

An underwater scene with a light blue background and sunbeams. Several yellow ducks and small blue fish are swimming. The bottom of the image features a dark blue seabed with various sea plants, rocks, and more ducks and fish.

# Shipwrecks in Oceans and Great Lakes

# Lets begin with...

## Ship terminology

But only the stuff you'll need because there's too many ship classifications since ships are deemed “different” just because one mast is rigged differently and the ships are different sizes.



These aren't even  
ships

## Wreck Type

- ⊕ Aircraft / Plane
- ⊕ Aircraft carrier
- ⊕ Ammunition / bomb(s)
- ⊕ Anchor(s)
- ⊕ Artifact
- ⊕ Barge
- ⊕ Barkentine
- ⊕ Barque
- ⊕ Battlecruiser
- ⊕ Battleship
- ⊕ Bomb vessel
- ⊕ Brig
- ⊕ Brigantine
- ⊕ Canal boat
- ⊕ Cargo vessel
- ⊕ Clipper
- ⊕ Collier
- ⊕ Colombian
- ⊕ Congo
- ⊕ Container ship
- ⊕ Corvette
- ⊕ Cruise ship
- ⊕ Cruiser
- ⊕ Cutter
- ⊕ Destroyer
- ⊕ Dredger
- ⊕ Escort vessel
- ⊕ Exploration ship
- ⊕ Ferry
- ⊕ Fishing vessel
- ⊕ Freighter
- ⊕ Frigate
- ⊕ Galleons
- ⊕ Gunboat
- ⊕ Hospital ship
- ⊕ Hovercraft

- ⊕ Icebreaker
- ⊕ Landing craft
- ⊕ Lighter
- ⊕ Lightship
- ⊕ Mine warfare vessel
- ⊕ Monitor
- ⊕ Motorboat
- ⊕ Naval ship
- ⊕ Ocean liner
- ⊕ Other
- ⊕ Paddle Wheel Steamer
- ⊕ Passenger ship
- ⊕ Patrol vessel
- ⊕ Pilot boat
- ⊕ Propeller
- ⊕ Sailboat
- ⊕ Sailing ship
- ⊕ Salvage vessel
- ⊕ Schooner
- ⊕ Scow
- ⊕ Sloop
- ⊕ Steamship
- ⊕ Submarine
- ⊕ Tanker
- ⊕ Torpedo boat
- ⊕ Trawler
- ⊕ Tug
- ⊕ Unknown Wrecks
- ⊕ Whaler
- ⊕ Yacht

What's even under "other"?  
More Canal Boats!

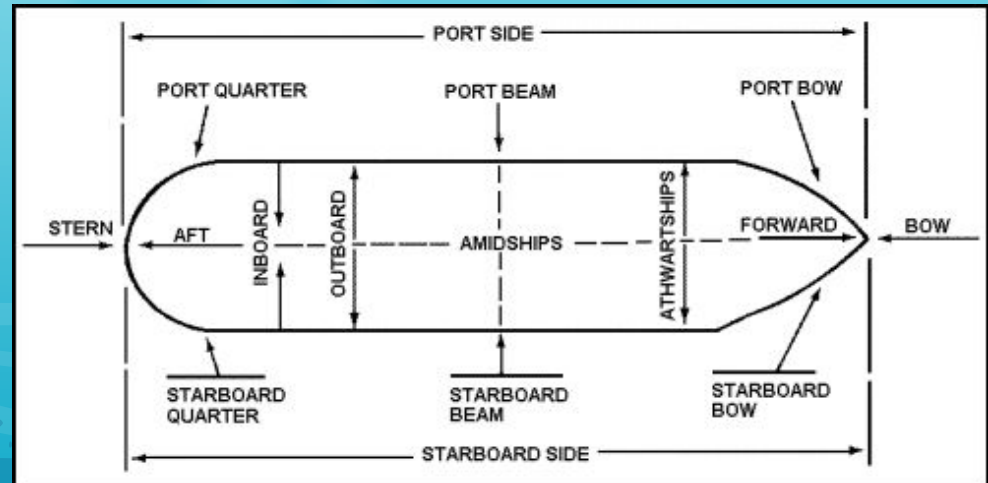
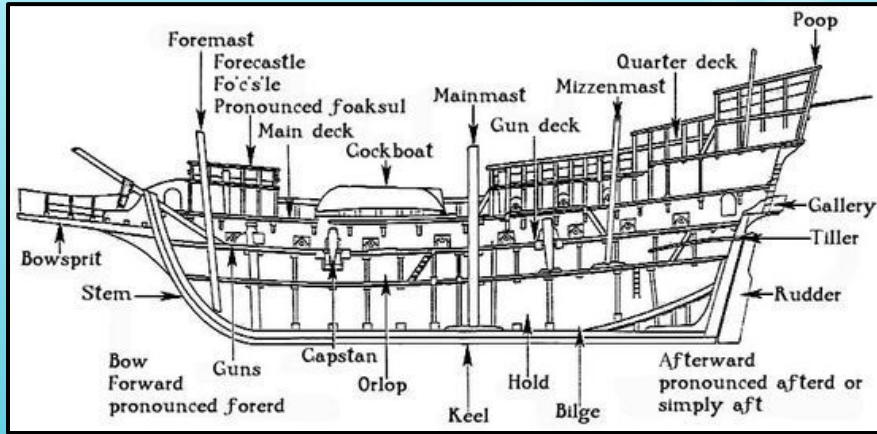
This is too  
many  
classifications  
to talk about

The background is a stylized underwater scene. At the top, several bright sunbeams (ray of light) descend from the surface. The water is represented by horizontal bands of different shades of blue. At the bottom, there is a dark blue silhouette of the ocean floor with various coral reefs, seaweed, and small fish. A small yellow duck emoji is visible at the end of the main text.

# Here's a picture of a ship 🦆

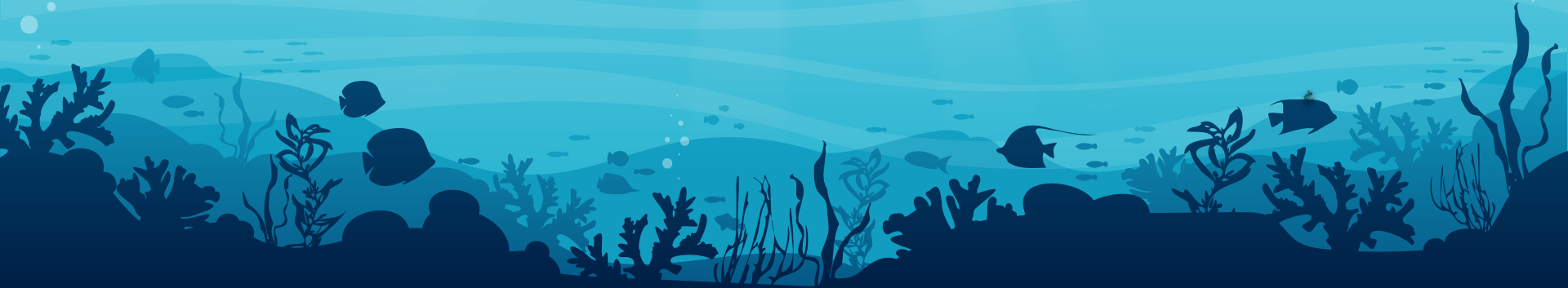
Let's label the different parts





# Most Common Wreck Types

You could probably guess this.



## Common Shipwrecks in the Great Lakes

The most common shipwrecks in the Great Lakes are trading vessels.



Majority are schooners



Moderately sized ships



Easily maneuverable and great for long voyages



Great for carrying cargo or passengers



Smaller merchant ships like sloops and scows



Larger merchant ships like freighters and barges



Freighter



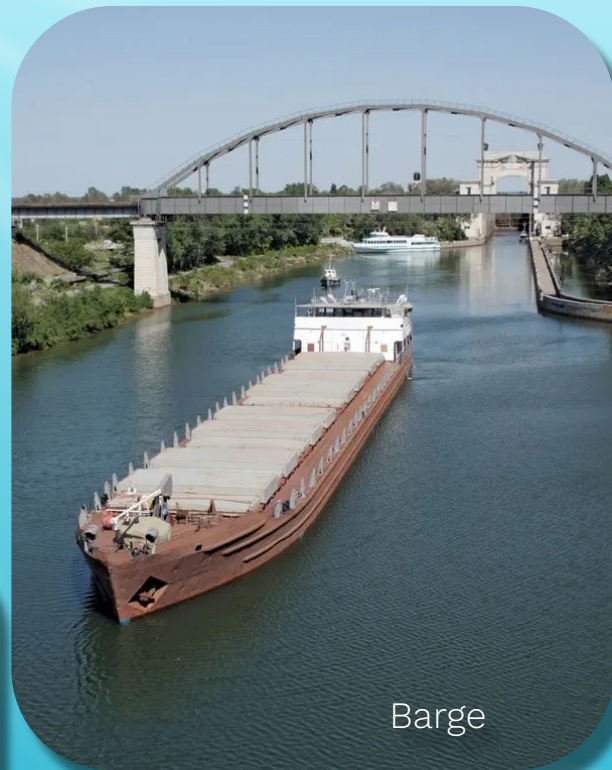
Scow



Sloop



Barge





## Most Common Cause of Wrecks

The most common cause of shipwreck in the Great Lakes are storm or weather related



Many ships capsize due to strong winds and gales



Storms can cause larger waves



Fog



Other wrecks were burned to the waterline



Intentionally or unintentionally

Steamship boilers often exploded if put under too much pressure



Abandoned, Collisions, Scuttled, and Run-aground

## Common Shipwrecks in the Oceans



The ocean shipwrecks are quite different from the Great Lakes



Out of the 3 million supposed shipwrecks, there's no one “most common wreck”



Warships, passenger ships, and merchant ships are all fairly common



Depending on where you look, merchant ships will usually be most common

Cruise Ship



Military Ship



Ocean Liner










Cargo Ship



## Most Common Cause of Wrecks

The most common cause of shipwreck in the oceans are also most likely storm or weather related

-  Many ships capsize due to strong winds and gales
  -  Storms can cause larger waves
  -  Fog
-  War-related
-  Abandoned or Scuttled
-  Collisions (not always with other ships, could be objects, too)
-  Run-aground



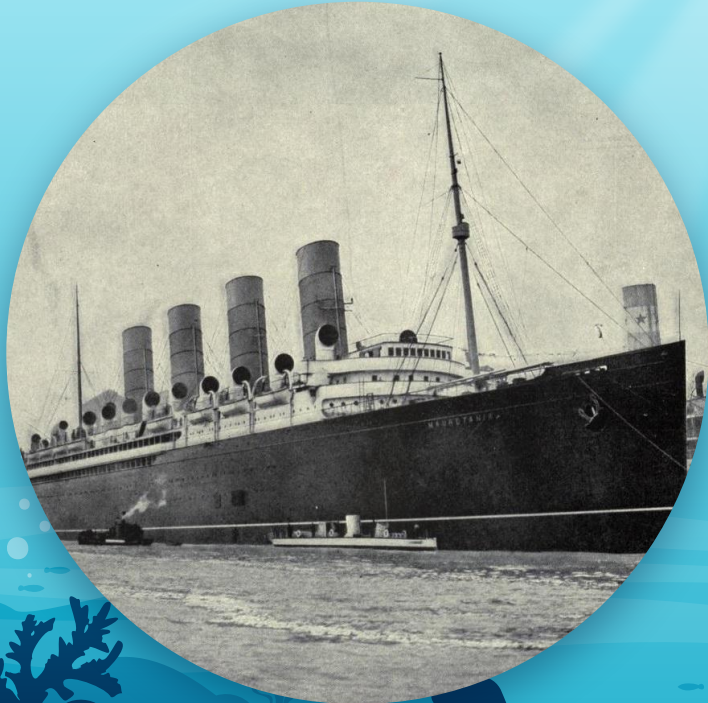
# Diverting Course for a Moment...

What's the difference between modern  
Cruise Ships and Ocean Liners?

Here's the video link if you want to watch it:

<https://youtu.be/w7mocEPlijs>

## Ocean Liners



Ocean Liners were designed to take people from Point A to Point B without stops in the middle <sup>4</sup>



Long voyages <sup>3</sup>



Ocean Liners are also designed differently



Have longer bows and stronger hulls to protect them from the ocean waves <sup>4</sup>



Navigation bridge set higher than cruise ships <sup>4</sup>



Lifeboat location is usually near the top of the vessel to protect the boats from high seas <sup>4</sup>



Require more speed than cruise ships, largely due to the need to maintain schedules <sup>4</sup>

## Cruise Ships

- 🐟 Cruise Ships were designed to take people from Point A to Point B to Point C then back to Point A<sup>3</sup>
- 🐬 These stopping points are usually tourist or recreational destinations<sup>3</sup>
- 🐬 Tend to embark on shorter voyages<sup>3</sup>
- 🐟 Also designed differently
- 🐬 Hulls are standard thickness<sup>3</sup>
  - 🐬 0.5- to 0.75-inch metal plates<sup>9</sup>
  - ☀️ Ocean Liner plates are thicker
  - 🐬 The *Titanic* had 1.875 cm thick plates with the bulkhead plate being 1.25 cm<sup>10</sup>
- 🐬 Not built to brave bad or stormy weather and will use slower speeds<sup>3</sup>





## Ocean Liners



## Cruise Ship



The background is a stylized underwater scene. At the top, several bright sunbeams (ray of light) descend from the surface into the water. The water is depicted with horizontal bands of varying shades of blue. In the foreground, there is a dark blue silhouette of the ocean floor, featuring various types of coral, seaweed, and rocks. Several small, dark blue fish are scattered throughout the scene, swimming in different directions. The overall atmosphere is serene and aquatic.

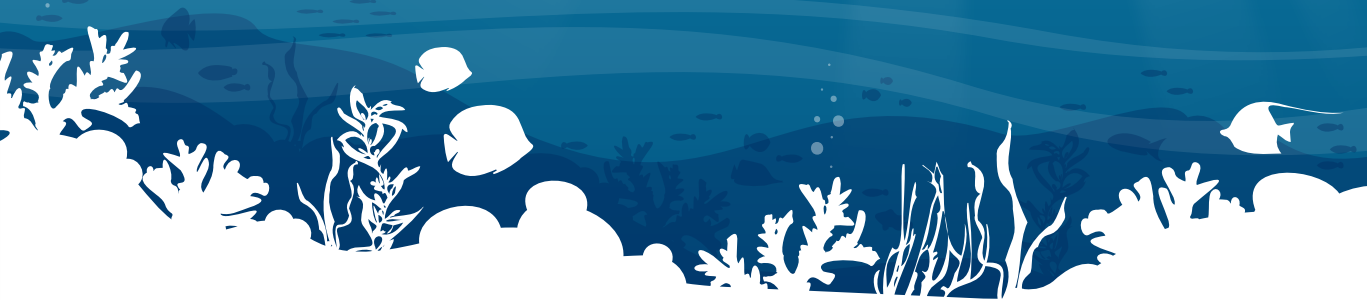
# Famous Shipwrecks

You should know at least two of these already



# *RMS Titanic*

Sunk April 15, 1912 at 2:20 A.M.



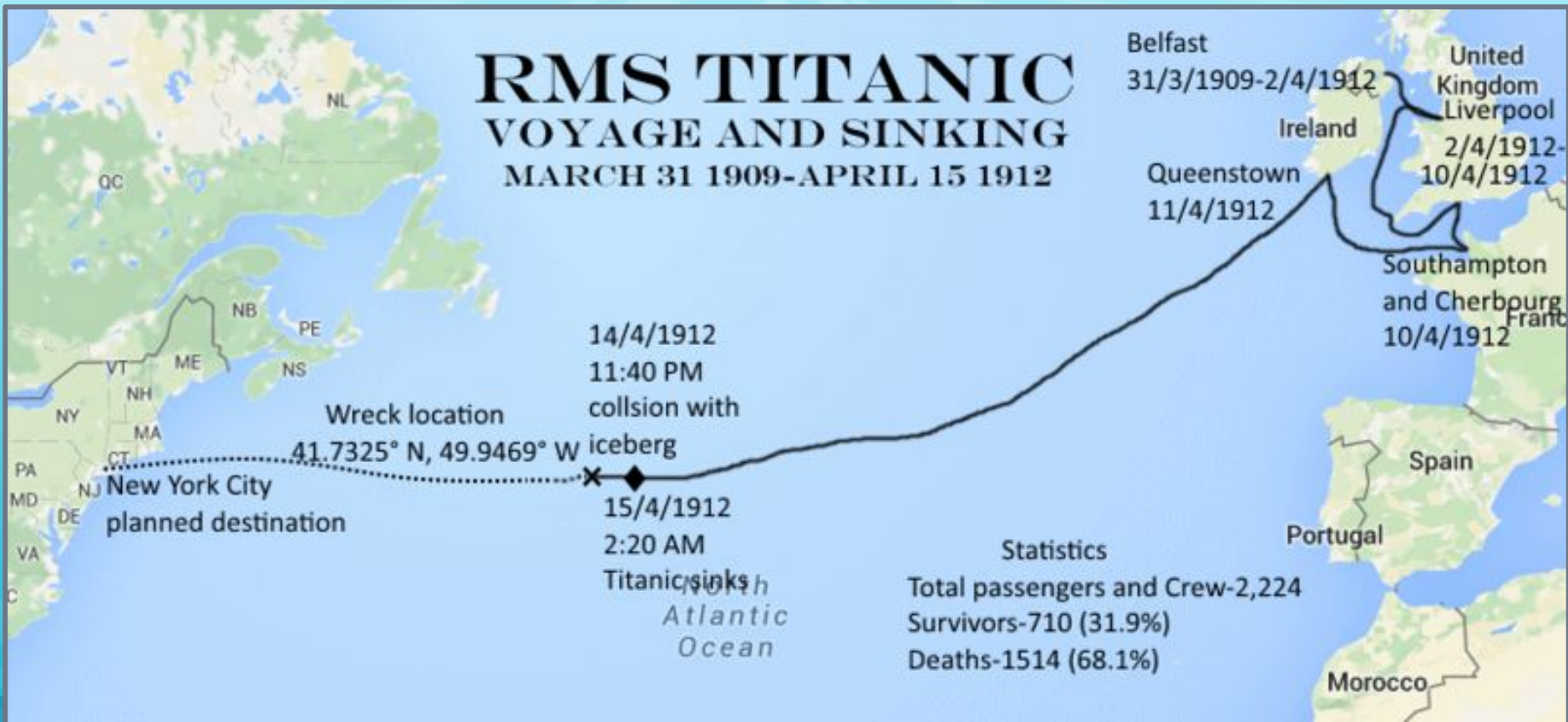




# RMS TITANIC

## VOYAGE AND SINKING

### MARCH 31 1909-APRIL 15 1912













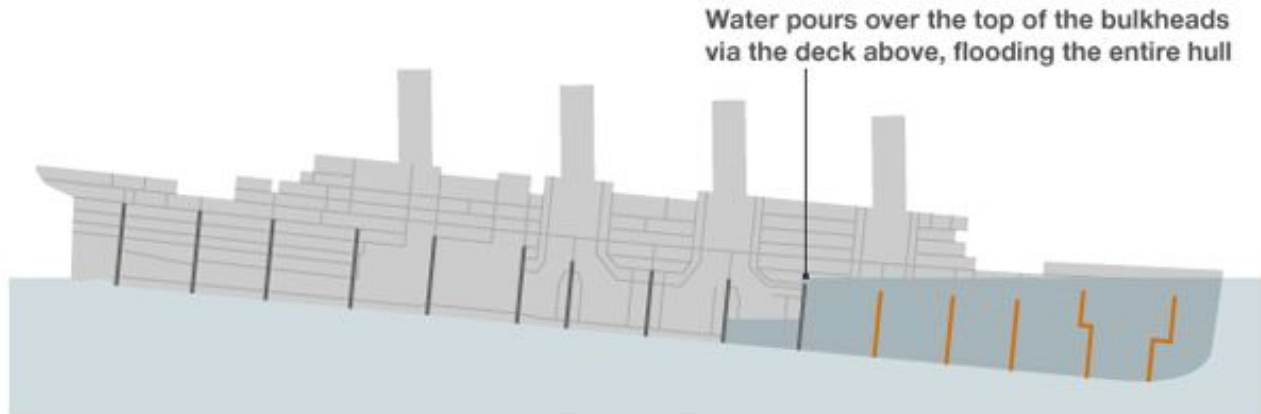
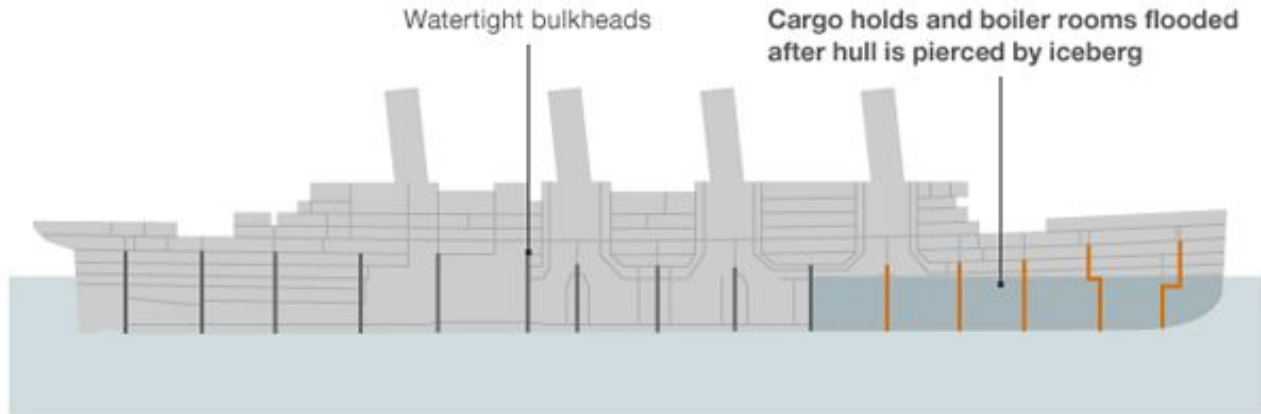
The *Titanic* Museums in both Pigeon Forge, Tennessee and Branson, Missouri are half-scale models of the actual dimensions from the ship's blueprints.

Just about every artifact, except for the interactive exhibits, are real items pulled from the debris zone or donated from survivors or their families. Other parts have been recreated to the specifications that were provided either from blueprints or testimonials.

## What Happened?

-  The iceberg created six thin gashes in the hull<sup>11</sup>
  -  The longest gap, 36 feet from end to end, extends between boiler rooms No. 5 and No. 6, just crossing the watertight bulkhead<sup>11</sup>
  -  20 feet below the waterline<sup>11</sup>
    -  Filled the ship's interior with some 39,000 tons of water just before the sinking<sup>11</sup>
-  These gaps are a result of the rivets holding the steel plates together breaking off<sup>10</sup>
-  The overall steel used was very brittle<sup>10</sup>

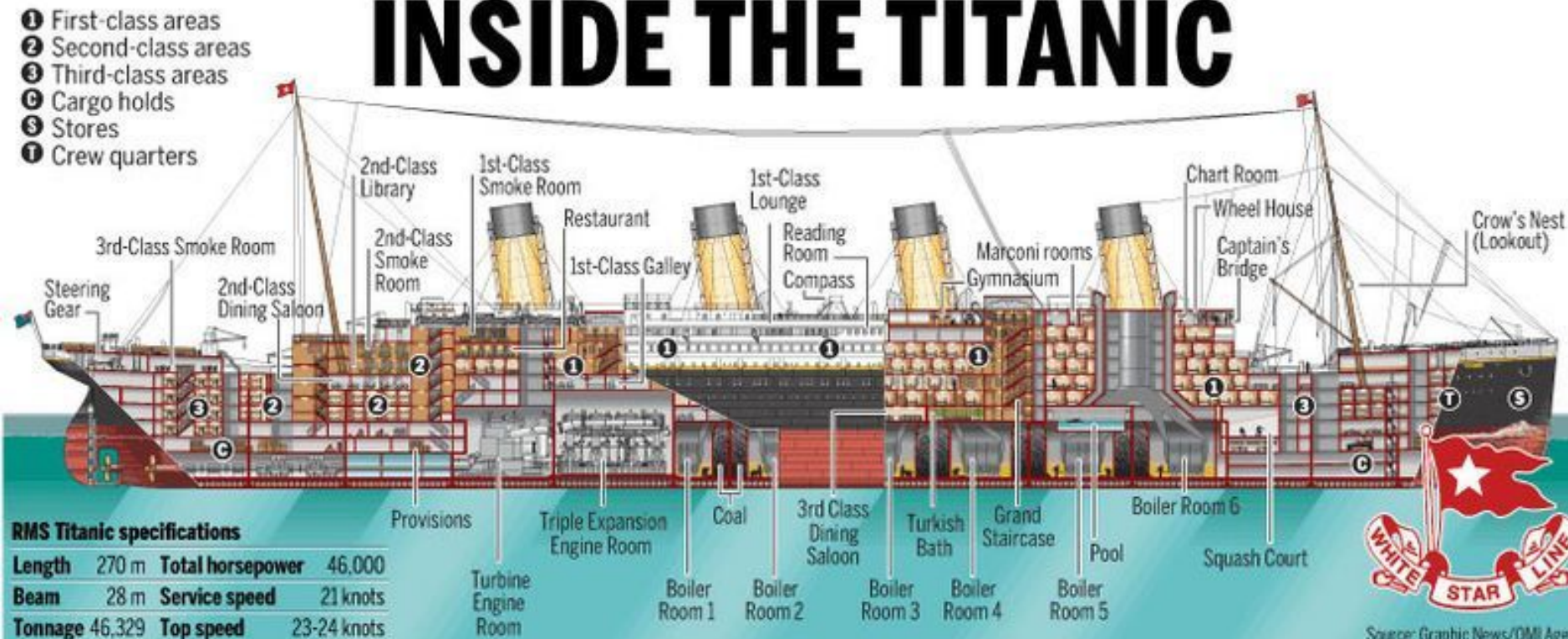
## RMS Titanic - key design fault



Source: D. Foerster, Report on the Loss of the Steamship Titanic



# INSIDE THE TITANIC



Source: Graphic News/QMI Agency

**Photosensitivity  
Warning:  
Flashing Lights**



**Flooding Staircase at the *Titanic* Museum in Pigeon Forge, Tennessee**

## The Orchestra



Consisted of eight musicians



All of them died



Only three were recovered<sup>12</sup>

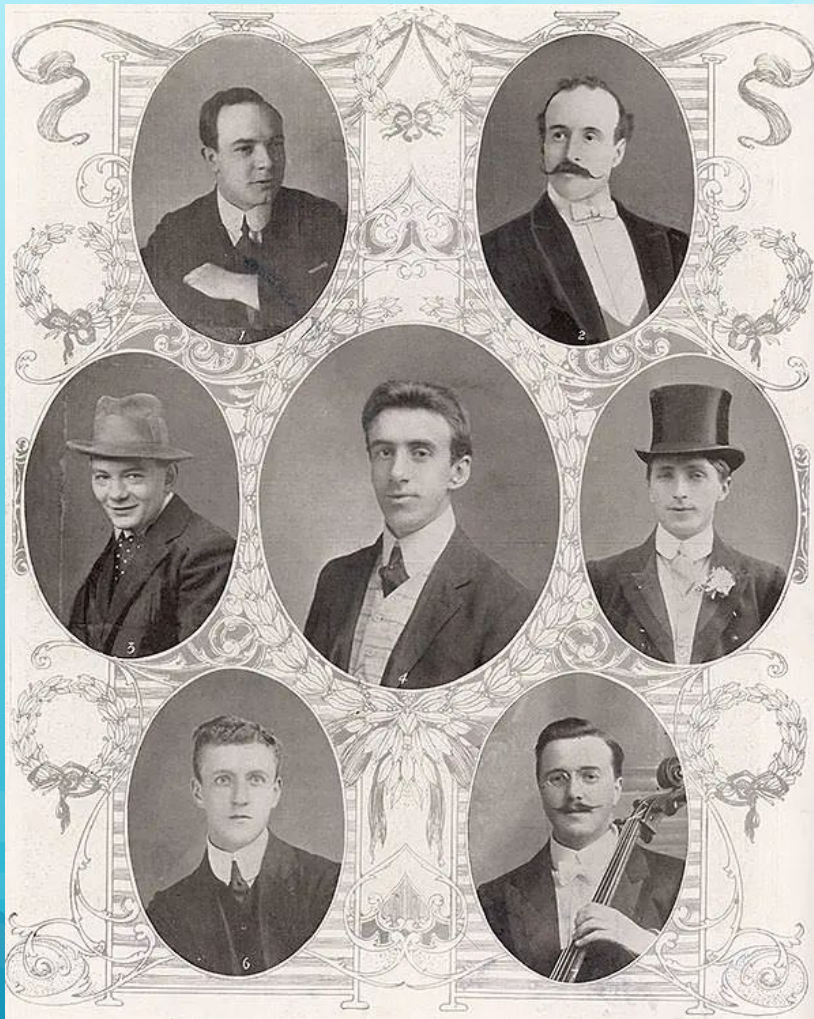


Clarke, Hartley and Hume<sup>12</sup>



It is believed that all eight continued playing for some time as the crew loaded the lifeboats<sup>12</sup>





(T. L.) John Frederick Preston Clarke – Bassist (aged 30)

(T. R.) Percy Cornelius Taylor – Cellist (aged 32)

(M. L.) Georges Alexandre Krins – Violinist (aged 23)

(M. C.) Wallace Hartley – Bandmaster, Violinist (aged 33)

(M. R.) Theodore Ronald Brailey – Pianist (aged 24)

(B. L.) John Law Hume – Violinist (aged 21)

(B. R.) John Wesley Woodward – Cellist (aged 32)

(Below) Roger Marie Bricoux – Cellist (aged 20)





This is a replica of the different stages of vertical tilting the *Titanic* underwent while it was sinking. The ramp on the right is 12 degrees, the one in the middle is 30 degrees, and the one on the left is 45 degrees.





## When The Ship Was Sinking

- 🐠 More people could have survived if there were more lifeboats<sup>7</sup>
  - 🐬 Could handle 64 lifeboats<sup>7</sup>
    - 🐟 48 was the amount originally planned<sup>7</sup>
  - 🐬 Only 20 were on board<sup>7</sup>
    - 🐟 Only 18 were able to launch properly<sup>7</sup>
- 🐠 Only 9 people were pulled from the water into lifeboats
  - 🐬 3 of which perished shortly after
  - 🐬 Only 1 lifeboat returned to the ship to help more people
- 🐠 Lifeboats were not completely filled when launched
  - 🐬 - Lifeboat 1 only had 12 people when its capacity was 65

## When The Ship Was Sinking



Lifeboats A and B (two collapsible lifeboats) floated away



30 people managed to survive by standing, sitting or kneeling on the upturned hull of collapsible lifeboat B



Tried and failed in their attempts to right it.

### Titanic Lifeboats - Order Of Launch

12:40 am – Lifeboat 7 (starboard)

12:43 am – Lifeboat 5 (starboard)

01:00 am – Lifeboat 3 (starboard) and lifeboat 8 (port)

01:05 am – Lifeboat 1 (starboard)

01:10 am – Lifeboat 6 (port)

01:20 am – Lifeboat 16 (port)

01:25 am – Lifeboat 14 (port)

01:30 am – Lifeboat 12 (port) and lifeboat 9 (starboard)

01:35 am – Lifeboat 11 (starboard)

01:40 am – Lifeboat 13 (starboard)

01:41 am – Lifeboat 15 (starboard)

01:45 am – Lifeboat 2 (port)

01:50 am – Lifeboat 10 (port) and lifeboat 4 (port)

02:00 am – Collapsible lifeboat C (starboard) – with J Bruce Ismay on board

02:05 am – Collapsible lifeboat D (port)

02:15 am – Collapsible lifeboats B (port) and A (starboard) are washed out to sea

## The Aftermath of the Sinking



Of the 2,228 people on board the ship, only 706 survived. <sup>6</sup>



Majority of which were First Class Passengers <sup>6</sup>



492 – the number of passengers who survived <sup>6</sup>



3 in 5 from first class passengers <sup>6</sup>



1 in 4 from third class passengers <sup>6</sup>



“Women and Children First” Rule



214 – the number of crew members who survived



DISCOVERY

It's biggest mass on the door."



### THIRD CLASS PASSENGERS

...

### SECOND CLASS PASSENGERS

...

### FIRST CLASS PASSENGERS

...

### CREW

...

First Class Survivors

61%

First Class Victims

39%

Second Class Survivors

42%

Second Class Victims

58%

Third Class Survivors

24%

Third Class Victims

76%

## Rescue Ships



SS *Carpathia* was the first ship to arrive<sup>13</sup>



It took 3.5 hours for the ship to travel 56 miles around the ice field<sup>13</sup>



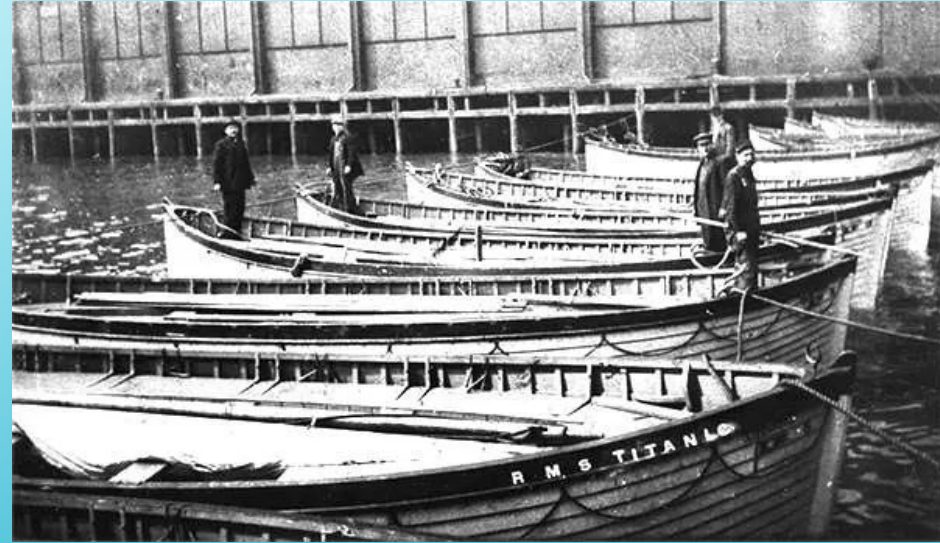
Reached the *Titanic* at 4:00 A.M.  
<sup>13</sup>



Continued to collect lifeboats until 8:30 or 9:00 A.M.<sup>13</sup>







Lifeboat 2 was the first to be rescued.

Lifeboat 6 is the one pictured on the left.

All of the lifeboats brought back to New York are on the right.

Seven lifeboats were left at sea since *Carpathia* was only able to handle was 13.



## The Non-Rescue Ship



SS *Californian* was nearby but didn't help



Closest ship to the Titanic



Only about 20 miles away



They were also stuck in an ice field



Ignored the distress flares



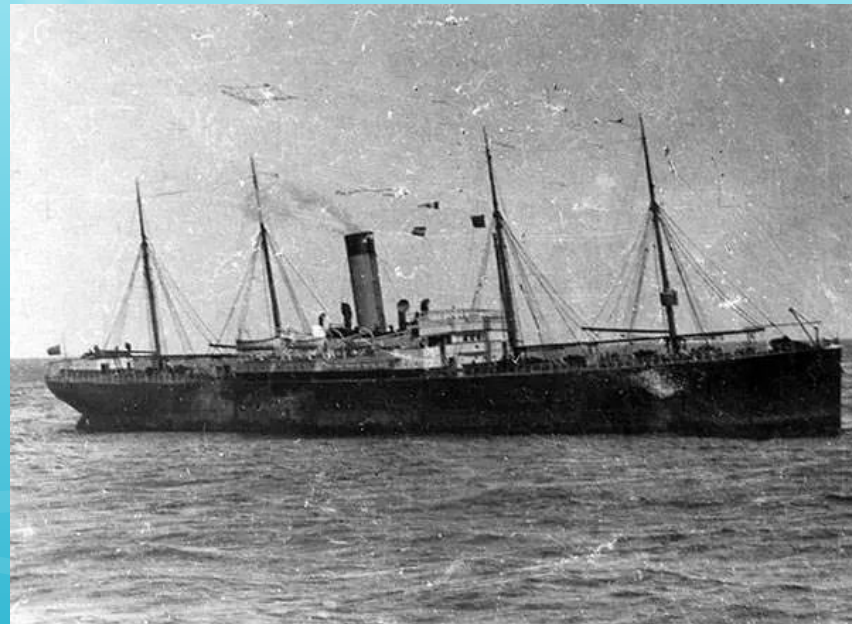
Thought they were shooting stars



Showed up at 8:00 A.M. the next morning to look for survivors

SS *Californian* crew testimonies:

<https://www.titanicinquiry.org/>



08.00 am – the time **the Californian** arrived at the scene of the sinking, at which point Carpathia set off to deliver the survivors to New York.

0 – the number of survivors found by the Californian.

## Robert Ballard and the Discovery

Robert Ballard discovered the wreck of the *Titanic* in 1975. Since then, he has traveled to other major shipwrecks with his yellow, submersible robot. He is a retired Navy Officer, and now works as an oceanography professor and marine archaeologist.



## Why Do the Different Sections Look So Different

The bow and the stern look different because of how they sunk to the ocean floor



Since the bow was more streamlined for hydrodynamics, it had a smoother descent



The bow is much more intact and recognizable



It is also estimated that the bow was travelling at 35 mph with a 15-20° angle when it hit bottom <sup>8</sup>



The stern, however, was not as graceful while it sunk



The stern was estimated to be sinking at 50 mph <sup>8</sup>

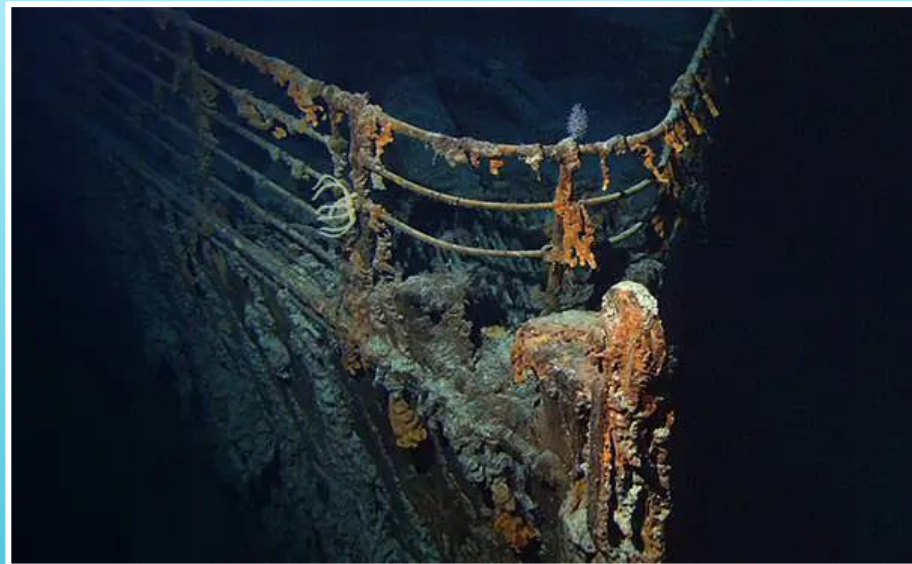


The stern rotated as it sunk, causing the drag and water pressure to tear off pieces <sup>8</sup>

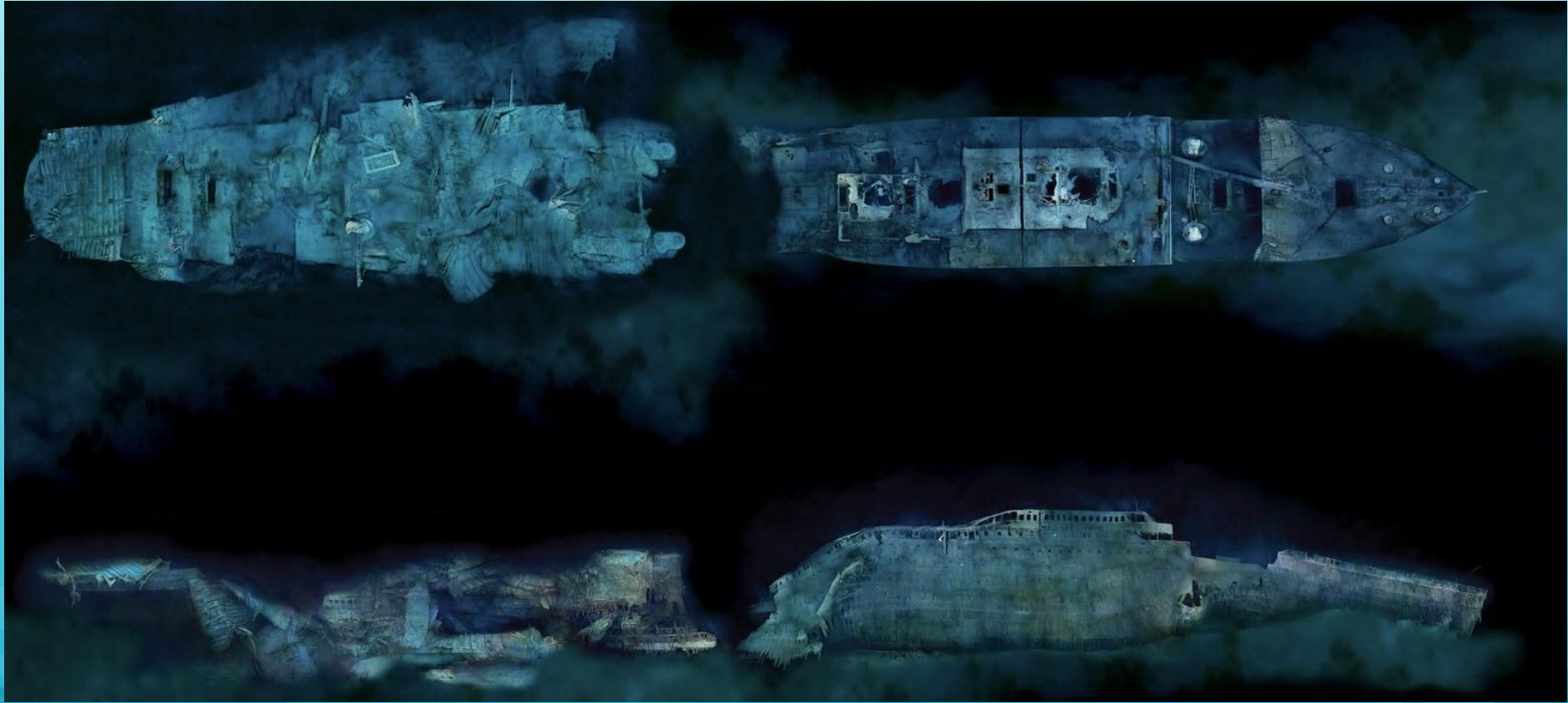


Some experts believe that the ship was still turning as it hit the ocean floor <sup>8</sup>







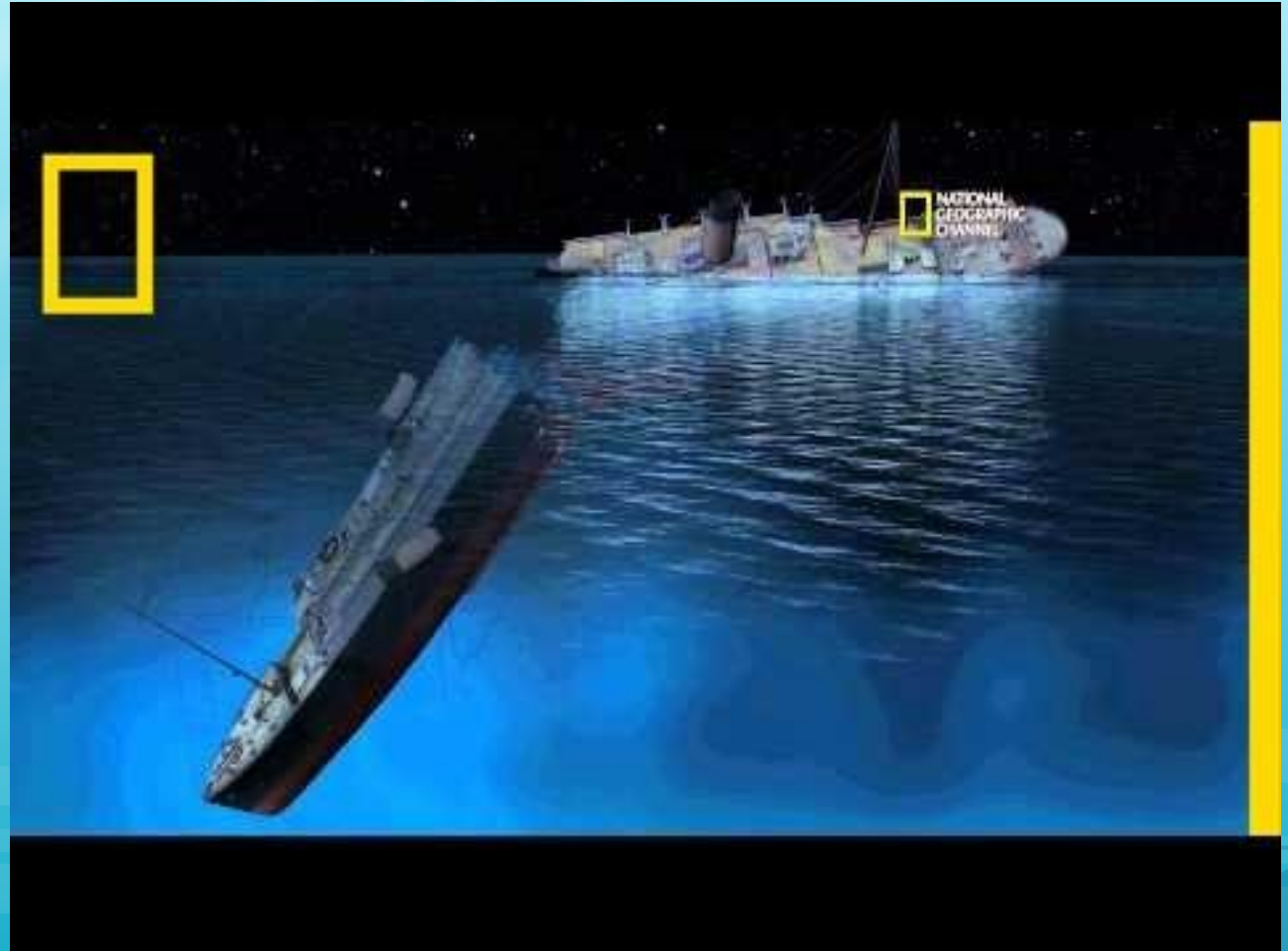


This animation was sped up.

Do remember that the *Titanic* sunk 2 hours and 40 minutes after it hit the iceberg.

However, researchers estimate that it only took 5 to 10 minutes for the ship to reach the bottom.

This animation also doesn't show the stern spiralling as it impacts the sea bed, which is how scientists now believe this section arrived.





# *RMS Lusitania*

Sunk May 7, 1915 at 2:28 P.M.



## What Happened?



Sunk after getting hit by a torpedo from a German U-boat at 2:10 P.M.<sup>14</sup>



An unknown, second explosion further damaged the ship soon after the torpedo strike<sup>14</sup>



Two popular theories:



Carried smuggled ammunition<sup>14</sup>



There is a little bit more evidence for this one<sup>16</sup>



Ship's boilers or other internal systems<sup>15</sup>



Sunk in 18 minutes<sup>14</sup>



# Sinking of the *Lusitania* May 7, 1915 2:10 PM

The RMS *Lusitania* was a British ocean liner owned by the Cunard Line. It was built to compete for the highly lucrative transatlantic passenger trade. On May 7, 1915, it was sunk by a German U-boat. The sinking solidified U.S. public opinion against Germany and indirectly contributed to the entry of the United States into World War I.

## TIMELINE

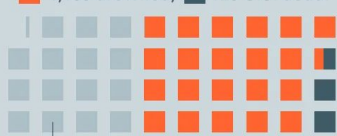
- June 7, 1906 – Launched.
- August 26, 1907 – Delivered to Cunard as the largest ship in the world, with a gross tonnage of 31,550.
- September 7-13, 1907 – Sailed on its maiden voyage from Liverpool, England, to New York City.
- October 1907 – Won the Blue Riband for the fastest Atlantic crossing, averaging about 24 knots.
- May 7, 1915 – Torpedoed and sunk by the German U-boat SM U-20. A secondary explosion occurred almost immediately after the torpedo hit, ripping the ship in two.

German-declared war zone, February 1915.  
All enemy ships in this area would be sunk.



## CASUALTIES

Of the 1,959 passengers on board,  
1,198 drowned, 128 U.S. dead.



## FACTS & FIGURES

101

round-trips in the 7 years  
and 9 months of its career



## GERMAN SM U-20 SUBMARINE

- Launched on December 18, 1912.
- Grounded on November 14, 1916, on Danish coast and destroyed by crew.







37 SHIPS SUNK



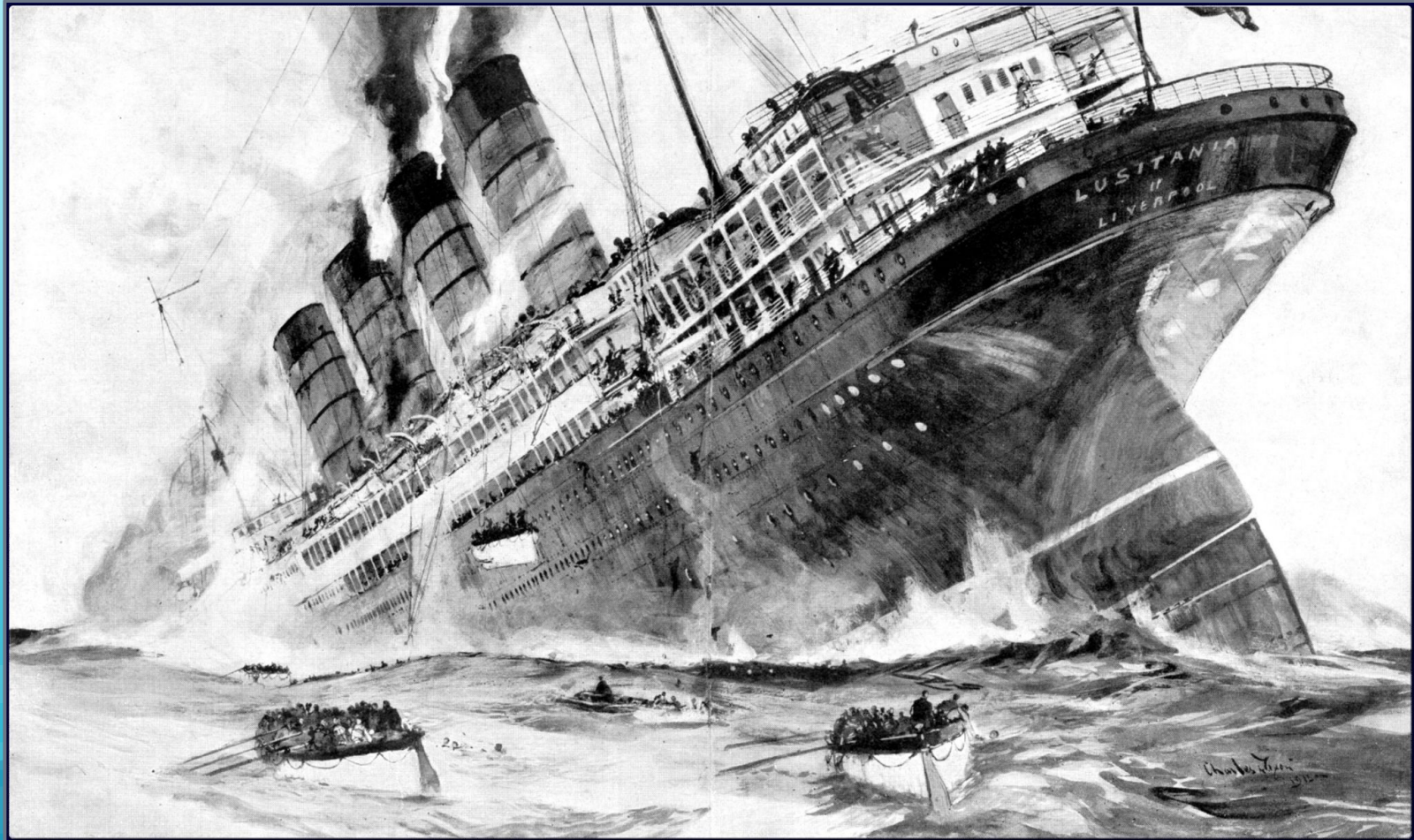
© Encyclopædia Britannica, Inc.



## During the Sinking

-  After the torpedo hit, the ship immediately listed 15 degrees to starboard<sup>14</sup>
-  Continued to grow as the ship filled with water<sup>14</sup>
-  The engines failed soon after the second explosion and the ship would not respond to any inputs<sup>14</sup>
-  The electrical grid failed<sup>14</sup>
-  It is believed that some people got trapped in an elevator while the ship sank<sup>14</sup>
-  The *Lusitania* sunk forecastle and bow first<sup>14</sup>





## Aftermath of the Sinking



Of the 1,959 passengers and crew on board, only 763 survived<sup>17</sup>



1,198 people died due to most of the lifeboats failing and the time it took for the ship to sink<sup>17</sup>



128 deaths were Americans<sup>18</sup>



This event was only one part that drew America into World War One<sup>18</sup>



Only 6 lifeboats were successfully launched



The rest either broke apart or capsized while being launched<sup>17</sup>





The wreckage rests on the starboard side where the torpedo hit. Therefore, we cannot examine the damage that the torpedo caused, nor do we know exactly where the torpedo struck. The wreckage itself has been damaged from people diving to the wreck and tampering with the superstructure. There are a lot of fishing nets, too.

## Second Explosion Theories



### Aluminum powder explosion



Aluminum powder is an ingredient in gunpowder



Deemed plausible because none of the baggage handlers who were above the magazine survived the sinking <sup>14</sup>



### Ammunition



Deemed plausible because none of the baggage handlers who were above the magazine survived the sinking <sup>14, 16</sup>



### Boiler explosion



Deemed plausible because boilers can cause large explosions  
<sup>14, 15</sup>

## Second Explosion Theories



Coal dust explosion



Deemed plausible if the torpedo hit the forward coal bunker  
<sup>14</sup>



This theory is backed by Robert Ballard



Pipe bomb



This theory believes that German agents planted a pipe bomb like they did at the Black Tom Railyard<sup>14</sup>



Steam line rupture



Believes that the torpedo hit a weak spot in the ship's design and that one torpedo was sufficient to sink the ship<sup>14</sup>

## Second Explosion Theories



Second torpedo



Believes that the U-boat fired another torpedo or that there was another submarine that fired upon the ship<sup>14</sup>



This has many contradictions since the testimonies of everyone in U-20 states that they only fired one torpedo



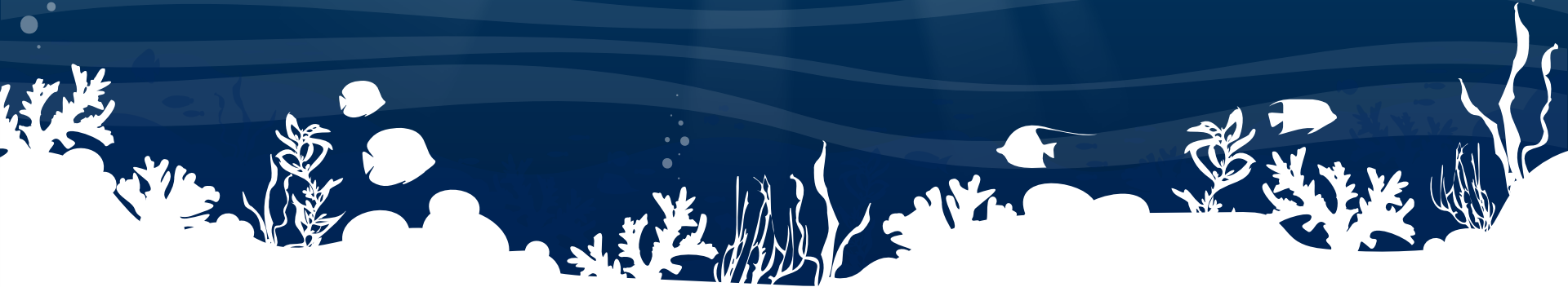
The torpedo itself



Believes that the torpedo had a delayed detonation<sup>14</sup>



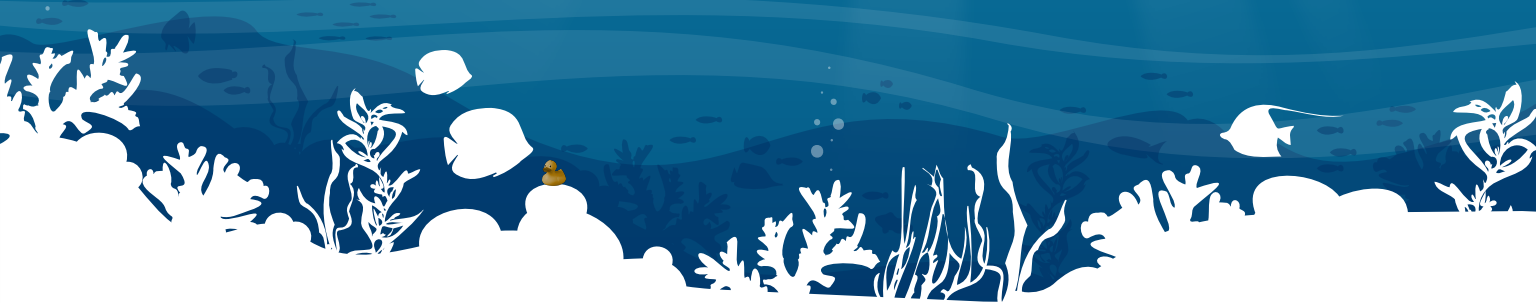
***Titanic* had enough time but not enough lifeboats;  
*Lusitania* had enough lifeboats but not enough time.  
Time and human error can cost you everything.**





# *HMHS Britannic*

Sunk November 21, 1916 at 9:07 A.M.



## The Third Sister



The *Titanic* had two, Olympic-class, sister ships <sup>20</sup>



The oldest was the *Olympic*



The youngest was the *Britannic*



Originally named the *Gigantic* <sup>21</sup>



Construction began on November 30, 1911



After the *Titanic* sunk, the *Britannic* was outfitted with more lifeboats to accommodate all passengers <sup>20</sup>



17 watertight compartments <sup>21</sup>



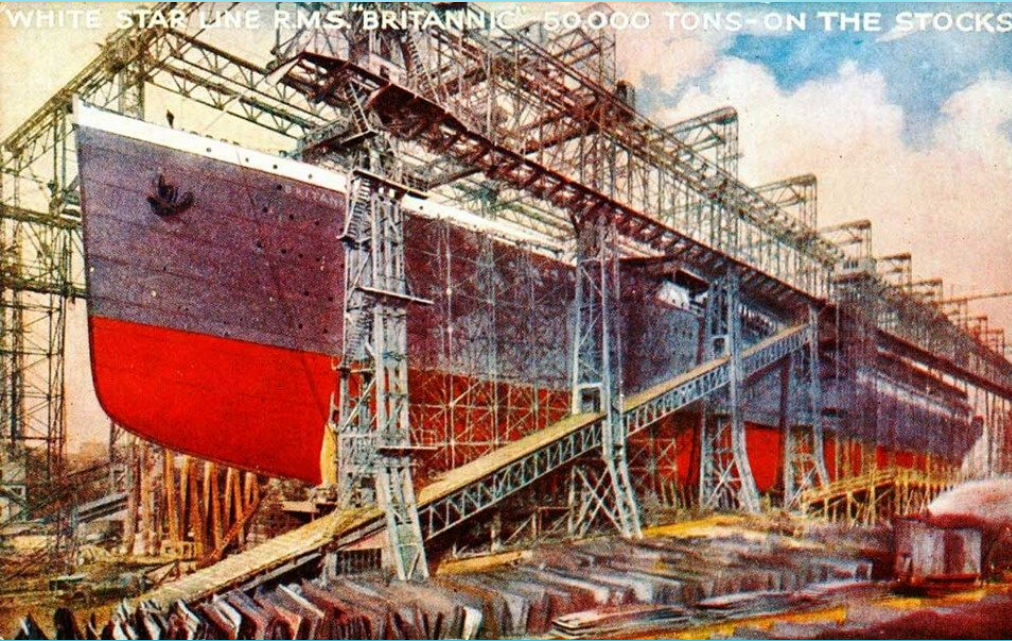
Was built to be a commercial ship until WWI broke out



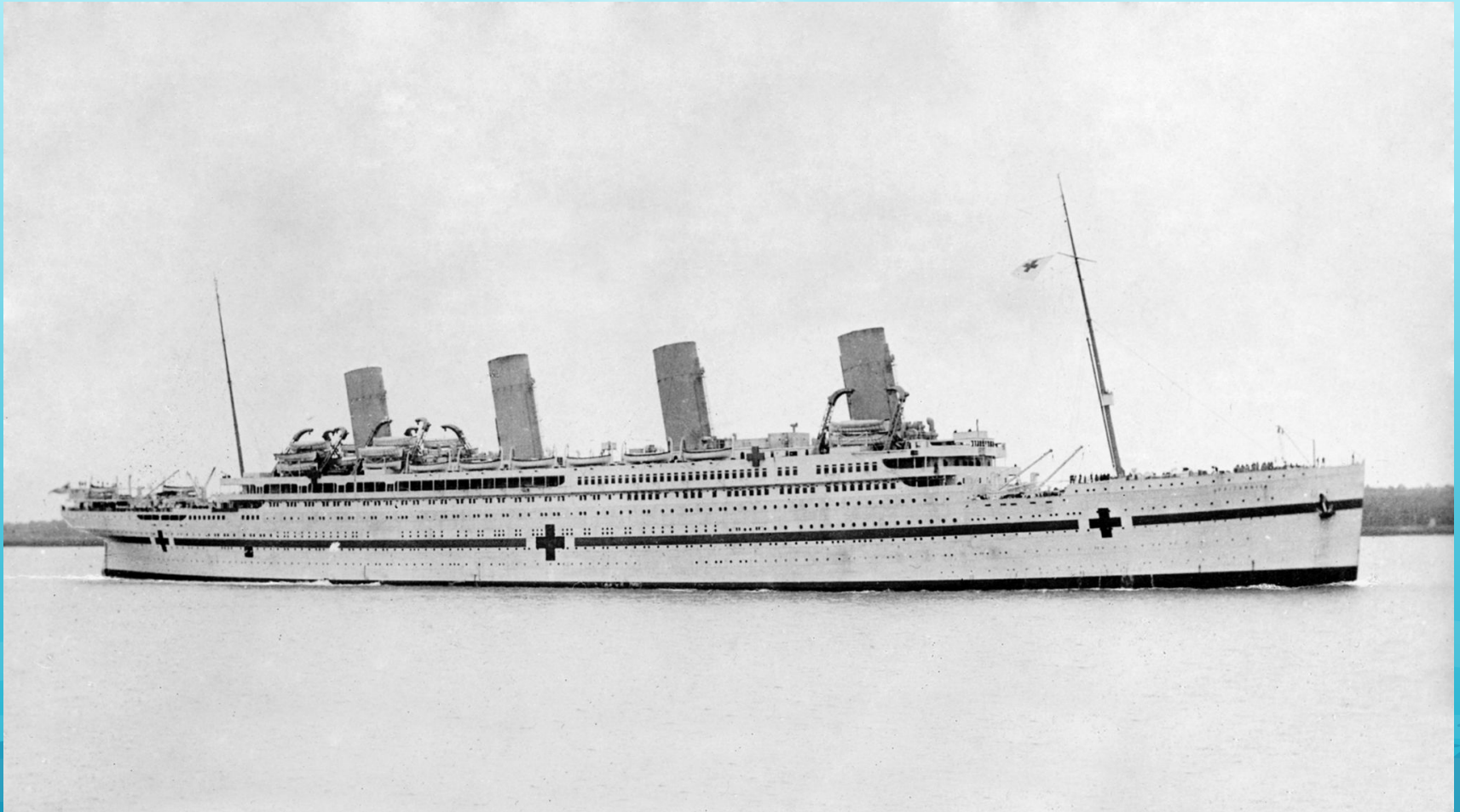
*Britannic* was requisitioned to serve as a hospital ship <sup>21</sup>










WHITE STAR LINE R.M.S. BRITANNIC - 50,000 TONS - ON THE STOCKS







## What Happened?

-  Hit an underwater mine at 8:12 A.M. <sup>22</sup>
-  Sunk in 55 minutes <sup>22</sup>
-  Smaller, coal dust explosions occurred soon after <sup>22</sup>
-  1,035 people survived the sinking <sup>22</sup>
-  Only 30 people were lost <sup>22</sup>
-  Britannic was the largest ship lost in the First World War <sup>22</sup>
-  Approximately 882 feet long <sup>21</sup>

## While It Was Sinking



The initial explosion caused six watertight compartments to be flooded <sup>23</sup>



The ship started to list



Nurses left the portholes open and water began to come through the windows <sup>23</sup>



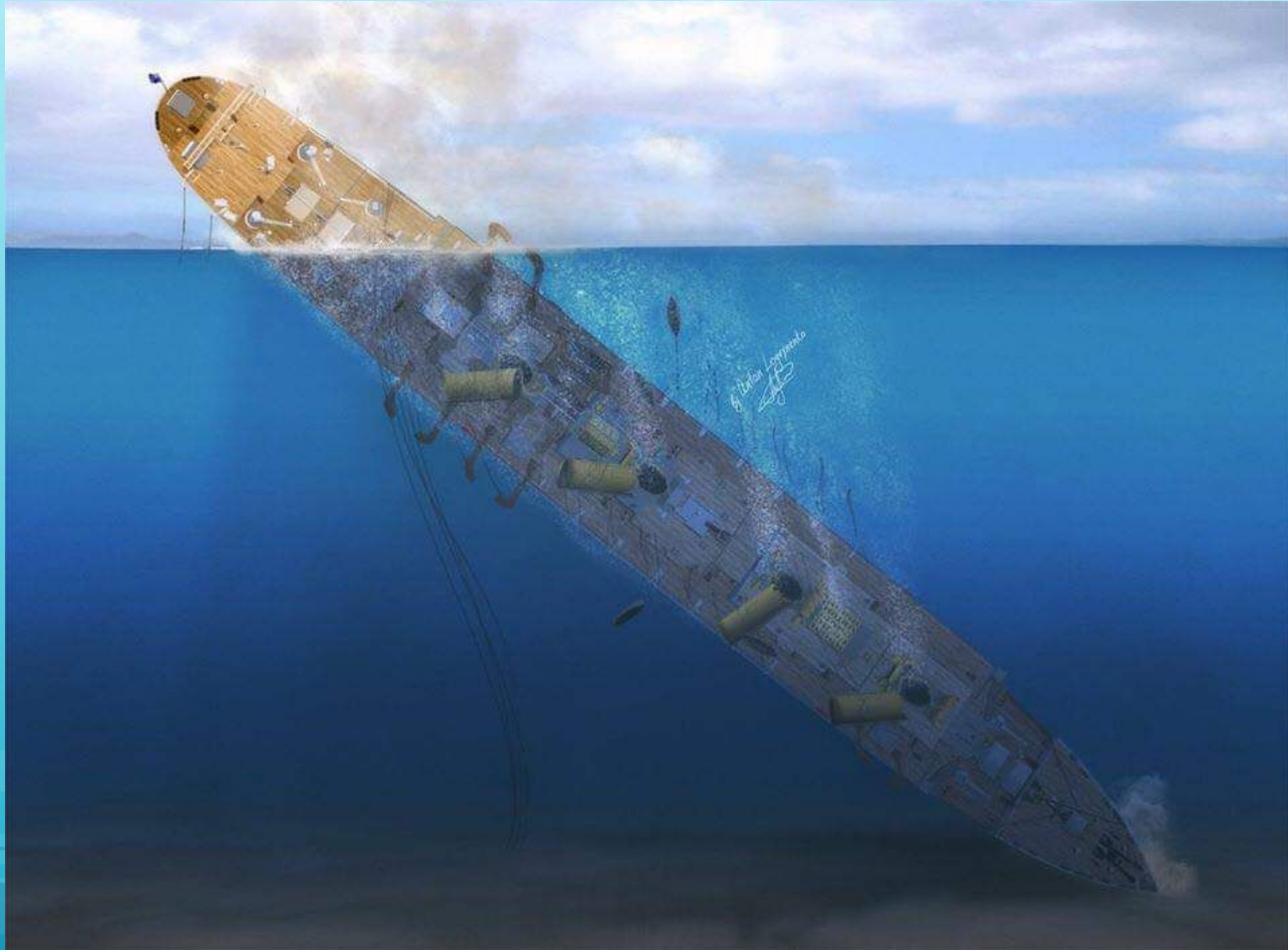
Captain ordered full speed in an attempt to beach the ship <sup>23</sup>



The movement, however, caused more water to enter the ship <sup>23</sup>

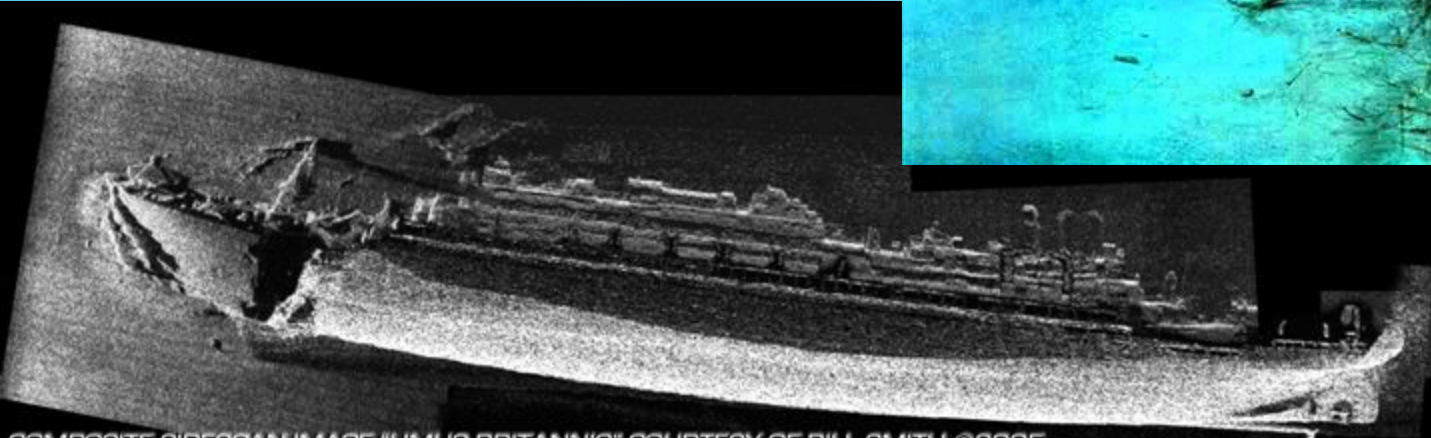


The engines were stopped soon after <sup>23</sup>





Sunk in the Aegean Sea,  
which is off the coast of  
Greece. The wreck is in  
400 feet of water.



COMPOSITE SIDESCAN IMAGE "HMHS BRITANNIC" COURTESY OF BILL SMITH ©2005






# *RMS Empress of Ireland*

Sunk May 29, 1914 at 2:10 A.M.



## What Happened

-  Thick fog was on the St. Lawrence River during the night of the collision <sup>24</sup>
-  The SS *Storstad* was travelling upriver toward Quebec as the *Empress* was coming downstream <sup>24</sup>
-  Since the collision happened during the night, many people were asleep <sup>24</sup>

## What Happened



We're not sure what actually happened



The survivors, crew, and captains all had different takes on the collision<sup>24</sup>



Crew Testimonies: <https://www.titanicinquiry.org/eoi/01header1.php>



The fog was the main culprit<sup>24</sup>

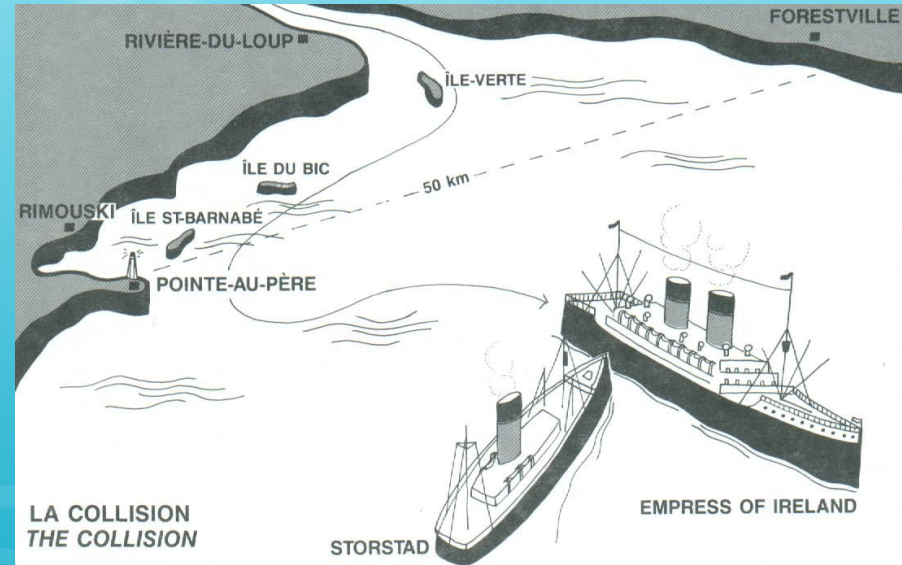
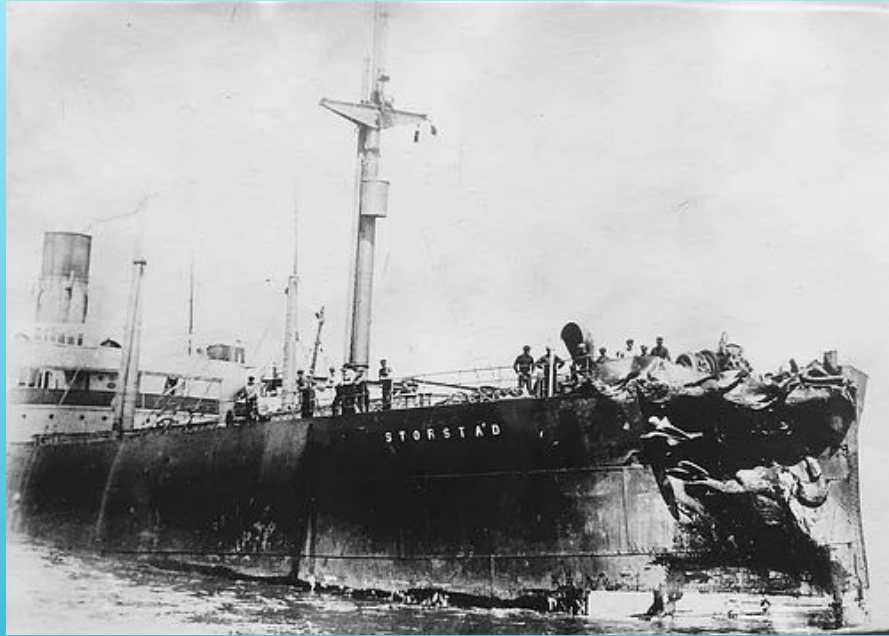


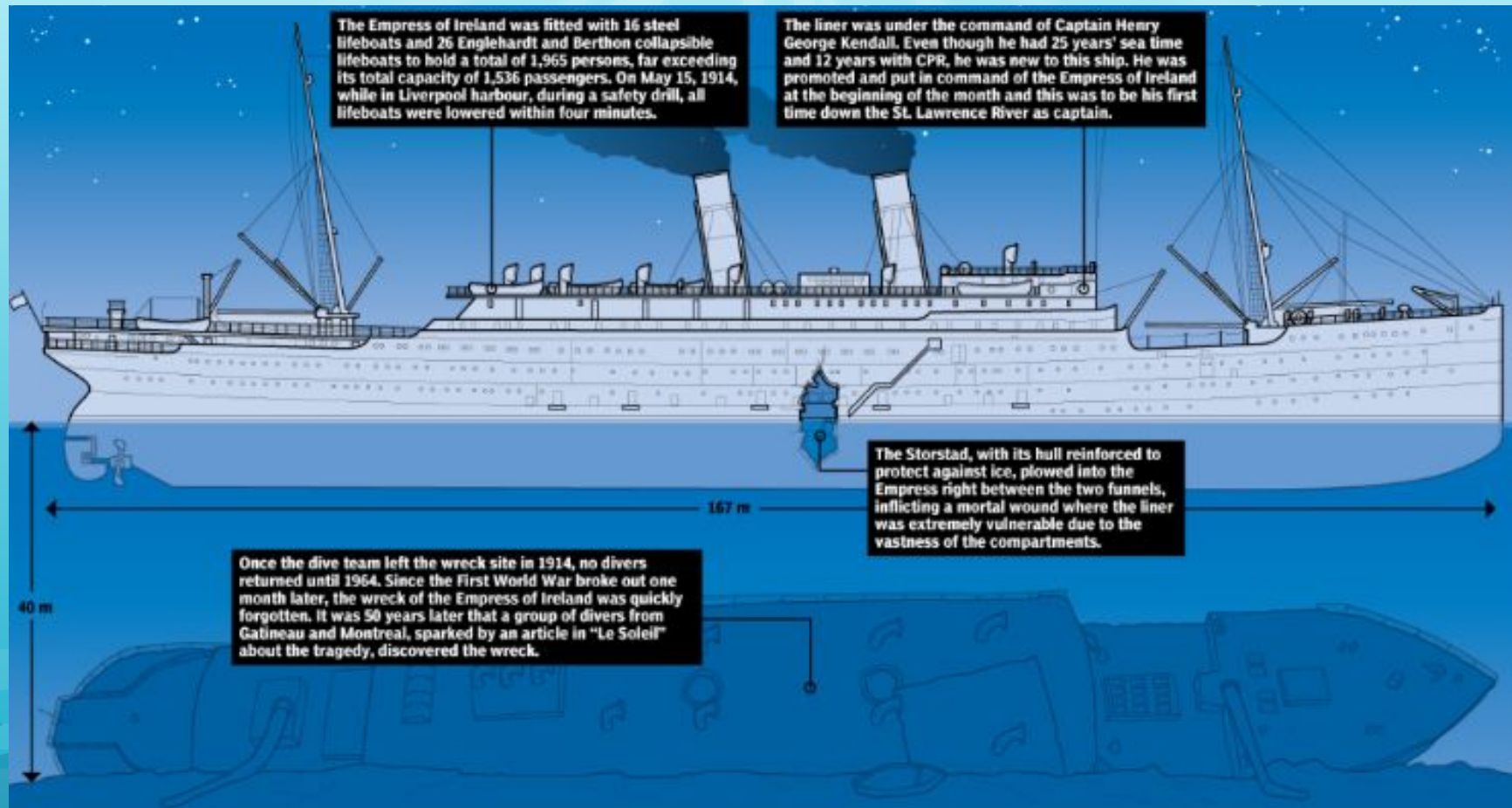
SS *Storstad* struck between the funnels, cutting a 16-foot-long vertical gash in the hull of the ship<sup>24</sup>













The gash allowed the ship to fill at the rate of 60,000 gallons per second<sup>24</sup>







## The Sinking

-  The current pulled the two ships apart<sup>24</sup>
  -  Captain Kendall wanted the *Storstad* to keep her engines at full speed to plug the hole<sup>24</sup>
-  The electricity on the ship went out immediately
  -  People had to find their way to the top deck in the dark
-  Ship listed sharply to starboard<sup>24</sup>
  -  The lifeboats were, therefore, useless
    -  The boats on the port side swung over the deck and could not be lowered<sup>24</sup>
    -  The starboard side were already immersed or slid down the deck into the river<sup>24</sup>
    -  The portholes in the cabins were also left open<sup>24</sup>
-  People who weren't killed or drowned immediately had to climb up sideways stairs<sup>24</sup>

## The Sinking



The *Storstad* was able to quickly launch her own lifeboats to help rescue people in the water<sup>24</sup>









However, most people had already drowned by the time the *Storstad* lowered the lifeboats

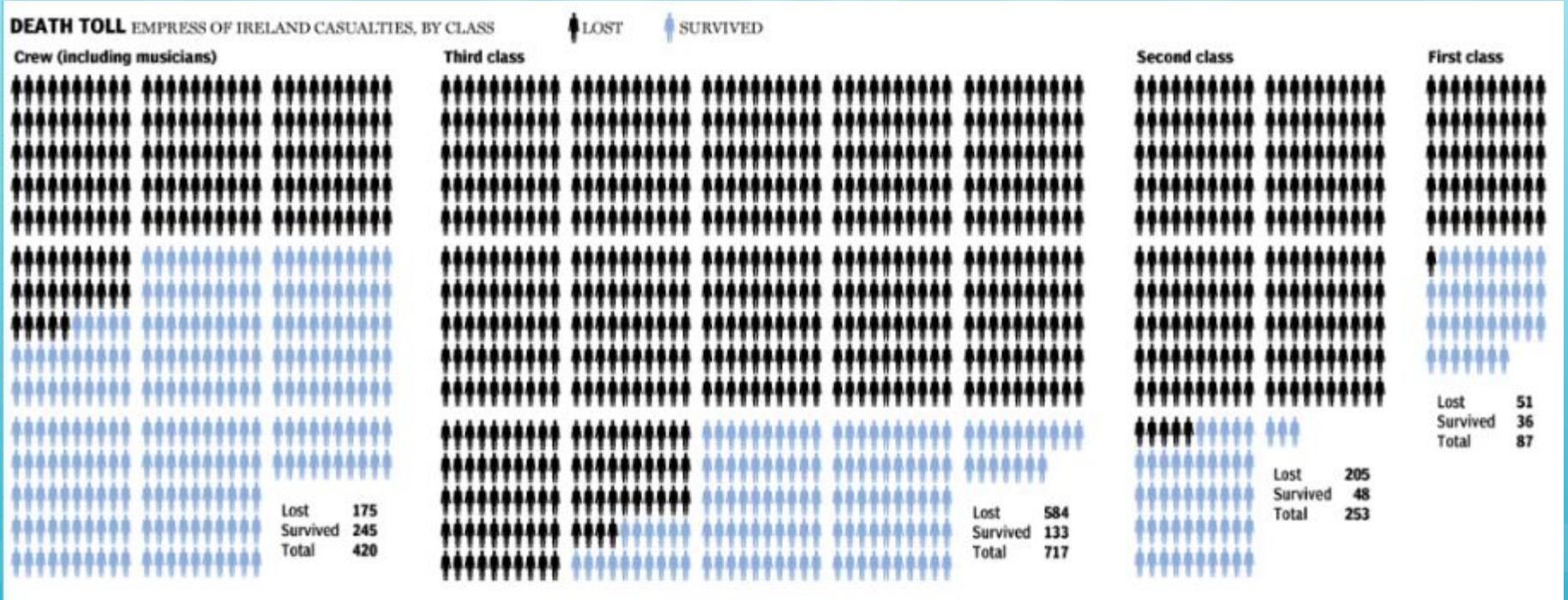


The *Empress of Ireland* sunk 14 minutes after the collision<sup>24</sup>



## The Death Toll

-  Of the 1,477 people on board, 1,012 people died<sup>24</sup>
-  Of the 420 crewmembers, 248 survived<sup>24</sup>
-  Captain Kendall is one of the 248<sup>24</sup>
-  217 passengers survived out of 840<sup>24</sup>
-  Only 4 of the 138 children on board survived<sup>24</sup>
-  A total of 465 people survived





A glance at the corpses taken in a walk along the line revealed the story of the collision and the incidents following. Almost all bore marks of violence inflicted by contact with parts of the wrecked ship or in struggles in the water. There were bodies of women whose heads were split open or gashed. It is possible that women running from their staterooms in the darkness following the collision ran against stanchions or were hurled against the walls or the sides of the corridors. The wounds also indicated that some of the women had been crushed when the collier buried her steel nose in the side of the Empress ([https://www.worldhistory.org/RMS\\_Empress\\_of\\_Ireland/](https://www.worldhistory.org/RMS_Empress_of_Ireland/)).



## The Wreck Today

The wreck site is now protected and buoyed by the city of Quebec. People cannot bring up any artifacts without permission <sup>25</sup>

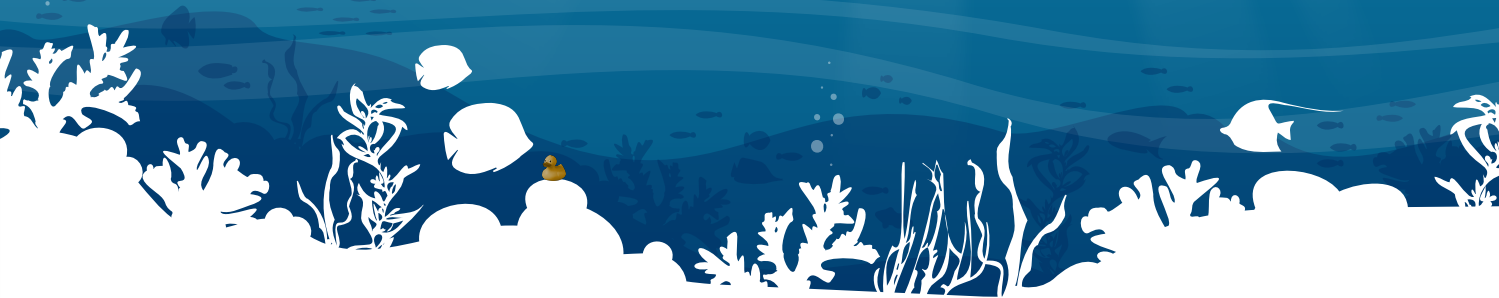












# *SS Andrea Doria*

Sunk July 26, 1956 at 10:09 A.M.



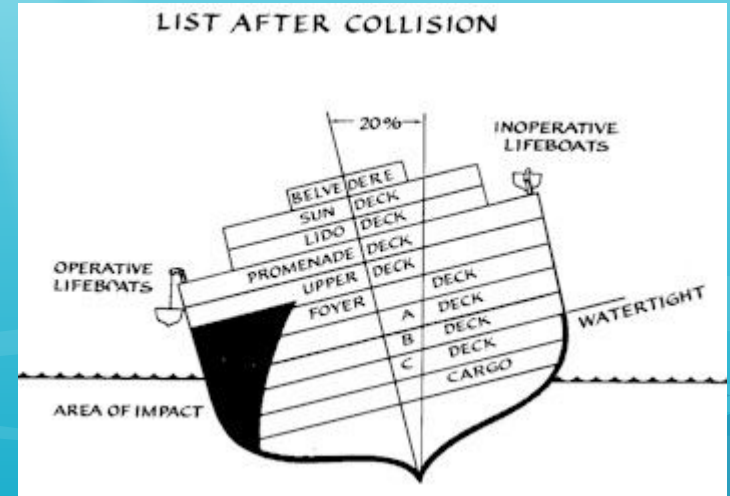
## What Happened?

-  The SS *Stockholm* collided with the SS *Andrea Doria* off of the coast of Nantucket
-  The *Andrea Doria* had 11 watertight compartments and radar<sup>26</sup>
  -  Radar was relatively new technology for ships to have<sup>26</sup>
-  Heavy fog had rolled in over the water, but a misreading of the radar screens led the ships to a collision course<sup>5</sup>
-  The ships collided at nearly 90 degrees<sup>5</sup>
  -  Stockholm's bow was built for ice-breaking<sup>5</sup>



This is the imprint of the *Stockholm*'s bow where the two ships collided.

Due to the ship's list, the portside lifeboats were inoperable. Fortunately, the ship capsized slowly and most of people aboard were able to be rescued. It took about 11 hours for the ship to sink.<sup>26</sup>



## Death Toll



Only 51 people died <sup>26</sup>



46 were from the *Andrea Doria* <sup>26</sup>



5 were from the *Stockholm* <sup>26</sup>



Because of all of the safety precautions, more people were able to survive <sup>5</sup>



“Equipped with the latest safety features, such as radar, the *Andrea Doria* was considered one of the safest ships afloat. Also as part of the design, 11 watertight bulkheads divided the ship and the exterior had a double hull in case of collisions”

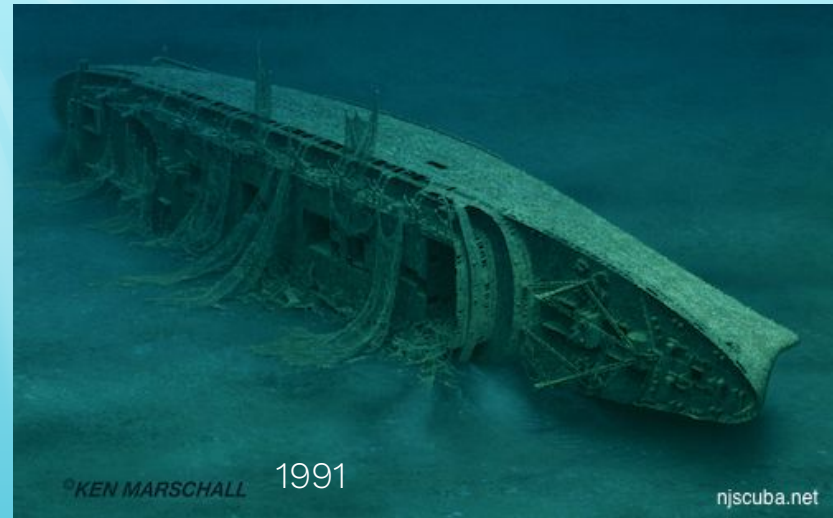
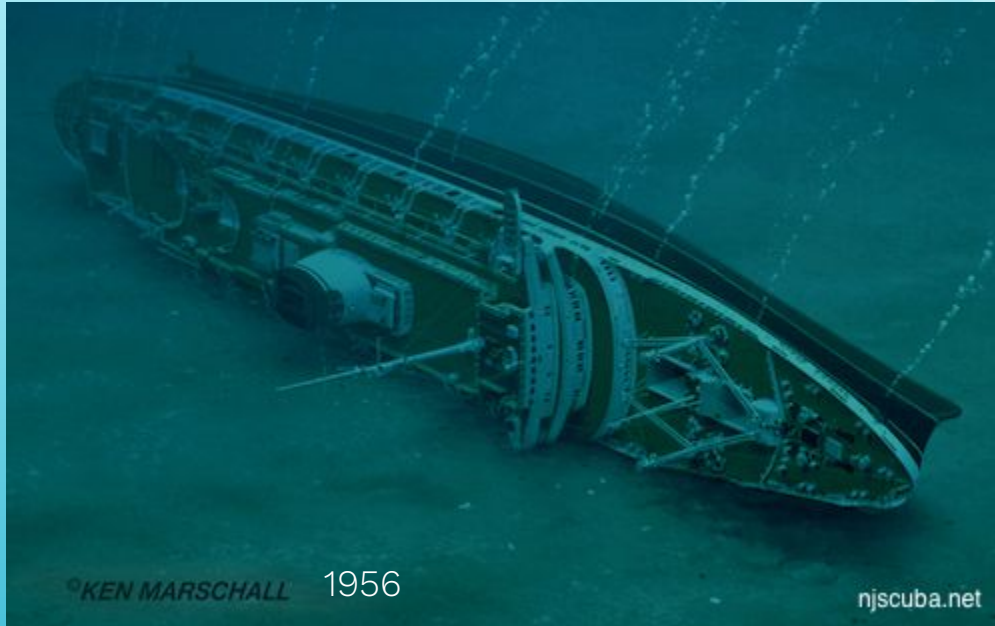
(<https://www.greatoceanliners.com/ss-andrea-doria>).





*Stockholm* (after the collision with the *Andrea Doria*)





## Ship Degradation Over the Years

These paintings by Ken Marschall are slightly inaccurate. The ship isn't resting on a hard surface; it is slowly sinking into the ocean floor.





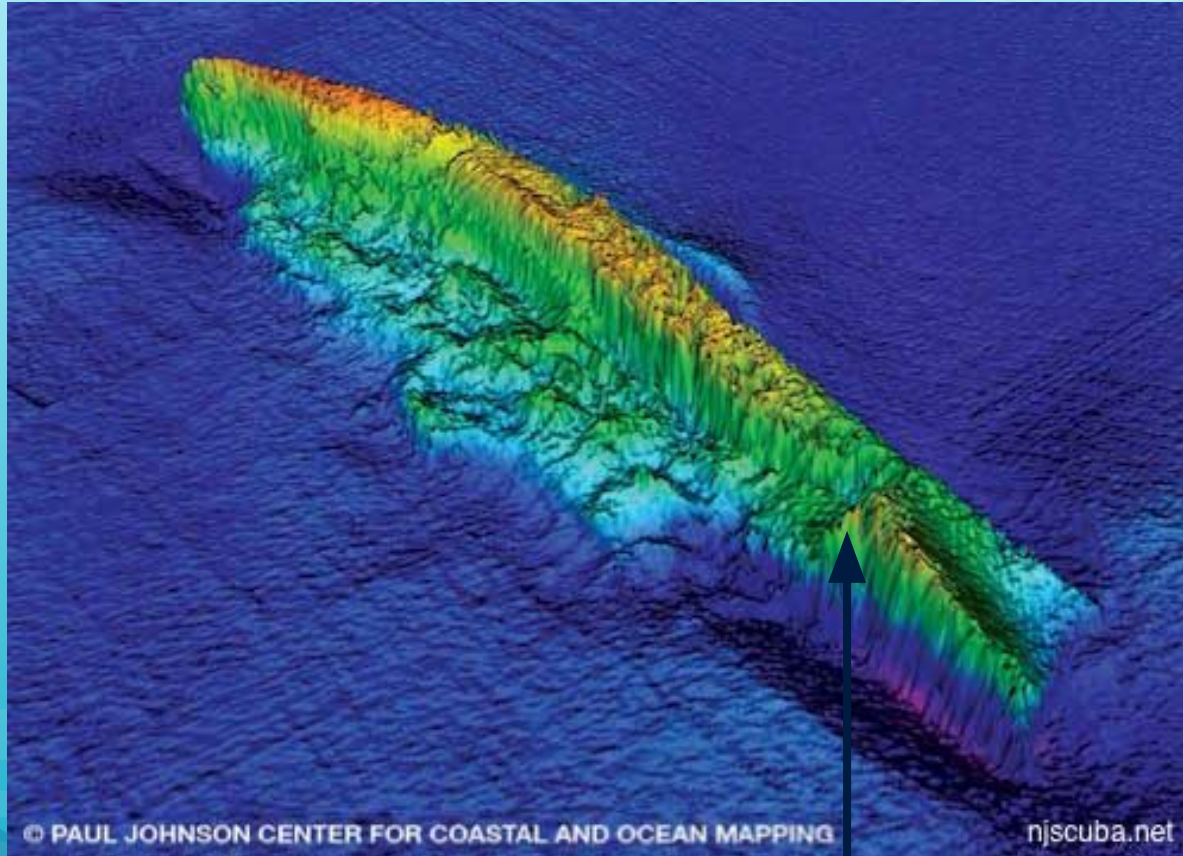
## Ship Degradation Over the Years

This is a sonar side-scan of the S.S. *Andrea Doria* from 2016.

Notice how much thinner the hull is from the painting from 2003.

As the years progress, organisms in the water and water currents are causing the metal to rust and break away on to the ocean floor. Wood is usually the first to go.

Parts of the wreck have also been brought up to the surface, but these are usually small things like china plates and other decor.

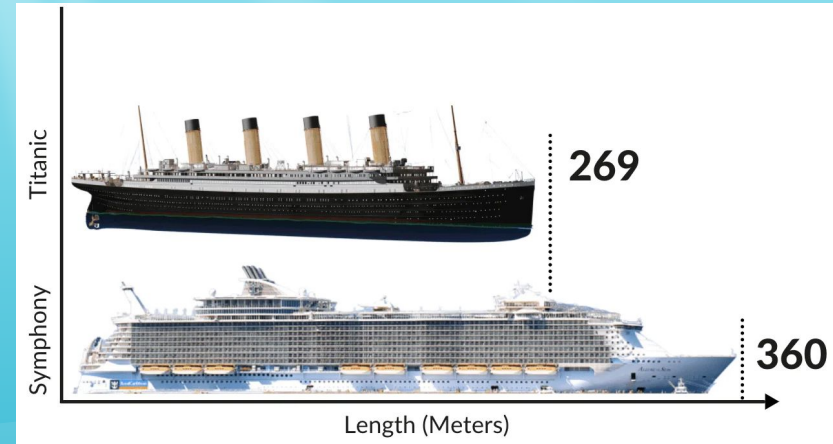


The original break in the hull is here.



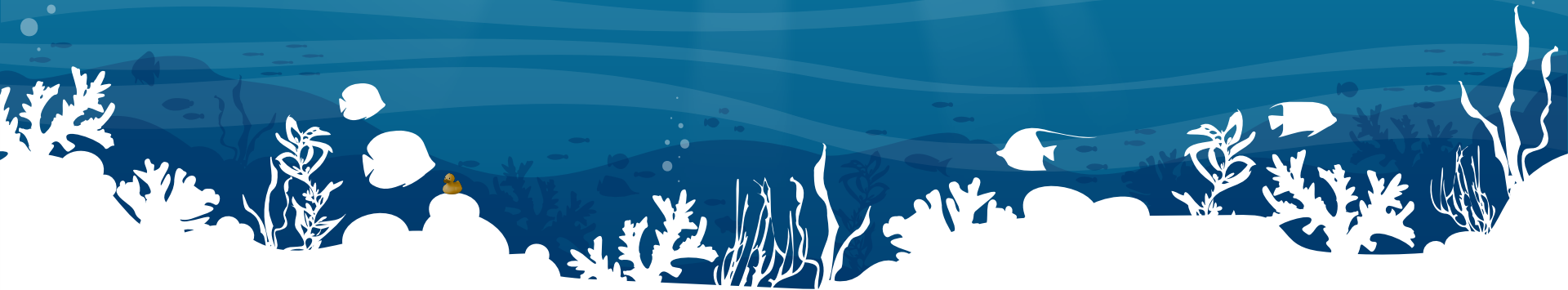
	Lusitania	Titanic	Empress	Britannic	A. Doria
Service Career	9/7/07-5/7/15	4/10/12-4/15/12	6/29/06-5/29/14	12/23/15-11/21/16	6/14/53-7/26/56
Length (ft)	780	882.75	548.90	903	697
Breadth (ft)	87.8	92	65	94	90
Displacement (gross tons)	30,396	46,239	14,191	48,158	29,100
Svc. Speed (knots)	25	21	20	21	23
Max. Capacity, Passengers/Crew	2,198	3,547	1,860	3,525	1,730
Passengers/Crew, Final Voyage	1,959	2,228	1,492	1,066	1,706
Lives Lost	1,198	1,523	1,014	30	46
Depth Sunk	295	12,460	150	395	225

This chart compares each of the ocean liners on different build and wreck criteria.



# *SS Edmund Fitzgerald*

Sunk November 10, 1975 around 7:10 P.M.



## What Happened?

-  The *Edmund Fitzgerald* and the *Anderson* were travelling over Lake Superior during a storm<sup>27</sup>
  -  The wind gales were about 50 knots<sup>27</sup>
  -  The waves that were reported were about 12 to 16 feet high<sup>27</sup>
-  The two ships were in contact with each other until the *Fitzgerald* vanished from radar (we're not completely sure what happened)

Here's the full report: [National Transportation Safety Board Marine Accident Report SS Edmund Fitzgerald Sinking In Lake Superior United States Government](#)

## How Are Waves Created?



Winds generate waves



The wind speed



The stronger the winds, the larger the force and thus the bigger the wave <sup>28</sup>



The wind must also be steady - a constant wind speed



The duration of the winds



The longer the wind blows over the open water, the larger the waves <sup>28</sup>

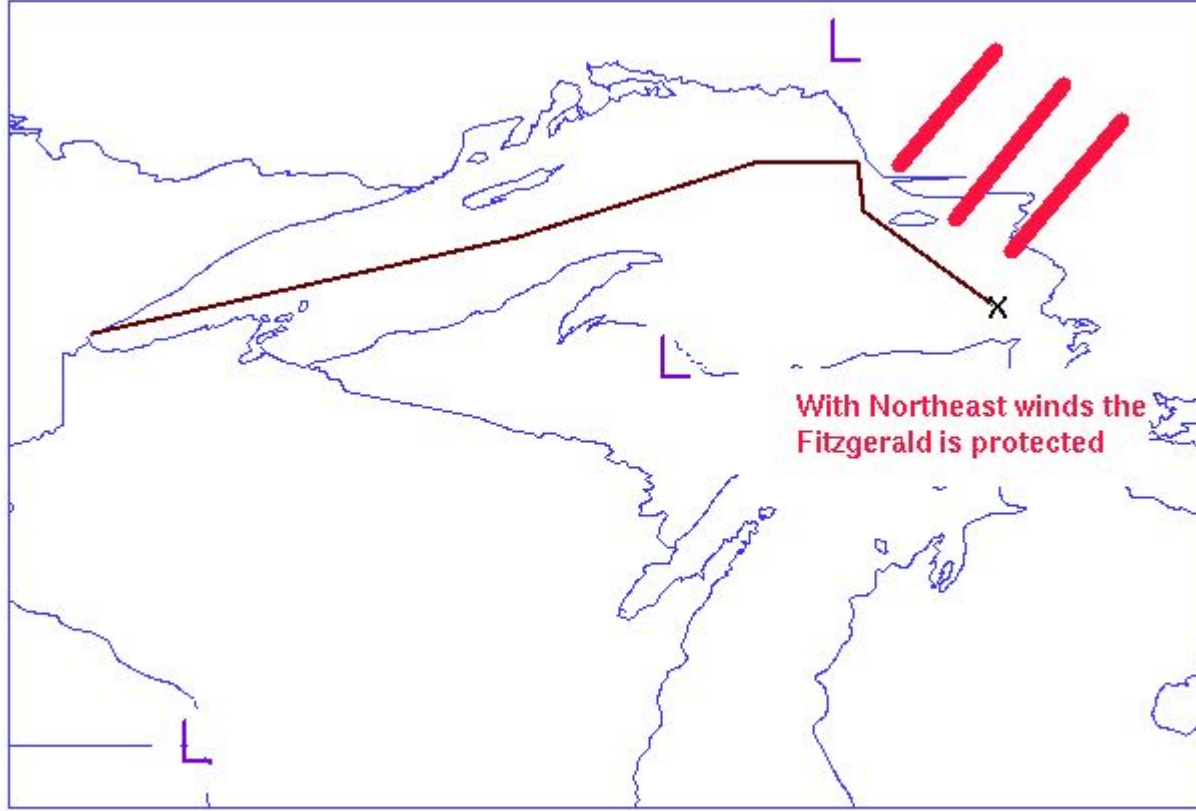


The fetch



The larger the fetch, the larger the waves <sup>28</sup>





The winds came from the northeast. This protected the *Fitzgerald* and the *Anderson* from large waves since it was a smaller fetch.

When the wind shifted to the northwest, the winds had the entire length of Lake Superior to build up waves.

According to the official report, leaky hatchways and the wintertime load line were also contributors to the sinking of the lake freighter.<sup>28</sup>



## Death Toll



All 29 crew members died<sup>28</sup>



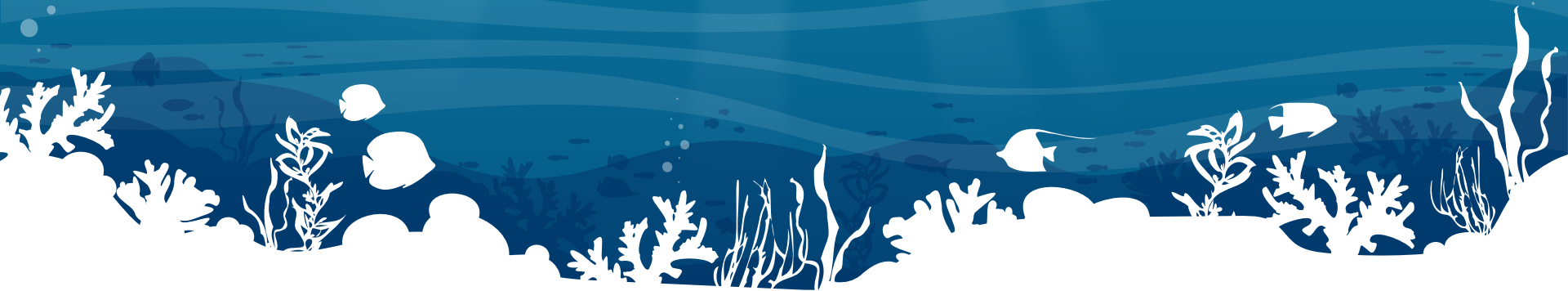
This tragedy was considered the worst shipping disaster on the Great Lakes in 11 years<sup>28</sup>



Gordon Lightfoot's 1976 song "The Wreck of the Edmund Fitzgerald" is a tribute to the ship and the people who were lost<sup>28</sup>






# *HMS Endurance*

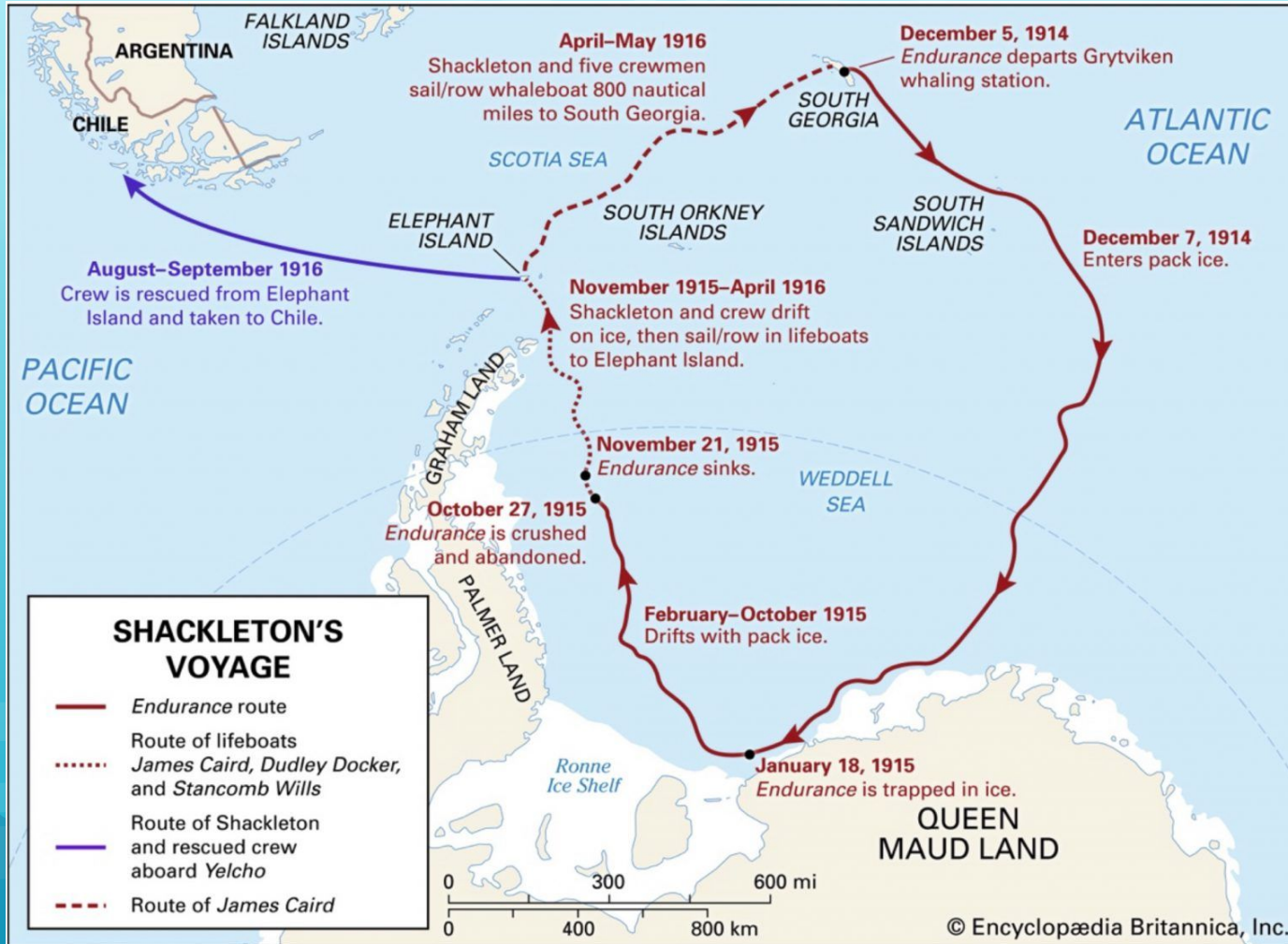
Sunk November 21, 1915 at 5:00 P.M.





## What Happened?

-  Trapped and crushed by sea ice <sup>29</sup>
  -  Extremely slow process
  -  The crew continued to live on the ship until the ice shifted, raised the stern, and tore off the keel and rudder <sup>29</sup>
-  Shackleton's crew survived on the ice for another couple months <sup>29</sup>
-  When the ice broke up beneath them, they traveled by boat to Elephant Island where they lived until they were rescued on April 30, 1916 <sup>29</sup>





## Death Toll



All 27 of Shackleton's men survived

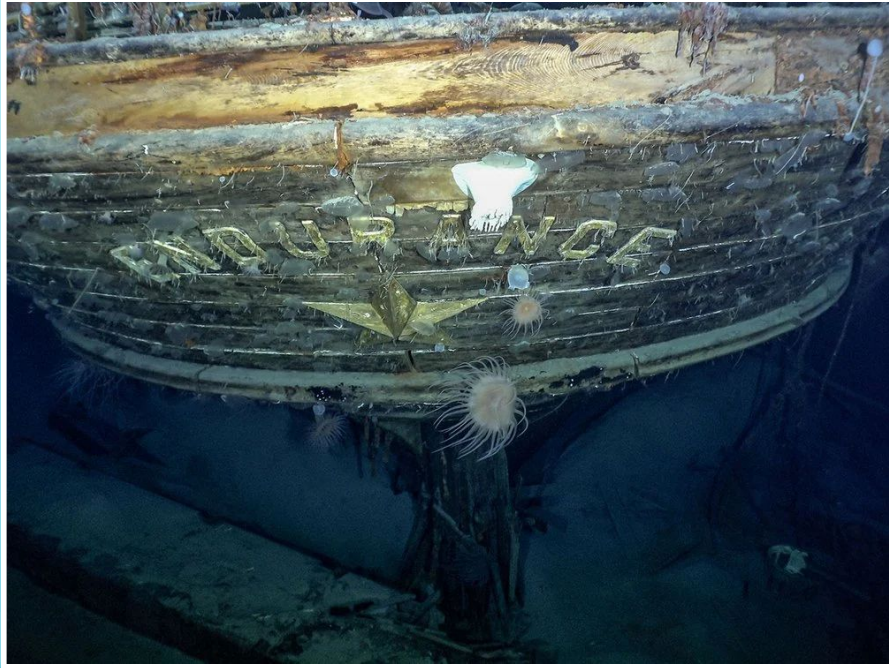


The same cannot be said about the smaller dogs and the cat, Mrs. Chippy



“Some of the younger dogs, too small to pull their weight, were shot, as was, to the chagrin of many, the unfortunate Mrs. Chippy” <sup>29</sup>





**Endurance** was just recently found. The Endurance22 Expedition found the ship on March 9, 2022 (<https://endurance22.org/the-expedition>).



## Why Are Certain Shipwrecks in Such Good Condition?



Colder waters preserve shipwrecks better than warmer waters



Less organisms can withstand the temperatures of the cold, northern or southern waters near the poles<sup>19</sup>



Less organisms to live in the depths (under thermocline)



Less organisms for decomposition



Absence of light<sup>19</sup>



no basis of food chain



Oceans have deep currents that can bring things like sediments and other decomposers past the shipwreck



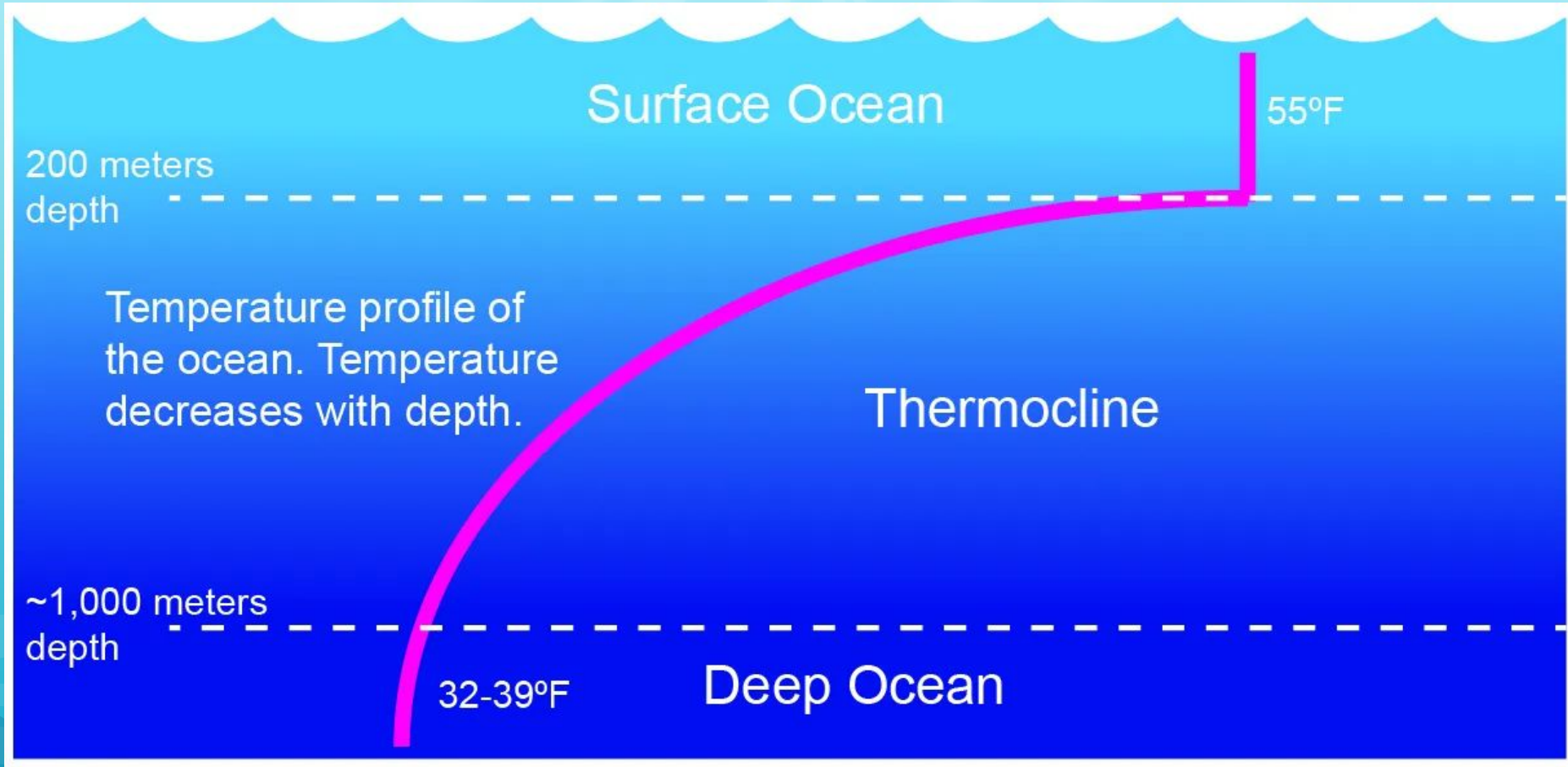
Can scatter wreckage across the sea floor



Lakes have an anoxic zone near the bottom



Not much upwelling from circulation of currents





# DISTANCE SUNLIGHT TRAVELS IN THE OCEAN

sea level



TUNA

## euphotic(sunlight) zone

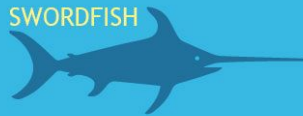
Sunlight rarely penetrates beyond this zone.

200 meters



SHRIMP

SWORDFISH



HATCHET FISH

## dysphotic (twilight) zone

Sunlight decreases rapidly with depth.  
Photosynthesis is not possible here.

1000 meters and deeper

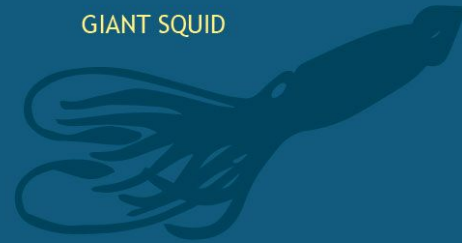
The aphotic zone includes:

- The **bathypelagic** (midnight) zone between 1000-4000 meters.
- The **abyssopelagic** (abyss) zone between 4000-6000 meters.
- The **hadopelagic** (hadal) zone is 6000 meters and deeper.



ANGLER FISH

GIANT SQUID



## aphotic zone

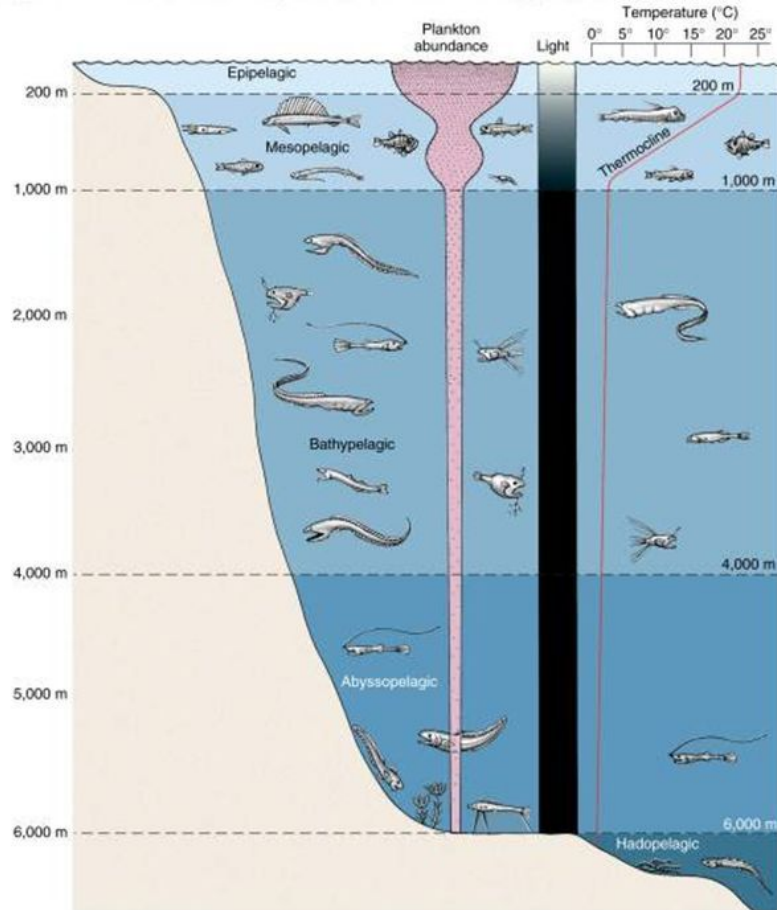
Sunlight does not penetrate.  
This zone is bathed in darkness.



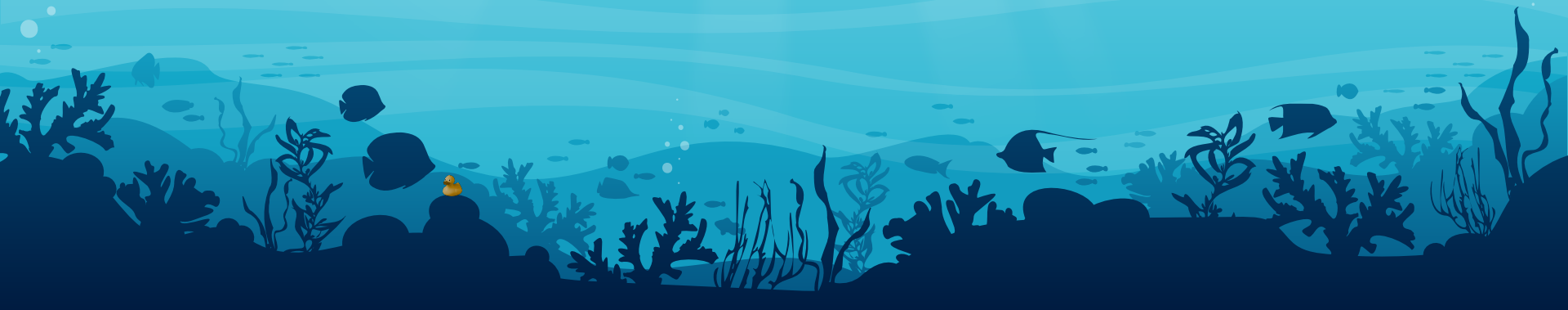
[oceanservice.noaa.gov](http://oceanservice.noaa.gov)



Life in the  
mesopelagic  
and deep sea  
is linked to  
plankton  
and light  
intensity in  
the water.



# Other Things That Happen in the Great Lakes







## Black Friday Storm of 1916

- 🐟 This was a particularly strong storm in Lake Erie
  - 🐟 The steel whaleback, *James B. Colgate*, was capsized by the strong winds and waves <sup>30</sup>
- 🐟 The ship was unable to lower her lifeboats
- 🐟 Three men, including the captain, found a small life raft, but by morning, only the captain was alive <sup>30</sup>
  - 🐟 The whaleback rests upside down, 12 miles southwest of Erieau, Ontario <sup>30</sup>



## Armistice Day Storm of November 11, 1940

-  This storm started as a cold front that eventually turned into a blizzard <sup>31</sup>
-  Many people from the midwestern states were affected <sup>31</sup>
-  154 people, in total, were killed <sup>31</sup>
-  Gales on Lake Michigan caused shipwrecks resulting in 59 deaths of the 154 <sup>31</sup>



## Great Lake Tsunamis



Meteotsunamis are usually driven by air-pressure disturbances <sup>33</sup>



Fast-moving weather events



Severe thunderstorms



Squalls



Waves are amplified by a shallow continental shelf and inlet, bay, or other coastal feature <sup>33</sup>



These are difficult to identify since they are very similar to seiches <sup>33</sup>

## What's The Difference Between a Meteotsunami and a Seiche?

**STORM/READY  
WEATHER**

### SEICHE VS. METEOTSUNAMI

**DURATION IS THE KEY**

#### SEICHE

STRONG WINDS  
PUSH WATER TO  
OTHER SIDE  
OF LAKE.

WATER  
OSCILLATES BACK.

"HIGH" TO "LOW" WATER  
AS LONG AS 4-7 HOURS

#### METEOTSUNAMI

STRONG  
THUNDERSTORMS  
OR WIND CREATED

CREATED IN A  
MATTER OF  
MINUTES

## Are Meteotsunamis Dangerous?



Not really since waves are only about six feet <sup>33</sup>



However, these waves can cause damages <sup>33</sup>



It could also kill people if they are not aware of the meteotsunami



People are also concerned about the number of nuclear power plants along the lakeshores <sup>34</sup>

### Historic Great Lakes Meteotsunamis



# Here's Something Else You should Know

It involves rubber ducks...





## The Great Rubber Ducky Spill





The Friendly Floatees Spill of 1992




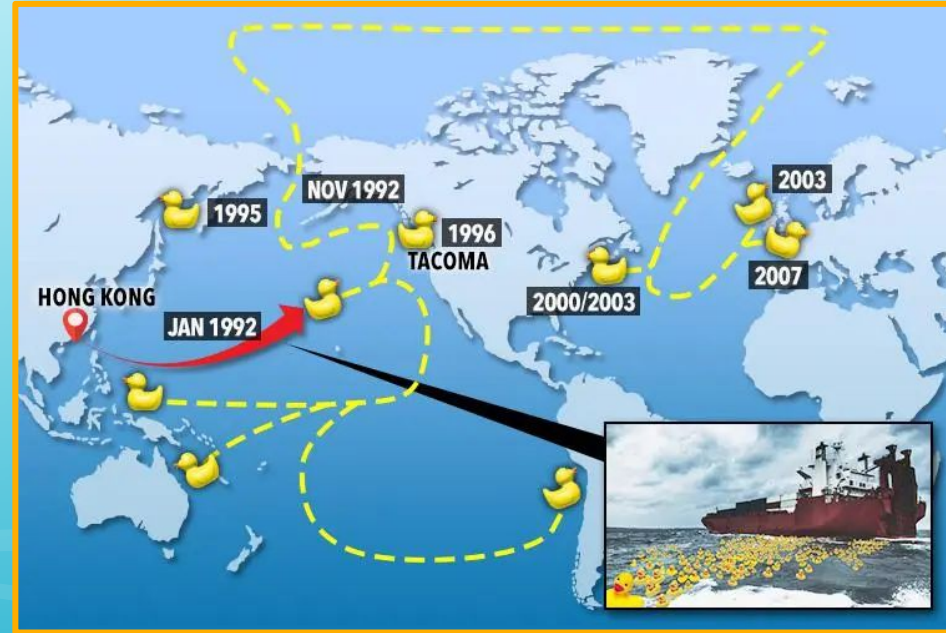
29,000 rubber ducks and other bath toys fell off of a cargo ship

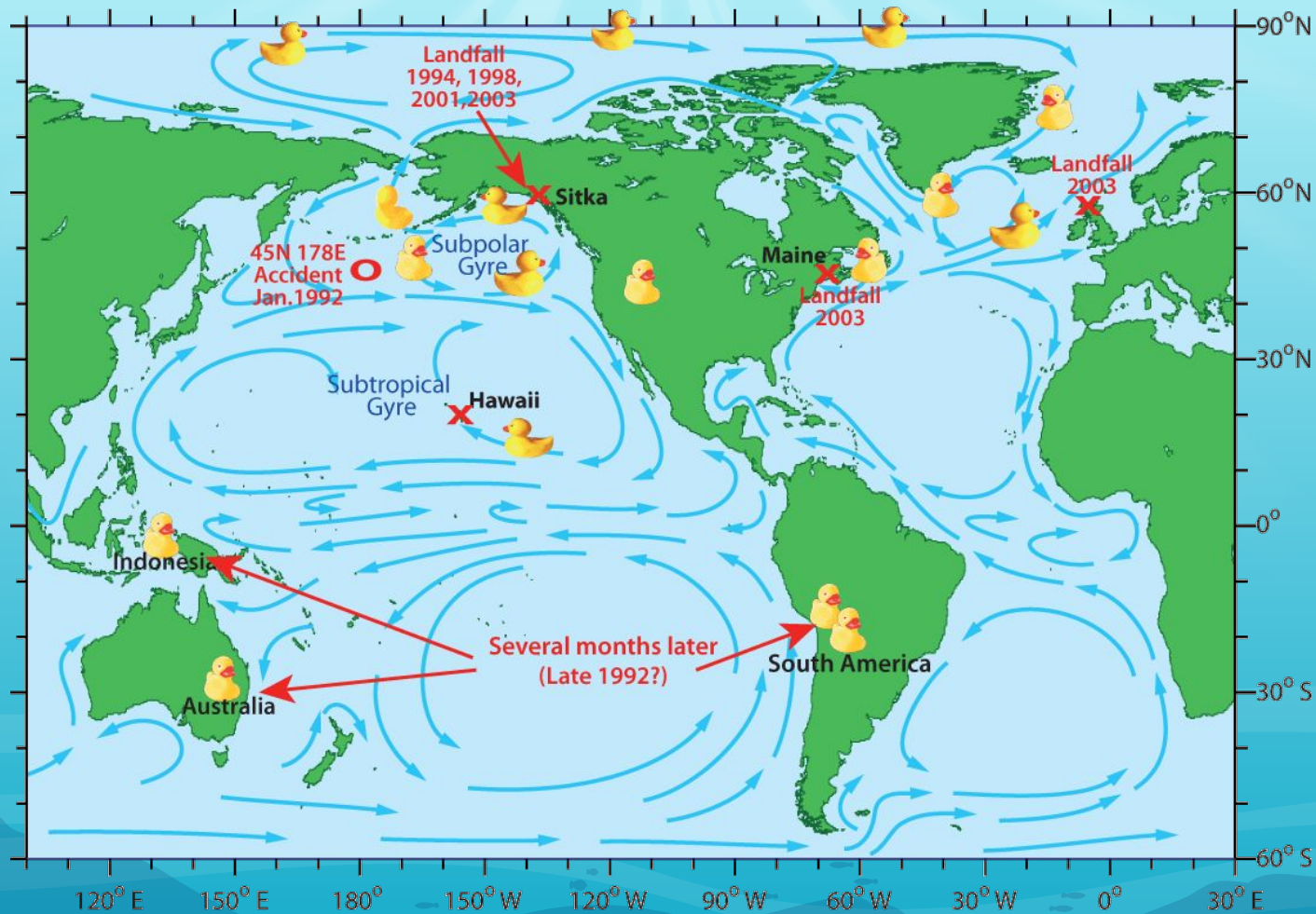
## Friendly Floatees of 1992

 This taught us more about the ocean currents and the Coriolis effect <sup>32</sup>

 Ducks were being found around the world and scientists wanted to know more <sup>32</sup>

 It also taught us that plastic lasts a long time, even in the ocean <sup>32</sup>







**Thanks!**

Any questions?



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