

## Joint Norwegian-Russian expedition to the sunken nuclear submarine Komsomolets in the Norwegian Sea

A joint Norwegian-Russian expedition will visit the sunken Russian nuclear submarine Komsomolets in the summer of 2019, 30 years after it sank in the Norwegian Sea while carrying two nuclear torpedoes. Previous Russian expeditions have shown that releases from the reactor have occurred and the submarine has suffered considerable damage.



Komsomolets (K-278) in operation prior to its sinking in 1989.

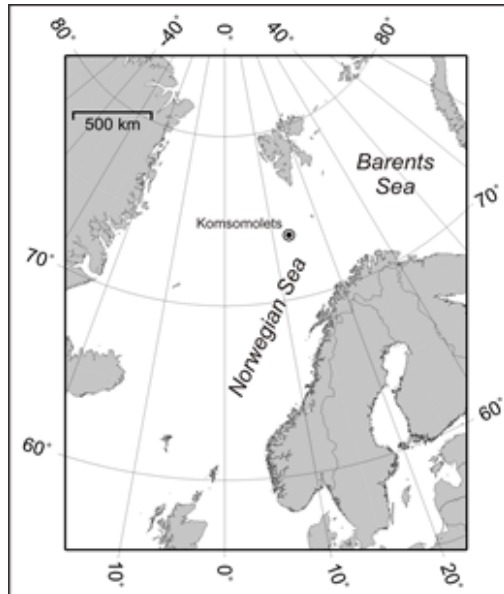
The 2019 expedition will utilise a remotely operated vehicle (ROV) to obtain up-to-date information about the level of radioactive contamination around Komsomolets. The expedition will take place on the Norwegian research vessel G.O. Sars and will use the advanced Norwegian ROV Ægir 6000. Using the ROV, we will carry out radiation measurements around the hull of Komsomolets to identify any leakages and visually document the condition of the submarine. In addition, environmental samples of seawater, sediments and biota will be collected next to the hull of the submarine and in adjacent areas to detail the levels of radioactivity in the environment. Such information is important to have an accurate understanding of any potential risks associated with Komsomolets and to ensure consumer confidence in Norwegian fisheries. The expedition will include participants from the Institute of Marine Research (IMR), the Norwegian Radiation

and Nuclear Safety Authority (DSA) and the Norwegian University of Life Sciences (NMBU/CERAD). From Russia, there will be participants from the Research and Production Association Typhoon and the National Research Centre Kurchatov Institute.

### The Komsomolets accident

Russian nuclear submarine Komsomolets (K-278) sank in the Norwegian Sea on the 7th of April 1989 following the outbreak of a fire that began in the steering compartment. The submarine sank after initially surfacing and now lies at a depth of 1680 m, south west of Bear Island. Komsomolets was powered by a single 190 MW OK-650b-3 pressurised water reactor that was shut down in the early stages of the accident. In addition, it was carrying two nuclear torpedoes in its armament when it sank. Of the 69 crew members, 42 were killed as a result of the accident and eventual

sinking. The total inventory of the reactor at the time of sinking has been estimated at 29 PBq with a further 16 TBq of Pu-239,240 within the two nuclear warheads. In 2019, the remaining activity in the reactor (~3 PBq) is almost entirely due to Cs-137 and Sr-90.



Location of the sunken nuclear submarine Komsomolets in the Norwegian Sea.

### Previous monitoring by Russia

A number of Soviet and subsequent Russian expeditions were carried out between 1989 and 2007 with the aid of manned submersibles. Initial investigations showed that the front part of the submarine had suffered considerable damage, with holes and cracks in both the outer hull and inner pressure hull. Damage to the hulls was observed above the torpedo compartment and it was reported that the nuclear material in the warheads were in contact with seawater. In 1994, the six torpedo tubes along with some holes in the torpedo section were sealed with titanium plates to reduce the flow of seawater into the torpedo compartment. Releases of radionuclides (Co-60, Cs-134 and Cs-137) from Komsomolets have been detected in a ventilation pipe that forms a connection between the compartment next to the reactor and the open sea. Levels of Cs-137 detected in this ventilation pipe in 1994 were of the order of 1 MBq/m<sup>3</sup> decreasing to 4 kBq/m<sup>3</sup> in the zone around the outlet. Based on rates of water flow in the ventilation pipe, annual releases of Cs-137 from the sunken submarine were estimated at that time to be around 500 GBq/yr. In the last Russian expedition in 2007, releases of Cs-137 from the ventilation pipe were reported to have decreased

significantly, with annual releases of Cs-137 and Sr-90 estimated at 0.1 GBq/yr.



A view of Komsomolets on the seafloor taken during a previous Russian expedition.

### No environmental impact

Previous modelling studies have shown that any releases from the submarine would have little impact on biota around the submarine nor result in any increases in concentrations in fish in the Barents Sea.

### Norwegian monitoring since 1990

Norway has carried out monitoring of the marine environment around Komsomolets annually since 1990. Due to the depth at which Komsomolets lies, it can be difficult to know the exact position and distance to the submarine of any collected bottom seawater or sediment when using traditional sampling gear. Since 2013, Norway has used an acoustic transponder that has allowed samples to be collected at precise locations at a distance of ~20 m from the hull of the submarine.

Norwegian monitoring detected Cs-134 in surface sediments around Komsomolets in 1993 and 1994 and elevated levels of Cs-137 in bottom seawater between 1991 and 1993. However, since then and up to the present, no increased activity concentrations of any radionuclides above values typical for the Norwegian Sea have been observed in any environmental sample collected around Komsomolets.

### Close collaboration

There will be close collaboration over the analyses, reporting and any further action. The joint expedition is being financed through IMR's grant from the Ministry of Trade, Industry and Fisheries and by the DSA through funding from the Norwegian Ministry of Foreign Affairs. Results will be published under the Norwegian-Russian Expert Group for Investigation of Radioactive Contamination in the Northern Areas.