Atlantic Adventures with ATLAS

Recommended style of activity: interactive show delivered by trained staff.
Suggested age range: 6-12 years
Approximate time : 45 minutes

Background:

This show was developed to explain the ATLAS project and the work of people involved in it. It starts with a brief introduction to how and why oceans are important, then moves on to how scientists and engineers work at sea. There are discussions around the technology used for exploration of the deep-sea and the challenges posed by deep water. It also features an introduction to cold-water corals, how they feed and how bottom trawling for fish damages them. The show finishes with information about marine protected areas and a compilation video from various ATLAS cruises (expeditions at sea).

The show was designed to be delivered by two people who select volunteers from the audience to run a series of demonstrations or activities but it can be adapted to suit different delivery styles and audiences and the script is meant to be a suggested outline which can be adapted too.

It is also designed to be modular so that the activities and demonstrations can be used individually to explain certain concepts. Use the kit-lists and referenced script pages to deliver individual activities.

Some of these have also been made available with explanatory packs and sheets on the ATLAS website. They are as follows:

- Ocean Importance (Explanatory pack and A3 public engagement sheet)
- Pressure in the Deep (Explanatory pack and A3 public engagement sheets)
- Robot Challenge (A3 public engagement sheets)

Kit List:

For delivery as the full show:

- 'Atlantic Adventures with ATLAS' PowerPoint presentation including videos
- Kit for demonstrations & activities (listed overleaf)
- Pressure in the Deep explanatory pack to explain how to set up one of the activities

These resources are available at:
https://www.eu-atlas.org/education/education-packs

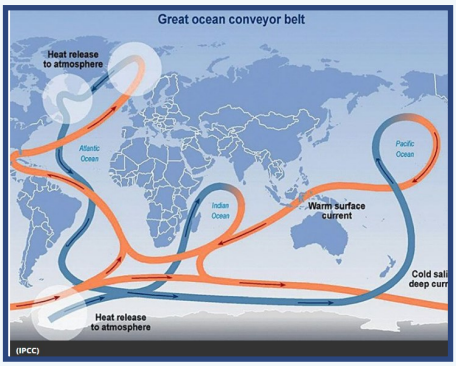
Kit List:

For the Ocean Importance activity (script p5-6):

(Props representing different aspects of ocean importance, alternatively you could just use printed images)

- Oxygen from the ocean (we used a 'Breathe in the Ocean' cushion from Redbubble.com)
- Medicines from the ocean (we used a plastic syringe from Amazon)
- Toy boats representing transport, travel and exploration
- Something to represent recreation/ holidays
- Something to represent food from the sea (e.g. tin of tuna)
- Something to represent energy from the sea (we used a foam lightbulb/stress reliever from Amazon)

- Inflatable globe with ocean currents (we had to draw them on!)



For the Engineer activity (script p7):

- Child-sized boiler suit (available from www.muddyfaces.co.uk)
- Child-sized/dressing-up hard hats
- Remote control toy crane (e.g. Dickie 203462411 Giant, Cable-Controlled Crane, 1 Meter High, from Amazon)
- Bucket or plastic fish tank filled with water

Kit List:

For the pressure in the deep activity (script p7):

- 'Rokit Kit' including bottle, valve and pump connection (available from toy shops & online https://www.rokit.com/the-product/)
- Two round, uninflated balloons
- A bike pump with a pressure gauge (e.g. https://www.argos.co.uk/product/8434599)
- Two pairs of safety goggles

(This needs to be assembled by staff/demonstrators before the show: see the 'Pressure in the Deep' explanatory pack for more information)

For the Robot challenge (script p8):

- Child-sized litter picker
- Vacum 'bug/spider catcher' (available on Amazon)
- Suitable objects to sample e.g. large shells or fish toys for the litter picker and pieces of kitchen or bathroom sponge for the vacuum.
- Blindfold (or you can improvise e.g. with a hat!)

Kit List:

For the 'scientists working at sea' activity (script p9):

- 3 or 4 'balance boards' - children's gym or playground equipment (available from https://www.tts-international.com)
- Objects to pass between participants e.g. beaker with water, plastic tweezers, piece of kitchen/bathroom sponge to act as a sample.
- 3 or 4 woolly hats

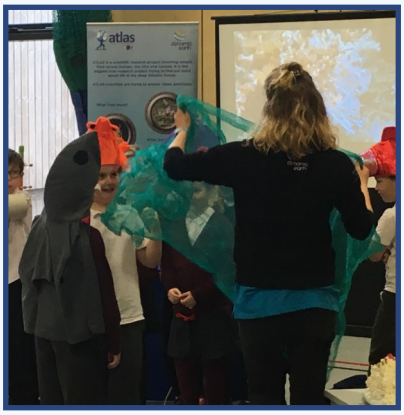
For the coral feeding activity (script p10):

- 5 x white plastic pipe sections, large enough for children to fit their arm in easily (available from building/plumbing suppliers). We used sections W x D x Lg: 125 x 125 x 350mm
- 5 x pairs child-sized orange or white gloves
- Blue blanket or netting material to act as an ocean current
- Objects which can be attached to the blanket using Velcro to act as food—we used ping-pong balls for 'marine snow' and cuddly Copepods from www.giantmircrobes.com.

Kit List:

For the bottom trawling activity (script p10):

- Range of sea-creature hats e.g. crab, octopus, fish (available from Amazon.com)
- Netting material
- (coral feeding activity kit)



Script for show:

[ATLAS covering slide – deep sea images/marine scientists]

Scientist 1: Hello! My name is … and I'm a marine scientist, my job involves trying to answer some big questions about the ocean.

Scientist 2 And I'm … We're here today to find out more about the oceans! So, who wants to find out more about the oceans? Give me a cheer!

(Wait for cheer, encourage group to be noisy if they aren't already!)

Scientist 1: Great, we'll do our best to help. I'd also like to talk about some of the scientists, engineers, and mathematicians who help us discover and appreciate all that goes on in our amazing seas.

Scientist 2: Well I have a question already then: if we're finding out more about the ocean, I want to know how it's important to me! Do we need the ocean?

Scientist 1: Well why don't we ask these lovely people and see what they think? Do you appreciate the ocean? Do you use the ocean for anything? Can you think why we might need an ocean on Planet Earth? Have a chat to the person next to you and see if you can come up with some answers. We have some items which might help you out…

(Throw or hand out the 'Ocean Importance' props to start discussions.)

Script for show (continued):

Scientist 2: Wow, that's a lot of great ideas there – it's certainly sounding like the ocean is hugely important to all life on Earth, including humans. We've talked about food, medicines, energy and fun but what does this [the oxygen from the ocean prop] represent?

Scientist 1: It's because of all the Oxygen! Just like plants on land take in CO_2 and give out Oxygen, so do things that live in the sea.

[New slide – phytoplankton]

These tiny creatures are called phytoplankton and there are so many in the ocean that they actually produce half of the oxygen that we breathe in! They're also very important as lots of other creatures in the ocean eat them – they're the base of a lot of marine food chains.

Scientist 2: Wow! So you're saying that when I breathe in, that's equivalent to the oxygen in every second breath being made by those tiny things?! That's amazing!

Scientist 1: Yep, awesome isn't it! Another vital thing that the ocean does is the movement of heat – that's what this globe shows you (*hold up currents globe/image*).

[New slide – ocean current animation]

The ocean is always moving. Huge currents carry warm water from the equator towards the poles. Cold water sinking at the poles carries the cold away. This spreads heat out, making Earth a better place to live. Ocean currents also have a big effect on our weather.

Scientist 2: I'm curious, I've heard that the ocean is mostly unexplored. We've just talked about how important the ocean is for all life on Earth. Why haven't we explored more of it?

Scientist 1: Good question! I suspect it's because the ocean is quite a difficult place to work, but don't worry there are many people trying to explore more! This includes scientists working on the 'ATLAS' project.

[New slide – ATLAS case study map]

Scientist 2: I'd better tell them all about ATLAS then! ATLAS involves people from all over Europe, America and Canada. The pink stars on the map shows you the parts of the ocean that ATLAS is looking at in the Atlantic Ocean. These are called the 'Case Studies'.

[New slide – Map with currents]

Remember the currents that go through the ocean? Many of the ATLAS Case Studies are connected by a special current in the Atlantic called the AMOC.

If people want to find out more about these case studies, they have to get to them. So how do they do that?!

(Ask audience - Answer: Research Ships!)

[New slide – Scientific cruise – MEDWAVES crew photo]

Teams of scientists, engineers and ship's crew will go to sea, sometimes for several months at a time to visit these places and take measurements.

Script for show (continued):

Scientist 1: That's right. Depending on your job on the ship you probably will have to wear different clothes. For example, engineers and technicians might get a bit mucky working with all the equipment so you can't go wrong with a good boiler suit! Does anybody want to be our engineer? (*Hand volunteer a small boiler suit and hard-hat*).

Scientist 2: (To volunteer) Excellent! Apparently, you will be carefully lowering measuring equipment into the ocean to get a water sample for the scientists to look at. Let's see how you do…

[New slide – CTD-Rosette (conductivity/saltiness, temperature and depth equipment) being lowered, MEDWAVES cruise]

(Toy crane activity – get volunteer up to use the controls and lower the bucket into the water container then raise it up again—this is the water sample!)

Scientist 1: ATLAS scientists are particularly interested in the deep ocean, looking at areas between 200-2000m deep. This is quite a challenge. Does anyone know why it's difficult to learn about the deep ocean?

(Allow time for discussion, then take some answers)

[New slide – darkness!]

I'll give you a clue – this is what we would see if we went down to the deep ocean floor. Can anyone see anything?! Why not? It's dark! As we go further down into the depths, we leave the light behind, so we have to take the light with us to see what's down there.

[New slide – animation of light levels decreasing with depth]

Recent expeditions have used 'drop-cams' which are lowered into the sea and can record videos of the deep. They can be baited with food to see if anything comes in for a nibble!

[New slide- clip of Octopus from camera in Azores!]

Scientist 2: That was cool! Wait, I thought that there was another problem about going into the deep…

Scientist: You're right: all the water above you increases the pressure. I can show you the effect of increasing pressure by doing a little experiment – I'll need a volunteer to help.

(Pressure experiment – volunteer uses a bicycle pump to increase the pressure in a plastic bottle containing a balloon. The balloon is compressed and visibly shrinks—you can use a laptop web camera to show larger groups - demonstrating the crushing effect of higher pressure).

Scientist 2: So that's why we need to use special equipment to discover more about the deep. Submarines or submersibles are designed to withstand the crushing pressures and can take people down to the deep!

Scientist 1: Yes! However, these are very expensive to build and use, they can only be used by a few people at a time. Plus, not everyone wants to go down that deep!

Script for show (continued)

Scientist 2: I guess it could be a bit scary, as well as being exciting. Instead, we can use a range of underwater robots and vehicles to do our exploration for us. One kind of underwater vehicle that is very useful for ATLAS is called an ROV or 'Remotely Operated Vehicle'.

[New slide – ROV 'LUSO' – Azores team]

This is the ROV 'LUSO' in action in the Azores. Luso is capable of diving to an incredible 6,000m depth – that's over four times the height of Ben Nevis!!

I have an idea for a ROV challenge. I'd like everyone to get themselves into pairs and number yourselves '1' and '2'.

(Robot and controller challenge: Pupils will divide themselves into pairs with number 1's as the Controllers and number 2's as the ROVs. ROVs will close their eyes and Controllers will try to direct them to shake hands with the nearest ROV. Play amusing music to go along with it – click speaker symbol in presentation).

Good job teams! As you can see, it's quite tricky and being an ROV pilot takes a lot of practice.

Scientist 1: The ROVs are expensive and take a lot of training to use properly but they are so useful. As well as being able to record videos from the deep, ROVs can have tools added to do all sorts of fancy things, including taking samples of some of the life found there. Many ROVs have a tool called a manipulator arm for this task.

[Video of ROV manipulator arm in action– Rockall Bank]

Alright – who thinks they would make a good ROV?! I'm going to need a volunteer to collect a sample for me. (*Select volunteer*)

Robot sampling challenge: the volunteer will need to try using the litter picker to act as their 'manipulator arm' and pick up a sample e.g. a shell/cuddly fish.

Well done! Please can we have a round of applause for our ROV and their manipulator arm!

Scientist: 1 Excellent work. You made that look easy! How about we make it more challenging?! Let's try again using another tool affectionately known by some people as the 'slurp gun!'

[New slide – video of slurp gun in action – Mingulay]

Scientist 2: Remember our Robot challenge earlier and how the 'Robot' had their eyes closed?! I think we should get our ROV person to wear this blindfold. I'll be the scientist on board ship, giving you instructions and see how you do…

(*Volunteer is now blindfolded and following instructions from staff, will try and suck up a piece of sponge with a 'vacuum spider catcher'*).

Great work team! Next, the samples are placed into special containers attached to the ROV and are brought up to the surface. Once the samples are brought on board, they have to be carefully photographed, labelled and preserved so that more tests can be done once the ship gets back to land.

Script for show (continued):

Scientist 1: We work in a special cold room on the ship which is kept at 4^0C to help look after the samples and keep them cool. It can get quite chilly and the team have to work fast to get the samples preserved as quickly as possible. It's even more difficult if there's a bit of wind and waves for the ship to contend with – who thinks that they could cope with a little bit of a wobbly room?!

[New slide – video of ship moving/waves]

(*'Scientists working at sea' activity: get three/four volunteers up and have them stand on balance-boards to simulate a moving ship. Give them woolly hats to show that it's cold! Get volunteers to pass samples & or water pots between them. Try and position the balance boards in a line but far enough apart so the volunteers do have to cope with tipping!*).

A round of applause for our sampling scientists!

Using the ROVs in the deep ocean revealed something very interesting: corals!! What do you think of when somebody mentions corals?

(Take answers, probably tropical reefs etc.)

[New slide – generic picture of a tropical coral reef!]

Did you all think of something like this?!

Scientist 2: It's very pretty, but what is it?! A rock? An animal? A plant? What do you all think it is? (*Get group to vote for different options by putting up their hands*).

Scientist: Coral is actually an animal. Each of these is made up of lots of little animals which can build themselves an external or outer skeleton made of a material called calcium carbonate (like chalk).

Scientist 2: Interesting, so when we look at a picture of a coral reef like this then they're actually animals!

[New slide – black coral from Rockall, Logachev mounds]

Scientist 1: Yes! And they're not all found in Tropical seas. In fact, over half of all the world's different types of corals are found in deep waters, like this black coral here. (It has a black skeleton!) Scientists have known about cold water corals for about 250 years but only in little pieces dragged up from the sea floor. In the last 50 years with new technologies and better maps of the deep sea, we've discovered that cold water corals are spread right across the world's oceans and we've learnt a lot more about how they live and grow.

[New slide – Mingulay Map and reef image]

Scientist 2: Excitingly, some of these cold-water corals are found around the Scottish coasts, with the closest area being the Mingulay Reef Complex, in the Outer Hebrides.

[New slide – ROV dive to Mingulay CWCs – very sped up! Took about 15 mins to dive 190m]

NB—Feel free to replace this discussion and video with a more local cold-water coral reef if you have know of one which you would like to highlight.

Script for show (continued):

Scientist 2: This ROV found these corals when it got down to the sea-floor, 190m below the surface. The corals here are very important environments in the deep sea and many creatures find shelter or lay eggs in the reefs they create including sharks, rays and cod! Some of the fish we eat may well have sheltered in a cold-water coral reef at some point!

I thought that corals needed all that sunlight in the Tropics to grow and get food. Earlier though we were talking about the darkness in the deep ocean! So how do these corals get their food?

Scientist 1: They have to catch it! Let's explore this in more detail by looking at the cold-water coral: *Lophelia Pertusa*.

[New slide – Lophelia close-up]

Corals are related to sea anemones. They have tentacles with special stinging cells called 'cnidocytes' (ny-doe-sites) which help them catch their food. However, the corals are fixed in place and can't go wandering along the sea-bed looking for food to eat, it has to come to them! Can I get some volunteers up to demonstrate this please?

Coral feeding demonstration – 3 or 4 volunteers will put on an orange/white glove representing a coral polyp then put their hand inside a pipe, which will act as their skeleton. They will need to extend their hand/tentacles to catch food and retract them back inside the pipe for protection. Other volunteers will act as the ocean current bringing the polyps food by moving a blue blanket/netting material past them. The blanket will have toy creatures &/or balls representing food particles stuck to it by Velcro which the polyps will have to pull off and 'eat'. You can also volunteer someone to pretend to be an urchin, which represents a threat, so the polyps will need to hide!

Scientist 2: That's definitely an interesting way to catch your food. I can't believe most people don't know about these amazing creatures!

Scientist 1: Well, they are quite tricky to find! And it's not just the corals, there could be hundreds of other fascinating creatures living in and around a cold-water coral reef. Unfortunately though, the reefs are in trouble. Things like a warming and changing ocean might badly affect the corals. Another big problem is bottom trawling.

Scientist 2: Pardon?!

Scientist 1: It's when a big net is dragged along the ocean floor trying to catch fish for us to eat. I can show you what that looks like but I'll need some help from the group.

Bottom trawling activity: Volunteers will be dressed up in various outfits representing biodiversity of a cold-water coral reef. Another set of volunteers will drag the net across the 'reef'. Some of the more mobile creatures (e.g. octopus and fish) can escape but the reef volunteers being coral will collapse (or sit down in place to show that they have been destroyed).

[New slide – before and after pictures of fishing-damaged corals]

Scientist 2: Oh no! Look what's happened to our lovely reef! The coral will grow back, right?

Script for show (continued):

Scientist 1: Well it might, but it's very slow to grow. *Lophelia pertusa*, the coral we looked at earlier only grows between 4-25mm a year, that's less than 3cm (indicate). In the meantime, all those creatures which were sheltering here will have to find somewhere else.

Scientist 2: Hang on, I'm sure I wrote a report recently about protecting parts of the sea. Has anyone heard of MPAs or Marine Protected Areas? *(Wait for response)*. There's a lot of different types of MPAs but some of them are special parts of the sea where people aren't allowed to fish or put anything on the ocean floor which might damage it.

[New slide – UK MPAs – JNCC interactive map]

(Again, feel free to change this for a more local set of MPAs)

These are some of the Marine Protected areas around the UK. It can be quite tricky to decide where to put them – people still need to get fish to eat. In addition, we heard earlier that we get many useful things from the ocean such as oil or even new medicines and parts for your phones.

Scientist 1: A country can create laws to protect the seas around them but there are huge parts of the ocean which no one country owns. The work of ATLAS scientists will help us decide if new areas of the ocean need protecting by working with people all over the world to agree on places that can be called a VME or Vulnerable Marine Ecosystem. This is where the creatures and the area they live in have been designated as ones that might be very badly affected by trawling.

It's not just corals, there are all sorts of other amazing creatures like sponges, sea-urchins, basket stars and these beautiful 'sea lilies' or crinoids.

[New slide – Frobisher Bay crinoids photo]

Scientist 2: If you like eating fish you can help look after these kind of creatures by buying fish which have the blue Marine Stewardship Council sticker on them. This means that they are making sure there are still plenty of fish left in the sea and aren't fishing in a way which damages the sea-floor or harms other creatures.

[New slide – sustainable fishing logo]

As we keep exploring more, we discover just how special the deep ocean is and how we can look after it so that it will be safe for years' to come. To finish we would like to share with you a video of what it's like being part of the ATLAS project. Maybe some of these people will inspire you to find out more and perhaps even get a job working for the oceans in the future!

[Final slide – ATLAS video compilation].

The video only has background music, so if you plan to use it as part of the show, we advise talking through the following transcript alongside viewing the videos.

Video Transcript:

Introduction:

Unless otherwise stated, all videos were recorded by Graham Tulloch, British Geological Survey, as part of his role assisting ATLAS outreach activities while taking part in a scientific 'cruise' or expedition on board the icebreaker CCGS Amundsen, on a 170-day scientific expedition to the Canadian Arctic with Canada's ArcticNet programme. This state-of-the-art research vessel has 65 scientific systems and 22 shipboard laboratories.

Clip one: a female engineer/technician operating the winch which lowers (or 'deploys') equipment into the sea. The camera then pans to crew who are assisting the lowering of a 'CTD' rosette. CTD stands for conductivity, temperature, and depth (the conductivity will tell us how salty the water is). The CTD has a package of electronic instruments that measure properties in the water column (from the surface to the bottom). Point out to the audience that they are wearing boiler suits and hard hats just like the 'engineer' operating the crane earlier in the show!

Clip two: the CTD Rosette coming back up at night and the door closing. This reflects how the crew can work through day and night to collect samples. This is sped up from about 2 hours of footage and shows all the scientists gathering round to get their desired water samples out of the CTD.

Clip three: a 'box corer' has just been hauled back on deck. The box corer can sample the seabed, allowing scientists to examine the creatures and sediments found there. Here you can see some scientists exited to see what it has collected!

Clip four: amazing ice! Just an illustration of the icebreaker ship doing its job!

Clip five: another great sight if you're off-duty – ask the audience if they can spot any wildlife?! Dolphins! This was recorded by Safo Piñeiro on board the Sarmiento de Gamboa research vessel during the 'Medwaves' cruise in September-October 2016.

Clip six: We saw wildlife at the surface just a moment ago but ATLAS scientists are interested in deep-sea creatures so this clip shows us the 'drop-cam' being lowered. A similar one was used for the clip of the octopus shown earlier in the show.

Clip seven: this is the ROV control room, often found in a shipping container on deck. You can see the two pilots and one is controlling the manipulator arm to get a coral sample. (Remind audience of how this was done earlier). You can also see the scientists behind the pilots who are there to suggest interesting samples. It appears to be exciting for them too!

Clip eight: *Pheromena* sponge grounds. This is an amazing clip of a deep-sea sponge ground—the sponges are living creatures and look like lots of white, slightly fuzzy tubes.

It was recorded during the BLUE AZORES PROGRAM: Expedition 2018 on board the NRP Gaga Coutinho during June 2018. The following partners were involved: Blue Azores Program of the Oceano Azul Foundation, in cooperation with the Waitt Foundation, and in the collaboration with National Geographic, the EU ATLAS project and the FRCT MapGES project, and through a partnership with the Regional Government of the Azores.

Video Transcript:

Clip nine: Pillow lavas – these curious structures form when lava erupts underwater and can be an interesting habitat. This was also filmed during the Blue Azores Program as above.

Clip ten: If you're not sure what it's like to be on a ship for weeks at a time – here's a quick tour of the cabin; clothes washing facilities and up to the bridge where the Captain is normally found, controlling the ship!

Clip eleven: Crew looking out for floating markers from the bridge. These will indicate where some equipment left on the sea-bed has floated up to enable it to be collected and the data gathered/analysed.

Clip twelve: Finally, if you're lucky, you might make an exciting discovery such as these new Hydrothermal vents which were discovered during the Blue Azores Program expedition in June 2018!

Acknowledgements.

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