DARK WATER · TEACHER PACK

Episode 5

Find the Raider First

The Indian Ocean, 1941 and 2008. HMAS Sydney and the raider Kormoran sink each other off WA. 66 years later a search team finds both, 2.5 kilometres down.

FOR
Marine and Maritime Studies ATAR Years 11 and 12

RUNNING TIME
13 min 23 sec

INSIDE
Teacher notes, listening guide, a sonar task, archive images, sources, answers

A PODCAST FROM scitech

Made for listeners 16 and over.

About this episode

On 19 November 1941 HMAS Sydney and the German raider Kormoran sank each other off the WA coast. All 645 men on Sydney were lost. Most of Kormoran's crew survived, and for 66 years theirs was the only account of what happened.

In 2008 the Finding Sydney Foundation and shipwreck hunter David Mearns found Kormoran first, then Sydney about 12 nautical miles away. The episode explains drift modelling and side-scan sonar, and a separate study of the German survivors' memories that landed close but whose part in the final search is still argued about.

BEFORE YOU PLAY IT

This is a war story with 645 Australian and about 80 German dead, and the wrecks are a war grave. Families of both crews are alive today and some students may have a connection. The episode mentions the conspiracy theories but doesn't repeat them. 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 12, Unit 3	Methods of locating shipwrecks. Historical records, sonar	3:12 to 10:30
MMS ATAR Year 11, Unit 1	Oceanography. Velocity of sound in seawater	The task on page 5

References are to the SCSA Marine and Maritime Studies ATAR syllabuses for teaching from 2026 (Year 11) and 2027 (Year 12). 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	16 March 2008	A shape comes up on Geosounder's sonar screen.
1:12	1941	Where the wrecks are and the battle as the German survivors told it.
3:12	The search begins	Rumours, the parliamentary inquiry, the Finding Sydney Foundation and David Mearns.
5:15	Drift and memory	Running a life raft's drift backwards and the UWA work on the German accounts.
7:28	Side-scan sonar	How echoes and acoustic shadows draw the seabed.
8:51	Found	Kormoran on 12 March, a rock field first taken for the battle site, Sydney on 16 March.
10:30	What the evidence settled	The 2009 Cole inquiry, Captain Burnett and the conspiracy theories.
12:06	Where they lie	The two wrecks as a war grave.

START HERE

Ask the class what time their last school assembly finished, without checking. Plot the answers on the board. Nobody will be exactly right, but the spread will sit around the real time. Come back to it at 7:00.

TAKE IT FURTHER

The National Archives of Australia holds the HMAS Sydney records. Students pick one document and say what it adds to, or leaves out of, the episode's account.

Listening guide

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

1 1:12 How deep is the water where the wrecks lie?

2 1:12 Sydney came in close to Kormoran. Why did that favour the disguised raider?

3 1:12 How many men were on each ship, and how many survived from each?

4 3:12 Why did Mearns decide to look for Kormoran first?

5 5:15 How does drift modelling work, and why does it give a patch of ocean and not a point?

6 5:15 Why would psychologists study a shipwreck? How close did they say their estimate came?

7 7:28 How does side-scan sonar tell steel from mud? What is an acoustic shadow?

8 8:51 Which was found first, Sydney or Kormoran? Give their dates and depths. What did the team think the hard shapes about four nautical miles south of Kormoran were, and what did the cameras show?

9 10:30 What did the 2009 inquiry find about the conspiracy theories? Why doesn't the episode repeat them?

10 12:06 Why are the wrecks treated as a war grave?

Listening for steel

Light doesn't reach 2.5 km down, but sound does. An echo sounder sends a pulse straight down from the ship and times the echo. (The side-scan sonar in the episode was towed near the seabed and worked differently.)

1,500 m/s
approximate speed of sound in seawater

1.852 km
one nautical mile

PART A. ECHO TIMES

The time for an echo is the distance down and back, divided by the speed of sound.

TARGET	DEPTH (M)	ECHO TIME (S)
HMAS Sydney	2,468	
HSK Kormoran	2,560	
Rocks taken for the battle site	2,740	

1 Fill in the echo times. Show one calculation in full.

2 Sound travels about 343 m/s in air. How long would the same echo from Sydney take in air, and why is sonar used underwater instead of radar or light?

PART B. DISTANCES

1 Kirsner says the memory work came within about 3 nautical miles of Kormoran. Convert that to kilometres.

2 Sydney was about 12 nautical miles from Kormoran. How far is that in kilometres?

PART C. READING A SHADOW

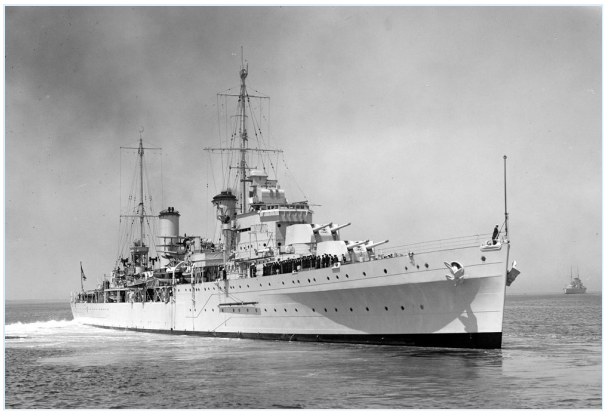
A towed sonar is 40 metres above a flat seabed. An object on the seabed 200 metres away, measured along the seabed, throws an acoustic shadow 60 metres long. By similar triangles, the object's height is the sonar's height multiplied by the shadow length, divided by the distance to the end of the shadow. **These numbers are made up for the exercise.**

SKETCH THE TRIANGLES

1 How tall is the object? Show your working.

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.



HMAS Sydney

1936

The light cruiser five years before she was lost.

Allan C. Green, 1936. State Library Victoria, H91.108/1019. Public domain.

Sydney was built to fight at long range. Why did coming in close cancel that out?



The raider Kormoran

1940 OR 1941

Photographed at sea from a German U-boat.

Bundesarchiv, Bild 146-1985-074-27 / CC-BY-SA 3.0.

Kormoran was a merchant ship with hidden guns. What here would make her look harmless?



The Carley float

RECOVERED NOVEMBER 1941, PHOTOGRAPHED 1959

A Carley float is a kind of life raft. This one is damaged by shellfire, and the 2009 inquiry found it came from Sydney. It is at the Australian War Memorial.

Australian War Memorial, 135152. Public domain.

This and a lifebelt were the only trace found at the time. Why would so little evidence lead to so many theories?

Sources

These sources are all free online. The National Archives guide is long, so point stronger students at it.

National Archives of Australia. The sinking of HMAS Sydney
naa.gov.au/help-your-research/fact-sheets/sinking-hmas-sydney
Lists the record series students can search, including interrogations of Kormoran survivors.

National Archives of Australia. The sinking of HMAS Sydney, a guide to Commonwealth Government records
naa.gov.au/help-your-research/research-guides/sinking-hmas-sydney-guide-commonwealth-government-records
What records exist and what the two inquiries found. Good for source evaluation.

Australian War Memorial. The Sydney Kormoran action
awm.gov.au/articles/encyclopedia/hmas_sydney/action
An account of the battle with the range, the losses and the depths of both wrecks.

Finding Sydney Foundation. Search diary, Kormoran found
sydneymemorial.com/diary/20080315-hsk-kormoran-discovered-report.htm
David Mearns's own report from the search ship on finding Kormoran.

Finding Sydney Foundation. Search diary, HMAS Sydney found
sydneymemorial.com/diary/20080316-hmas-sydney-ii-discovered.htm
The joint statement from Mearns and the navy's observer on finding Sydney, with Glenys McDonald's account from on board.

Finding Sydney Foundation. Search diary, 6 April 2008 report
sydneymemorial.com/diary/20080406-report.htm
Mearns on the camera dive that showed the "battle site" in the two reports above was a field of large rocks.

Kim Kirsner. Target definition for shipwreck hunting (2015)
doi.org/10.3389/fpsyg.2015.01615
Kirsner's own paper on the memory work. It puts the estimate 2.7 nautical miles from Kormoran, and gives his side of how the search box was chosen.

Parliament of Australia. The loss of HMAS Sydney (1999)
aph.gov.au/Parliamentary_Business/Committees/Joint/Completed_Inquiries/jfadt/sydney/reportinx
The parliamentary report written before the wrecks were found. Compare what it could conclude with the 2009 inquiry.

NOAA Ocean Exploration. Side-scan sonar
oceanexplorer.noaa.gov/technology/sonar-side-scan
How side-scan sonar works and why it can't measure depth on its own.

WHERE THE SOURCES DISAGREE

They make a good exercise in reading sources.

- Kormoran's crew is given as 393, 397 or 399 depending on the source, and the number rescued as anywhere from 314 to 318.
- Estimates of how close Sydney came range from under 1,000 metres to about a nautical mile. The AWM says 1,500 metres.
- Most official accounts say 11.03 am for the find and one search team account says 10.03. That is most likely daylight saving: Western Australia was in a trial from December 2006 to March 2009, so 11.03 am is 10.03 am standard time.
- The Australian War Memorial's record for the Carley float says Sydney was found on 17 March. The search team's diary says 16 March.

Answers

Suggested answers. Accept anything that shows the same understanding.

LISTENING GUIDE

1. About two and a half kilometres. Sydney is at 2,468 metres.
2. A warship's advantage is heavy guns at long range. Up close, the raider's hidden guns and torpedoes could hit hard and most of that advantage was gone. The episode says about a kilometre and a half.
3. Sydney had 645 men and none survived. Kormoran had 397 and about 317 survived.
4. Nobody from Sydney survived to say where she sank, but hundreds of Germans survived and described Kormoran's position. Find Kormoran and Sydney should be close by.
5. Start from where and when a Kormoran life raft was found, use weather and ocean records for the wind and current each hour, and run the drift backwards. Each hour adds a little error, so the answer is an area.
6. The German accounts didn't agree. Memory drifts each time it is recalled, but independent witnesses drift in different directions, so weighting the accounts finds the centre. Kirsner says it came within about three nautical miles. How much the final search used it is disputed.
7. Hard steel sends back a strong echo and soft mud a weak one. Anything standing up blocks the sound behind it and leaves a dark strip, the acoustic shadow, which shows it has height.
8. Kormoran was found first. Kormoran on 12 March 2008 at 2,560 metres. Sydney on 16 March 2008 at 2,468 metres. The hard shapes at 2,740 metres were taken for the battle site, but when the cameras went down three and a half weeks later they were a field of big rocks.
9. "... none were found to have any substance whatsoever" (Terence Cole, statement on releasing the report, 12 August 2009). Repeating a rumour is most of how it stays alive.
10. They lie where Sydney's men and about 80 Germans died. One of Sydney's sailors, Thomas Welsby Clark, was recovered and now lies in Geraldton. Families of both crews are alive today.

TASK

PART A

1. Sydney 2 × 2,468 ÷ 1,500 = 3.29 s. Kormoran 2 × 2,560 ÷ 1,500 = 3.41 s. Rocks 2 × 2,740 ÷ 1,500 = 3.65 s.
2. 2 × 2,468 ÷ 343 = about 14.4 s. Light and radio waves are absorbed within a short distance in seawater, but sound carries for kilometres.

PART B

1. 3 × 1.852 = about 5.6 km.
2. 12 × 1.852 = about 22.2 km.

PART C

1. 40 × 60 ÷ (200 + 60) = about 9.2 metres.