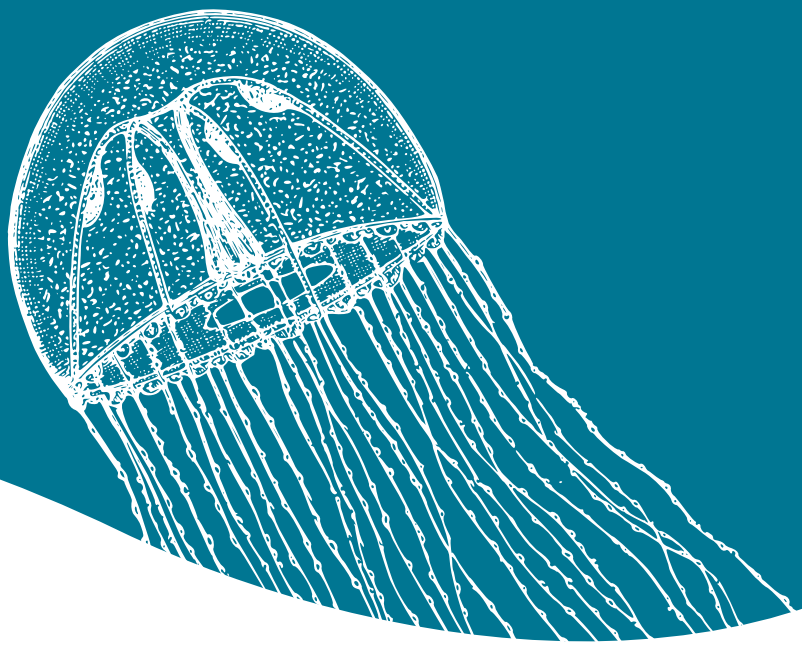
MUFFIN

Marine Education for Deaf Youth:

A Practical Guide for Marine Centres



THE UNIVERSITY of EDINBURGH

SSC scottish sensory centre

Erasmus+ Enriching lives, opening minds.

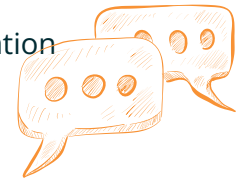
Co-funded by the European Union

INTRODUCTION

Marine environments offer extraordinary opportunities for learning. The ocean communicates through movement, colour, pattern and touch. For Deaf youth, this visual-tactile world aligns naturally with how they experience their environment. This manual has been created as part of the MUFFIN project (Marine, Underwater, Fish For INclusion), funded by Erasmus+, to assist marine centres in increasing access to their educational activities for deaf learners. The project is a partnership between organisations working with deaf people in Malta, Croatia, Italy, Spain, and the UK, developing signs in each country's native signed languages to improve understanding and communication about marine species and environmental conservation. Whether you run an aquarium, research station, beach programme or boat-based ecotour, this manual provides practical strategies to create welcoming programmes for Deaf youth. It includes guidance to help staff develop awareness about the experiences of deaf learners, practical advice for running accessible sessions, and introduces the British Sign Language (BSL) signs developed to deepen deaf people's connection with the oceans.

Why This Matters

- **466 million Deaf and hard-of-hearing people worldwide**
- Deaf youth bring enhanced visual awareness to marine observation
- Inclusive programmes benefit all participants
- Marine centres can lead in accessibility innovation.
- Tactile-rich marine environments offer unique opportunities for Deafblind people
- New BSL resources available: 90 marine species signs, accompanied by description videos in BSL and 25 educational videos.



QUICK START GUIDE

Ready to welcome Deaf youth today? Start with these essential actions:

Visual communication basics

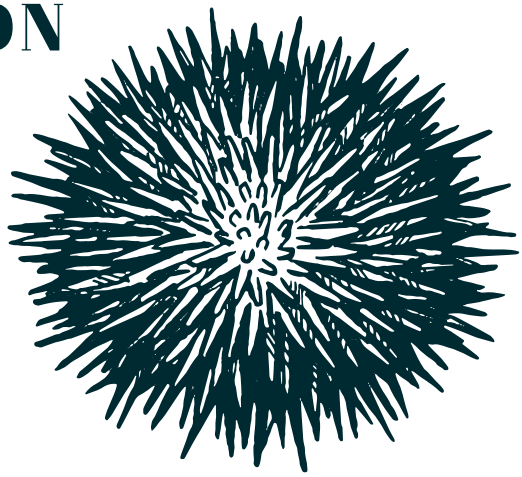
1. **Get attention appropriately** – wave, tap on the shoulder or use a visual signal
2. **Face the light** – light on your face, not behind you
3. **Maintain eye contact** – look at the deaf person, not the interpreter
4. **Use gestures** – point, demonstrate and show
5. **Keep groups small** – 8-12 participants maximum
6. **For Deafblind participants** – use tactile signing, hands-on demonstrations, and describe everything they touch.

Essential Setup Changes

1. Arrange seating in semicircles for visibility
2. Test lighting to eliminate shadows
3. Create clear sightlines
4. Add visual alerts for emergencies

CONTENTS

UNDERSTANDING DEAF DIVERSITY IN MARINE EDUCATION



Understanding the Deaf community is essential for creating truly inclusive marine education programmes. Deaf people are diverse, each with distinct experiences, identities, and capabilities (Friedner and Kusters, 2020). Their access to sound ranges across a spectrum, with some experiencing unilateral hearing loss (deaf in only one ear). Medical and educational institutions often classify deafness with categories such as 'hard of hearing', 'mild', 'moderate', 'severe', and 'profound'.
Some people are born deaf, while others develop deafness later in life. These categories reflect different levels of access to sound, but they do not determine a person's abilities or potential—particularly their capacity to observe, understand, and connect with marine environments.

Educational Backgrounds and Learning Experiences

Deaf people come from a variety of educational backgrounds. Some attended specialised schools for deaf children or other schools for children with disabilities. Others were the only deaf pupil or among a few in a mainstream school or a school with a resource base, where they might have received support from qualified teachers for deaf children and taken some mainstream classes with communication assistance. This range of experiences means that deaf youth may have different needs when accessing their learning in marine education settings. For instance, some may be familiar with specialised marine science vocabulary in sign language, while others may encounter these concepts for the first time in any language. Below, we explore how marine educators can meet these diverse needs and share insights about creating accessible ocean learning experiences.

Communication Methods and Preferences

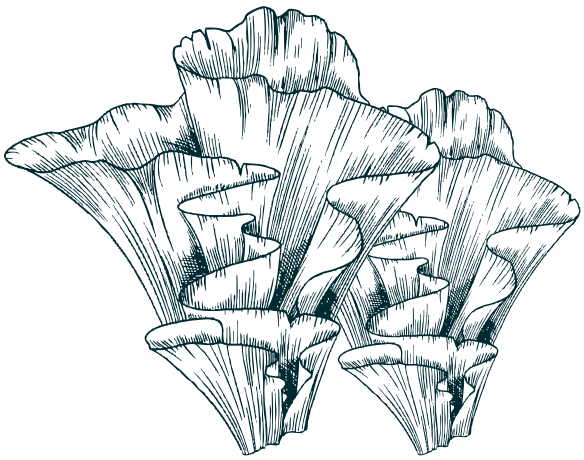
Assistive Technology in Marine Settings

Communication access in marine settings requires understanding both individual preferences and environmental factors. Many deaf people use various assistive technologies to improve their access to sound in their environment. These include hearing aids, bone-anchored hearing aids, and cochlear implants. Technology such as induction loop systems with microphones can also make venues and spaces more accessible. However, marine education settings present unique challenges for assistive technology. Water spray, wind, engine

noise on boats, and the need to remove devices near water, can complicate technology use. Marine educators should be prepared with alternative communication strategies and understand that some participants may choose not to use assistive devices in marine environments. Each deaf person's experience with technology varies. Some find certain devices significantly enhance their access to sound, while others prefer different approaches to communication and their environment, partly due to a lack of access to meaningful sound.

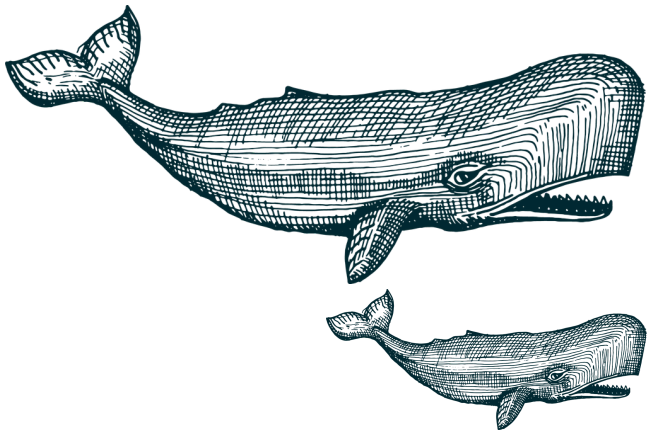
Sign Languages and Visual Communication

Deaf people have diverse communication preferences (Kusters et al., 2017). Some deaf people communicate primarily through lipreading and speech, while others prefer signing. Sign languages are natural languages that use visual gestures, signs, and facial expressions. They have existed for many years and have flourished worldwide as rich linguistic systems (De Meulder, 2015). Each country has its own unique sign language. However, sign languages have only recently gained official recognition in many countries. For this MUFFIN project, British Sign Language (BSL), Croatian Sign Language – Hrvatski znakovni jezik (HZJ), Italian Sign Language – Lingua dei Segni Italiana (LIS), Maltese Sign Language (LSM) and Spanish Sign Language – Lengua de Signos Española (LSE)) have all been officially recognised between 2007 and 2022. This recent recognition reflects the ongoing journey toward full linguistic and cultural acknowledgement of Deaf communities.



This diversity becomes relevant in international marine research stations, aquariums with global partnerships, and marine conservation programmes that serve diverse communities.

International Sign and Communication Flexibility

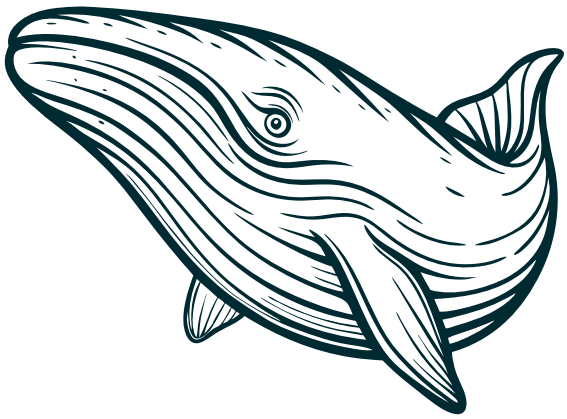


When deaf people from different countries come together, they often use International Sign (IS)—adapting their signed languages to promote cross-cultural communication (Allsop et al, 1995, Green, 2014 and Kusters, 2024). Many deaf people move fluidly between different communication modalities and languages (written, spoken, gesturing, and signed), adapting their approach based on specific situations and who they communicate with (Wolbers, 2023).

In marine environments, this linguistic flexibility is especially valuable – whether pointing to a breaching sperm whale, sketching a tide pool food web, demonstrating gentle touch for a purple sea urchin, or signing about coral bleaching, all serve as different modes of marine science communication.

Deafblind Community

Deafblind individuals experience varying combinations of vision and hearing loss. Some people are born Deafblind, while others develop dual sensory loss over time. The Deafblind community includes people with Usher syndrome, CHARGE syndrome and other conditions affecting both vision and hearing. Each Deafblind person has unique communication needs and preferences.

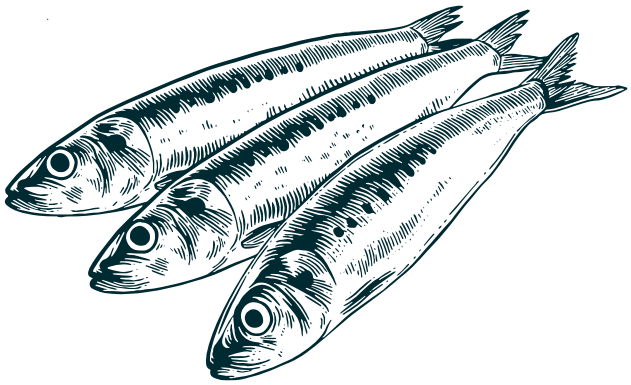


Marine education for Deafblind youth required additional adaptations beyond those for deaf participants. Tactile communication methods become essential, including tactile sign language (signing into someone's hands), the Deafblind manual alphabet, hands-on descriptions, and close visual communication for those with residual vision. **Always ask participants about their preferred communication methods.** The ocean's naturally tactile nature-feeling water movement, touching shells and seaweed, experiencing temperature changes - makes marine environments particularly well-suited for Deafblind people when programmes are thoughtfully adapted.

Always ask participants about their preferred communication methods.

Deaf Culture and Community

Deaf culture is rich and vibrant, centred on visual ways of experiencing and communicating about the world. Rather than viewing deafness as a deficit, Deaf culture celebrates it as a natural part of human diversity and a source of community identity. Visual communication through sign language is valued as a sophisticated and complete form of expression. Many Deaf people have strong connections to the Deaf community, sharing cultural values that include directness in communication, the importance of visual access, and face-to-face interaction.

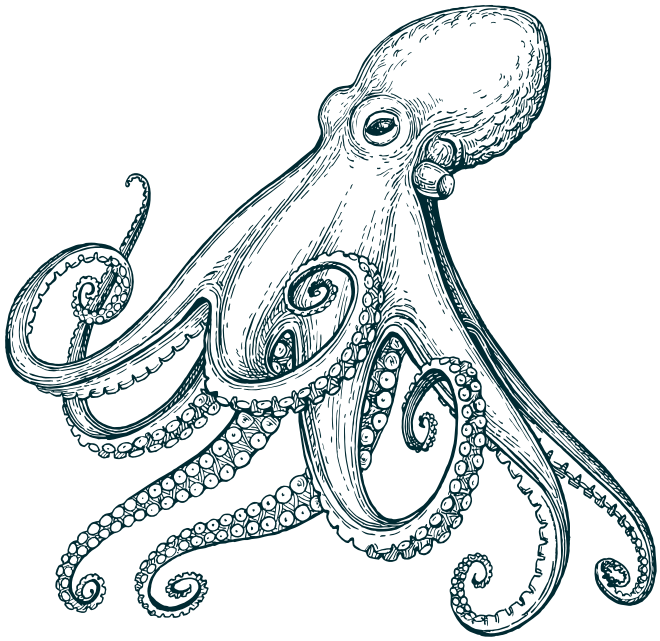


In marine education settings, understanding these cultural values involves recognising that deaf participants bring valuable visual observation skills, appreciating direct communication styles, and ensuring that visual access is prioritised in all activities. Deaf culture thrives on shared experiences and collective identity, making group marine programmes an opportunity for both learning and community connection.

Building Inclusive Marine Education Environments

This linguistic flexibility demonstrates the adaptability and communication skills within the deaf community. Each deaf person has unique communication preferences, cultural connections, and lived experiences that shape their identity and interactions. Understanding and respecting these individual differences, rather than making assumptions, is crucial for building effective relationships with deaf participants and creating inclusive marine educational environments.

Key principle: *Always ask each visitor about their preferred communication method and any access needs before or at the start of their visit, rather than making assumptions based on assistive technology or other factors.*

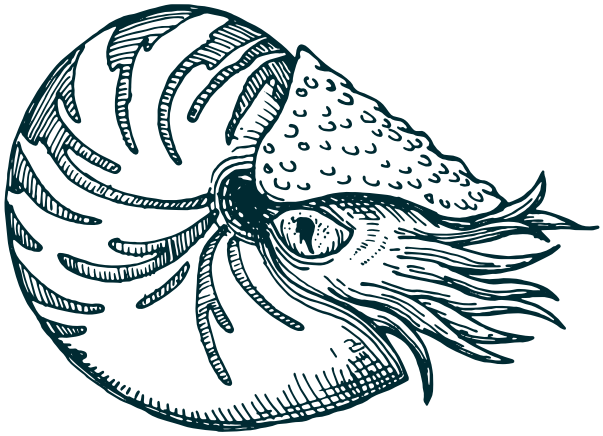


While understanding this diversity is crucial, it is especially important to consider how different language experiences and communication preferences influence the development of marine science understanding. The link between language acquisition and conceptual growth presents unique considerations in marine education. However, the visual and tactile qualities of marine environments – where phenomena can be observed, touched, and directly experienced – provide powerful learning opportunities that surpass language barriers. A hermit crab moving between shells, the spiral pattern of a nautilus shell, the camouflage of a common octopus – these marine phenomena communicate directly through observation, making ocean science particularly accessible to diverse learners with different linguistic backgrounds.

For marine educators, this means that successful programmes recognise and build upon both the diverse backgrounds of deaf participants and the inherently visual nature of ocean learning.

Key Takeaways for Marine Education Staff

- **Diversity is the norm** – deaf visitors will have varied communication preferences, educational backgrounds, and relationships with assistive technology.
- **Ask, don't assume** – always inquire about individual communication preferences and access needs.
- **Plan for technology challenges** – marine environments can be difficult for assistive devices. Have alternative communication strategies ready.



- **Leverage visual learning** – the visual and tactile nature of marine species makes it naturally accessible across language differences.
- **Respect linguistic flexibility** – deaf visitors may use multiple communication styles – be ready to adapt with them.
- **Individual-centred approach** – focus on each person's unique needs rather than applying a one-size-fits-all solution.

Note on terminology: *Throughout this manual, we use both "Deaf" (capital D) when referring to cultural and community identity, and "deaf" (lowercase) when referring to audiological status. We primarily use identity-first language ("deaf people") as this is generally preferred within the Deaf community, though we recognise that preferences vary by individual and region.*

WORKING WITH SIGN LANGUAGE INTERPRETERS

Sign language interpreters are essential for making marine education accessible to many deaf participants. Knowing when to organise interpreters, how to collaborate with them effectively, and what to expect will help you develop successful programmes.

When to book interpreters

Not all deaf participants will require or desire an interpreter, but many will benefit from professional interpretation services. Book interpreters when:

- **Group Sessions with Mixed Communication Preferences:** When Deaf participants who prefer interpretation are alongside hearing participants, interpreters facilitate full access to group discussions and activities. This is especially important for programmes involving families where deaf youth are with hearing parents or siblings.

- **Complex Scientific Content:** Marine science involves specialised vocabulary and abstract concepts. Professional interpreters with science backgrounds can accurately convey technical information about ocean chemistry, marine ecosystems, or conservation policy.

- **Formal Educational Programmes:** School groups, university courses, or structured educational programmes typically require professional interpretation. Teachers and group leaders often request this service in advance.

Always ask during booking if participants require interpretation services. Some will request this explicitly, while others may prefer different communication methods.

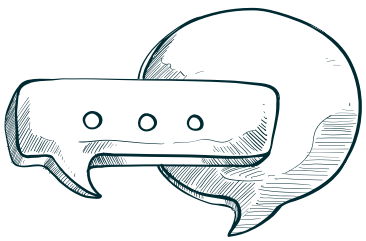
Booking Interpreters: Practical Guidance

- **Advance Notice:** Book interpreters at least two to three weeks in advance. Qualified interpreters are in high demand. For regular programmes, consider building relationships with specific interpreters who can become familiar with your centre and marine content.

- **Provide Context and Materials:** Share your programme details, species list, key vocabulary and MUFFIN project sign videos so interpreters can familiarise themselves with relevant signs. More context means more accurate interpretation.

- **Session Length and Breaks.** For sessions over one hour, book two interpreters to work in rotation. Interpreters typically rotate every 20-30 minutes to maintain accuracy and prevent fatigue.

- **Specialist Interpreters.** When possible, request interpreters with an educational or scientific experience. If specialist interpreters aren't available, the materials you provide become even more important for preparation.



Working Effectively with Interpreters

The Interpreter's Role

- **Facilitating Communication:** Interpreters translate information between spoken English and BSL, interpreting everything said and voicing for deaf participants.
- **Professional neutrality:** Interpreters remain impartial and do not add, omit, or modify information. If a deaf participant asks the interpreter a question about marine biology, the interpreter will direct it to you, the educator.
- **Positioning and visibility:** Interpreters need clear sightlines to both you and deaf participants. Work together at the start of the session to identify optimal positioning.

Best Practices for Educators

- **Speak Directly to Participants:** Always address deaf participants directly, not the interpreter. Make eye contact with the deaf person. Say "What species did you find?" not "Ask her what species she found."
- **Allow Time for Interpretation:** Pause after asking questions to give the interpreter time to finish and the participant to respond. This slight lag is normal and necessary.
- **Face the Deaf Participants:** Position yourself so they can see both you and the interpreter. During demonstrations, stand beside or slightly behind the interpreter. Remember, participants must split their visual attention between your demonstration and the interpretation.
- **Use Clear, Paced Speech:** Speak at a natural but steady pace. Avoid mumbling or covering your mouth. Use straightforward language and explain jargon when introducing new terms.
- **Pause During Visual Activities:** When participants are observing the specimens or exhibits, stop speaking. Deaf participants cannot watch the specimens and the interpreter at the same time. Structure activities with clear observation moments followed by discussion moments.
- **Brief the Interpreter:** Before the session, allow interpreters a few minutes to discuss the plan, specialised vocabulary, and positioning logistics. Share which species will be featured and any activities requiring special consideration.

Managing Group Dynamics

- **Include Interpreters in Space Planning:** Ensure interpreters have clear sightlines to both you and deaf participants. In touch tanks, the interpreter might stand at the tank's end. On boats, consider how movement affects visibility.

- **Support Two-Way Communication:** Encourage deaf participants to share observations and questions. Allow time for signed contributions, which the interpreter will voice for the group.

- **Multiple Deaf Participants:** interpreters will be positioned to be visible to all deaf participants. Deaf participants may also communicate directly in BSL without interpretation—this is normal and encourages positive communication.

Environmental Challenges in Marine Settings

Marine education environments present unique challenges for interpretation that require planning and flexibility.

- **Boat-Based Programmes:** Wind and engine noise make hearing difficult for interpreters. Position them close enough for clear hearing, possibly using microphones. Boat movement affects balance and makes signing challenging. Brief interpreters about boat safety and establish visual emergency signals.

- **Outdoor Settings:** Bright sunlight causes glare that makes signing difficult to see. Position interpreters with the sun behind deaf participants when possible. Wind and cold weather may decrease signing stamina, so plan for more frequent rotations or warming breaks.

- **Aquarium Tours:** Interpreters should stay visible when participants view exhibits, often standing slightly to the side of tanks. In crowded areas, ensure clear sightlines and keep groups manageable.

- **Touch Tanks:** Position interpreters where they are visible to all participants surrounding the tank. Ensure lighting highlights the interpreter's hands and face. Pause speaking when attention is on the specimens.

Costs and Booking

Professional interpretation is a specialised skill requiring years of training. Interpreters typically charge hourly rates with minimums often covering two to three hours. Rates vary by region and experience. Explore funding options through grants supporting inclusive education. Understand cancellation policies when booking and communicate schedule changes early.

Alternatives to Interpreters

Professional interpreters are not always necessary or preferred. Some deaf participants do not use sign language as their main communication method and might prefer speech and lipreading. Small groups or one-on-one sessions can work well with written communication, demonstrations, and visual aids. Always maintain multiple communication methods: visual demonstrations, written instructions, laminated species cards, drawing materials, pointing and gesturing, and tablets for typed communication.

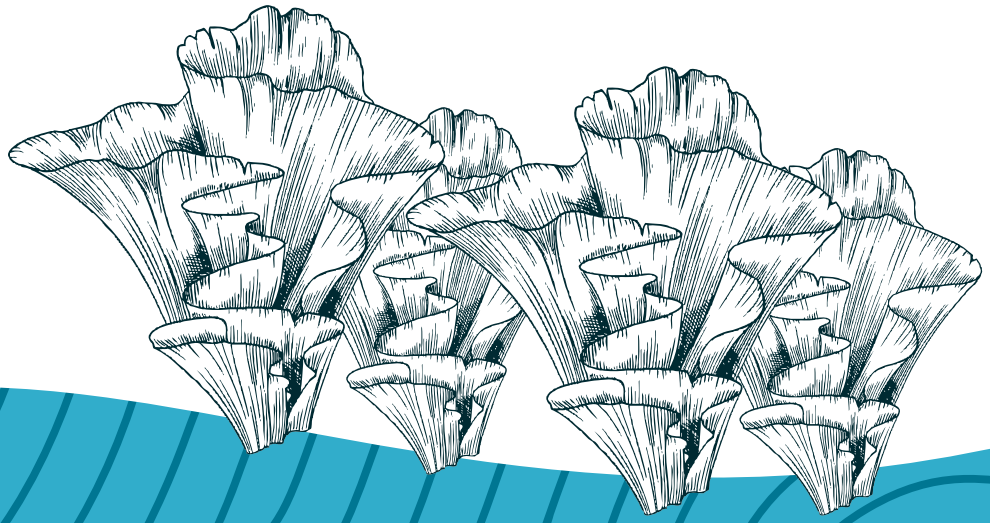
Key Principles for Working with Interpreters

- **Before the session:** Book early with as much advance notice as possible. Provide context, materials, and species lists. Brief interpreters on the programme structure and any challenging conditions. Discuss positioning and logistics.

- **During the session:** Speak directly to the deaf participants, not the interpreter. Allow time for interpretation lag. Pause speaking during visual observation moments. Face the group so participants can see both you and the interpreter. Use clear, measured speech and explain new vocabulary.

- **After the session:** Thank interpreters for their work. Ask for feedback from them and the deaf participants on what went well and what could be improved. Note any vocabulary or signs that were particularly helpful. Incorporate these insights into future planning.

Working effectively with sign language interpreters is a skill that improves with practice. Each session will teach you more about timing, positioning, and communication flow. The effort invested creates truly accessible marine education experiences where Deaf participants have full access to learning, discovery, and connection with the ocean.



SAFETY AND EMERGENCY PROCEDURES

Marine centres already have comprehensive safety procedures in place. When welcoming deaf participants, adapt these existing protocols to ensure visual access to emergency information and alerts.

Visual Emergency Alerts

Standard auditory alarms (fire alarms, sirens, whistles) will not be accessible to many deaf participants. Install visual alert systems such as flashing lights in all programme areas, or ensure staff can quickly attract visual attention using agreed signals. For outdoor and boat-based programmes where visual alert systems are unavailable, assign staff members to maintain visual contact with Deaf participants at all times.

Emergency Signals and Communication

Before any session starts, establish and demonstrate clear visual emergency signals that all participants can recognise. Use hand signals such as raising both hands for "stop/danger," waving arms overhead for "return to group immediately," and pointing combined with an urgent facial expression for "move away from this area." Practice these signals with the group so everyone recognises them instantly. Ensure interpreters (if present) are familiar with these signals and can quickly communicate emergency instructions.

Buddy Systems and Visual Check-ins

Implement buddy systems where each deaf participant is paired with another participant or staff member for regular visual check-ins. This is especially important in outdoor environments, on boats, or in areas where the group might spread out. Establish a simple check-in signal (such as thumbs up) that buddies exchange at regular intervals. Staff should stay visually aware of the whereabouts of deaf participants at all times, particularly near water or in changing conditions.

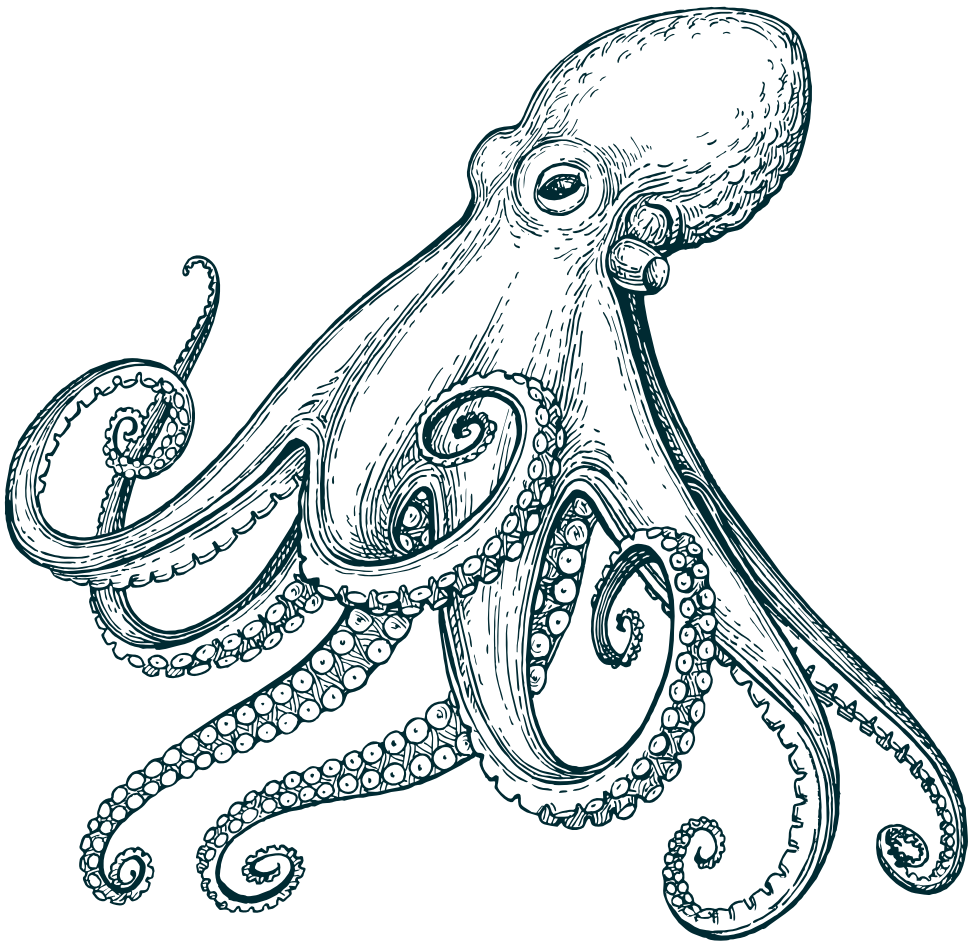
Evacuation and Meeting Points

Display evacuation routes and emergency meeting points visually before activities start. Use maps, diagrams, or physical walk-throughs instead of just spoken instructions. Assign a specific staff member to ensure all deaf participants have evacuated and reached the meeting point. In emergencies, never assume deaf participants have heard announcements or alarms - always verify visually.

Marine Environment Specific Considerations

For boat-based programmes, demonstrate life jacket use and man overboard procedures visually before departure. Establish specific visual signals for boat emergencies. On beaches and in rock pools, use high-visibility markers to indicate safe boundaries. In all marine environments, ensure mobile phones or communication devices are available as backup communication methods if necessary, and verify that emergency services can be contacted via text or other non-voice means if required.

Key principle: Adapt your existing safety procedures to be visually accessible rather than creating entirely new protocols. Visual access to safety information is not optional - it's essential for ensuring all participants can respond appropriately in emergencies.



ADAPTING MARINE ACTIVITIES FOR DEAF YOUTH

Marine education naturally lends itself to visual and tactile learning. This section provides practical strategies for adapting common marine centre activities to ensure Deaf youth have full access to learning experiences.

General Principles for All Activities

Before diving into specific activities, keep these core principles in mind:

- **Visual First** – Always prioritise visual communication by demonstrating before explaining, using physical models and props, and showing examples rather than merely describing them.
- **Hands-on learning** – Prioritise hands-on learning through direct interaction with the marine specimens, allowing extra time for observation and exploration. Encourage touching, feeling, and close examination where appropriate, using tactile experiences to reinforce concepts.
- **Clear communication** – Keep sightlines unobstructed at all times. Critical Principle: Deaf participants cannot look at the marine specimens and watch the educator or interpreter for communication simultaneously. Pause activities so everyone has a clear view and avoid talking while participants are looking down at specimens or writing. Position yourself where the lighting is optimal, so participants can see your face clearly.

Touch Tanks and Tactile Exhibits

Touch tanks are ideal for Deaf youth because they emphasise observation and tactile exploration over auditory explanation.

Setup Considerations

When organising touch tank activities, arrange participants around the tank with enough space so everyone can see both the educator and the tank. If using an interpreter, position them so that all participants can see them. Keep the group small, with a maximum of 8-10 people around one tank. Make sure faces are well-lit for lipreading and sign language, avoiding backlighting that creates shadows. Add extra lighting if needed.

Teaching Strategies

Start with a demonstration first. For example, show how to gently touch the purple sea urchin before explaining, demonstrate the hermit crab's movement, and model proper handling of the European lobster. Let participants observe your technique before they try it themselves.

Use visual prompts such as laminated cards with images and key information about each species. Include simple diagrams showing anatomy, like where the octopus's arms connect to its body, and create visual guides for appropriate touch techniques.

Structure the exploration by giving participants time to investigate independently, then use visual cues to attract attention, such as raising your hand, gently flashing lights, or waving. Between observations, ensure everyone's focus is on the communicator. Remember that the participants need to choose between watching the specimen or watching you communicate – they cannot do both at the same time. This is why the pause-and-gather approach is essential. Ask the participants to show others what they have discovered rather than simply describing it.

Key Vocabulary

Introduce marine science vocabulary visually by showing the actual body part while signing or saying, for example, "siphon" or "tentacle." Use gestures that mirror the concept, such as flowing motion for a siphon or wiggling fingers for tentacles. Write key terms on a whiteboard that participants can reference. The MUFFIN project has developed BSL signs for marine species (see MUFFIN Project Resources section for details).

Boat-Based Programmes

Boat environments present unique challenges and opportunities for Deaf youth.

Pre-Trip Planning

Conduct a visual safety briefing with demonstrations using large visual cards or a tablet to illustrate the process of wearing a life jacket, emergency signals, designated meeting points, and steps to take if someone falls overboard. Assign a buddy system with visual check-in signals and rehearse emergency procedures before departure.

Establish visual signals for common situations: "Look here" can be indicated with a raised hand or wave, "Marine life spotted" uses a pointing gesture, "Return to group" signals a gathering motion, and "Stop/danger" is shown with a flat hand raised. Brief all staff and participants on these signals before boarding and consider using waterproof visual cards displaying key signals.

On-Board Adaptations

Arrange the seating so participants can see both the educator and the water, preferably in a semi-circle. Keep the interpreter (if present) in a stable, visible position, and be aware that boat movement can make signing and lipreading more difficult.

The boat environment presents specific challenges. Wind, spray, and engine noise diminish the effectiveness of hearing aids and cochlear implants, and some participants may opt to remove their devices, which is expected and acceptable. Rely more on visual communication and gestures, using pointing and demonstrating instead of lengthy explanations, and write key information on waterproof boards or tablets.

When wildlife such as a basking shark, common bottlenose dolphin, or loggerhead turtle is sighted, attract attention first by waving or gently tapping shoulders. Clearly point to the animal's location and encourage participants to use binoculars, suggesting they do the same. After the sighting, discuss what was observed. Consider bringing identification cards displaying local species and taking photos or videos to review and discuss later.

Teaching Moments

Use the environment itself as a teaching resource. Show phytoplankton samples under a portable microscope, collect surface water to observe zooplankton, and demonstrate how to tell a moon jellyfish from a Portuguese man o' war from a safe distance. Utilise the actual seascape to teach about marine habitats.

Aquarium Tours

Aquarium settings provide controlled environments that are ideal for structured learning.

Tour Structure

Allow for longer tour durations than usual groups and include regular pauses for discussion and questions. Never attempt to communicate while participants are observing the exhibits and use a gather signal to regain attention directed towards the guide.

Focus on fewer exhibits to enable participants to examine them more thoroughly. Choose exhibits that highlight strong visual features such as short-snouted seahorse camouflage, common eagle ray gliding patterns, red gorgonian colony structure, or common octopus colour changes. Allow time for independent observation before group discussion.

Teaching Techniques

Engage in comparison and observation activities by asking questions such as: How does the blue shark move differently from the swordfish? Which fish have camouflage and which have bright colours, and why? How does the body shape of the bluefin tuna compare to the common eagle ray? Provide drawing materials for participants to sketch what they observe and encourage visual note-taking. This will depend on what is available at the aquarium.

If possible, incorporate interactive elements by using touchscreens and interactive displays (ensuring captions are available for video clips), provide clipboards with observation sheets, include visual matching games such as matching species to their habitat, and use scale models that participants can handle.

Tell stories about marine life using props, photos, and gestures. Use a timeline with images to show life cycles, demonstrate predator-prey relationships with visual aids or models, and show video clips with captions.

Beach and Rock Pool Exploration

Rock pools offer incredible hands-on learning opportunities with natural marine life.

Site Selection and Safety

Choose accessible locations with solid ground and good visibility. Ensure the area allows participants to spread out while remaining in view of staff. Carefully check tide times and weather conditions, and confirm that emergency services can be contacted (make sure staff have alternative communication methods if needed).

Establish visual boundaries using flags, cones, or natural markers, and implement a buddy system with regular visual check-ins. Wear high-visibility vests or armbands for easy identification. Agree on clear visual signals before starting: raised hand means "Look at me," waving arms means "Come back," and both arms up in an X means "Emergency/danger."

Suggested Exploration Activities

Provide magnifying glasses, collection containers, and waterproof field guides with clear images. Give participants observation tasks such as finding three different types of seaweed (Neptune grass, common eelgrass, and others), locating a creature with a shell, or discovering something that changes with the tide. Create a visual scavenger hunt with laminated cards.

For hands-on exploration, demonstrate gentle handling of the hermit crab, such as carefully turning over rocks and replacing them, and model respectful observation of marine species in their habitat. Allow participants to feel different textures like smooth shells, rough barnacles, and soft algae.

Encourage participants to photograph their discoveries and provide waterproof notebooks for sketching. Create a group collection of findings to review together, using photography to capture moments for later discussion.

Post-Activity Discussion

Gather the group in a sheltered area with good visibility and use collected specimens or photos to facilitate discussion. Ask participants to show and share their favourite discoveries, connect observations to larger marine concepts, and then clean and return all specimens to their habitats.

Supporting Independent Learning

Visual Resources to Provide

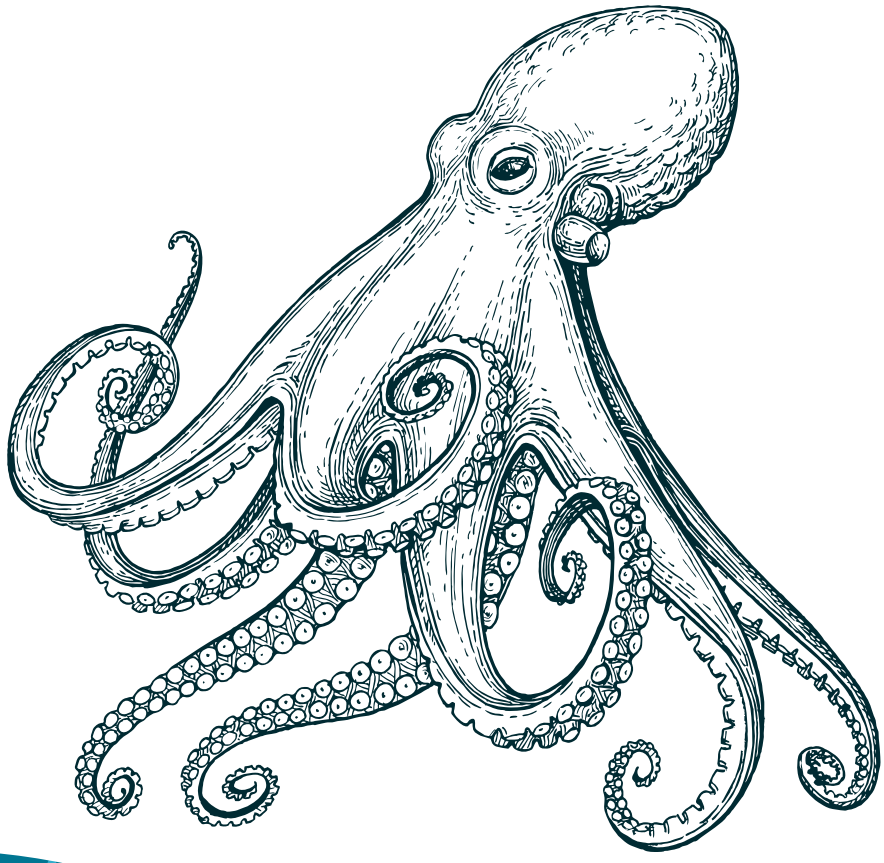
Provide species identification cards with images and key facts, laminated anatomy diagrams, and visual glossaries of marine science terms. The MUFFIN project's educational videos (available on YouTube) offer excellent visual introductions to 25 common marine species in sign language, making them ideal for pre-visit preparation or during sessions. QR codes can link directly to these captioned videos or other sign language resources, along with drawing templates for visual note-taking.

Technology Tools

Tablets and smartphones enable participants to take photos and videos and access visual resources. Underwater cameras allow participants to document their own discoveries. Apps with visual features such as species identification tools and marine life guides are valuable resources, as are captioned videos for pre-visit preparation or post-visit review.

Differentiation Strategies

Remember that Deaf youth, like all learners, have diverse prior knowledge of marine science, comfort levels with hands-on activities, communication preferences, and learning styles. Offer multiple ways to access information (visual, tactile, written), demonstrate understanding (drawing, signing, writing, showing), and engage with content (observation, hands-on exploration, discussion).



MUFFIN PROJECT RESOURCES

As introduced earlier, the MUFFIN project has developed sign language resources specifically for marine education. This section provides details on accessing and using these resources.

How the Signs were Developed

The marine species signs developed through the MUFFIN project represent a unique approach that combined interdependent national development with international collaboration. Each partner country – Croatia, Spain, Italy and the UK – worked to create their own sign language glossaries for the 50 marine species, ensuring the signs were appropriate and meaningful within its respective sign language (HZJ, LSE, LSM, LIS and BSL).
https://www.youtube.com/@MUFFIN_Erasmus/playlists

The UK team took an additional collaborative step by working with six deaf marine biologists from the USA, Canada, the Netherlands, France, and Germany via Zoom. These international discussions were conducted using International Sign, allowing deaf marine scientists from different countries to share their expertise and perspectives with sign linguists. This cross-border exchange enriched the sign development process by bringing together diverse experiences of marine science education and research from the global Deaf community.

The development approach is built upon the established methodology of the Scottish Sensory Centre (SSC) BSL glossary project, which emphasises collaborative, concept-focused sign development. The process focused on what marine species visually represent, their functions, and how they behave in their environment. Rather than simply translating written terms into sign language, teams discussed and visually represented the distinctive characteristics of each species.

For example, when developing a sign for "hermit crab," the team would not simply combine signs for "hermit" and "crab." Instead, they would discuss and visually represent the hermit crab's distinctive behaviour, its method of locomotion, or its characteristic appearance. The resulting sign uses the right clenched hand to represent the shell and the left fingers to represent the legs walking. This sign captures the essence of what makes a hermit crab unique in the marine environment – a creature that carries its borrowed shell home while walking along the seabed.
https://www.ssc.education.ed.ac.uk/BSL/marine/hermitcrab.html

Working via Zoom allowed for flexible, accessible collaboration across countries and time zones. The UK team's international discussions through International Sign demonstrated the linguistic flexibility within the Deaf community and ensured that the signs reflected authentic marine species expertise from multiple perspectives.

After development and refinement, each country's signs were professionally filmed and made publicly available through the SSC glossary website. This approach resulted in five distinct but conceptually related glossaries, each reflecting the linguistic structure and cultural context of its respective sign language while maintaining scientific accuracy. The signs are meaningful visual representations rooted in both marine science expertise and the linguistic knowledge of deaf scientists and sign language specialists.

Marine Species Signs

The UK partner created new signs for 87 marine species and they can be found on the SSC Glossary website - https://www.ssc.education.ed.ac.uk/BSL/marinehome.html or on the MUFFIN project's YouTube playlist where you can find also other country's glossaries - https://youtube.com/playlist?list=PLZGEbImZLsmgB4Kq91o_jcf1oRsLusy5I&si=0HbwEhvTn9JGFiGW

Species covered include:

- Atlantic salmon
- Barnacles
- Barracuda
- Basking shark
- Blue fin Tuna
- Blue shark
- Brown meagre
- Butterfish/Rock Gunnell
- Cold-water Coral
- Common bottlenose dolphin
- Common dolphin
- Common eagle ray
- Common eelgrass
- Common octopus
- Common prawn
- Common starfish
- Cotton spinner (Sea Cucumber)
- Cuttlefish
- Damselfish
- European anchovy
- European lobster
- Fan mussel
- Fried egg jellyfish
- Giant grouper
- Gilt-head bream
- Gobies

English names

Species covered include:

English names

- Greater pipefish
- Grey seal
- Hermit crab
- Loggerhead turtle
- Mauve stinger
- Mediterranean moray
- Moon Jellyfish
- Mutable nassa
- Neptune grass
- North Atlantic fin whale
- Nursehound
- Phytoplankton
- Picked dogfish
- Portuguese man o'war
- Purple sea urchin
- Red coral
- Red gorgonian
- Red starfish
- Sardine
- Shore crab
- Short Snouted Seahorse
- Shortfin Mako shark
- Sole
- Sperm whale
- Sun fish
- Swordfish
- Variegated scallop
- White seabream
- Zooplankton

Educational Videos

The MUFFIN project produced 25 educational videos featuring commonly encountered species in marine centres. These videos are available on YouTube with captions and present information in sign language - https://www.youtube.com/playlist?list=PLZGEbImZLsmiL3bXlRgzY7Moh8K6VUvoJ

The 25 species featured are:

Common names

- Basking shark
- Blue fin tuna
- Blue shark
- Common bottlenose dolphin
- Common eagle ray
- Common eelgrass
- Common octopus
- Cotton spinner (sea cucumber)
- European lobster
- Fan Mussel
- Hermit crab
- Loggerhead turtle
- Moon jellyfish
- Neptune grass
- North Atlantic fin whale
- Phytoplankton
- Portuguese man o'war
- Purple sea urchin
- Red coral
- Red gorgonian
- Red starfish
- Short snouted seahorse
- Sperm whale
- Swordfish
- Zooplankton

How to Use These Resources

For Staff Training:

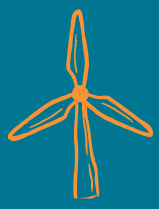
- **Learn** the signs for the marine species you have in your centre
- **Watch** educational videos to see how marine concepts are explained in sign language
- **Practice** signs before sessions to build confidence

During Sessions:

- **Show** educational videos as introductions to species
- **Use** QR codes to link to relevant signs and videos
- **Encourage** deaf participants to teach hearing participants the signs
- **Create** visual reference materials using screenshots from the videos

For Pre-Visit Preparation:

- **Share** links to relevant videos with schools or families before visits
- **Allow** Deaf youth to familiarise themselves with the vocabulary in advance
- **Build** anticipation by showing what species they'll encounter



Accessing the Resources:
All MUFFIN project resources are freely available on:
https://www.ssc.education.ed.ac.uk/BSL/marinehome.html
https://www.youtube.com/@MUFFIN_Erasmus/playlists

Key Principles Summary

- **Demonstrate, then explain** – Show before you tell
- **Pause for communication** – Never talk while participants are engaged with the specimens
- **Use visual signals** – Establish and practice attention signals
- **Allow extra time** – Visual observation and communication take time
- **Leverage natural visual learning** – Marine environments are inherently visual
- **Provide multiple access points** – Visual, tactile, and written resources
- **Prioritise direct experience** – Hands-on learning transcends language barriers

The visual and tactile qualities of marine environments naturally make them accessible to Deaf youth. By carefully adapting your activities with these strategies, you create learning experiences where Deaf participants can fully engage, explore, and deepen their understanding of ocean science.

RESOURCES AND APPENDICES

This section provides quick-reference materials, useful contacts, and practical checklists to support your work with Deaf youth in marine education.

Useful Contacts and Organisations

- **National Deaf Children's Society (NDCS)**
  Provides information, support, and resources for deaf children, young people, and their families. Website: www.ndcs.org.uk

- **British Deaf Association (BDA)**
  The UK's leading organisation for deaf people, offering advocacy, information, and community connections. Website: www.bda.org.uk

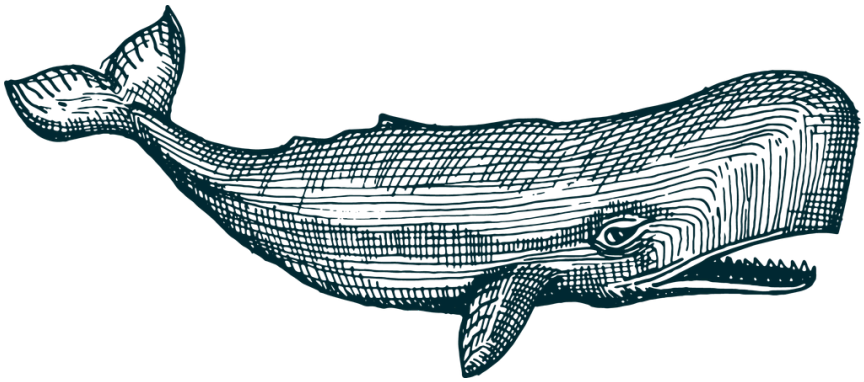
- **Deafblind UK**
  a national charity supporting people with sight and hearing loss
  Website: https://Deafblind.org.uk/about-us/

- **SSC BSL glossary website,** based at the University of Edinburgh: https://www.ssc.education.ed.ac.uk/BSL/marinehome.html

- **Association of Sign Language Interpreters (ASLI)**
  Professional body for sign language interpreters in the UK. Use their directory to find qualified interpreters. Website: www.asli.org.uk

- **Scottish Register of Language Professionals with the Deaf Community (SRLPDC)**
  Professional body for sign language interpreters in Scotland. Use their directory to find qualified interpreters.
  Website: https://thescottishregister.co.uk

- **MUFFIN project Marine Underwater Fishes For Inclusion – provides BSL marine science signs and educational videos.**
  YouTube: Search “MUFFIN project BSL marine signs”



APPENDIX 1: PRE-VISIT PLANNING CHECKLIST

Successful marine education experiences for Deaf youth begin well before participants arrive. Use this comprehensive checklist to ensure thorough preparation.

Initial Contact (At Time of Booking)

- [ ] Ask whether any participants are deaf or hard of hearing during the standard booking process.
- [ ] Establish the communication method with family or school (email is usually the most accessible).
- [ ] Frame questions positively: "Do any participants have access needs we should be aware of?"

Access Needs Assessment (2-4 Weeks Before Visit)

Gather specific information about each Deaf participant:

- [ ] Communication preferences: BSL user? Spoken English with lipreading? Combination? Other?
- [ ] Interpreter needs: Will they bring their own support or do you need to arrange interpretation?
- [ ] Assistive technology: Hearing aids? Cochlear implants? Will they use devices near water?
- [ ] Group composition: Attending alone, with Deaf peers, or with hearing family/friends?
- [ ] Previous experience: Visited marine centres before? Familiar with marine vocabulary in BSL?
- [ ] Additional needs: Any other considerations (sensory, mobility, learning preferences)?

Arrange Support (2-3 Weeks Before Visit)

- [ ] Book qualified BSL interpreters if needed (minimum 2-3 weeks' advance notice)
- [ ] Provide interpreters with: programme details, species lists, MUFFIN videos, timing, and any challenging conditions
- [ ] If participant is bringing own support, clarify roles and expectations

- [ ] Confirm whether additional professional interpretation would be beneficial for complex content

Share Pre-Visit Resources (1-2 Weeks Before)

- [ ] Send links to relevant MUFFIN educational videos (species they'll encounter)
- [ ] Provide a visual programme overview with photos of the facility and key species
- [ ] Share visual safety information (especially for boat/water activities)
- [ ] Explain accessibility features: induction loops, visual alerts, and written materials available
- [ ] Be transparent about what you can/cannot provide

Prepare Staff and Facility (Week Before Visit)

- [ ] Brief all staff on: communication methods, interpreter availability, specific participant needs.
- [ ] Review Quick Start Guide principles with the team
- [ ] Identify programme moments needing adaptation or extra time
- [ ] Plan how to gather attention during outdoor/boat activities
- [ ] Check lighting and sightlines in all programme spaces
- [ ] Test videos for captions; prepare visual alternatives for audio content
- [ ] Prepare visual resources: laminated species cards, whiteboards, observation sheets, emergency signal cards

Final Confirmation (1-2 Days Before)

- [ ] Send confirmation with: arrival time, meeting point, what to bring, weather information
- [ ] Include contact details with text/email options (not just phone)
- [ ] Invite any last-minute questions or concerns

Day-of-Visit Setup

- [ ] Position interpreter optimally (if applicable)
- [ ] Arrange seating for visibility (semicircles/U-shapes)
- [ ] Check lighting (faces well-lit, no backlighting)
- [ ] Have visual resources ready and accessible
- [ ] Confirm all staff know communication protocols
- [ ] Establish and practice visual emergency signals with the group at the start

Day-of-Visit Setup

Keep these principles in mind during sessions:

- [ ] Established visual emergency signals and practiced with group
- [ ] Positioned interpreter (if present) for optimal visibility
- [ ] Arranged seating in semicircles or U-shapes for clear sightlines
- [ ] Checked lighting on faces (no backlighting)
- [ ] Demonstrated activities before explaining verbally
- [ ] Paused speaking when participants were looking at the specimens
- [ ] Used visual attention signals (raised hand, waving)
- [ ] Maintained eye contact with deaf participants, not the interpreter
- [ ] Allowed extra time for communication and observation
- [ ] Provided multiple communication options (writing, gestures, visuals)
- [ ] Used buddy system for visual check-ins
- [ ] Confirmed all participants could see emergency meeting points
- [ ] Gathered feedback from participants and interpreters

APPENDIX 2: STAFF QUICK REFERENCE: VISUAL COMMUNICATION BASICS

Getting Attention:

- Wave hand in peripheral vision
- Gently tap on the shoulder
- Flash lights briefly
- Use the agreed visual signal

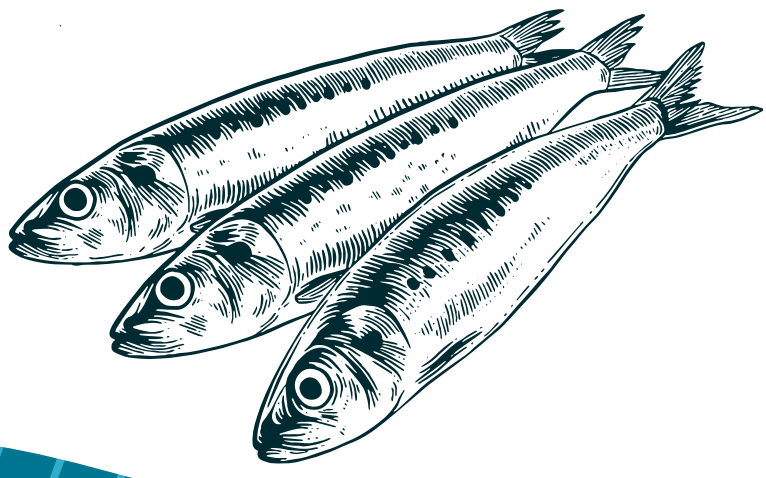
During Communication:

- Face the light (light on your face, not behind you)
- Maintain eye contact with deaf person, not interpreter
- Speak at natural but measured pace
- Use natural gestures and facial expressions
- Don't cover your mouth or turn away while speaking

Critical Rule: Deaf participants cannot simultaneously watch the marine specimens and watch you communicate. Always pause speaking during observation moments.

Emergency Signals:

- Both arms raised in X = Stop/Danger
- Waving arms overhead = Return to group immediately
- Pointing + urgent expression = Move away from this area
- Thumbs up = Check-in signal (all okay)



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ACKNOWLEDGEMENTS

This manual was developed as part of the MUFFIN project, funded by Erasmus+. We thank the international team of deaf marine biologists, sign linguists, and marine educators who contributed their expertise.

Final Note: *This manual is a living document. As you implement these practices and learn from experience, you will discover additional strategies and approaches. Share your learning with colleagues and the broader marine education community. Together, we can ensure that Deaf youth everywhere have full access to the wonder, excitement, and educational opportunities offered by marine environments.*

MUFFIN

THE UNIVERSITY of EDINBURGH

SSC scottish sensory centre

Erasmus+ Enriching lives, opening minds.

Co-funded by the European Union

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