



# Does the legacy of 20<sup>th</sup> century naval warfare affect monitoring baselines for cetaceans in Europe?

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## INTRODUCTION

The two World Wars of the 20<sup>th</sup> century were environmental disasters. Given current concerns and our improved understanding of potential impacts arising from recent oil spills and naval activities, it appears likely that marine mammal populations were negatively affected. However, we do not know what impact naval warfare had on European marine mammal populations. Here we merely point out the scale of environmental damage to the oceans caused by some aspects of those conflicts and caution on the implications this may have for the status of populations in the following decades.

## OIL SPILLS

During the Battle of the Atlantic from 1939-45, a total of 3,500 allied ships and 783 German submarines (U-boats) were sunk. Oil tankers were selectively targeted, resulting in the world's first large scale oil spills at sea.

U-boats sank 42 tankers off the east coast of the USA, causing a total spillage of about 460,000 tons of petroleum and refined products – comparable to the *Deepwater Horizon* spill in 2010. The volume of oil spilled in the North-east Atlantic is unknown, but was almost certainly far greater.



## TONNAGES OF SHIPPING SUNK

Total tonnage of Allied and neutral merchant ships sunk by U-boats in the North Atlantic and adjacent seas:

WW I: 12,850,814 tons

WW II: 14,500,000 tons (approximately)

Data on naval warfare sourced from Wikipedia.

## DEPTH CHARGES

Underwater explosions were caused by mines, torpedoes and bombs, but the largest number were from depth charges used in attacks on submarines. Due to uncertainty about the exact positions of submarines, which carried out erratic evasive manoeuvres, each attack involved the detonation of large numbers of depth charges. Most U-boats sunk by depth charges were destroyed by damage accumulated from a long barrage rather than by a single precision attack. For example, U-427 survived 678 depth charge blasts aimed at her in April 1945.

## WW I

The depth charges used by the Royal Navy contained 140 kg TNT. Monthly use of depth charges increased from 100 to 300 per month during 1917 to an average of 1745 per month during the last 6 months of WW I.



## WW II

The Royal Navy Mark VII depth charge had a maximum detonation depth of 300 m and held a 130 kg high explosive charge.

A 130 kg charge has an estimated Source Level of at least 285 dB re 1  $\mu$ pa. Allowing only for spherical spreading losses, this would result in received levels of 219 dB re 1  $\mu$ pa at 2 km and 199 dB re 1  $\mu$ pa at 20 km. Auditory injury to cetaceans can occur at these levels<sup>1</sup>.



<sup>1</sup> Southall, B.L., Bowles, A.E., Ellison, W.T., Finneran, J.J., Gentry, R.L., Greene Jr., C.R., Kastak, D., Ketten, D.R., Miller, J.H., Nachtigall, P.E., Richardson, W.J., Thomas, J.A., Tyack, P.L., 2007. "Marine mammal noise exposure criteria: initial scientific recommendations". *Aquatic Mammals* 33, 411–521.

## ON-GOING PROBLEMS

War-time wrecks continue to leak oil. Bombs, mines and other ordnance continue to be discovered and are usually blown-up in situ.



## WHAT MIGHT HAVE BEEN...

The US Navy detonated a 20 kt nuclear depth charge off San Diego in May 1962.



## POST-WAR DEVELOPMENTS

The unregulated development of fisheries in post war years, now equipped with navigation and fish-finding technologies developed during the war, may have slowed the recovery of some species, such as harbour porpoises.



## CONCLUSIONS

The scale of disturbance and damage to the marine environment arising from the two World Wars was immense. The impact this had on marine mammal populations, particularly small cetaceans, is unknown as quantitative monitoring did not begin until the final decades of the 20<sup>th</sup> century. If there had been significant impacts from the World Wars then populations may still have been recovering when monitoring began. We should be cautious therefore, and take this possibility into account when setting base lines for the assessment of "favourable status".