

## D. Global sea war and climate changes

### Oceans in times of war: 1942 to 1945 (4\_11)

#### Merging together what does not belong?

This section is about global climatic changes. Points in focus are the halt of a warming trend and a slight cooling from 1940 to the mid-1970s. Usually one regards a climate change as something that happens in the atmosphere. Indeed it happens in the atmosphere, as humans feel and see it that way. But this paper does not attempt to follow this approach. It seeks to find explanations for the four-decade cooling process from 1940 to about 1980 in the depth of the seas, contrary to global warming debate.

This section is to deal with global naval warfare during World War Two (WWII). In a brief but convincing form it shall try to draw a picture of the destructive forces of the naval warfare unleashed on the sea body in the areas stretching from the Aleutian, Hawaii and Indonesia to Singapore in the Pacific and from Murmansk, Iceland and Florida to Gibraltar in the Atlantic.



Trying to link changes in the atmosphere to the fighting of battles in the seas seems odd in the first place. It is not so with a 'facilitator' in between.

Main facilitators in this case are the oceans. This investigation is based on the assumption that the ocean is the dominating force on climatic conditions. Climate should be defined as 'the continuation of the oceans by other means', or, as 'the blueprint of the oceans and seas'<sup>1</sup> & <sup>2</sup>. Water



is of 95% importance in all weather related 'atmospheric components'. Other means refer to water vapour, respectively humidity. Any ocean water released to the air as vapour comes down as rain after 2 to 3 weeks. The weather and climate would not exist without water, and the interconnection of ocean water and humidity is so manifold, strong and interdependent, that the definitions have their own merits.

<sup>1</sup> Bernaerts, Nature

<sup>2</sup> Bernaerts, Climate 1992, p.23f

Although the picture on the role of the ocean as ‘communicator’ illustrates the situation perfectly, it tells only half the story. Actually, the oceans act according to their ‘own rules’. They are not messengers; they are the rulers of climate. The war at sea may have, ‘by force’, imposed many changes to the ocean waters. Thereupon the oceans will generate a ‘blueprint’ for the atmosphere. The atmosphere will fall in line within a short period of time. Subsequent ‘oceanic conditions’ are the decisive factor of climate.

Quite different from the interaction between ocean and atmosphere is presumably the reaction time between the in-put and out-put a war at sea has on ocean composition and property. Every sea water change inevitable will influence the status of the atmosphere. It might happen within a couple of hours, within a few months, years, or generations. This paper primarily focuses on the latter time periods in support of its theses:

- The old period from about 1940 to 1980 was due to the cooling of mid-latitude ocean areas in the Northern Hemisphere.
- Warm seawater, which the war at sea forced to lower depth levels from 1939-1945, will – one day - contribute to warming the atmosphere.
- The accelerated global warming since the 1980s may partly be traced back to naval activities during war years 1942 –1945.

However, this paper will primarily attempt to present a plausible picture of the war activities at seas during WWII, mainly after Japan’s attack on Pearl Harbour, on December 7<sup>th</sup>, 1941. The period before this will be dealt with briefly in the next paragraph.

### War at sea in the Atlantic, 1939-41

#### *Time period and sea area*

The issue of climatic change during WWII has two distinct periods, viz. the period before Pearl Harbour and the one thereafter. From September 1939 until early 1942 naval warfare was largely confined to European waters. The great climatic relevance of the war at sea in the North European waters prior to the winters of 1939/40, 1940/41, and 1941/42 has been extensively discussed in a number of previous chapters, e.g. Winter 1939/40, North Sea cooling. (A)



From a naval point of view also the war at sea in the Mediterranean had been massive and very destructive from 1940 onwards. While it would not be difficult to agree on this point, there is little this investigation could contribute to link this sea area to the climate change issue. Abundant

availability of sunrays, the structure of the water body and the remote interconnection with the Atlantic water system, make the Mediterranean Sea less interesting for this research.

Further details: (A) Winter 1939/49, 2\_11; North Sea cooling, 2\_16.

Outside Europe's waters naval activities during 1940 and 1941 were largely confined to the North Atlantic. Most affected areas were the transportation routes from Britain to North America, and the routes from Britain to Gibraltar and Dakar. Naval war operations mainly concentrated on the deployment of U-boats by Germans and Italians and hunting and destroying them by the Allies.

### *U-boats in the Atlantic*

A number of German U-boats were already in the Atlantic when the war started in September 1939. Britain introduced the convoy system rapidly. A convoy consisted of up to sixty, either slow or fast vessels, accompanied by up to ten naval escort ships. The first convoy sailed in September 1939. Also in September 1939, groups of three to five naval vessels were formed to control large areas in the North Atlantic. These groups criss-crossed the seas day and night searching for U-boats and dropped depth charges when a U-boat was detected, or assumed to be around.



On September 14<sup>th</sup> three destroyers hunted U39 and sunk her. Two days later U29 torpedoed the fleet carrier *Courageous* southwest of Ireland. The ship was lost. Until the end of December 1939 the Allies and Neutrals lost 55 vessels with a total tonnage of 300,000 in the Atlantic. Five U-boats were also sunk. The Allies' patrol vessels stopped hundreds of ships, and confiscated goods from

vessels if the crew had not scuttled it. Also surface naval vessels, such as the battleships *Deutschland*, *Scharnhorst* and *Gneisenau* sailed in the Atlantic with a number of escort vessels.

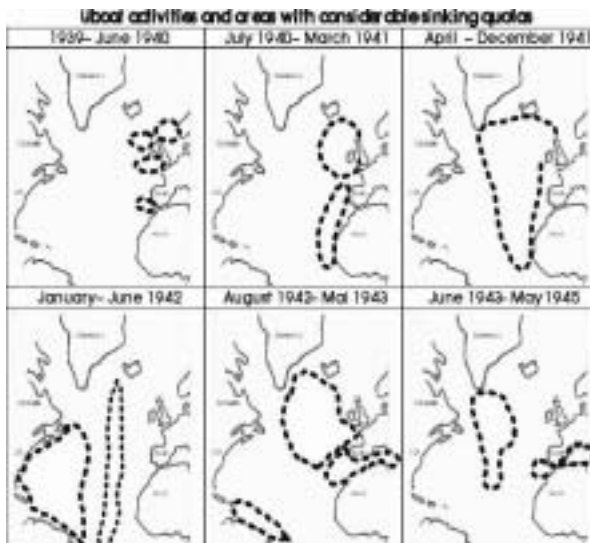
Fighting in the North Atlantic increased during the war years 1940 and 1941. In August 1940 the Germans lifted all restrictions on U-boat targets. The number of available U-boats was 50 (January 1940) and 230 (December 1941) of which about 8 were on permanent mission in the Atlantic during 1940, and 15 during 1941. The total loss inflicted on British, Allied and Neutral shipping in the Atlantic by the Axis powers (U-boats, air force, mine, and surface naval vessels) was 3 million tons in 1940 and 4 million tons in

1941. These figures relate to about 1,500 ships, with cargo, stores and fuel. The Germans lost about 40 U-boats in the Atlantic in these two years.

Thousands of accounts have been written about dramatic events. Unfortunately, little efforts have been made on investigating the damages inflicted on the ocean water structure. It appears that the prevailing view was ‘that it does not matter’; the oceans



are large enough to take it without a murmur. This was certainly a mistake. The faith on Convoy HX72 continued. On September 21/22, 1940, HX72 was caught in a twelve-hour battle, in which eleven ships were sunk and two damaged, with a total loss of 100,000 tons of supplies and some 45,000 tons of fuel<sup>3</sup>. One can only assume that the naval escort vessels had been extremely active during the 12-hour period and had dropped several hundred depth charges. A convoy of 50 vessels covered an area of about five to two nautical miles (about 10 square nautical miles, or 25 square km). If the convoy’s speed per hour was 15 nm and the battle lasted for 12 hours, the ocean area to which changes might have been caused could possibly amount to 400 to 1,000 square kilometres.



Various types of naval vessels accompanied the convoys, of which one deserves particular mention due to its effectiveness on using depth charges. The Flower class corvette, a relatively slow naval vessel, first launched in 1939, could carry a large number of depth charges

<sup>3</sup> Slader, p. 69

<sup>4</sup> Slader, p.104

<sup>5</sup> Slader, p.146

constituting the main method of attacking U-boats. The charges could be thrown in patterns of up to ten at a time<sup>4</sup>. Later on depth charges, which could explode at a depth of 500 feet, were used. There was also the ‘Hedgehog-bomb’, fired by a multi-barrelled mortar and filled with Torpex, a much higher-powered explosive. Its range was 250 yards ahead of the escort vessel<sup>5</sup>.

A special chapter deals with the loss of tankers from 1939 to 1941. The British fleet lost 1,469 tank-ships and the Norwegians 430<sup>6</sup> in just 28 months. If one assumes that the average loading capacity of each ship was 2,000 cargo tons and half of the sunken vessels were laden, the total oil spill could sum up to two million tons in 2 years, an amount corresponding with the total of all major tank ship oils spills between 1967 and 2002.

However, U-boats were not acting alone in the North Atlantic. Since the Luftwaffe could operate out of France since summer 1940, long-range aircraft were sent out into the Atlantic to attack supply routes. The total shipping tonnage sunk by Axis airplanes in all sea areas during the first two war years is claimed to be 1.5 million tons.



### War at sea in the Pacific

On December 8<sup>th</sup>, 1941 The New York Times reported: Yesterday morning Japan attacked the United States at several points in the Pacific, with a major attack on Pearl Harbour. President Roosevelt ordered United States forces into action and a declaration of war was expected soon. Seven hostile actions from a naval ship off the coasts of San Francisco to Malaysia were reported (NYT, 08 December 1941). This was to continue for four years. Allied



forces, viz. USA, Britain and Holland had a total strength of about 220 big naval vessels including 70 submarines; Japanese had 230 naval vessels and 64 submarines in December 1941. Several aircraft carriers were available on both sides, and many thousand airplanes.

Recording four years of naval warfare in context with ocean water modification in the upper

<sup>6</sup> Slader, p.316

level of e.g. 1,000 metres depth is not achievable by a small study. It could only attempt to kindle the readers' imagination as to what the war could have done to the ocean temperature and salinity structure. Oceanic matters have been discussed in the corresponding paper: 'Ocean system affected' (page 225), mentioning that the sea surface temperatures were low from 1945 to 1977 (Source:www.pmel.noaa.gov/).

The clash of the naval forces in the Pacific had no precedence. The fighting included every means and military options. Heavy battles were fought.



Already in May 1942 the combatants met in the Coral Sea each with three dozen ships and several hundred airplanes. In a first attack on May 05<sup>th</sup> the US Navy destroyed one Japanese destroyer, three minesweepers, and 4 smaller vessels with 22 torpedoes and 76 bombs (each weighing 450 kg). Further attacks followed during next days. On the 8<sup>th</sup> each side lost about 35 aircraft. The aircraft carrier *Lexington* was sunk by a mighty explosion<sup>7</sup>. The Battle of Midway saw even more naval vessels, more airplanes, and more destruction and losses in June 1942. The Japanese alone deployed more than 200 big naval vessels under five separate commands. The USA and Japan lost a number of naval vessels (more than 120,000 tons), and 400 airplanes (ditto).

Aircraft played a significant role in the Pacific war. Japan's front line strength was its air power consisting of about 4,000 planes; the USA had 4,000 in January 1941, and 22,000 in July 1945. After taking over Okinawa, the US Third fleet had deployed some 26 aircraft carriers, 64 escort carriers and 14,000 combat aircraft for a final attack on Japan<sup>8</sup>. The Japanese loss of combat aircraft was 37,000 (army and navy); the USA lost 8,700 in the battle.

The material loss in the battle was gigantic. Japan lost more than 500 warships (including 150 submarines) with a total tonnage of about 2,000,000, the figure in merchant tonnage was about 8,000,000 of which 5 Mio (1,150 ships) were sunk by US-submarines and 1.5 Mio by airplanes<sup>9</sup>. A special chapter could possibly be written on the sinking of tanker tonnage resulting in oil spills. During the war



<sup>7</sup> Ruge, p. 64-71

<sup>8</sup> Overy, p.96

<sup>9</sup> Overy, p.96

<sup>10</sup> Kemp, Convoy protection, p. 85

years Japan had some 700,000 tonnage permanently afloat and lost 1,500,000-tanker tonnage over the war period. The US lost 52 submarines. Many of them fell pray to depth charges. Kemp<sup>10</sup> explains: The standard Japanese depth charge contained about 230lb of explosives. Anti-submarine bombs carried by aircraft were 131lb and 550lb each, the latter being preferred when available. The Japanese had no means of determining the depth of a submarine to be targeted and so the pattern of attack usually was the dropping of depth charges with a variety of settings on the time fuse. The Japanese lost 150 submarines, many of them to depth charges. It is necessary to consult special literature available in great number and detail even to imagine what happened in the Pacific war theatre. One cannot help getting the impression that WWII left its imprint on the Pacific.

### **War in the Atlantic, 1942 –1945**

#### *Presentation of the theme*

As in the previous section, this paper does not intend to give a historical and detailed picture of naval warfare in the Atlantic. This presentation is intended to create simple awareness that war in the oceans can not be ignored with regard to four decades of declining temperatures in the Northern Hemisphere. The mention of heavy ‘turning the sea about’ shall also indicate the serious possibility, that the warm water that had been forced into greater water depths, will eventually ‘resurface’ after years or generations, viz. since about 1980.

The so-called Battle of the Atlantic was actually a fight by German U-boats against Britain’s supply lines through the seas. The merchantmen sailed in convoys. These convoys were escorted by a number of specialised naval vessels, or received air cover.

This presentation will raise a number of relevant issues but without maintaining chronological order or observing military and historical relevance. All dates and figures are only rough estimations.

#### *Aerial warfare over the Atlantic*

The use of the planes in war in the Atlantic made tremendous headway since the USA had entered the war after the Pearl Harbor attack in December 1941. The US production was estimated at 127,000 planes in 1942, exceeding the total number of German aircraft production during the whole war period<sup>11</sup>. It meant that more aircraft with much better quality and capability were available for surveillance, bombing and combat missions in the Atlantic. Even in August 1942 only eighteen American B-24 aircraft, called ‘Liberator’ were available to service Atlantic convoys. These planes had a

<sup>11</sup> Overy, p.62

<sup>12</sup> Slader, p.148

<sup>13</sup> Overy, p.71

range of 2,400 miles, had fuel tanks of 2,500 gallons and reached heights of 30,000 feet<sup>12</sup>. From the winter 1942/43 onwards long-range aircraft were assigned for anti-submarine warfare in the Atlantic, which sunk 33 submarines between April 1943 and September 1944<sup>13</sup>. 209 long-range bomber aircraft were available to the US navy in July 1942. The number increased progressively to 2,200 searching and chasing U-boats between June 1943 and May 1944<sup>14</sup>.

U-boats, vice-versa, got very little support from the Luftwaffe in 1942 and 1943 but even that little became less and diminished after D-Day (1944), while the Allies' air force presence in the Atlantic improved impressively. The British Coastal Command flew approximately 238,000 sorties, totalling 1,300,000 flying hours<sup>15</sup>. Fourteen U-boats were confirmed destroyed with another twelve damaged.

The German Luftwaffe had not been well equipped to put up a significant performance in the North Atlantic battle. However, they had a few hundred long-range four engine planes in service, which flew from bases in France in 1941. During the month of August 1941, they succeeded in sinking more than 300.000 tons of shipping, i.e. almost one-third more than the U-boats sank in the same month. Axis airplanes shall have sunk a total of about 800 merchant ships in all war theatres. Even if less than half of that number has been sunk in the sensitive waters of the Northern Atlantic and Northern Pacific, it actually meant the use of many ten-thousands of bombs and the fall of many thousands of planes into the oceans as well.

#### *U-boats off Florida and Cape Hatteras - 1942*



There was a short period from January to about June 1942 when U-boats operated extremely successfully along America's East coast. Within half a year they had sunk about 400 vessels. In two weeks a handful U-boats could sink 25 ships with a total tonnage of 200,000, of which 70% were tankers. In summer 1942 the U-boat operation 'Paukenschlag' (Drumbeat) ended. The US Navy had become effective.

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<sup>14</sup> Bernaerts, Atlantic

<sup>15</sup> Thomas, p.249



The Gulf Current flows from Florida to Cape Hatteras, before turning at Cape Hatteras into the Atlantic to go eastwards to Europe. The warm current on the one hand and the colder Atlantic water off Cape Hatteras on the other, built a highly sensitive water body having a significant impact on daily weather, the seasons and climatic conditions in the Northern Hemisphere. Waging a war at sea in these waters is presumably effective in introducing changes to the sea water sphere.

### *U-boats*

In August 1942 the German U-boat fleet had reached the number of 340, which was almost 300 boats more than three years earlier. During the whole war period, the U-boat force had comprised about 1,100 boats, of which 850 participated in at least one combat mission, 630 were destroyed in enemy attacks.

- Loss incurred by German U-boat attacks (all told) is 2,822 vessels (14,220,000 tons).
- The Italians 152 boats sank 132 vessels (700,000 tons).
- The Axis U-boat fleet (German, Italian, Japanese) is credited with the sinking of 25 big naval vessels, 41 destroyers and about 150 other naval vessels<sup>16</sup>.

Main field of operation of the U-boats was the Atlantic. They were quite successful only in 1942 until March 1943.

### *Atlantic Convoys*

A convoy was a group of 30 to 70 ships organised to travel in a fixed formation and in a given direction (zigzagging) in order to minimise the threat from torpedoes<sup>17</sup>. A naval escort protected the convoy. These escort vessels were able to hunt and depth charge U-boats. During the early times of the war, the escort was small in number and was usually not staying with the group for the full travel distance. By 1941 the average size of a convoy was about forty ships with six naval vessels as escort. Later some escorts became quite massive. For example, in 1942, Convoy ON202 with 38 merchant ships had an escort of 3 destroyers and 3 corvettes; while the escort for Convoy ONS18 comprised 6 destroyers, 8 corvettes, and one trawler.



<sup>16</sup> Potter, p.550

<sup>17</sup> Bernaerts, Atlantic<sup>1</sup>

<sup>18</sup> Slader, p.152

In March 1943 two convoys, viz. SC122 and HX229 encountered forty-four U-boat attacks on their route. During the three-day battle that ensued, twenty-three merchantmen were sunk from the two convoys<sup>18</sup>. At the same time, convoy HX229A, which included thirteen tankers, eight refrigerator and four cargo liners (39 ships), was routed northeast towards Greenland. There they came upon Arctic conditions (ditto). Three convoys with a total of 131 ships carried about 1,000,000 tons of cargo – petroleum fuel, frozen meat, food, tobacco, grain, timber, minerals, steel, gunpowder, detonators, bombs, shells, lorries, locomotives, invasion barges, aircraft and tanks (ditto).

The Allies completed over 300,000 Atlantic voyages during the period of the war<sup>19</sup>.

### *Tankers*

The destiny of many tankers proved extremely disastrous for their crew and presumably the ocean area also. The Allied and Neutral countries had about 1,000 tankers in service since 1942. The loss of tankers with a size over 1,600 tons between December 1941 and May 1944 was 4,221 ships<sup>20</sup>.



Report 1, October 1941, (extract):  
 “Attacking from inside the convoy between the seventh and eighth column, U-432 torpedoed the Norwegian tanker *Barforn*. U-558 destroyed British *W.C.Teagle* and Norwegian *Erviken*, both laden with aviation spirit. Tankers could merit the description of a ‘floating volcanos’<sup>21</sup>.

Report 2, November 15, 1942 (extract):

“Shortly after 3.00 a.m. all hell was let loose. The *Avenger* was hit by two torpedoes and being little more than a large floating petrol can, she blew up instantly in a sheet of flame.....an enormous bright red glow on the near horizon where *Avenger* blew up”<sup>22</sup>.

### *Ammunition ships*

Report 3, 1942, (extract):

To the southwest of Ireland convoy SC107 lost fifteen merchantmen from its forty-two vessels during the last week of November. The attack came from a pack of sixteen U-boats. After sinking two vessels and the *Empire Linx*, U-132 was on target for being bombed by a Liberator of 120 Squadron. Then

<sup>19</sup> Winton, p.320

<sup>22</sup> Thomas, p.178

<sup>20</sup> Slader, p.317

<sup>23</sup> Slader, p.147

<sup>21</sup> Slader, p.144

from beneath the water came a tremendous explosion as *Empire Linx*, an ammunition ship blew up. It is assumed that U-132 was within lethal range and thus became a victim of her own victory<sup>23</sup>.

Report 4, 1941, (extract):

Sugar carrier *Silvercedar* had been loaded in New York with high explosives in the holds and bombers on deck. Amidst the wind gale of 8-9 Beaufort a torpedo struck her in hold No.3 which was loaded with condensed milk. *Silvercedar* blew up with a mighty explosion and sunk in less than two minutes<sup>24</sup>.

#### Depth Charges

Report 5, 1941, (extract):

U-94 came upon the convoy and sank two ships, then suffered damage a from depth charge counterattack by *Amazon*, *Bulldog* and *Rochester*. The battle lasted four hours. The attacker account said eighty-one depth charges were used, the U-boat commander acknowledged only sixty-seven.



Report 6, March 1944  
(extract):

On 29 February, frigates *Gore*, *Garlies*, *Affleck* and *Gould* attacked U-358 with depth charges and Hedgehogs. They held contact virtually continuously until next day, 1<sup>st</sup> March, but although they made one 'creeping attack' of 104 depth charges, which detonated like 'a marine convulsion', their enemy lay very deep, and very low, and very stubborn. The hunt was

carried on for thirty-eight hours<sup>25</sup>. How many depth charges the three frigates eventually dropped in total is not mentioned. It seems it could go into many hundreds.

As already mentioned earlier: One of the most effective means of penetrating deep below the sea surface is the depth charge. Depth charges, which could explode at a depth of 500 feet, were in use since 1942. The 'Hedgehog bomb', fired by a multi-barrelled mortar and filled with Torpex, a highly-powered explosive, was also in use. Its range was 250 yards ahead of the escort vessel<sup>24</sup>. Attacking ships could fire twenty-six depth charges in pairs,

<sup>24</sup> Slader, p.147, p. 316

<sup>25</sup> Winton, p.306

<sup>26</sup> Winton, p.306

set to explode at 500 feet and 740 feet alternately, at ten-second intervals, whilst continuing to steam ahead of the U-boat<sup>26</sup>.

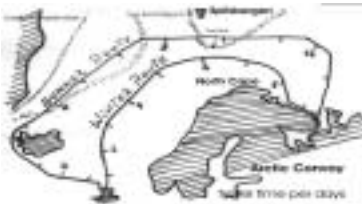
It seems difficult to obtain reliable figures with regard to the number of the depth charges dropped in the Atlantic or Pacific. The total figure could be as high as 500,000 or even more.

### *The Gunner*

Due to experience in WWI transport ships were equipped with guns to defend themselves against U-boats and surface raiders. Within 12 months some 3,000 vessels were armed with a 4.7-inch gun manned by trained gunners, usually six.

Report 7 (extract): *Orient City* was attacked in a convoy at night by a Focke-Wulf bomber. The gunner trained his gun as the aeroplane approached which flew straight into the shell-burst. The aircraft's engine stopped as if switched off suddenly. It fell into the sea like a giant leaf. As it crashed, its bomb-load, intended for the *Orient City*, exploded<sup>27</sup>.

### *Arctic Convoy*



Russians received about 4,000,000 tons of cargo, including 7,000 aircraft and 5,000 tanks via the most difficult and dangerous route from Britain to Murmansk. It was climatically the most sensitive sea route; presumably manifold more effective to climate changes than

naval activities one thousand miles further south. Out of the total cargo shipped, 7% was lost at sea. Danger came not only from the arctic climate during most of the year, but from attacks by the German Navy and Luftwaffe from their bases in North Norway. At peak time the Luftwaffe had 264 aircraft in the area<sup>28</sup>, while the British Fleet Air Arm and the Royal Air Force flew 17 combat missions to North Norway from January 1942 to November 1944, involving a total of 600 airplanes<sup>29</sup>.



<sup>27</sup> Slader, p.54  
Arctic Convoy

<sup>28</sup> Schofield, p.182

<sup>29</sup> Kemp, Arctic

Convoys started to sail in August 1941; the 35<sup>th</sup> convoy sailed in May 1945; convoys guarded a total of 715 ships. The loss of merchant ships was 100 with 600,000 tons. The German side lost five surface naval ships including a battle ship and a battle cruiser and 32 submarines. The British Navy lost 20 surface vessels and one submarine.

To avoid the confrontation with German forces the convoys sometimes travelled far to the North. For example: Ships of convoy PC17 navigated in July 1942 close to Edge Island (Spitsbergen) 77°N, and at the edge of the ice border, but were still attacked by aircraft of the Luftwaffe and U-boats.

Report 8 (extract):

An anti-aircraft gunner who was on service on the high-octane tanker the steamer *Bolton Castle* which was



**Arctic Convoy bombed**

sunk from the ill-fated Arctic Convoy PQ17 reported: “We were sunk in the ice fields and the ship sank in thirteen minutes<sup>30</sup>. Sunk by three bombs of a Junker 88, the *Bolton Castle*, which had hundreds of tons of cordite in cargo hold 2, looked ‘like a giant Roman candle’<sup>31</sup>.



Of the 35 cargo ships and three rescue vessels convoy PQ17 consisted of, only 11 vessels and two rescue ships survived<sup>32</sup>.

By and large the convoys were escorted by a considerable number of naval ships. Fighting East and West from the North Cape produced some of the hardest fought battles of WWII<sup>33</sup>. For the Norwegian and Barents Sea the military presence will not have passed by without any impact on the sea. Unfortunately, one does not know any details. Although the following information has also been given somewhere else, it seems reasonable to repeat it here:

Barents Sea: Lamb<sup>34</sup> reproduces data from

<sup>30</sup> Slader, p.54

<sup>33</sup> Schofield, p.1

<sup>31</sup> Slader, p.101

<sup>34</sup> Lamb, p.532

<sup>32</sup> Slader, p.100

<sup>35</sup> Hartmann, p.241

Rodewald (1972) showing that at Franz Josephs Land (80°N, 53°E) a deep fall in temperatures occurred in 1950 by over 5°C in one decade after the mean temperatures had varied between -10°C and - 11°C between 1936 – 1950.

A connection between WWII activities in North and the drop in temperature cannot be excluded.

#### *Atlantic Sea Mines*

A 110,000 mines strong barrage laid by Britain between 1940 and 1943 between Orkney and Iceland, received little notice. The mines 'Mk XX' were supposed to prevent U-boats from reaching shipping routes in the Atlantic<sup>35</sup>. Whether the barrage was a serious threat to U-boats is not known, but it seems not. It would have been a tremendous threat to the sea if the mines had tended to explode prematurely.



It is not clear as to what happened to the mine barrage after the war ended. Were the mines 'gone' by 1945? Were remaining mines swept after 1945? The British deployed 300 minesweepers on the assumption that it would take 549 days to clear moored mines and 676 days for ground mines around its coast<sup>36</sup>. The Germans also were made to address the issue with the deployment of about 400 minesweepers.

#### **Summary**

Even though only very little information could be conveyed in a brief paper about the naval warfare from 1942 to 1945, it is hoped to be educative enough to raise the awareness that oceans had been 'stirred and shaken' in a way that could have caused their extra normal cooling for four decades.



<sup>36</sup> Elliot, p.170