Chemical Munitions in the Baltic Sea – the Lithuanian experience

Galina Garnaga-Budrė
Environmental Protection Agency
Marine Research Department
Lithuania

A side event at the OPCW 22nd session of the Conference of the States
"Sea Dumped Chemical Weapons"
2017-11-29

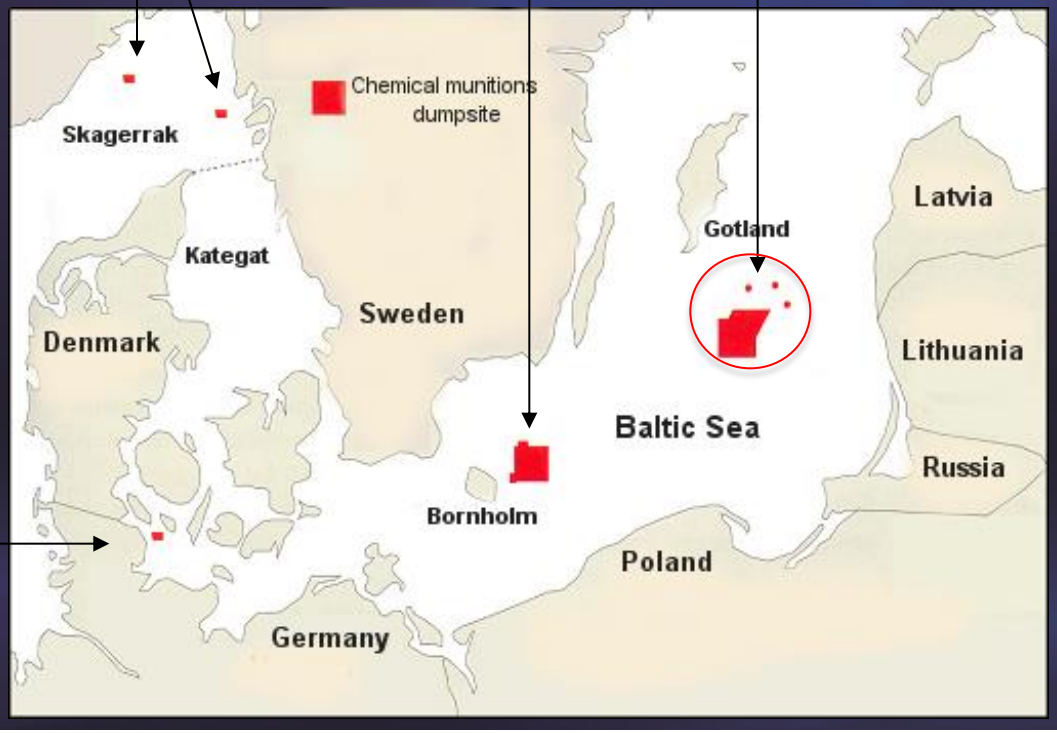
After World War II

~40 vessels (170 000 t of chemical warfare) at the depth 200-700 m

35 000 t at the depth of 70-105 m

10 000 t at depth of 70-120 m

2 vessels with 69 000 tabun grenades at the depth 30 m (retrieved)

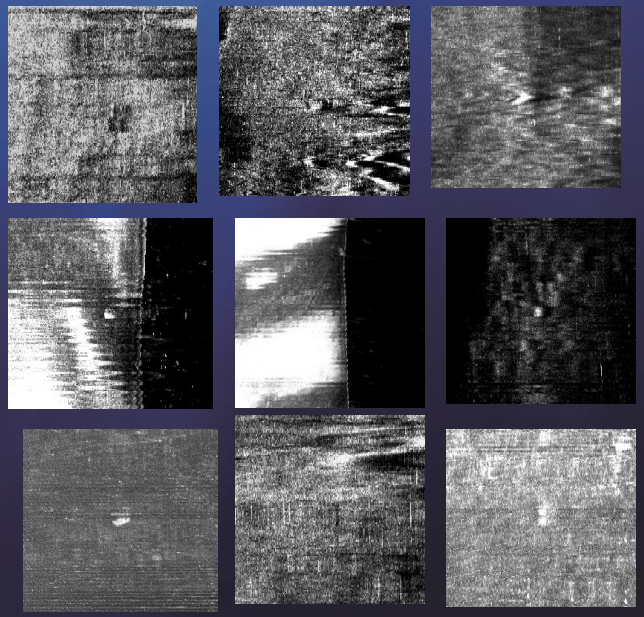


(gross tones, CW with shells)

National project 2002-2004

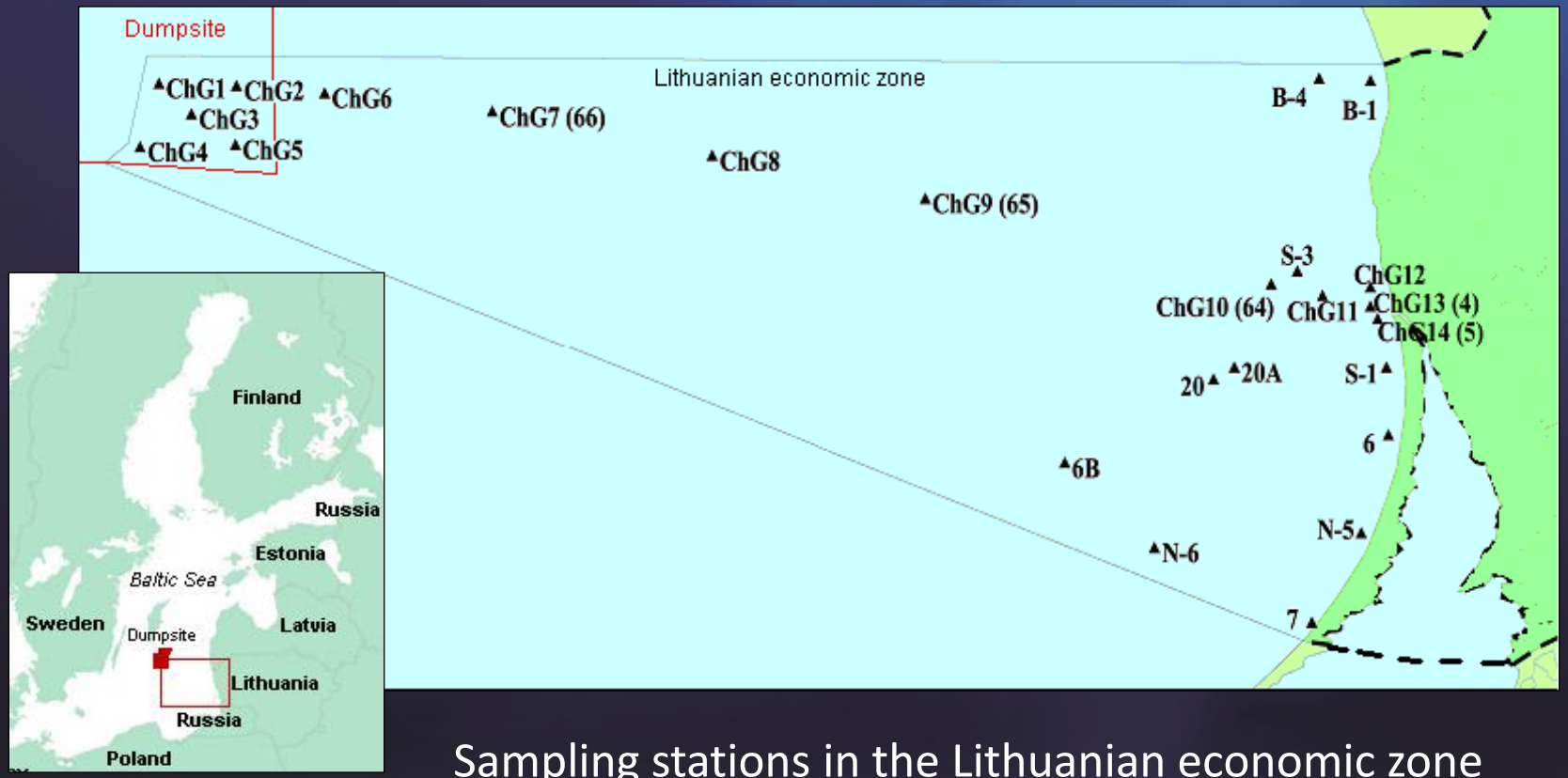
- October, 2002 (scanning of the dumpsite bottom)
- June, 2003 (CW dumpsite)
- August, 2004 (national monitoring stations)

Scientific research vessel “Vėjas”



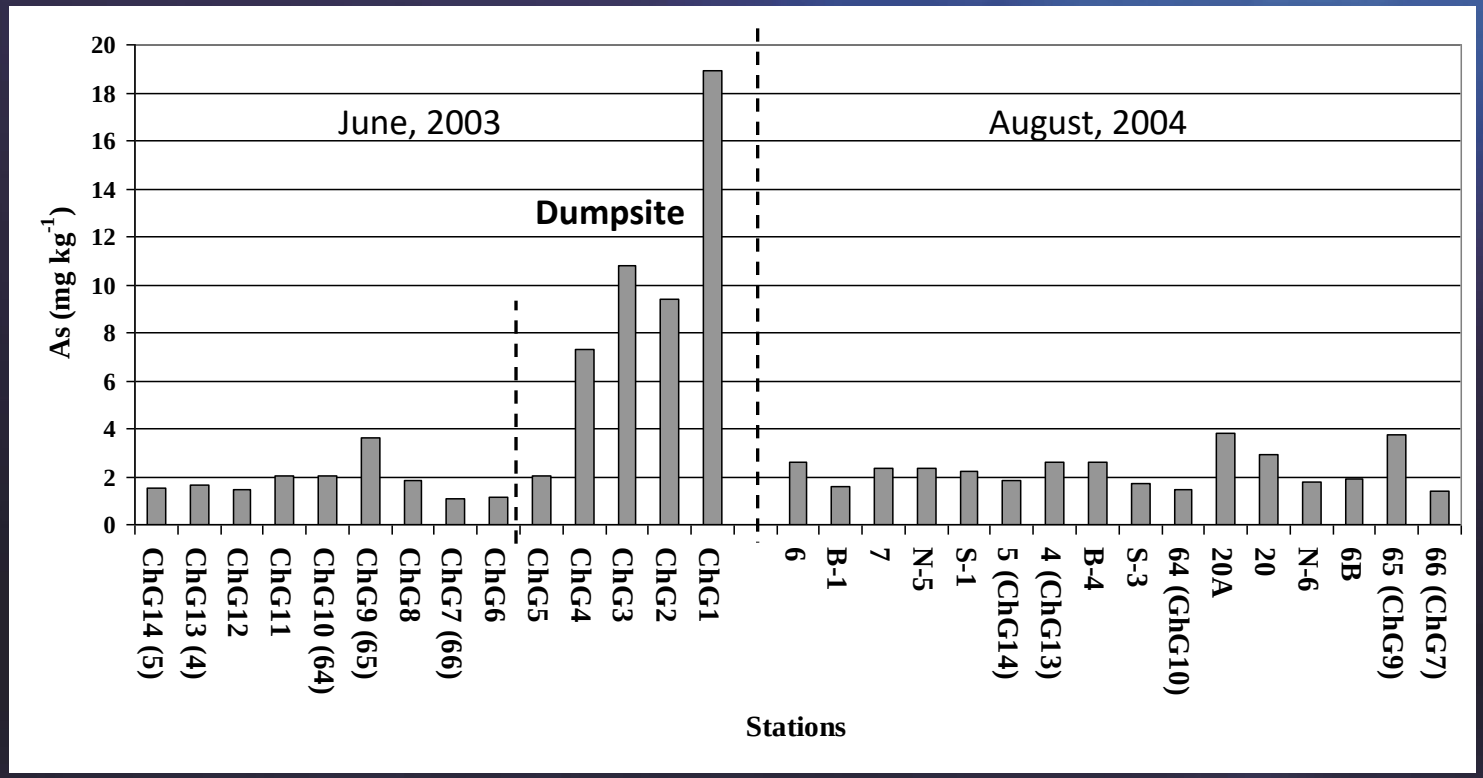
Totally 39 objects: 13 bombs, 2 barrels

National project 2002-2004



Sampling stations in the Lithuanian economic zone (prefix ChG mark stations from the mission in June, 2003)

IAEA Technical Cooperation project (2004-2005)



As range from 1.1 to 19.0 mg/kg

- 9.7 mg/kg at dumpsite

-2.1 mg/kg in other samples

As concentrations in the surface sediments in the Southeastern Baltic

National project 2002-2004

Conclusions (2002-2004)

- Water depth, north direction bottom water currents, bottom currents velocities and bottom relief prevent chemical munitions from reaching the Lithuanian coast

- Studied parameters did not show any changes of the environment at the chemical munitions dumpsite

- Higher As concentrations were found at the chemical munitions dumpsite, compared to other sites. However As concentrations were low relative to other investigations

- Chemical munitions - **subject for future investigations**

UN Resolution (2010)

United Nations A/RES/65/149

Distr.: General

10 February 2011

General Assembly

Sixty-fifth session

Agenda item 20

Resoliution adopted by the General Assembly

[on the report of the Second Committee *(A/65/436 and Corr. 1)*]

65/149. Cooperative measures to assess and increase awareness of environmental effects related to waste originating from chemical munitions dumped at sea

The General Assembly,

Recalling the recommendations of the United Nations Conference on the Human Environment, held in Stockholm in June 1972,[1]

Noting relevant provisions of Agenda 21,[2] adopted at the United Nations Conference on Environment and Development in Rio de Janeiro, Brazil, in June 1992 and reaffirmed in the Plan of Implementation of the World Summit on Sustainable Development ("Johannesburg Plan of Implementation"),[3] adopted in Johannesburg, South Africa, in September 2002,

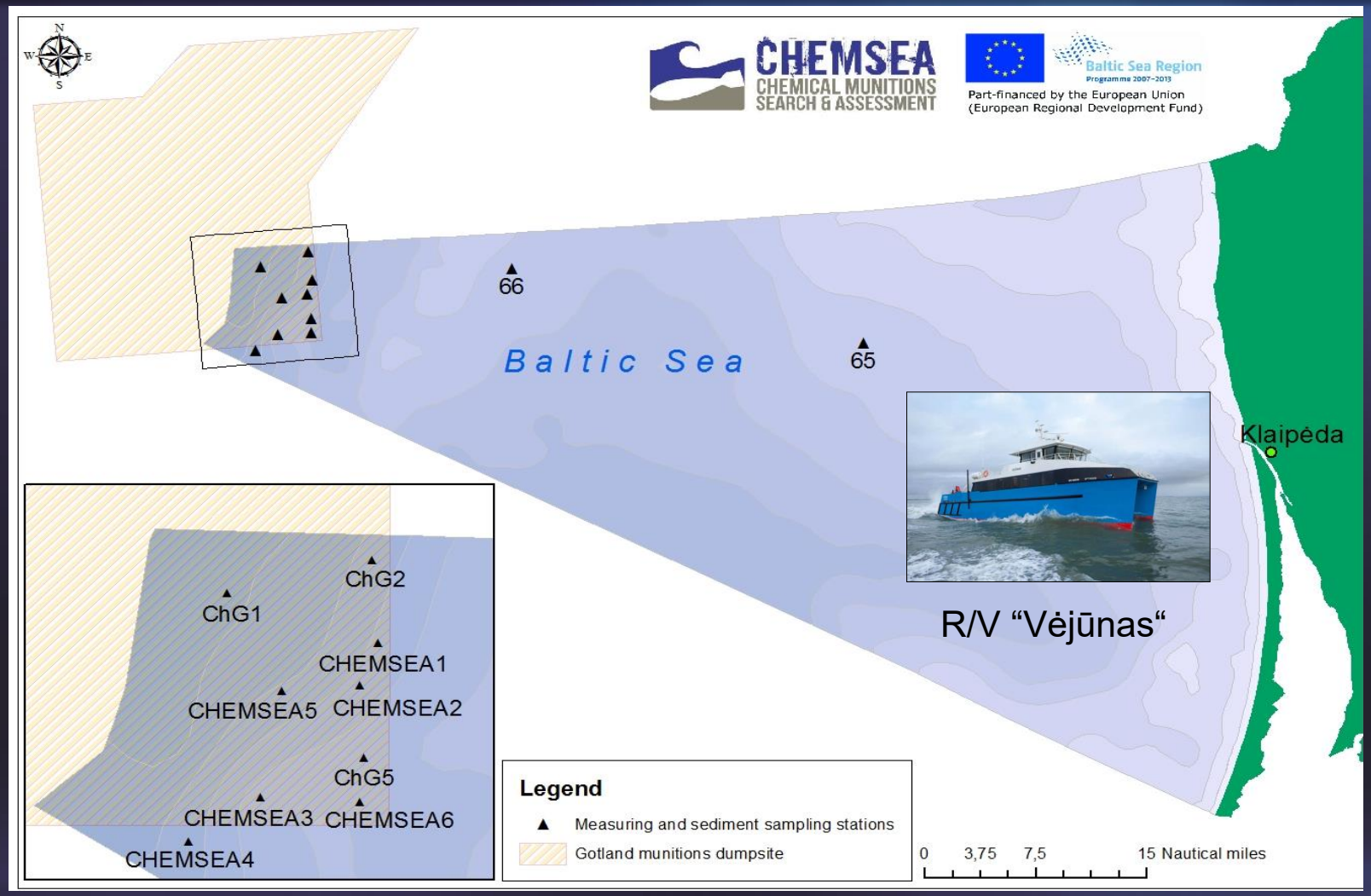
Recalling relevant international and regional instruments such as the United Nations Convention on the Law of the Sea,4 the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter,5 the Convention for the Protection of the Marine Environment of the North-East Atlantic,6 the Convention on the Protection of the Marine Environment of the Baltic Sea Area, 7 the Convention for the Protection and Development of the Marine Environment of the

Scientific Advisory Board (2010)

An independent Scientific Advisory Board on the chemical munitions dumped at seas has started its work in 2010 under the initiation of Lithuania.

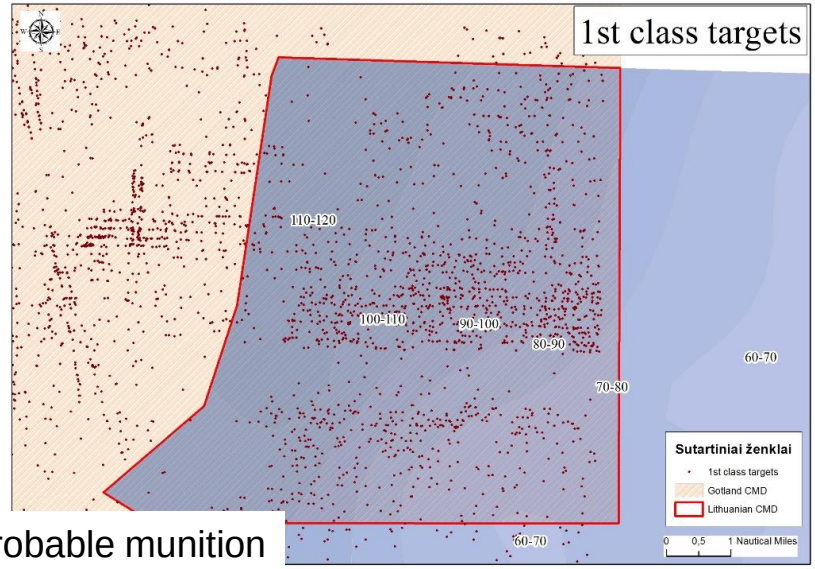
Representatives and scientists from different environmental organizations from Australia, Belgium, Japan, USA, Canada, Poland, Lithuania, France, Russia and Sweden became members of the Scientific Advisory Board.

CHEMSEA project 2011-2014

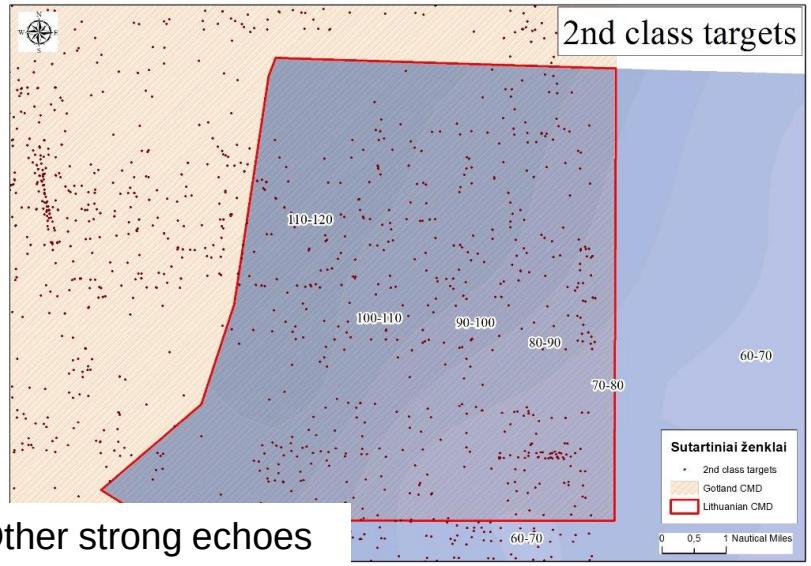


Sampling stations in 2013 and R/V "Vėjūnas" (EPA)

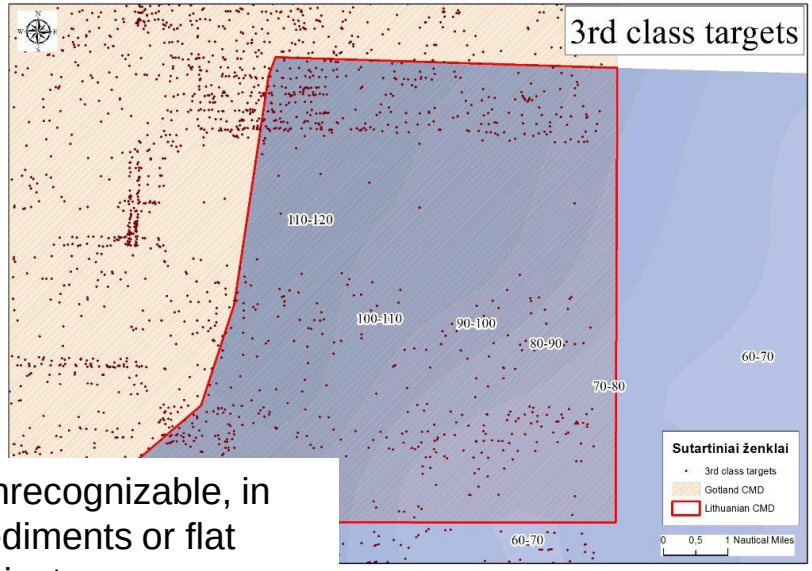
CHEMSEA project 2011-2014



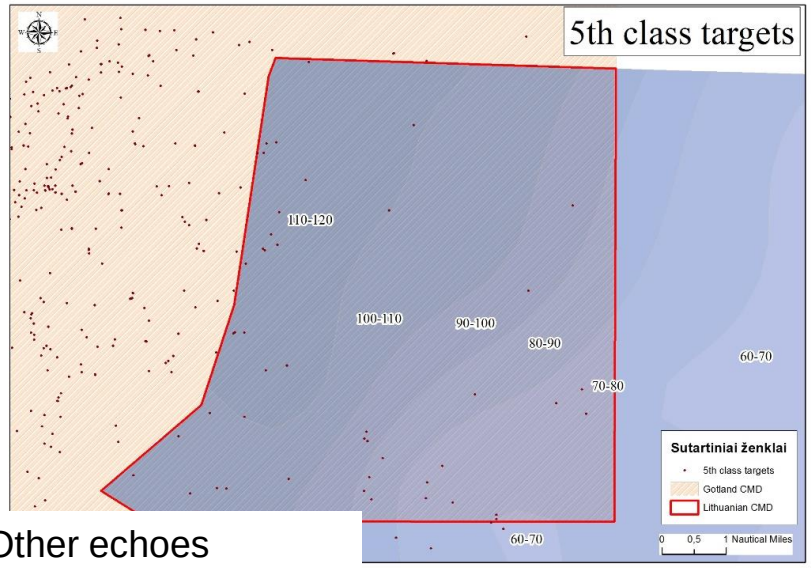
Probable munition



Other strong echoes



Unrecognizable, in sediments or flat objects



Other echoes

CHEMSEA project 2011-2014





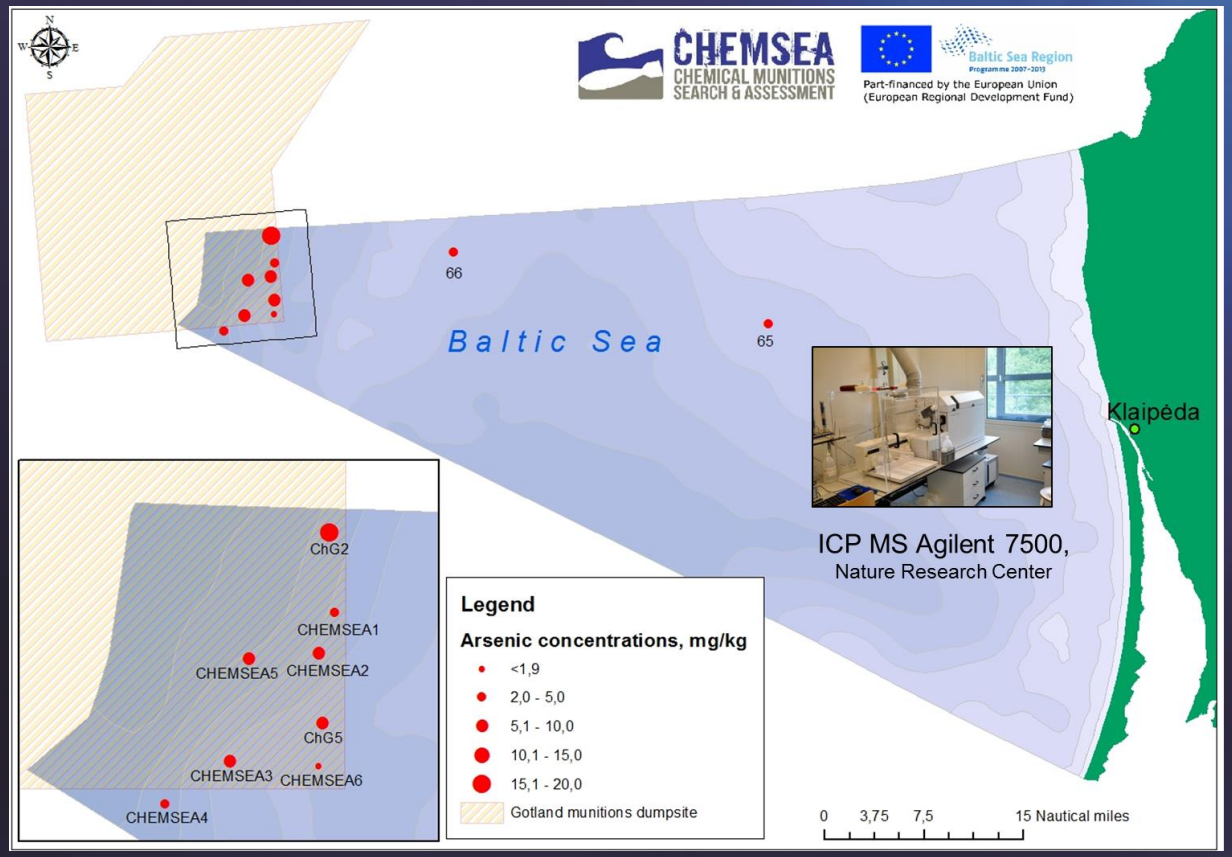

Sediment sampling and detection of CWA with ChemPro100i detector in 2013

CHEMSEA project 2011-2014

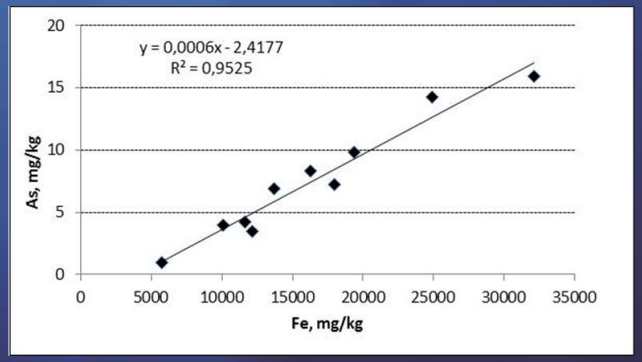
Macrozoobenthos organisms were found in all the studied stations except CHEMSEA5. During the research period 1981-1993, 10 macrozoobenhtos species were found in 78-110 m depth. In 2013 only *Halicryptus spinulosus*, *Bilgydes sarsi* and Ostracoda were found in 18 samples.

Large heaps of damaged valves of *Macoma balthica* were found in 85 m (CHEMSEA3) depth, but no one was alive.

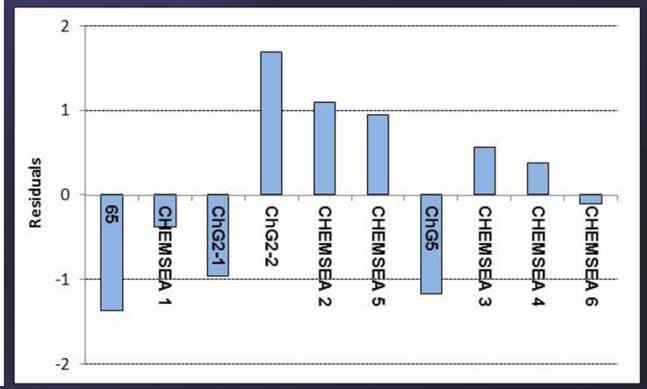
CHEMSEA project 2011-2014



Arsenic concentrations (mg/kg dry weight) in the surface sediments of the Lithuanian economic zone



Correlation between Fe and As in the Baltic Sea sediment



Residual arsenic normalized to iron

CHEMSEA project 2011-2014

Results

Station	Hydrogen sulphide in near-bottom water, mg/l	Macrozoobenthos	Chem Pro100i detector	Arsenic, mg/kg	Residuals As/Fe	Clark I/II-related, µg/kg	TPA-related, µg/kg	PDCA-related, µg/kg
						3T	4	5T
ChG1								
ChG2-1			not detected	15.9	-1,0			
ChG2-2			**Blister***	14.2	**1,7**			
ChG5			not detected	7.2	-1,2			
66			not detected	2.2	-			
65			not detected	3.5	-1,4			
CHEMSEA2			not detected	6.9	**1,1**			
CHEMSEA1			not detected	4.2	-0,4			
CHEMSEA4			not detected	4.0	0,4			
CHEMSEA3	**0.01**	**Large heaps of dead Macoma valves**	**Chemical hazard****	9.8	0,6			
CHEMSEA5		**No organisms found**	not detected	8.3	**1,0**	**17**	**14**	**42**
CHEMSEA6			not detected	<1,9	-0,1			

*Blister - sulphur mustard (HD), lewisite (L), nitrogen mustard (HN_3)

**Chemical hazard - generic alarm for chemicals in hazardous concentrations or chemical mixtures

Conclusions (2011-2014)

- Arsenic concentrations in sediments of the chemical munitions dumpsite (<1.9 to 15.9 mg/kg) are in line with the concentrations found during previous study of the dumpsite in 2003 (2.1 to 19.0 mg/kg).
- Number of the macrozoobenthos species has decreased notably (from 10 in 1981-1993 to 3 in 2013).
- Chemical warfare agents (Clark I/II-related; Triphenylarsine and PDCA-related) were found in sediments of station CHEMSEA5.
- Chemical munitions - **subject for future investigations.**

MODUM project 2013-2015

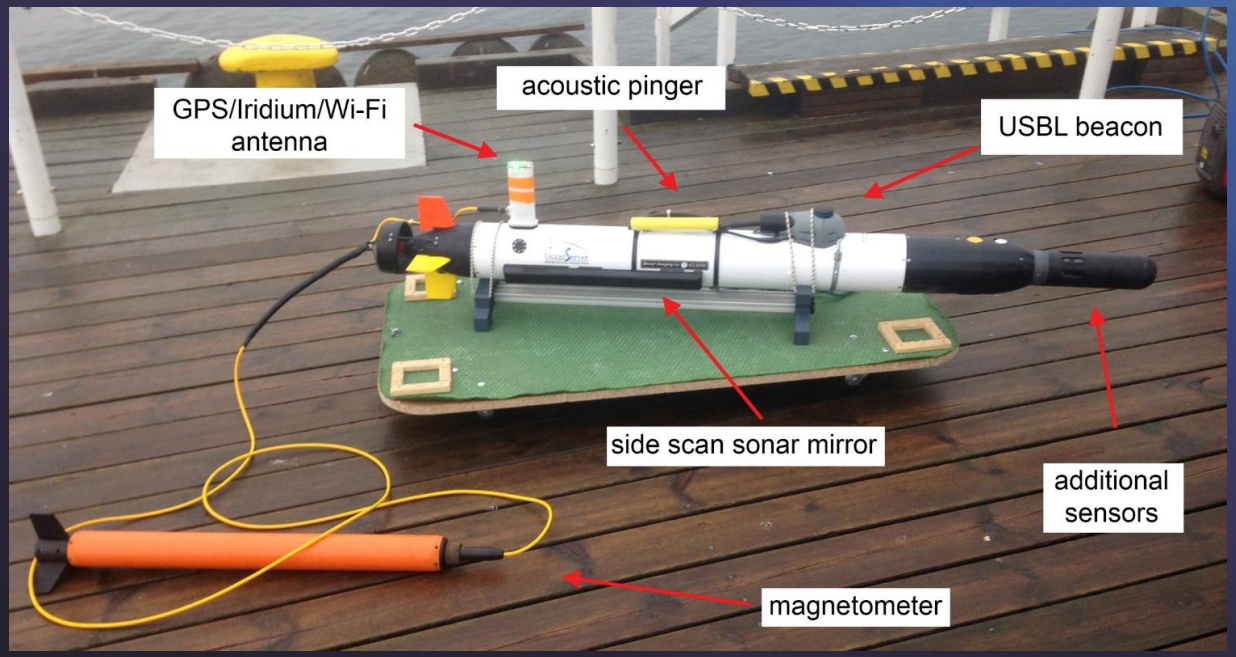
Towards the monitoring of dumped munitions threat - MODUM

The main aim of the project – establishment of the monitoring network observing CW dumpsites in the Baltic Sea, using Autonomous Underwater Vehicles (AUV's) and Remotely Operated Underwater Vehicles (ROV's).

MODUM
This project is supported by: The NATO Science for Peace and Security Programme
NATO OTAN

MODUM project 2013-2015

IVER-2 Autonomous Underwater Vehicle (AUV)



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

Performance:

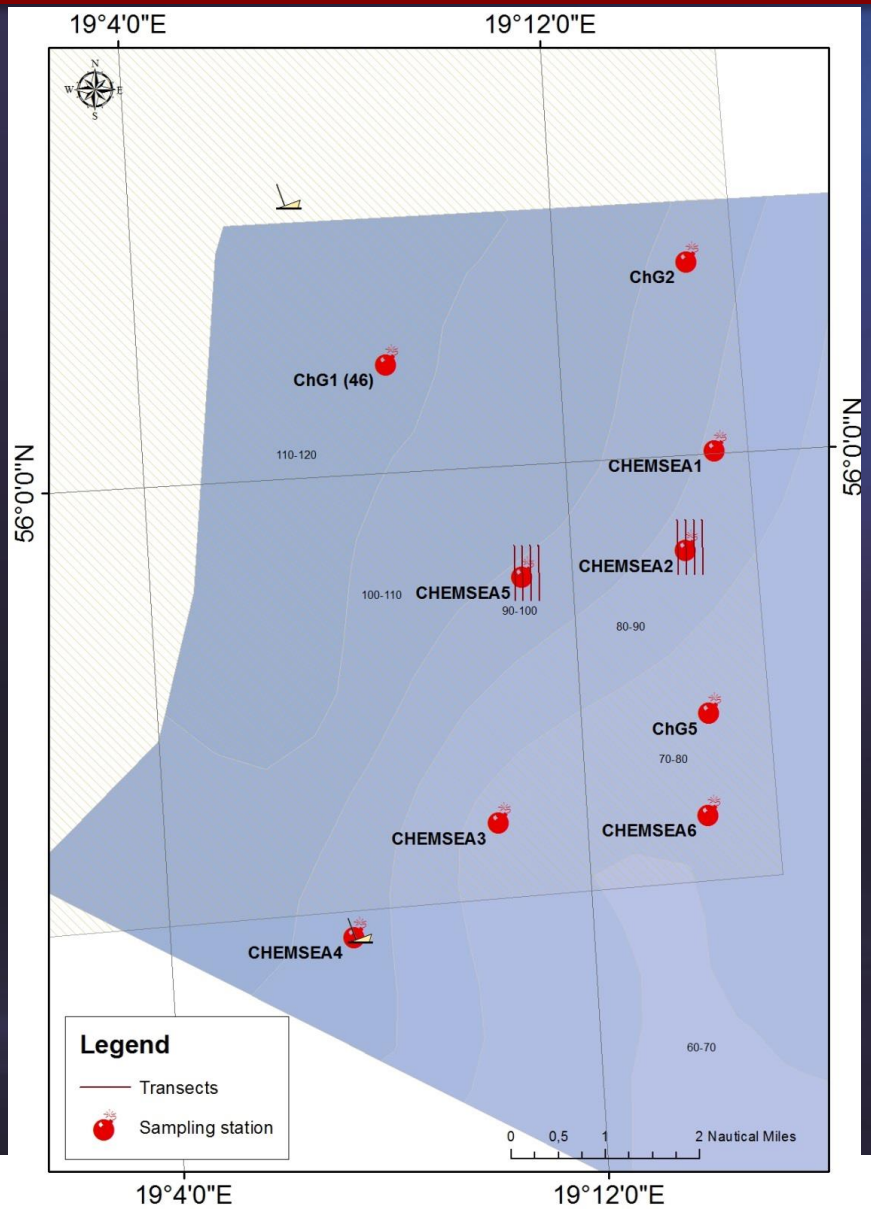
- Maximum operation depth – up to 150 m
- 2-3 missions per day
- Average mission time – 2,5 h

Sensors:

- CTD/STD
- sound speed
- pH
- turbidity
- chlorophyll
- oxygen saturation
- REDOX

MODUM
TOWARDS THE MONITORING OF DUMPED MUNITIONS THREAT

MODUM project 2013-2015



Chemical munition dumpsite survey

2014.09.01- 03

Activities:
- **SideScanSonar survey**
- **Sediment sampling**

Chemical munition dumpsite survey

2015.09.03- 05

Activities:
- **AUV**
- **SideScanSonar**
- **Sediment sampling**

MODUM
TOWARDS THE MONITORING OF DUMPED MUNITIONS THREAT

MODUM project 2013-2015

Gotland Deep Baltic Sea in 2015 Autumn

MODUM
TOWARDS THE MONITORING OF DUMPED MUNITIONS THREAT

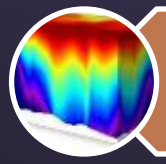
MODUM project 2013-2015

Student's Post, on NATO Science for Peace and Security (SPS) Summer School on Sea Dumped Chemical Weapons, Canada

Published on September 14, 2016

Decision Aid for Marine Munitions
DAIMON: Methods

Munition Status Examination



Modelling of possible release

Pollution of sediments and water

Impact on biota assessment

Risk categorization procedure

Decision Support System / DSS

DSS input

- Risk levels
- Binary or scale

Documentation

- Explanation
- Knowledge based

Place in DSS

- Weight – for overall risk
- Geographical extent

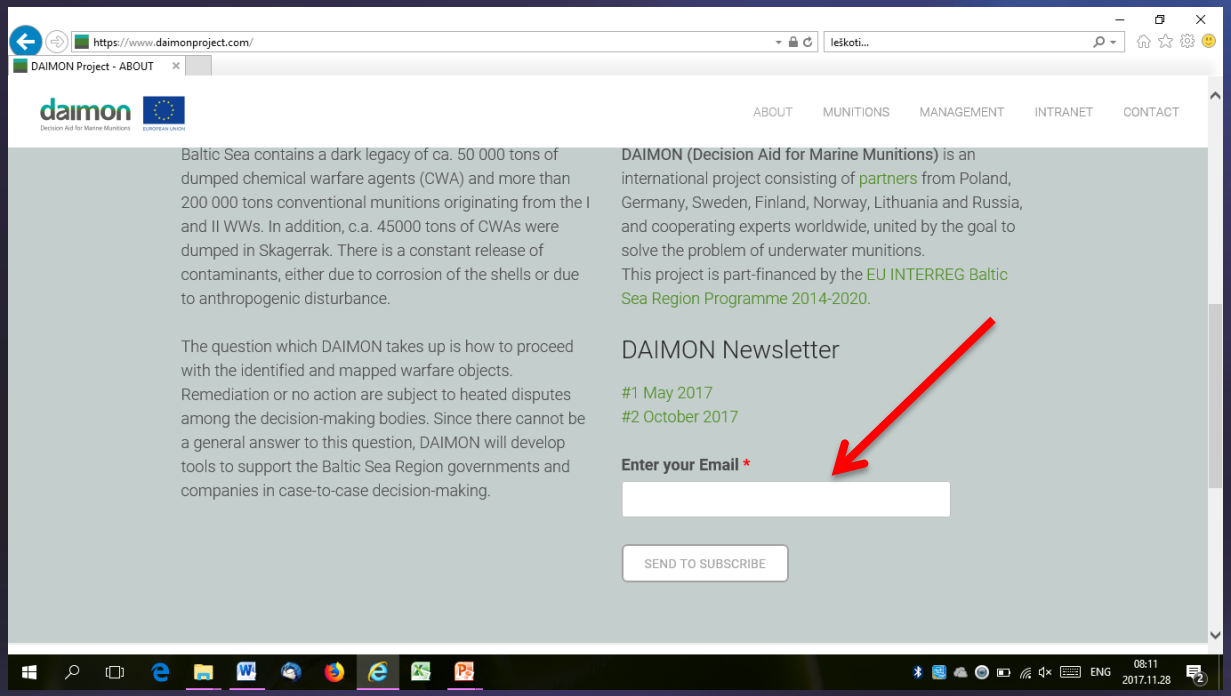
DSS beta version ready to test at the beginning of 2018 during workshops in LT, PL, FI and DE.

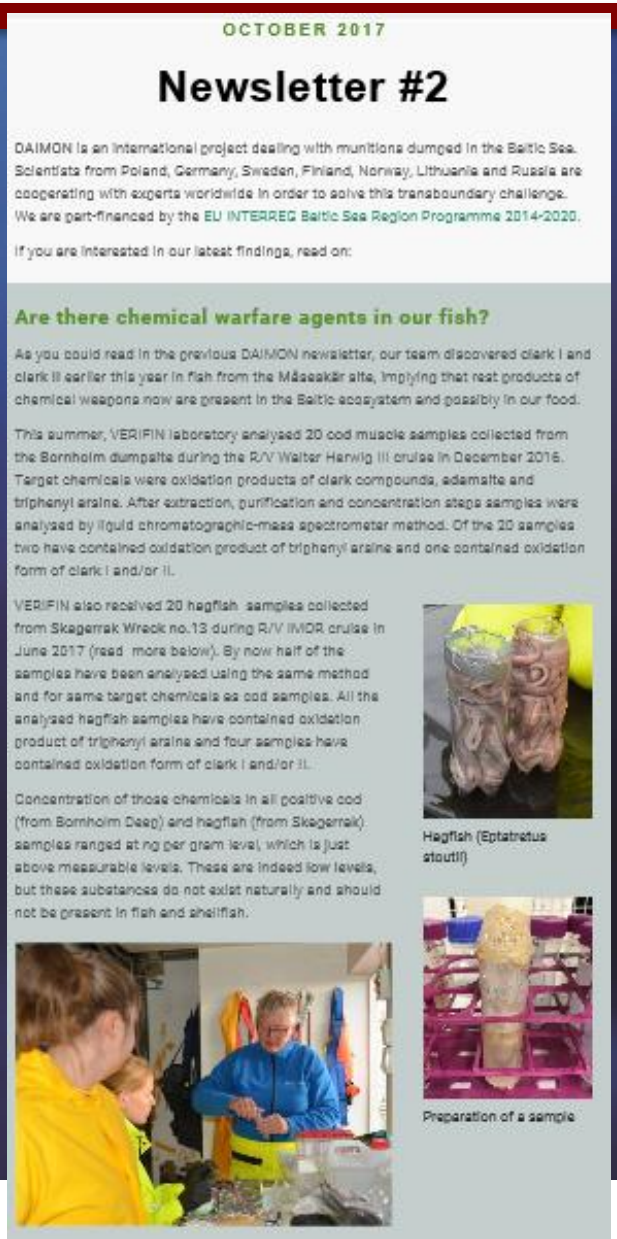
daimon
Decision Aid for Marine Munitions

DAIMON project 2015-2019

www.daimonproject.com

Subscribe the DAIMON newsletter





OCTOBER 2017

Newsletter #2

DAIMON is an international project dealing with munitions dumped in the Baltic Sea. Scientists from Poland, Germany, Sweden, Finland, Norway, Lithuania and Russia are cooperating with experts worldwide in order to solve this transboundary challenge. We are part-financed by the EU INTERREG Baltic Sea Region Programme 2014-2020.

If you are interested in our latest findings, read on:

Are there chemical warfare agents in our fish?

As you could read in the previous DAIMON newsletter, our team discovered clark I and clark II earlier this year in fish from the Måseskär site, implying that neat products of chemical weapons now are present in the Baltic ecosystem and possibly in our food.

This summer, VERIFIN laboratory analysed 20 cod muscle samples collected from the Bornholm dumpsite during the R/V Walter Herwig III cruise in December 2016. Target chemicals were oxidation products of clark compounds, adamsite and triphenyl arsine. After extraction, purification and concentration steps samples were analysed by liquid chromatographic-mass spectrometer method. Of the 20 samples two have contained oxidation product of triphenyl arsine and one contained oxidation form of clark I and/or II.

VERIFIN also received 20 hagfish samples collected from Skagerrak Wreck no.13 during R/V IMOR cruise in June 2017 (read more below). By now half of the samples have been analysed using the same method and for same target chemicals as cod samples. All the analysed hagfish samples have contained oxidation product of triphenyl arsine and four samples have contained oxidation form of clark I and/or II.

Concentration of those chemicals in all positive cod (from Bornholm Deep) and hagfish (from Skagerrak) samples ranged at ng per gram level, which is just above measurable levels. These are indeed low levels, but these substances do not exist naturally and should not be present in fish and shellfish.

Hagfish (Eptatretus stoutii)

Preparation of a sample

THANK YOU FOR YOUR ATTENTION!