DARK WATER · TEACHER PACK

Episode 4

The Nor'-West Run

Port Hedland, March 1912. The steamer Koombana sails into a severe cyclone with about 150 people aboard and is never seen again. The science is cyclones, ship stability and magnetometer searches.

FOR

Marine and Maritime Studies ATAR Years 11 and 12

RUNNING TIME

13 min 28 sec

INSIDE

Teacher notes, listening guide, a magnetometer survey task, archive images, sources, answers

A PODCAST FROM scitech

Made for listeners 16 and over.

About this episode

On 20 March 1912 the steamer Koombana left Port Hedland for Broome and sailed into a severe cyclone. The Bullarra, following her out, came through the eye and reached Cossack without her funnel. The Koombana disappeared with about 150 people aboard, and apart from scattered wreckage, most of it picked up at sea between 20 and 70 miles from Bedout Island, nothing of her has been found.

The episode explains how a tropical cyclone works, why partly filled ballast tanks make a ship less stable and how a magnetometer searches for steel under sand.

> **BEFORE YOU PLAY IT**
>
> About 150 people were lost and no bodies were recovered. Nothing is graphic. Please preview it before class. Near the end it gives Lifeline's number, 13 11 14.

WHERE IT FITS

COURSE AND UNIT	SYLLABUS CONTENT	IN THE EPISODE
MMS ATAR Year 11, Unit 1	Trip planning. Components of weather, including storms and cyclones	4:45 to 6:52, how a tropical cyclone forms and why the wind drops in the eye
MMS ATAR Year 12, Unit 3	Methods of locating shipwrecks. Historical records, aerial survey, magnetometer, sonar	9:34 to the end, every search from the 1960s to 2021 and how a magnetometer works
Earth and Environmental Science ATAR Year 12, Unit 4	The cause and impact of Earth hazards. The syllabus names tectonic hazards; use the cyclone as a further example.	4:45, a cyclone as a case study of an Earth hazard

References are to the SCSA Marine and Maritime Studies ATAR syllabuses for teaching from 2026 (Year 11) and 2027 (Year 12), and Earth and Environmental Science ATAR Year 12 for teaching from 2026. Check against the version your school is using.

Episode map

Times are from the start of the file. The show sting runs for the first ten seconds.

TIME	SECTION	WHAT HAPPENS
0:10	No funnel	The Bullarra limps into Cossack without her funnel.
1:12	The coast	The Pilbara, its huge tides, the Nor'-West Run, the Koombana herself and the Port Hedland bar.
2:50	20 March 1912	The departure, the cyclone, the wreckage found on 2 April and the disputed number aboard.
4:45	Cyclones	Warm water, rising air, falling pressure, the spin of the Earth and why the wind drops in the eye.
6:52	Stability	Ballast tanks and the free surface effect, explained with a half-full bucket.
7:52	The inquiry	What the court found, what the coast believed, what the loss changed and the cursed pearl legend.
9:34	The search	Every search from the 1960s to 2011.
10:33	Magnetometers	How steel bends the Earth's magnetic field, false hits and the 2021 search that worked backwards from the wreckage.

START HERE

Half-fill a clear container with water and tip it gently from side to side. Ask students what the water does and how it feels in their hands. Come back to it at 6:52.

TAKE IT FURTHER

Students find a recent cyclone that crossed the Pilbara coast on the Bureau of Meteorology website. What warnings were issued, and what did a captain in 1912 have instead? In the episode (3:07), Captain Allen asks the Bullarra's master what he thinks of the weather, and the Port Hedland editor later said Allen told him he didn't like the glass, meaning the barometer. After the loss, the inquiry recommended daily weather telegrams between stations on the north-west coast and storm signals at all ports.

Listening guide

The time next to each question tells you roughly where to find it.

1 1:12 The tide at the northern ports can rise and fall by up to nine metres. Why would that matter to a ship using Port Hedland?

2 1:12 Why would a ship want to sit high in the water to get over the Port Hedland bar?

3 2:50 What was found on 2 April 1912, and where?

4 2:50 Why has the number of people aboard never been settled?

5 4:45 Describe the cycle that keeps a tropical cyclone going. Start with warm sea water.

6 4:45 Why does the wind drop in the eye, and where are the strongest winds?

7 6:52 Explain the free surface effect using the half-full bucket.

8 7:52 What did the Court of Marine Inquiry find, and what did people on the coast believe instead?

9 9:34 List the search methods the episode names from 1985 to 2011.

10 10:33 How does a magnetometer detect a steel wreck, and why do so many hits turn out not to be the ship?

Find the bump

A magnetometer measures the strength of the Earth's magnetic field as it is towed or flown along a line. Steel makes the number jump, and so does rock with iron in it.

The table shows readings from six survey lines, A to F, 200 metres apart. Readings were taken at 12 stations along each line, also 200 metres apart. Each number is how far the field is above the normal background, in nanotesla. **The readings are made up for this exercise.**

	STATION											
LINE	1	2	3	4	5	6	7	8	9	10	11	12
A	24	22	19	14	8	4	2	1	2	1	0	1
B	26	25	21	15	9	5	3	2	1	2	1	0
C	25	23	20	16	9	6	4	18	3	1	1	2
D	23	22	18	13	8	5	21	64	27	2	1	1
E	21	20	17	12	7	4	6	30	9	1	2	1
F	20	19	15	11	6	3	2	3	2	1	0	1

1 Shade every reading above 15 nT. Describe the two areas you find, giving lines and stations.

2 One of the areas is probably a wreck and the other is probably geology. Which is which? Give two reasons based on size and shape.

3 Roughly how big is the wreck-like target, in metres? Could it still be a ship? Explain.

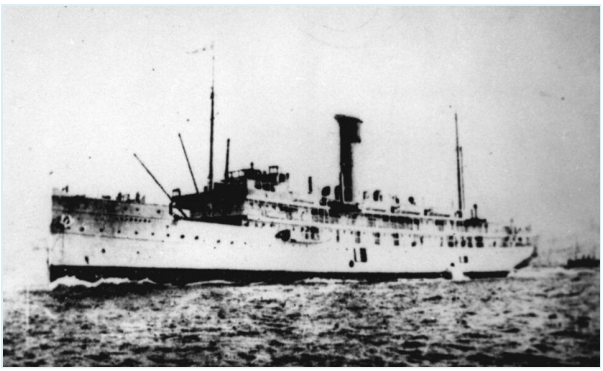
4 The search team can send a diver or a camera to one target. What would you want to know before spending the money?

WORKING BACKWARDS

The Koombana's wreckage had been adrift for up to 13 days when it was found. Suppose wind and current moved it at an average of 0.4 knots in a steady direction. How far had it drifted, in nautical miles and in kilometres? Why does the real calculation give a box and not a point?

From the archive

These are records from the time or close to it. Each was made by someone with their own reasons, so treat them as sources.



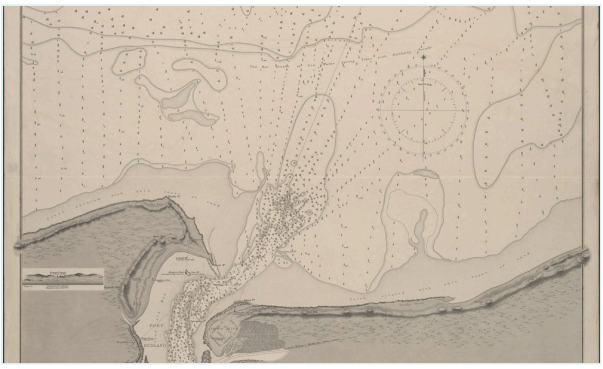
The Koombana at sea

BEFORE 1912

The Adelaide Steamship Company's steamer, built for the Nor'-West Run.

Koombana (ship). John Oxley Library, State Library of Queensland. Public domain.

Look at how high she sits in the water. Why was that useful at Port Hedland?



Admiralty chart of Port Hedland

SURVEYED 1896, PUBLISHED 1897

A note across the bar reads "The Bar breaks at Low Water Spring Tides with Northerly winds".

Detail. Admiralty Chart 1437, Port Hedland, 1897. National Library of Australia. Public domain.

Find the bar. Why did ships have to time their arrival to the tide?



Cossack and Butchers Inlet

ABOUT 1900

The port where the Bullarra came in after the cyclone, missing her funnel.

Cossack from the hill above the cemetery, c.1900. Item 136, The H.M. Wilson Archives. Public domain.

The Bullarra came through. What does her damage tell you about what the Koombana faced?

Sources

Start with the WA Museum's Koombana page.

WA Museum. SS Koombana, 1912
visit.museum.wa.gov.au/koombana-1912
The ship, the departure, the Bullarra, the ballast tanks, the inquiry and every search to 2021. Use the search list as a timeline.

Hedland Advocate, 6 April 1912. Koombana foundered
trove.nla.gov.au/newspaper/article/251351832
The local paper's report two weeks after the storm, with the weather log taken in Hedland, the wreckage found and the theories of the time. It gives about 140 aboard.

West Australian, 11 May 1912. Koombana inquiry
trove.nla.gov.au/newspaper/article/23872152
The Court of Marine Inquiry's finding. It gives her size and load, the stability tests, 76 passengers and 74 crew, where the wreckage was picked up and the court's call for daily weather telegrams and storm signals.

Koombana Days online. Chapter 13, The Ill-Fated Complement
koombanadays.com/ch13/idx/kd13fq1.html
How the Adelaide Steamship Company rebuilt its list of the missing, because the only complete record went down with the ship.

Bureau of Meteorology. Tropical cyclones affecting Port Hedland
www.bom.gov.au/cyclone/history/wa/pthed.shtml
The Bureau's history of Port Hedland cyclones, starting with 1912. Also covers storm surge and storm tide.

Bureau of Meteorology. What is a tropical cyclone?
www.bom.gov.au/resources/learn-and-explore/tropical-cyclone-knowledge-centre/what-is-a-tropical-cyclone
How cyclones form and what happens in the eye. Use it to check the episode's explanation.

NOAA Ocean Exploration. Magnetometer
oceanexplorer.noaa.gov/technology/magnetometer
A short explainer on how magnetometers find wrecks, including buried ones.

WHERE THE SOURCES DISAGREE

They make a good exercise in reading sources.

- The number aboard varies a lot. The Hedland Advocate said about 140 at the time, the Bureau of Meteorology says about 140, the inquiry counted 150 and the WA Museum gives about 157.
- The episode says the wreckage drifted for thirteen days. The Bureau says the cyclone crossed the coast on 22 March, so if she sank in the storm's last days it could have been closer to eleven.
- The court's finding and the Hedland Advocate, both listed above, have the Koombana leaving Port Hedland first, as the episode says. The court puts the Bullarra about half an hour behind and the Advocate about an hour. One secondary source, the Australian Institute for Disaster Resilience, has the Bullarra sailing ahead.

Answers

Suggested answers. Accept anything that shows the same understanding.

LISTENING GUIDE

1. The depth in the harbour changes hugely, so ships have to time their arrivals and departures to the tide. At low tide a berth can be dry.
2. Sitting high means less hull below the waterline, so she is less likely to ground on the sandbar across the harbour mouth.
3. A cabin door about 25 nautical miles north of Bedout Island, and, from a different ship, a cushion and boards from one of her boats, much further west.
4. There was no complete passenger list. The only full record was lost with the ship, so the Adelaide Steamship Company rebuilt its list from the memories of clerks, passengers who got off and relatives. The totals differ: the episode gives 150 from the inquiry, about 140 from the Hedland Advocate and 157 from the WA Museum.
5. Warm water evaporates. Warm wet air rises and cools, the vapour condenses into cloud and releases heat, so the air rises harder. Pressure at the surface drops and more warm wet air is drawn in. The Earth's spin curls the incoming air.
6. In the eye the air sinks, so the wind drops. The sea isn't calm, though: waves pile in from every direction. The strongest winds are in the eyewall right beside it.
7. When the ship rolls, water in a half-full tank runs to the low side, adds weight there and pushes the roll further. A full tank has nowhere for the water to go.
8. The court found the cyclone was the only cause and cleared the ship and Captain Allen. People on the coast believed her ballast tanks were only partly filled to get her over the bar.
9. An RAAF aerial magnetometer in 1985, a towed magnetometer in 1987, the NOAA Project Magnet flight in 1988, a WA Museum remotely operated vehicle in 1989 and Fugro's side-scan sonar and multibeam in 2011.
10. Steel is magnetic and bends the Earth's field, so the reading jumps over it. Iron-rich rock, wellheads and other steel also make the reading jump, and every hit has to be checked.

TASK

1. One area runs along the start of every line, stations 1 to 3 (1 to 2 on line F, and station 4 on line C). The other is a small cluster around line D, station 8, taking in C8, D7, D8, D9 and E8.
2. The cluster is small and peaks sharply at 64 nT, like one steel object. The other area is weaker and spreads across every line, like rock.
3. About three stations by three lines, so roughly 400 to 600 metres across. The disturbance in the field spreads wider than the object causing it, so yes, a target this size could still be a ship.
4. Open. For example how strong the anomaly is compared with what a 104-metre steel ship should give, whether it sits inside the drift box and whether there are known wellheads, pipelines or iron-rich rock nearby.

WORKING BACKWARDS

13 days × 24 hours × 0.4 knots = 124.8 nautical miles, about 231 km. The wind and current are only known roughly and the errors add up each hour, so the result is an area.