost for preventive removal of threat – Swedish taxpayers



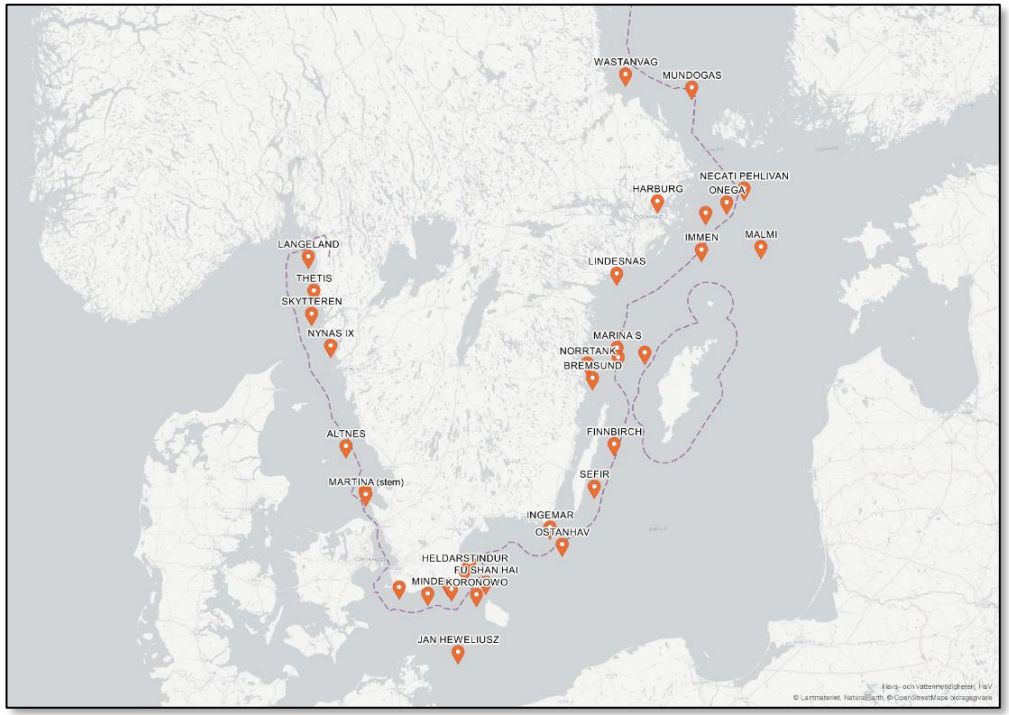
Inventory – potentially polluting ship wrecks

Swedish Agency for Marine and Water Management

Main outcomes:

- 17 000 objects
  - >100 gt
  - After 1900
  - Oil as propulsion
- 2700
  - More thorough evaluation of the propulsion

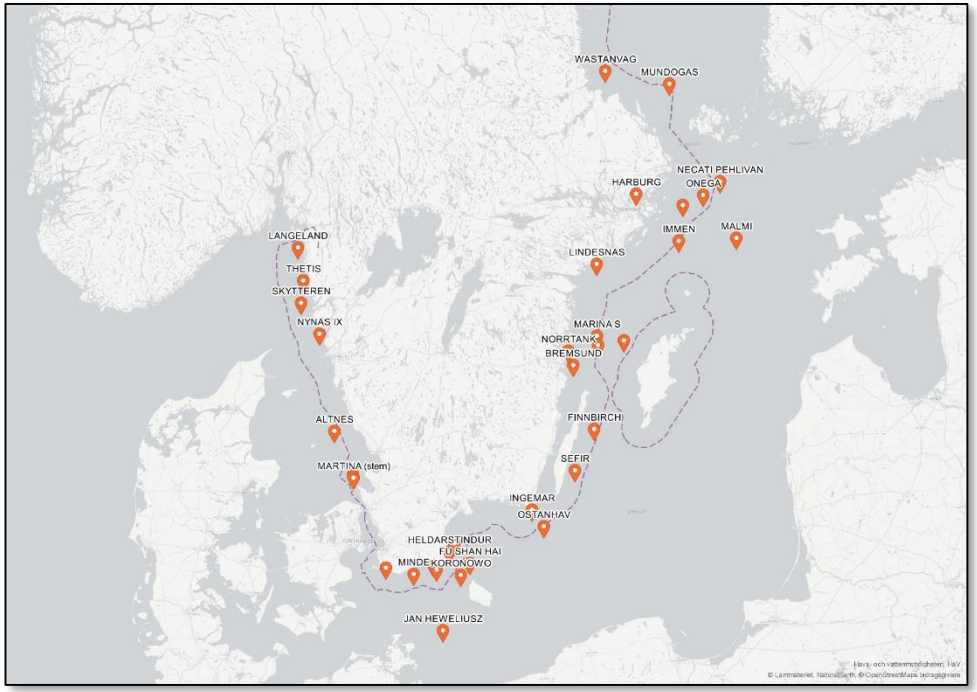
    Oil vs coal
- 316 potentially polluting ship wrecks
  - Oil still contained
- ~30 hazardous ship wrecks



Risk management – prioritizing for oil removal operations

Swedish Agency for Marine and Water Management

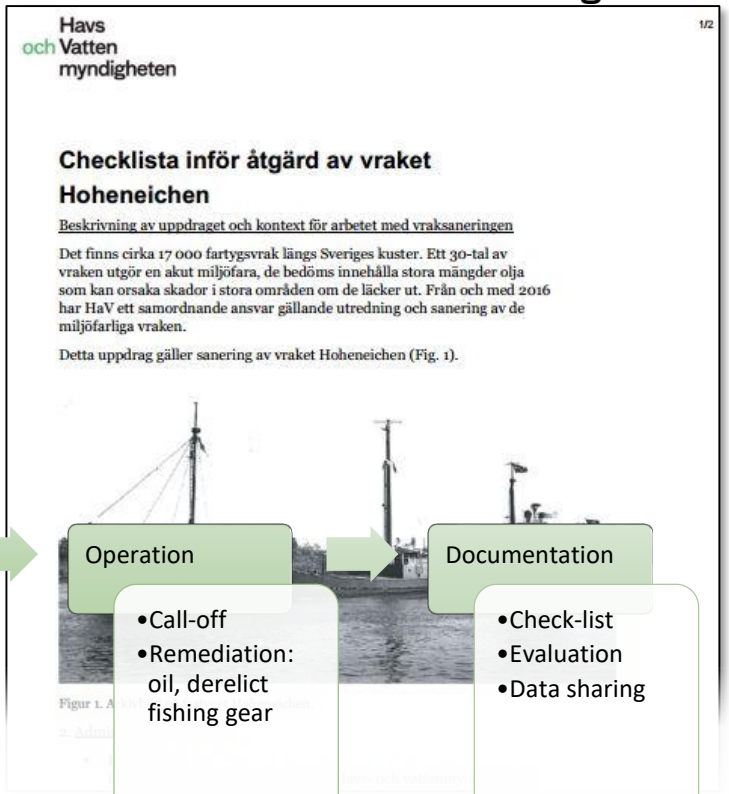
- ~30 wrecks
  - Which one constitutes the largest risk?
  - How do we use tax money most efficiently?
- Environmental risk
  - Probability of leakage
  - Volume oil inside the wreck
  - Where would the oil end up
  - Sensitivity of the nature type
- Prioritizing for oil removal operations
  - Time
  - Cost



Work procedure

Swedish Agency for Marine and Water Management

- Checklist
- Documentation of project
- Methodology


Havs och Vatten myndigheten

1/2

Checklista inför åtgärd av vraket Hoheneichen

Beskrivning av uppdraget och kontext för arbetet med vraksaneringen

Det finns cirka 17 000 fartygsvrak längs Sveriges kuster. Ett 30-tal av vraken utgör en akut miljöfara, de bedöms innehålla stora mängder olja som kan orsaka skador i stora områden om de läcker ut. Från och med 2016 har HaV ett samordnande ansvar gällande utredning och sanering av de miljöfarliga vraken.

Detta uppdrag gäller sanering av vraket Hoheneichen (Fig. 1).

Inventory
- Legal
- Check-list
- Agreement

Risk Assessment
- Data
- Survey
- VRAKA
- Site-specific modelling

Decision
- VRAKA-list
- Feasability
- Consultation with local authorities
- Cost-benefit
- Other aspects?

Operation
- Call-off
- Remediation: oil, derelict fishing gear

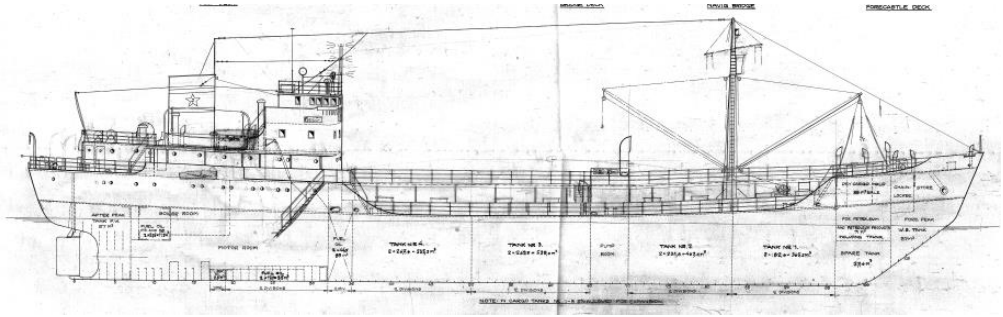
Documentation
- Check-list
- Evaluation
- Data sharing

Work procedure - Investigations

Swedish Agency for Marine and Water Management

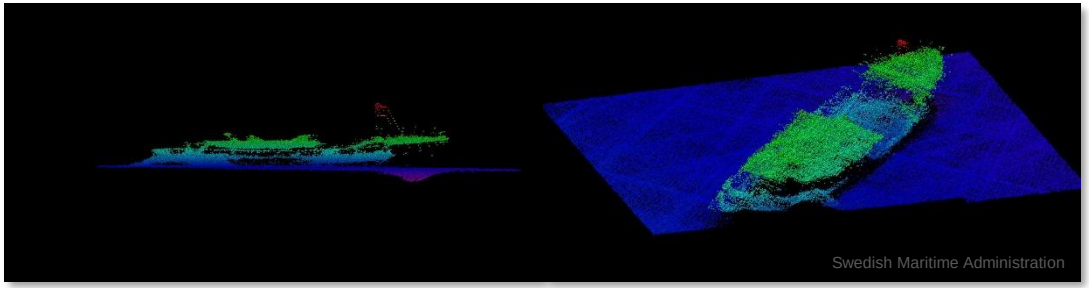
Step 1: Archive search

- General arrangement drawings
  - location of tanks
- Maritime Declarations
  - amount of oil on-board



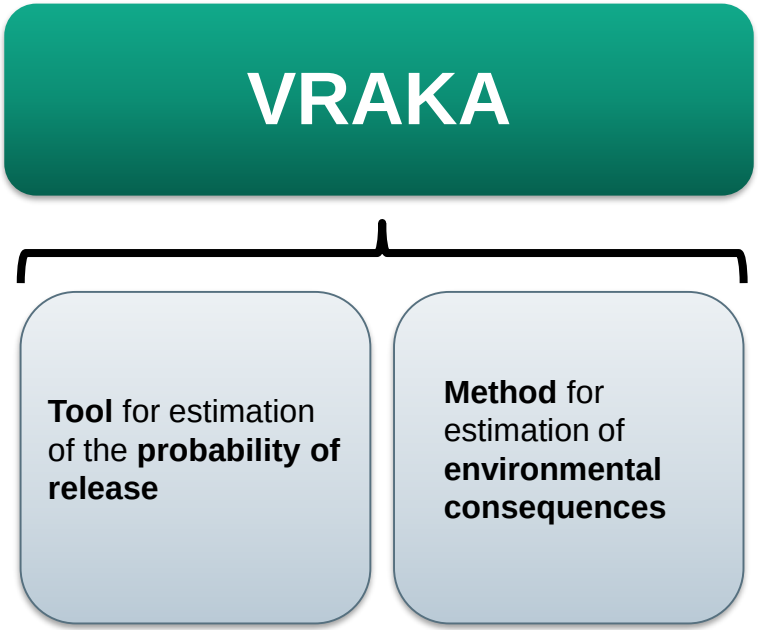
Step 2: On-site surveys

- Investigations/hydrographic surveys
  - multibeam / sidescan sonar
  - film, photo - photogrammetry
- Physical surveys
  - sediment samples
  - oil samples
  - hull thickness measurements



Risk assessment -VRAKA

Swedish Agency for Marine and Water Management



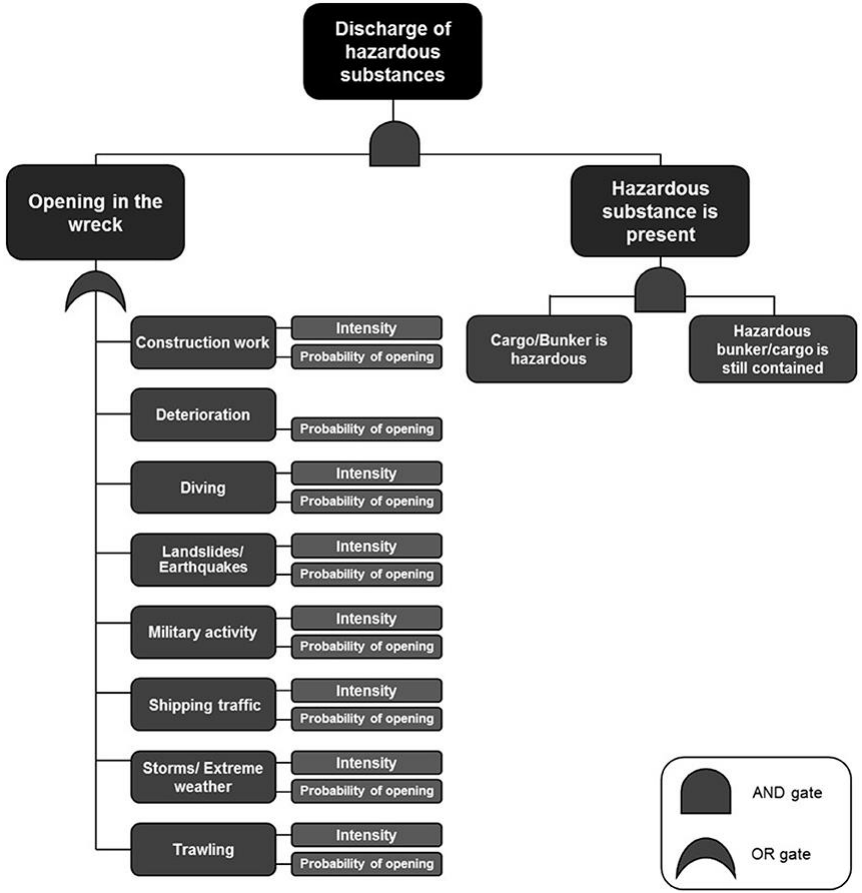
- Decision support tool
  - Prioritization of wrecks for remediation
- Risk assessment of shipwrecks
  - What can happen?
  - How likely is it?
  - What are the consequences?
- Petroleum products
  - Cargo
  - Bunker
- Chalmers University of Technology

Risk assessment -VRAKA

Part 1

Hazardous activities

- 8 different types of activities
  - Intensity
  - Probability of opening

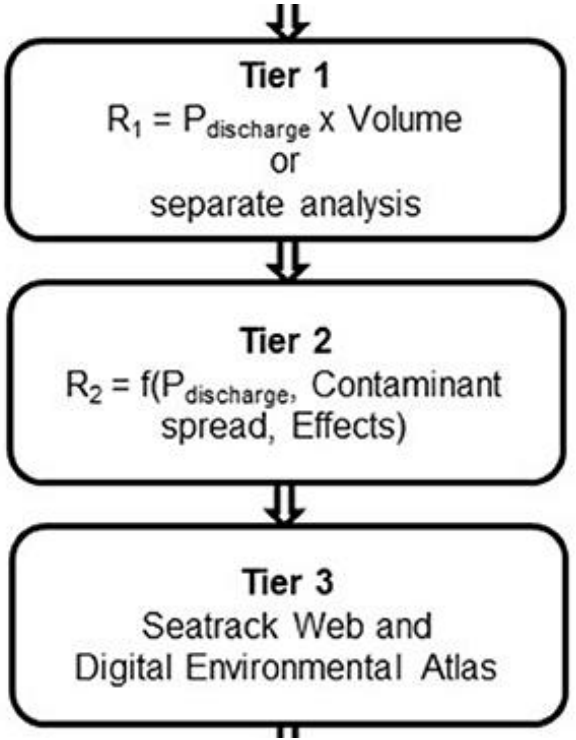


Risk assessment -VRAKA

Swedish Agency for Marine and Water Management

Part 2
Method for estimation of environmental consequences

- Three levels of Risk estimation
  - Level of detail
  - Users choice



Risk assessment -VRAKA

Swedish Agency for Marine and Water Management

Tier 1

- Probability of discharge x Volume released.
  - $P_{Release}$ x Expected amount of oil = $Risk_{Total}$

Risk assessment -VRAKA

Swedish Agency for Marine and Water Management

Tier 2

- Probability of discharge
- Volume
- Distance to shoreline
- Sensitivity

	Low severity	Moderate severity	High severity
Volume	<100 m^3	100 – 500 m^3	> 500 m^3
Distance to shore	> 10 nm	1 – 10 nm	< 1 nm
Sensitivity	Nearest shore is: Sand, steep cliffs or rock walls or facilities.	Nearest shore is: Cliff beaches, pebble, boulder or gravel beaches.	Nearest shore is: Reedbeds, meadows, fine sediment beaches, or mixed beaches

Risk assessment -VRAKA

Swedish Agency for Marine and Water Management

Tier 3

Tools for oil spill trajectory modelling and sensitivity of receptors:

1. SeaTrack Web
   - Oil spill trajectory simulation
   - Release from the sea floor
2. Digital Environmental Atlas
   - Sensitivity to oil spill
   - Ecological aspects, foremost difficulty to remediate
   - Shore types have a value 1-9

Work procedure:
Prioritization - decision

Swedish Agency for Marine and Water Management

- Prioritization – VRAKA
  - Input from workgroup
  - Input from in situ investigations
  - Risk value
- Feasability
  - Information i.e GA plans
  - Conditions on site
- Cost of remediation
- Input County administrative board, municipalities

Start of operation

Vrak (namn)	Tier 1 Riskvärde	Ritningar finns	
SKYTTEREN	318	X	
LINDESNAS	129	X	Vraket ej inom svenskt vatten eller EEZ.
JAN HEWELIUSZ	82		
KORONOWO	45		
MALMI	44	X	
NYNAS I	39		
FU SHAN HAI	33		
RONE	32	X	
SANDÖN	15,5	X	
NECATI PEHLIVAN	15		
NYNAS IX	12		
FINNBIRCH	11		
IMMEN	9,49		
HARBURG	7	X	
OSTANHAV	6		
HOHENEICHEN	6	X	
MUNDOGAS	4,8		
MINDE	4,7		
TILIA	4,5	X	
ONEGA	4,3		
IREVIK	3,4		
HELDARSTINDUR	3		
INGEMAR	3		
ALTNES	2	X	
WASTANVAG	1,2		
MARINA S	1,1	X	
MARTINA (akter)	0,6		
VILLON	0,6	X	
LANGELAND	0,4		
BREMSUND	0,36		

Frame agreement, requirements

Swedish Agency for Marine and Water Management

- Experience of working with hazardous ship wrecks, oil removal, removal of ghosts nets
- Experience of oil removal operations
- Certifications – quality management system
  - Health, safety
  - Environment
- Economy
- Reference cases

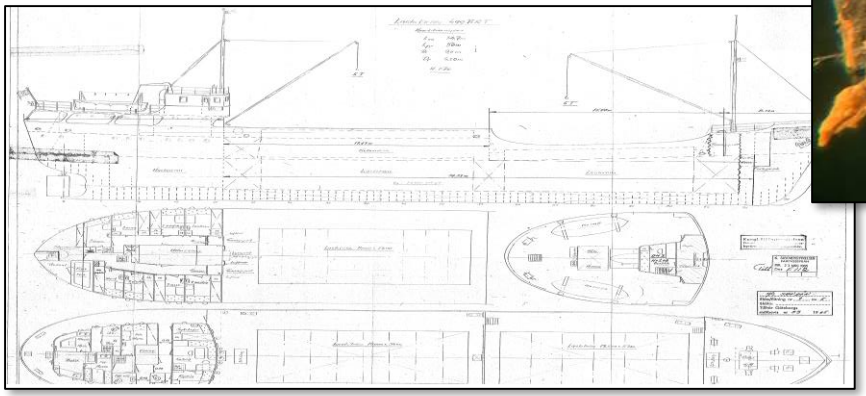
Work Procedure: Call-off

Swedish Agency for Marine and Water Management

Call-off from frame agreement

Tender documents

- Information regarding wreckage
- On-site conditions: currents, sea floor
- General arrangement plans

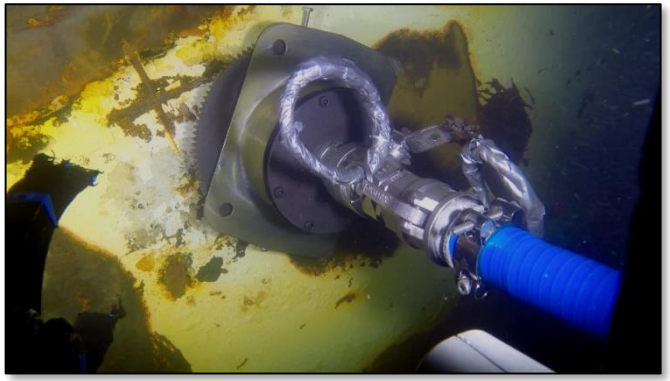


Oil from gooseneck piping, shipwreck Harburg. Swedish Coast Guard

Work procedure:
Oil removal

Swedish Agency for Marine and Water Management

- Remotely underwater vehicle (ROV) and/or diving
- Closed loop system
  - Penetration of tanks
  - Oil pumped to surface vessel
- Remove derelict fishing gear from wreck
  - Destruction
  - Recycling



Drill equipment with hose, attached on hull. Marine works, 2017

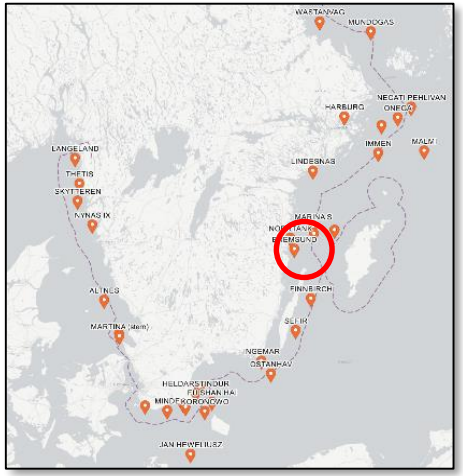
Removal of ghost net. Victor Jensen/Sveriges Radio, 2018

Experiences: On-site survey

Swedish Agency for Marine and Water Management

Shipwreck Bremsund

- Side-scan sonar documentation of the wreck site (500x500m)
  - General area of the wreck site
- Detailed investigations of the wreck.
  - Video- and image documentation
  - 3D-model of the wreck, photogrammetry
  - Digital Elevation Model (DEM)
- Hull thickness measurements
  - Four relevant positions, four measurements per point
  - Starboard and larboard (if possible)
- General hydrological data of the area
  - salinity
  - temperature
  - oxygen
  - sea-floor currents (if possible)



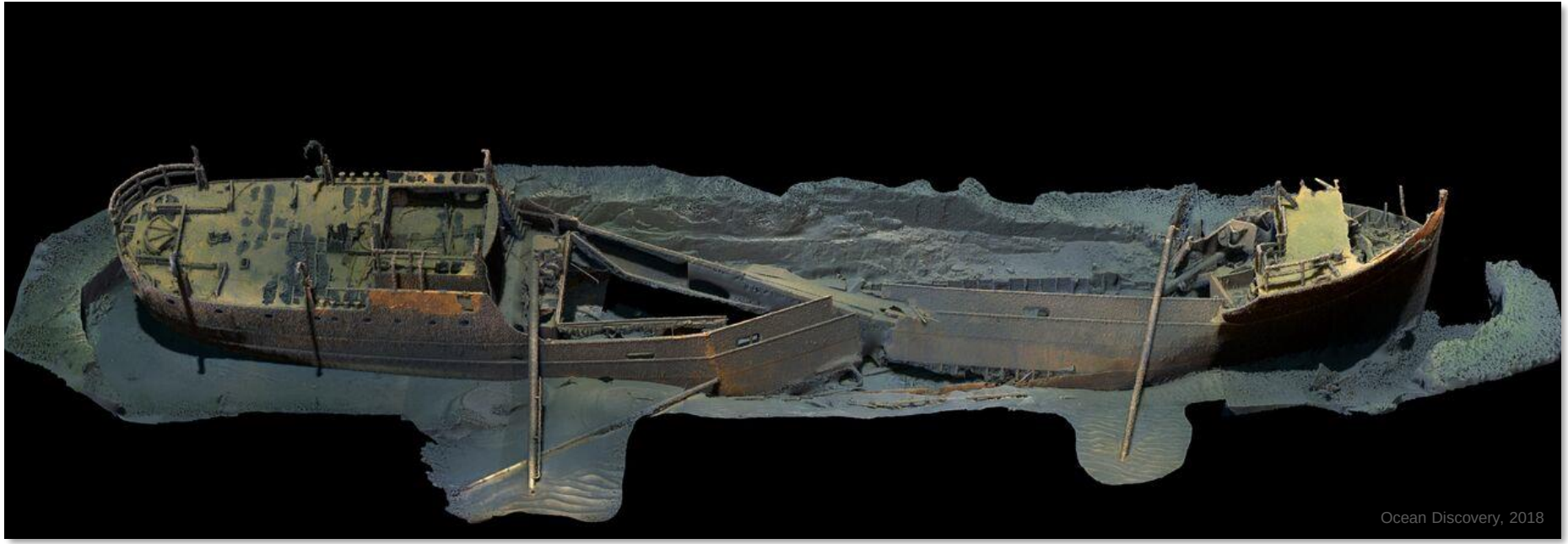

Ocean Discovery, 2018

Experiences: On-site survey

Swedish Agency for Marine and Water Management

Shipwreck Bremsund

Pictures from 3D-model of the wreck, photogrammetry



Experiences: On-site survey

Swedish Agency for Marine and Water Management

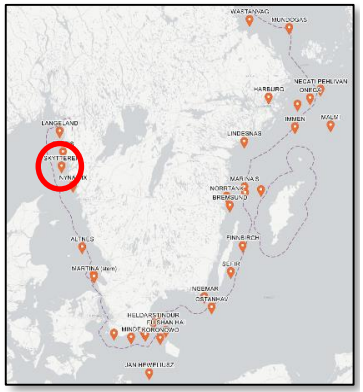
Shipwreck Bremsund

Pictures from 3D-model of the wreck, photogrammetry

Experiences: On-site survey

Shipwreck Skytteren

- 172m, 12000 gt, 1942, ~500 t oil
- ROV/Diving assignment
- Swedish navy - HMS Belos
  - Belos divers – wet bell
  - Clearance divers



Stampsnall www.delcampe.net

- General investigation of the wreck, condition, deterioration
- Places of oil leakage
- Hull thickness measurements
- Other - holes, pit corrosion, fishing gear?

Rebecka Signäs/Swedish Armed Forces

Experiences: *Skytteren - results*

- Strong surface (1-3 knots) and sea-floor (1-1,5 knots) current
- Investigations of the keel area, whole length of wreck

First impression - good condition, but;

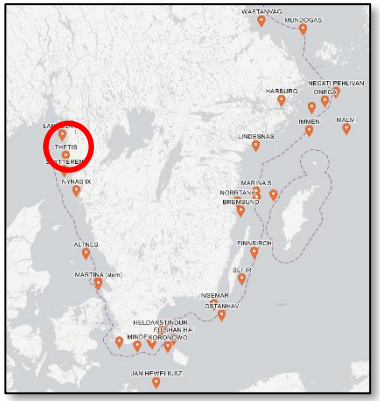
- Hull thickness - 4-11 mm
- Nails more corroded than hull
- Oil leakage visible on surface

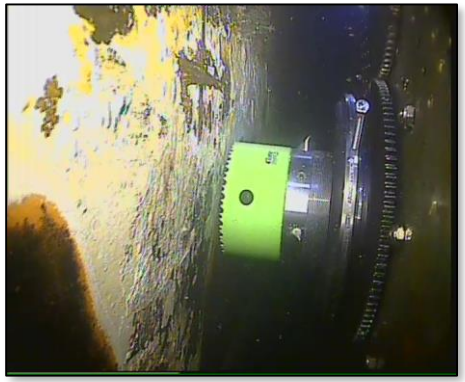
Experiences: Remediation

Swedish Agency for Marine and Water Management

Shipwreck Thetis

- Oil removal – 2017
  - Test case
  - Close to shore, ROV and diving operation
  - Time of wreckage ~22 m^3 diesel
  - Recovery ~1m^3
    - Filling pipes corroded



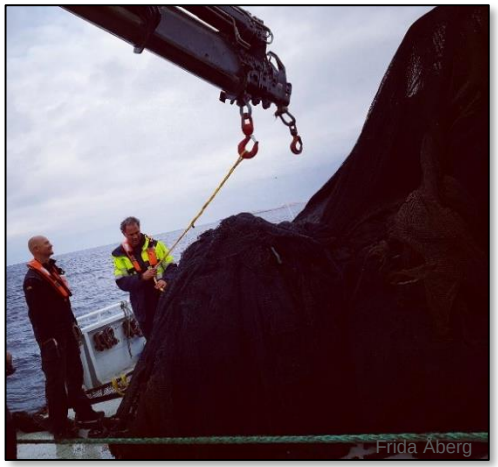


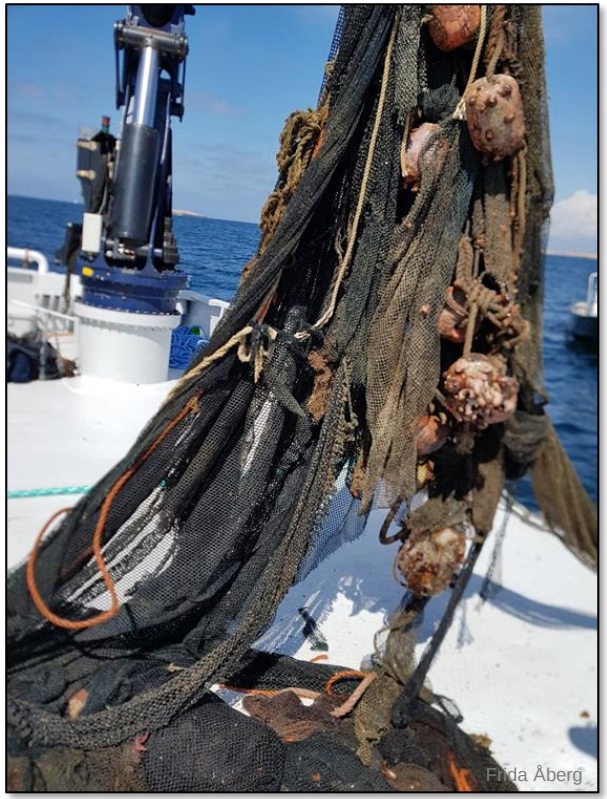
Experiences: Remediation

Swedish Agency for Marine and Water Management

Shipwreck Thetis

- Oil removal – 2017
- Ghost net – 2018
  - Purse seine (400x100m)
  - Recovery 12- 15 tons



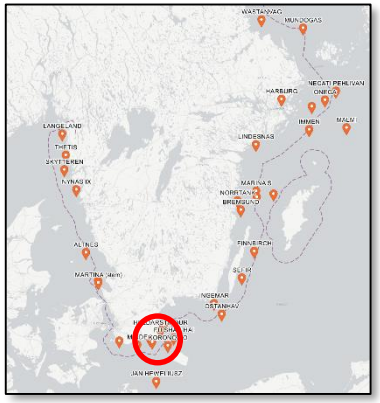


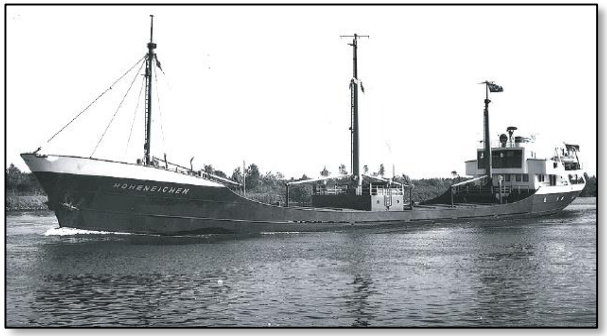
Experiences: Remediation

Swedish Agency for Marine and Water Management

Sandön & Hoheneichen

- Geographically close – economically advantageous
- Easy objects – possibility within 2018
- M/S Sandön
  - Coaster, 499 gt
  - Fire in machine room, 1975
  - Bunker 40t
- M/S Hoheneichen
  - Coaster, 499 gt
  - Storm, 1959
  - Bunker 18t
- No reports of oil leakage

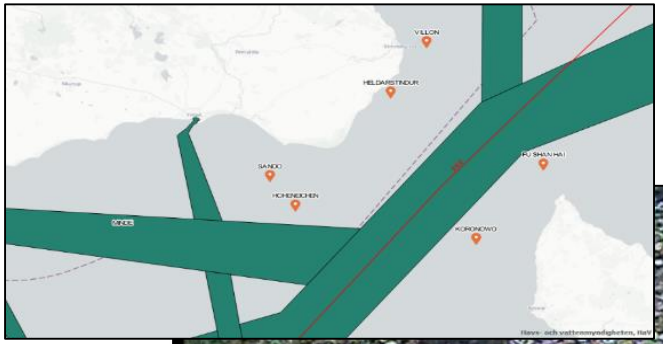


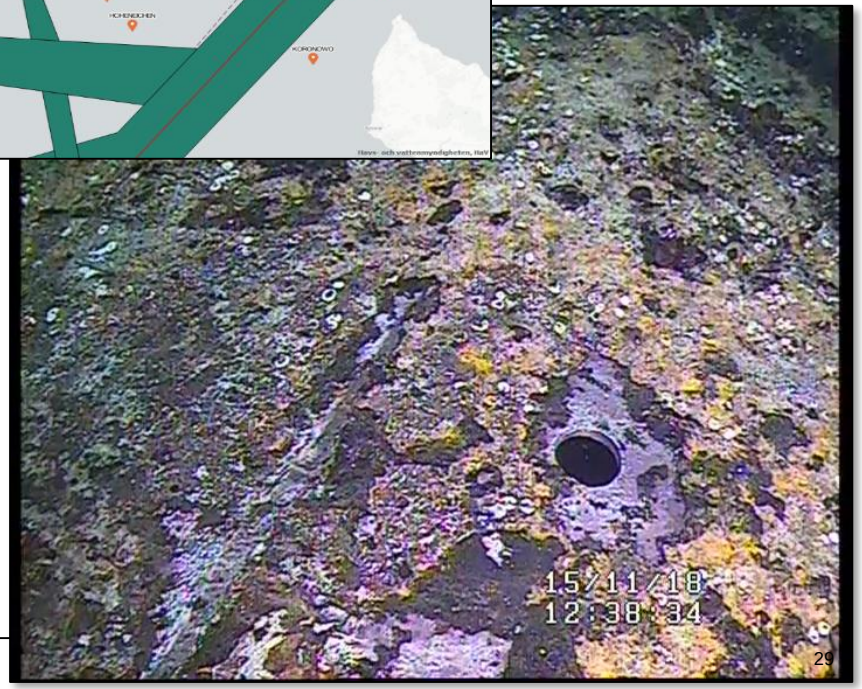


Experiences: Remediation

Swedish Agency for Marine and Water Management

Sandön & Hoheneichen





Prerequisites:

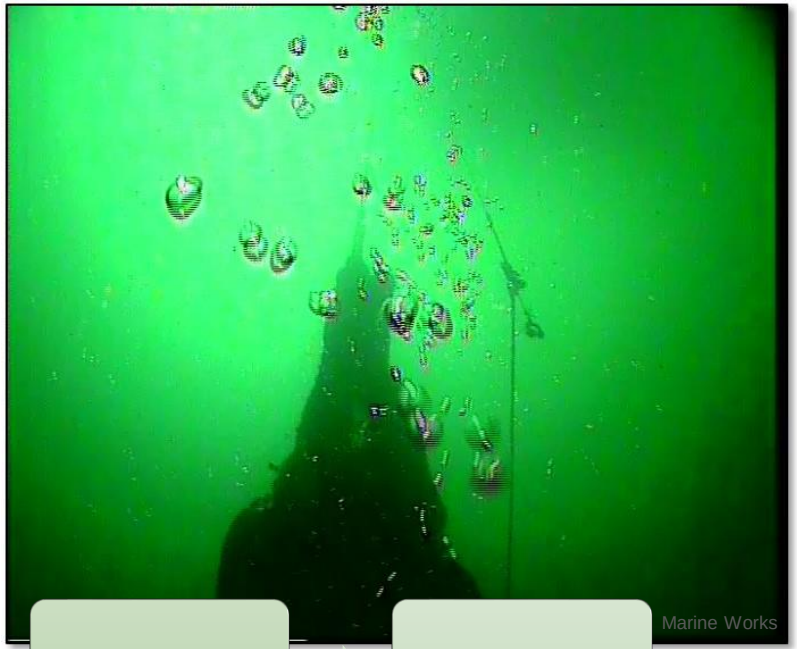
- Depth: 31-18 m
  - Diving operation
- Easy access: keel-side up
- No owner
- No human remains in the wreck
- Not in a shipping lane
- Limited commercial fishing activity in the area

Result : no oil!

Summary

Swedish Agency for Marine and Water Management

- Swedish National Programme
- ~30 wrecks on the shortlist
- Risk assessment, VRAKA, a decision tool
- Remediation, closed loop drilling
- Be prepared for anything and everything!



Inventory → Risk Assessment → Decision → Operation → Documentation

Thank you!

Frida Åberg
frida.aberg@havochvatten.se

Fredrik Lindgren
fredrik.lindgren@havochvatten.se

https://www.havochvatten.se/en/swam/facts--leisure/environmental-impact/shipwrecks.html

Swedish Agency
for Marine and
Water Management

Further reading

Swedish Agency for Marine and Water Management

https://www.havochvatten.se/en/swam/facts--leisure/environmental-impact/shipwrecks.html

VRAKA, Ph.D-thesis by Hanna Landquist (2016)

http://publications.lib.chalmers.se/records/fulltext/244266/244266.pdf

SwAM Youtube-playlists from shipwreck operations

https://www.youtube.com/playlist?list=PLr3k-vNFdXs3WyKMoJcgCWoaArRk1P62T

https://www.youtube.com/watch?v=2FWrnjLB_C4&list=PLr3k-vNFdXs0ikmAPNna4DR4M8vtHwB05

https://www.youtube.com/playlist?list=PLr3k-vNFdXs1BJfYp9fzKz3SDDEIfxOT-