Pedagogical sequence associated with the box

« The Sea Turtle Mission: A Journey of Protection and Discovery »

Theme: **Water (monitoring of natural resources)**

Ages: **(8-10 / 10/12)**

Duration: **4 sessions of 45–50 minutes each**

Storyline overview: **Miguel and Isabel travel across the Mediterranean with their father, Antonio, a marine biologist. Their journey soon turns into a mission to protect the marine environment. Near Valencia, they encounter an oil spill and work alongside rescue teams to estimate its size and plan a clean-up. Later, they rescue a sea turtle named Luna, who is released with a GPS tracker. By following Luna's signals, they trace her journey across the Mediterranean. The mission concludes in Zakynthos, where they support volunteers in cleaning key areas and protecting turtle nests.**

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Session n°1 – « Oil Spill: Exploring and Estimating the Spill»

This lesson focuses on…

Engaging pupils in estimating the surface of an oil spill by working with irregular zones and geometric shapes. Pupils calculate and record surface values to understand how large the spill is. The surface estimations produced in this session will be used in the following lesson to represent the thickness of the spill and plan the clean-up.

At the end of this lesson, pupils should be able to:

- Estimate the surface area of irregular shapes using geometric pieces.
- Work collaboratively in groups, compare strategies, and explain their reasoning.
- Recognise how surface estimations help describe an environmental problem and prepare for further work.

Aims of the lesson

- To connect mathematics with a real environmental situation.

Historical context of the concept or/and Real-life connection:

Oil spills are among the most harmful forms of marine pollution, affecting both ecosystems and coastal communities. In real situations, scientists begin by estimating the extent of a spill in order to understand how large the affected area is. This lesson reflects that initial step, showing how surface estimation is used to describe an environmental problem.

LESSON PREPARATION

Prior knowledge and skills:

For this lesson, pupils should already be able to:

Level 1 (ages 8–10)

- Recognise basic shapes (squares, right triangles).

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- Understand area as "how much space a shape covers" and recognise the square metre (m^2) as the basic unit of measurement.
- Perform simple addition and multiplication with small numbers.
- Count forward in steps of 25 (25, 50, 75, 100…).
- Work cooperatively in small groups, record observations, and share simple ideas with peers.

Level 2 (ages 10–12)

- Apply the above skills with larger numbers and greater precision (including multiples of 225, and rounding where needed).
- Record reasoning more clearly and explain strategies to peers.

Materials (per group)

- **Printed image of the oil spill** with three zones (dark, blue, grey), assembled from four A4 sheets.
- **Cardboard geometric pieces printed on 250 g/m^2 paper** (squares and right triangles with marked surface values):
    - **Level 1 (ages 8–10):** 35 squares = 25 m^2, 30 right triangles = 12.5 m^2
    - **Level 2 (ages 10–12):** 35 squares = 225 m^2, 30 right triangles = 112.5 m^2
- **Printed Isabel's tools: Surfaces**! (differentiated per level)
- **Printed Mission sheet** (Step 1 : Surface estimates) for recording estimates and ideas.
- Paper, pencils, erasers. (differentiated per level)
- Calculator (optional)

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INSTRUCTIONS FOR THE LESSON

Level 1 and 2	Introduction to the subject
8 – 10 years old **10 – 12 years old**	The session begins with the narration of **Chapter 1**, where pupils follow Miguel and Isabel and step into the role of young explorers. A short compass-and-map warm-up introduces pupils to the story context and helps them get ready for the mission. The narration then continues with **Chapter 2**, where the oil spill near Valencia is introduced. Through the story, pupils learn about the situation and are invited to help the heroes understand **how large the affected area is**. When the characters receive their **Mission Pack**, pupils receive the first **Mission Sheet** and begin working on the first challenge. At the same time, the teacher distributes the necessary materials to support the activity. <u>Specific vocabulary introduced with simple definitions:</u> • **Surface area** – how much space something covers. • **Estimate** – an approximate calculation or careful guess. • **Oil spill** – when oil accidentally leaks into the sea.

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Level 1	Activities
8 – 10 years old	What the teacher says/does: • Distributes to each group: ▪ the printed image of the oil spill, ▪ the geometric pieces (squares and triangles), ▪ and Isabel's tools: Surfaces. • Invites pupils to look carefully at the geometric pieces, turning them over if needed, and asks guiding questions such as: **"What is written on each side of the pieces?"** **"What are we trying to estimate right now?"** **"Which side of the pieces do you think will help us talk about surface?"** • Allows groups a short moment to discuss and decide which side of the pieces they will use for this task. • Invites each group to place the geometric pieces inside the spill area and estimate its surface, using the side they have chosen. **Note:** Pupils aim to cover most of the spill area using the geometric pieces. As groups try to fit the shapes to the spill, **overlapping may occur**. Use this moment to support discussion by inviting pupils to think about **how much surface is overlapped** and **how they could compensate by leaving a similar area uncovered elsewhere**, so that the same surface is not counted twice. The goal is for pupils to reach an estimation that is **as close as possible to the actual surface through**

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	their own reasoning, not through exact measurement. • Encourages pupils to discuss their ideas within their groups and record their estimations and reflections in the Mission Sheet. <u>What the pupils do:</u> • Estimate surface areas with geometric pieces. • Discuss different ways of covering the spill area and make decisions as a group. • Record their estimations and ideas in the Mission Sheet through group discussion.

Level 2	Activities
10 – 12 years old	The activity follows the same steps as for ages 8–10. **<u>Differentiation:</u>** • Pupils work with larger geometric values (squares = 225 m^2, triangles = 112.5 m^2), requiring them to handle larger numbers. • They are expected to record their reasoning more precisely in the Mission Sheet, with clearer justification of their choices.

Conclusion Level 1 8-10 years old	Invites groups to share their results and ideas from the Mission Sheet. Through a short whole-class discussion, pupils explain how they estimated the surface of the oil spill and justified their choices. The teacher briefly highlights that, in real situations, scientists often begin by estimating the size of a problem using available information and by explaining their reasoning before taking further action. The session closes by reinforcing

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	collaboration and highlighting the real-life relevance of pupils' mathematical thinking.
Conclusion Level 2 10-12 years old	The conclusion follows the same process as Level 1. Pupils are expected to explain their surface estimations more precisely and justify their choices using clearer mathematical reasoning. The teacher briefly highlights how, in real situations, scientists rely on estimation and well-explained reasoning to understand the scale of a problem before deciding on next steps.
To go further…	**Level 1 (ages 8–10):** • Pupils could draw a 25 m^2 square in the schoolyard (5 m × 5 m). This helps them visualise the size of one "model square" used in the activity and better understand the scale of the oil spill. Then, they can compare: "How many classrooms or playground squares would fit into the oil spill zones?" to realise how large the spill really is. **Level 2 (ages 10–12):** • Pupils could measure a 225 m^2 square (15 m × 15 m) in the schoolyard and then compare it with familiar large surfaces (e.g., approximately half a basketball court (~210 m^2) or about 5–6 standard classrooms). This helps them better grasp the scale of the oil spill zones.

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Indicative solutions:

Step 1: Surface estimates

The responses are indicative and may vary depending on pupils' choices, strategies, and ways of reasoning. There is no single correct answer to the Mission Sheet questions. Answers are considered valid when they are clearly reasoned and justified.

Level 1 (ages 8–10):

- Dark zone: 4 triangles = 2 squares = 50 m²
- Blue zone: 7 squares + 10 triangles = 175 + 125 = **300 m²**
- Grey zone: 22 squares + 12 triangles = 550 + 150 = **700 m²**

Total surface: 1000 m²

Level 2 (ages 10–12):

- Dark zone: 4 triangles = 2 squares = 450 m²
- Blue zone: 7 squares + 10 triangles = 1575 + 1125 = **2700 m²**
- Grey zone: 22 squares + 12 triangles = 4950 + 1350 = **6300 m²**

Total surface: 9000 m²

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Session n°2 – « Oil Spill: From Surface to Volume and Clean-up Planning»

This lesson focuses on…

Building on the surface estimation from the previous session, pupils explore how thickness influences the quantity of oil and how this information supports clean-up decisions.

At the end of this lesson, pupils should be able to:

- Use a layered model to compare thicker and thinner zones of the oil spill.
- Estimate the amount of oil:

  Level 1 (ages 8–10):

  Estimate the amount of oil using litres as a familiar unit, understanding that oil is not only spread on the surface but also has depth.

  Level 2 (ages 10–12):

  Estimate the volume of oil by combining surface and real thickness values, expressing results in cubic metres.
- Design and justify a plan of action while considering real-life constraints (time, team capacity, limits per zone).
- Work collaboratively in groups, compare strategies, and explain their reasoning.
- Reflect on how mathematics can support environmental problem-solving.

Aims of the lesson

- To show how mathematics can help make decisions in a real environmental issue.
- To help pupils explore how surface and thickness together affect the amount of oil.
- To show how mathematical information can be used to plan actions to protect the sea.

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Historical context of the concept or/and Real-life connection:

After the affected area of an oil spill is estimated, scientists and response teams need to determine how much oil is actually present. This requires taking into account differences in thickness across zones. Such information is crucial for planning effective actions and prioritising clean-up efforts. This lesson reflects that stage of the process, showing how combining surface and thickness helps describe the amount of oil and supports environmental decision-making.

LESSON PREPARATION

Prior knowledge and skills:

This session builds directly on Session 1 and uses the same prior knowledge and skills.

Materials (per group)

- Printed image of the oil spill with three zones (dark, blue, grey), assembled from four A4 sheets (same image as in Session 1).
- **Cardboard geometric pieces printed on 250 g/m² paper** (squares and right triangles), reused from Session 1 and supplemented as needed to allow layering:
    - **Level 1 (ages 8–10):** 70 squares (the reverse side indicates quantities in litres; used in this session to estimate the amount of oil through layering), 30 right triangles = 12.5 m²
    - **Level 2 (ages 10–12):** 70 squares = 225 m², 30 right triangles = 112.5 m²
- Printed **Isabel's tools: Volumes!** (differentiated per level)
- Printed **Mission sheets** (Step 2: Volume estimates / Step 3: Planning the clean-up) for recording estimates and ideas. (differentiated per level)
- Printed **"Rescue Teams Boats".** (differentiated per level)
- Paper, pencils, erasers.
- Calculator (optional)

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INSTRUCTIONS FOR THE LESSON

Level 1 and 2	Introduction to the subject
8 – 10 years old **10 – 12 years old**	The lesson builds directly on Session 1. Pupils briefly recall the oil spill near Valencia and the surface estimations they produced in the previous session. In this stage, pupils are invited to help the heroes take the next step of the mission: understanding that oil is not only spread on the surface, but also has depth, and that this information is essential for planning the clean-up. Using the same visual material and the Mission Sheets, pupils explore how different zones of the spill have different thicknesses. • **For ages 8–10**, thickness is explored through layered representations linked to quantities in **litres**, a familiar and meaningful unit. • **For ages 10–12**, pupils combine surface and real thickness values to estimate volume, expressing their results in **cubic metres (m^3)**. The focus of this session is on combining information (surface and thickness) and using mathematical reasoning to support decision-making in a real environmental situation. <u>Specific vocabulary introduced with simple definitions:</u> • **Thickness** – the depth of a layer. • **Volume** – how much space something takes up

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	(capacity) • **Cleanup team** – people who remove the oil to protect the environment.

PUTTING IT INTO PRACTICE

Level 1	Activities
8 – 10 years old	What the teacher says/does: • Asks pupils to bring back the oil spill image and square tiles used in Session 1. • Invites groups to quickly reconstruct the surface of the oil spill, using their Mission Sheet from Session 1 if they wish. • Provides additional square tiles, inviting pupils to think about how they can represent the same surface using only squares. • Encourages pupils to discuss and decide how to rebuild the surface using only squares, using guiding questions such as: **"If we want to use only squares, what could we do with the triangles?"** **"What happens to the surface if we replace two triangles with one square?"** Leads pupils to notice that **two triangles can be replaced with one square without changing the total surface area.** • Clarifies that, even if the pieces do **not visually cover the spill in the same way**, the **estimated surface**

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	remains the same, since the values represented by the pieces have not changed. • If an odd number of triangles appears, invites pupils to **think and decide** whether they will leave it aside or replace it with a square, reminding them that the activity is based on **estimation**, not exact measurement. • Distributes **"Isabel's tools: Volumes"** to each group and invites them to use it as a team reference for the next step. (Pupils work autonomously in teams, while the teacher circulates, observes, and intervenes only if clarification is needed.) • Invites pupils to work collaboratively on the Mission Sheet (**Step 2: Volume estimates**), discussing their ideas, recording their estimations, and presenting their reasoning to the class. • Distributes Mission Sheet – Step 3: Planning the clean-up and the printed "Rescue Teams Boats" to each group. • Invites pupils to use the results from Step 2 to organise the clean-up, using the boats to visualise and test their plan. • Invites groups to complete the Mission Sheet collaboratively and present their plan, explaining their choices to the class. <u>What the pupils do:</u> • Reconstruct the surface of the oil spill using geometric pieces. • Build layers of squares to represent oil thickness in each

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	zone. • Observe and compare the number of layers across zones. • Estimate the amount of oil in each zone. • Use their estimations to plan how rescue teams could organise the clean-up. • Share their strategy with the class, compare approaches, and reflect on their decisions.

Level 2	Activities
10 – 12 years old	The activity follows the same steps as for ages 8–10. **Differentiation:** • The concept of volume is introduced explicitly as the combination of surface area and thickness. • Thickness is expressed using real values and converted from millimetres to metres. • Pupils apply the formula Volume = Area × Height and express their results in cubic metres (m^3). • Greater emphasis is placed on unit conversion, mathematical reasoning, and interpretation of results.

Conclusion **Level 1** **8-10 years old**	Invites groups to share their ideas and reflect using the final Mission Sheet prompts. A short whole-class discussion connects pupils' work with how mathematics helps us reason, estimate, and collaborate when exploring real-life environmental situations.

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Conclusion **Level 2** **10-12 years old**	The conclusion follows the same process as Level 1. Pupils share their results and use the final Mission Sheet prompts to justify their calculations and explain their reasoning. A guided whole-class discussion helps pupils connect their mathematical results with a scientific explanation of oil spills. In the sea, oil spreads very quickly and does not remain thick in one place. Instead, it forms a very thin layer on the surface of the water, often only a few millimetres thick or even thinner. This happens because oil has a lower density than water, allowing it to float; it spreads easily across the water surface as a thin film; and it is moved and stretched by waves and currents. Pupils then reflect on how their volume estimates can inform clean-up decisions, such as which zones should be prioritised. The activity closes by highlighting that a large surface area does not necessarily mean a large volume, and by reinforcing the importance of evidence-based reasoning, mathematical modelling, and collaborative discussion.
To go further…	**Level 1 (ages 8–10):** • Pupils could create a poster or draw a comic showing how an oil spill affects sea animals and why cleanup is important. • As an alternative, groups could write a short article for the school newspaper or prepare a short message to inform their classmates about the impact of oil spills on marine life. **Level 2 (ages 10–12):**

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	• Pupils could collaboratively build a cube representing 1 cubic metre (1 m^3) using cardboard or lightweight materials (e.g. polystyrene). By constructing a cube with edges of 1 metre × 1 metre × 1 metre, pupils develop a concrete reference for what one cubic metre represents. This hands-on activity helps them better understand and interpret the volume values calculated during the oil spill activity. • Pupils could research a recent Mediterranean oil spill and compare its size with the classroom model. • As an alternative, groups could write a short newspaper article or awareness leaflet addressed to their classmates, highlighting both the environmental impact of oil spills and the importance of acting with science and mathematics.

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Indicative solutions:

Step 2: Volume estimates

- Before estimating the volume, pupils have reconstructed the surface using only squares, replacing pairs of triangles with squares during the previous step.
- Different results are expected, as pupils work with estimations rather than exact measurements.
- For the open-ended questions in this activity, there is no single correct or incorrect answer. What matters is that pupils support their ideas with clear reasoning and evidence drawn from their model, calculations, or observations.

Level 1 (ages 8–10):

- **Dark zone:** 2 squares × 4 layers × 40 L= **320 L**
- **Blue zone:** 12 squares × 2 layers × 40 L= **960 L**
- **Grey zone:** 28 squares × 1 layers ×40 L = **1120 L**

Level 2 (ages 10–12):

Surface

Zone	Surface area
Grey zone	**6300 m²**
Blue zone	**2700 m²**
Dark zone	**450 m²**

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Thickness

Zone	Layers	Thickness (mm)
Grey zone	1	**0.25 mm**
Blue zone	2	**0.50 mm**
Dark zone	4	**1 mm**

Convert to metres

Zone	Thickness (mm)	Thickness (m)
Grey zone	0.25	**0.00025 m**
Blue zone	0.50	**0.00050 m**
Dark zone	1	**0.001 m**

Calculating the volume

Volume = Area × Height

Zone	Area (m^2)	Height (m)	Volume (m^3)
Grey zone	6300	0.00025	**1.575 m^3**
Blue zone	2700	0.00050	**1.35 m^3**
Dark zone	450	0.001	**0.45 m^3**

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OVERALL

Estimated total volume of oil spilled: 3.375 m³

Step 3: Planning the clean-up

Level 1 (ages 8–10)

Indicative solution (other strategies also possible):

Zone	Day 1	Day 2	Day 3	Day 4	Total teams	Total litres
Dark	1	1	1	1	4	320 L
Blue	3	3	3	3	12	960 L
Grey	4	4	4	2	14	1120 L
Total	**8**	8	8	6	**6**	**2400 L**

Level 2 (ages 10–12)

Volumes from Step 2

- **Dark zone:** 0.45 m³
- **Blue zone:** 1.35 m³
- **Grey zone:** 1.575 m³
- **Total:** 3.375 m³

Capacity

- 1 team-day = **0.15 m³**

Required team-days:

- Dark: 0.45 ÷ 0.15 = **3 team-days**
- Blue: 1.35 ÷ 0.15 = **9 team-days**

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- Grey: 1.575 ÷ 0.15 = **10.5 team-days → 11 team-days**

One possible valid plan

Zone	Day 1	Day 2	Day 3	Day 4	Total team-days	Total volume cleaned (m^3)
Dark	2	1	–	–	3	0.45
Blue	2	2	2	3	9	1.35
Grey	3	3	3	2	11	1.575
Total	**7**	**6**	**5**	**5**	**23**	3.375

Important note

On Day 4 in the **grey zone**, two teams are assigned:

- one team cleans **0.15 m^3** (full capacity),
- the second team cleans only **0.075 m^3** and stops early.

This is allowed because a team can clean **up to** 0.15 m^3 per day and may clean less if needed.

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Session n°3 – « Tracking Luna: Mapping and Measuring a Sea Turtle's Journey»

This lesson focuses on…

Level 1 (ages 8–10): Pupils trace Luna's route step by step using GPS points and map symbols. They decide which path is possible, justify why it is safe, and reflect on the challenges turtles face during migration.

Level 2 (ages 10–12): Pupils not only trace and justify Luna's route but also calculate the distances covered, comparing alternative paths (shortest, safest, or mixed). They analyse how currents, eddies, and storms affect the journey, and see how mathematical tools support real scientific tracking.

At the end of this lesson, pupils should be able to:

Level 1 (ages 8–10):

- Follow a grid map with coordinates and interpret symbols (feeding areas, currents, busy zones).
- Choose and justify a safe route for Luna.
- Identify new dangers when conditions change (e.g., after a storm) and reflect on their impact.
- Work collaboratively in groups, recording ideas.
- Reflect on how mathematics helps to understand turtle migration challenges.

Level 2 (ages 10–12):

- Use a grid map with coordinates and symbols to plan, compare, and justify different routes.
- Calculate and compare distances travelled (in km, with optional conversion to nautical miles).
- Discuss the effect of natural events (e.g., storms) versus human threats (e.g., habitat loss), linking maths with environmental reflection.
- Work collaboratively in groups, recording and presenting strategies clearly.
- Reflect on how mathematics supports scientific tracking and broader conservation

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issues.

Aims of the lesson

- To connect mathematical reasoning (coordinates, distance, proportional thinking) with a real environmental challenge.
- To foster inquiry and decision-making in group settings.
- To highlight how changing natural conditions or human actions can influence outcomes.
- To raise awareness of the difficulties and risks of sea turtle migration.

Historical context of the concept or/and Real-life connection:

Scientists use satellite transmitters and GPS to track sea turtles and other migratory species. Each signal provides a coordinate that helps map their routes, measure distances, and study how animals interact with currents, feeding areas, and human activity. This information is vital for protecting endangered species like the loggerhead turtle in the Mediterranean. By recreating this process with grid maps and symbols, pupils experience how mathematics supports real conservation work.

LESSON PREPARATION

Prior knowledge and skills:

For this lesson, pupils should already be able to:

Level 1 (ages 8–10)

- Recognise rows and columns in a grid layout.
- Follow and describe a path step by step.
- Identify and understand basic map symbols (feeding areas, currents, busy zones).
- Share simple ideas in group discussions.

Level 2 (ages 10–12)

- Apply the above skills with greater precision over a longer route.
- Use coordinates to locate points on a grid.

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- Estimate and calculate distance in kilometres.
- Record reasoning clearly and present strategies to peers.

Materials (per group)

- Grid map of the Mediterranean with letters and numbers, assembled from 3 A4 sheets.
- Mini turtle figure to move step by step across the map.
- Mission Sheets - A long journey (Steps 1 - 3)
- Paper, pencils, erasers.

INSTRUCTIONS FOR THE LESSON

Level 1 and 2	Introduction to the subject
8 – 10 years old **10 – 12 years old**	The story continues in Chapter 3 with the rescue of a sea turtle named Luna, affected by the oil spill. Miguel, Isabel, and Antonio take it to a vet, who treats it and attaches a GPS transmitter before releasing it back into the sea. Pupils learn that the device sends signals whenever Luna surfaces, providing scientists with coordinates to follow its migration and identify the challenges it faces. Specific vocabulary introduced with simple definitions: • **Coordinate** – a letter and a number that give the exact location of a square on the grid. • **Grid map** – a map divided into squares to help us describe positions and paths. • **Distance** – how far something travels from one point to another.

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	• **Scale** – the rule that tells us how much real distance each square represents. • **Nautical mile** – a unit sailors use at sea (about 1.85 km). • **Current** – moving water in the sea that can help or hinder the turtle's journey.

PUTTING IT INTO PRACTICE

Level 1	Activities
8 – 10 years old	What the teacher says/does: • Distributes the grid map to each group. • Gives pupils time to observe the map and read the Symbols Card on the Mission Sheet. • Briefly reminds pupils how to read coordinates: **"Each square has a letter and a number, like an address on the map."** • Adds a short real-life connection: **"Scientists really do this with sea turtles. They put a GPS tag on the turtle, and every time it comes up to breathe, they get a signal with coordinates. By following the points on a map, they can understand the turtle's journey and protect the places it visits. So what we are doing now is just like the real work of conservation scientists."** • Encourages pupils to plot one example coordinate on the grid together (e.g., "Mark I5 and check the symbol there. What does it tell us about this place?"). • Distributes the **Mission Sheet – A Long Journey (Step 1)**, then introduces the **mini turtle figure** and explains

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	how to use it: **"This small turtle represents Luna. You will move her on the map, one square at a time, following the coordinates. Each move shows the next step of Luna's journey. Before moving the turtle, your group should agree on which square comes next and why."** • Lets groups work with the Mission Sheet to trace Luna's route and note the coordinates. • Prompts only when necessary: **"Which coordinate comes next?"** **"Why might Luna choose that square?"** **"What effect does this symbol have on its movement?"** • Invites groups to present their proposed route to the whole class, explaining their choices using coordinates and symbols. • Encourages comparison between routes, highlighting that different paths can be valid if they are well justified. • Distributes the **Mission Sheet – A Long Journey (Step 2)** and invites pupils to move on to the storm stage and continue their work. • Invites groups to present how and why they modified their route after the storm, focusing on new risks and constraints. • Distributes the **Mission Sheet – A Long Journey (Step 3)** and invites pupils to work in groups. <u>What the pupils do:</u>

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	• Practice reading coordinates and recognising map symbols. • Trace Luna's journey step by step and record their reasoning on the Mission Sheet. • Adjust the route after the storm and reflect on natural vs. human risks.

Level 2	Activities
10 – 12 years old	The activity follows the same steps as for ages 8–10. **Differentiation:** • Pupils extend Luna's journey further, from I7 to Zakynthos (Q7), and choose between alternative routes (the shortest, the safest, or a mixed option). • They calculate and compare total distances in kilometres (with an optional conversion to nautical miles). • They record their reasoning in more detail in the Mission Sheet, explaining decisions step by step and justifying their choices using map evidence. • In the storm stage, they reflect not only on natural challenges but also on human actions (such as ship traffic and habitat loss), linking mathematics with real conservation issues.

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Conclusion **Level 1** **8-10 years old**	Invite groups to share their final reflections from **Mission Sheet – A Long Journey (Step 3)**, focusing on what changed in Luna's journey and the dangers it may face. Lead a short whole-class discussion highlighting that more than one path can be valid. Close the activity by reinforcing collaboration and the real-life relevance of pupils' ideas and decisions.
Conclusion **Level 2** **10-12 years old**	The conclusion follows the same process as Level 1. Pupils are encouraged to present more detailed reflections from Mission Sheet focusing on the impact of natural events and human actions on turtle survival. The whole-class discussion places greater emphasis on comparing interpretations and linking pupils' conclusions with how scientists analyse and interpret turtle migration data, highlighting precision in reasoning, collaboration, and the connection between mathematical thinking, scientific understanding, and real-world conservation challenges.
To go further…	**Level 1 (ages 8–10):** • Pupils can create a simple poster about "How to protect sea turtles," using drawings or short sentences. • They can search (with teacher guidance) for pictures of sea turtles and their habitats to better understand their environment. • Simple role-play: pupils imagine they are sea turtles and describe what helps or hinders them in their journey. **Level 2 (ages 10–12):** • Extend the calculations by converting the distances from kilometres into nautical miles (without a calculator

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	if possible), practising proportional reasoning. • Create an awareness campaign: groups prepare posters, short slogans, or even short presentations about protecting sea turtles. They share their work with the whole school community.

Indicative solutions:

There is no single correct answer. Pupils' solutions are valid if they are clearly justified using the map, symbols, and distances.

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Session n°4 – « Beach Patrol – Protecting the Nests»

This lesson focuses on…

Pupils take the role of volunteers on a nesting beach. They begin by analysing waste data from two hotspots to decide which area poses a greater risk to hatchlings. Then, they measure and record nest conditions on a beach map (such as distance from the sea, light exposure, and nearby trash) and evaluate which nests are safer. In the final stage, they propose realistic actions to improve the conditions, linking mathematics directly to real conservation decisions.

At the end of this lesson, pupils should be able to:

- Gather and organise data from waste cards or nest measurements and use it to make a decision.
- Explain which types of threats are most dangerous for hatchlings and justify their choice of where to act first.
- Use numbers (counts, points, or percentages) to evaluate nest safety and compare different options.
- Support their decisions with evidence from the data recorded in the Mission Sheet.
- Collaborate in groups and share reasoning, recognising that mathematics can guide real-life conservation work.

Aims of the lesson

- To show how mathematical observation, counting, and measurement support conservation decisions.
- To foster collaboration, critical thinking, and evidence-based decision-making.
- To raise awareness of how human activity impacts turtle hatchlings and what actions can reduce risks.

Historical context of the concept or/and Real-life connection:

On turtle nesting beaches, conservation teams regularly collect and analyse data to decide where to act first. Small plastic items are often more dangerous than large ones, because

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hatchlings may swallow them, while light pollution and obstacles can disorient them on their way to the sea. Scientists and volunteers use tables, scales, and scoring systems to evaluate risks and prioritise their actions. In this session, pupils replicate this process in the classroom through hands-on activities and simplified data analysis, using mathematics as a tool to support real conservation decisions.

LESSON PREPARATION

Prior knowledge and skills:

For this lesson, pupils should already be able to:

Level 1 (ages 8–10)

- Recognise and count objects, grouping them into categories.
- Compare numbers and use them to support a decision.
- Apply addition and multiplication to calculate totals.
- Measure length in centimetres with a ruler.
- Work cooperatively in small groups and give simple explanations.

Level 2 (ages 10–12)

- Apply the above skills with larger numbers and greater precision.
- Read scales on a map and convert measured distances into real distances.
- Use percentages to compare risks.
- Record and explain reasoning clearly when justifying a decision.

Materials (per group):

- Two envelopes per group (Hotspot A, Hotspot B), each containing printed trash cards adapted to the age group (different sets for ages 8–10 and 10–12).
- Printed visual nest map with scale, assembled from 3 A4 sheets
- Mission Sheets – Operation Beach Patrol and Operation Safe Nest
- Paper, pencils, erasers, ruler.

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INSTRUCTIONS FOR THE LESSON

Level 1 and 2	Introduction to the subject
8 – 10 years old **10 – 12 years old**	The narration in Chapter 4 moves to the nesting beach, where the heroes invite pupils to join them as volunteers. They discover that the baby turtles must cross a beach filled with obstacles, such as plastic waste, bright lights, and disturbed nests. Pupils are invited to investigate these threats and help decide which actions can best protect the hatchlings. Specific vocabulary introduced with simple definitions: • **Threat** – something that can cause harm. • **Risk** – the chance of something bad happening. • **Conservation** – actions to protect animals and nature.

PUTTING IT INTO PRACTICE

Level 1	Activities
8 – 10	What the teacher says/does: • Distributes the **two envelopes (Hotspot A & B)** and invites groups to examine the trash cards, discuss what they notice, and follow the **Mission Sheet – Operation Beach Patrol.**

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years old	• Circulates between groups, prompting: **"Which items seem most dangerous for the hatchlings? Why?"** • Invites groups to present the results recorded in their Mission Sheet and justify their choice of the more dangerous hotspot. • Distributes the **Mission Sheet – Operation Safe Nest** and the **visual nest map** to each group, and explains briefly: **"On this map, every 1 cm stands for 1 metre in real life. Use your ruler to measure the distances."** • Encourages pupils to measure and record the conditions of each nest (distance from sea, lights, trash, netting) and then apply the point system to evaluate which nest is safest. • Invites groups to suggest further protective actions (e.g. reduce lights, add netting, remove obstacles). • Invites groups to present their decisions and reasoning to the class. <u>What the pupils do:</u> • Sort waste cards into categories. • Count and compare quantities of waste. • Identify which hotspot is more dangerous for hatchlings and explain why. • Observe the scaled nest map and measure/record key conditions (distance from sea, lights, trash, netting). • Use a simple point system to evaluate which nest is safest. • Suggest simple actions to make a nest safer (e.g.

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	covering lights, adding netting, removing obstacles). • Record their results in the Mission Sheets. • Share and justify their choices with the class.

Level 2	Activities
10 – 12 years old	The activity follows the same steps as for ages 8–10. **Differentiation:** • Pupils work with larger numbers and use percentages to evaluate nest safety. • They recognise the scale on the map and convert their measurements into real distances. • They are expected to record and justify their reasoning in greater detail in the Mission Sheets, using evidence from the data. • They propose protective actions and reflect on how different threats interact, discussing possible trade-offs between choices.

Conclusion Level 1 8-10 years old	Invite pupils to complete and share their final reflections from the Mission Sheet. Lead a short whole-class discussion that helps pupils express what they discovered, what questions they still have, and how their thinking changed during the activity. Close the activity by reinforcing collaboration and highlighting that mathematics can help us understand problems and think about ways to protect turtle hatchlings.
Conclusion	The conclusion follows the same process as Level 1. Pupils are encouraged to justify their reflections more precisely, using

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Level 2 **10-12 years old**	examples from the data and decisions they made. The discussion places greater emphasis on recognising trade-offs and the complexity of conservation choices, helping pupils reflect on how mathematical reasoning supports informed decision-making in real-world environmental situations.
To go further…	**Level 1 (ages 8–10):** • Pupils can make a "turtle diary page": one drawing or short sentence per day of Luna's journey, showing what danger she met (plastic, lights, nets) and how it was solved. • They can build a mini beach model in a shoebox using sand, paper, and small objects, placing nests and obstacles, then showing how to make it safer. • As a class, they can create a simple pledge wall: each pupil writes or draws one action children can do to help sea turtles (e.g., "throw trash in the bin," "turn off lights at night near the sea"). **Level 2 (ages 10–12):** • They can research a real Mediterranean turtle nesting site (with teacher guidance, e.g. Zakynthos, Crete, Cyprus) and present in small groups how volunteers protect nests there. • Pupils can create a short awareness leaflet or poster aimed at local communities, explaining why protecting hatchlings matters and what simple steps people can take (e.g. keep beaches clean, avoid lights, protect dunes). • As a class, they can organise a small clean-up or awareness activity on a nearby beach, turning their

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	mission into a real contribution

Indicative solutions:

Step 1: Operation beach patrol

Level 1 (ages 8–10)

Hotspot A:

- Small items: bottle caps 61, crushed cans 84, can tabs 23, straws 30, batteries 70, pizza pieces 12, chips packets 32 – **Total: 312 items.**
- Large items: plastic bottles 92, nets 12, plastic bags 30, broken glass bottles 40, shovels 54 – **Total: 228 items.**

Total: 312+ 228 = 540 items

Hotspot B:

- Small items: bottle caps 96, crushed cans 62, can tabs 40, straws 29, batteries 33, pizza pieces 14, chips packets 18 – **Total: 292 items.**
- Large items: plastic bottles 74, nets 18, plastic bags 80, broken glass bottles 20, shovels 45 – **Total: 237 items.**

Total: 292+ 237 = 529 items

Level 2 (ages 10–12)

Hotspot A:

- Small items: bottle caps 1520, crushed cans 829, can tabs 161, straws 220, batteries 711, pizza pieces 118, chips packets 101 – **Total: 3660 items.**

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- Large items: plastic bottles 1243, nets 15, plastic bags 297, broken glass bottles 286, shovels 80 – **Total: 1921 items.**

  Total: 3660+ 1921 = 5581 items

Hotspot B:

- Small items: bottle caps 1143, crushed cans 622, can tabs 414, straws 120, batteries 307, pizza pieces 183, chips packets 259 – **Total: 3048 items.**
- Large items: plastic bottles 1239, nets 19, plastic bags 698, broken glass bottles 241, shovels 130 – **Total: 2327 items.**

  Total: 3048 + 2327 = 5375 items

Discussion / Reflection:

- **Hotspot A** contains more **small items** (e.g., caps, straws) → dangerous because hatchlings may mistake them for food, leading to ingestion.
- **Hotspot B** contains more **large items** (e.g., bottles, bags, nets) → dangerous because they block the path, cause exhaustion, or risk entangling hatchlings.
- Pupils may reach **different conclusions**:
  - Some may argue A is worse (direct swallowing danger).
  - Others may argue B is worse (physical barriers).
- **Key point:** there is no single correct answer; what matters is the reasoning and justification pupils provide.

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Step 2: Operation safe nest

Level 1 & 2

In this task, pupils evaluate each nest using environmental criteria (distance from lights, distance from the sea, protective mesh, proximity to trash). Measurements are taken directly from the map; slight variations between groups are acceptable as long as the correct risk range is identified.

Level 1: Pupils assign risk points (0–3) and calculate the total score for each nest. The lowest total indicates the safest nest.

Level 2: Pupils determine the risk level (%) for each condition and calculate the total risk score. The lowest final percentage indicates the safest nest.

Pupils compare results and justify their choice based on both the calculations and the environmental impact of each condition.

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