NOTE ON THE FEASIBILITY OF TELE-NECROPSY SYSTEMS
Implementation of a scientific photography protocol adapted to cetacean strandings

The aim of this initiative is to organize training in scientific imaging in order to harmonize and standardize photographs and to set up a suitable protocol as a prerequisite for tele-necropsy.

Summary
Within the ACCOBAMS area, the size of stranding areas is often out of proportion to the means available to countries to cover them and to intervene effectively in relation to the recommendations of good necropsy practice. Experts and specialized equipment are mainly concentrated in the north-western part of the Mediterranean, which leads to a significant disparity in diagnostic capacities for the causes of stranding within the ACCOBAMS area. Following on from the training courses organized by ACCOBAMS on necropsies and good practices for determining the causes of mortality of stranded cetaceans, experts are now proposing to develop a discipline that is known to all, accessible, easily standardized and whose data can be immediately analyzed via computerized pooling: scientific photography.
This discipline, which is perfectly suited to a **One Health**[1] approach, opens the way to the deployment of a tool that is essential to implement because of the constraints in the field: tele-necropsy. Parties using scientific photography would thus strengthen their capacity to obtain diagnoses of causes of death, whether via their internal network of skills or by effectively calling on international experts.

Background
The ACCOBAMS area includes 24 country Parties and covers more than 50,000 km of coastline. Each country contributes to coastal surveillance according to its human and material resources, which makes the quality and quantity of data collected in the field uneven.
Investigating the causes of cetacean strandings requires a multidisciplinary approach, demanding both a reactive monitoring network and facilities for post-mortem examinations, and advanced laboratory techniques.
Such complexity make it all the more important to standardize data and thus improve the state of knowledge on these animals. Harmonizing practices within the same team is not always easy and doing so within a group of 24 contributors is therefore a considerable task. This concern for harmonization and standardization is reflected in the recommendations of *Best practice on cetacean post mortem investigation and tissue sampling (Joint ACCOBAMS and ASCOBANS document, 2019)*.
In response to these constraints, seminars are regularly organized in different countries to improve training in marine mammal dissection and necropsy. ACCOBAMS collaborates with the Department of Morphology and Pathology, University of Liège, Belgium (in collaboration with Pelagis, University of La Rochelle, France and LAB, University of Catalonia-Barcelona, Spain) to train experts from the ACCOBAMS area.

Recently (2021-2022), as a follow-up to these trainings and with a new partner (the Cre.Di.Ma, Istituto Zooprofilattico Sperimentale Piemonte, Liguria e Val d'Aosta, Torino, Italy), a seminar has been organized under the auspices of ACCOBAMS (ACCOBAMS 5-DAYS MARINE MAMMAL NECROPSY TRAINING - MOP8/2022/Inf30).

[1] The concept of "One Health" has been promoted since the early 2000s, with the awareness of the close links between human and animal health and the global ecological state. It aims to promote a multidisciplinary and global approach to health issues https://www.anses.fr/fr/content/one-health

The objective was to train biologists and veterinarians from the different countries of the ACCOBAMS area in the recommendations of *Best practice on cetacean post mortem investigation and tissue sampling (2019)*. An additional objective was to highlight new technologies to develop and apply the **concept of tele-necropsy and online consultation of marine mammal health experts to improve diagnosis**.

The participants to the last seminar were particularly interested in those aspects. Indeed, taking photographs as a scientific discipline in its own right makes it possible to improve the quality of the data collected and even to propose their analysis online via the use of digital tools. Finally, the recorded images can be re-injected into the initial and ongoing training of all the members, thereby participating in the standardization of methods as well as data.

Concrete proposal

The present feasibility study, called "DAUPHINS initiative", proposes to initiate a cycle of training courses in different phases (figure 1).

It consists of providing simple standardization tools and methods, giving basic theoretical knowledge but also practical advice to improve the quality of photographs and facilitate their interpretation by cetacean specialists who cannot travel to all necropsies. Covering the context of the stranding, the external aspect of the animal, the taking of samples and then the photographs of the necropsy itself, should enable each trained team to participate in the creation of a photo library with high added scientific value. The training will be supervised by a veterinarian specializing in marine mammal pathology and a veterinarian specializing in scientific photography. If the photographic part is successful, it will be possible to extend the training to video, which will logically pave the way for the implementation of tele-necropsy devices in order to link local teams to available specialists in real time, without having to make them travel. The time saved between the stranding event and the necropsy will **result** in better quality analyses.

Morocco has been chosen as pilot country for the implementation of this project. This choice is based on several elements: significant interest in setting up a stranding network analyzing the causes of mortality, and the possibility of developing bilateral (Morocco-Belgium) research projects.

The training cycle can be summarized as follows:

Phase 1

- Creation of two documents for the Parties participating in the training:
- A. Checklist of photographs that must be included in stranding reports (Annex 1)
- B. Guidelines on how to take pictures to ensure standardization of the process (Annex 2)
  These documents can be produced on site. Although not very costly, they are of significant scientific value.
- Distance learning course covering the basics of scientific photography;
- Face-to-face training in the form of a workshop, in Morocco, in order to put into practice, the concepts covered above.

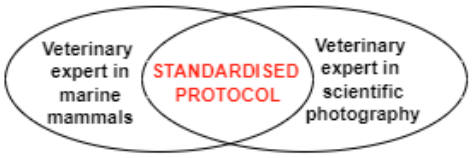
At this point, no camera equipment is required; the aim is to use the equipment available from Parties, mainly smartphones. In scientific photography, method and rigor are more important than technical performance.

Costs will be mainly linked to expertise in scientific photography (52€ HT/hour), as well as travel expenses linked to the practical training on site.

At the end of this phase, the party concerned will be able to start developing its national stranding network via the tool of scientific and medical photography through the distribution of checklists, guidelines and awareness raising on scientific photography.

At the same time, participation in the usual necropsy workshops at the University of Liège will serve as continuous training and will allow the progressive integration of the skills acquired in scientific photography.

From scientific photography to tele-necropsy : proposition of a training course adapted to cetacean strandings



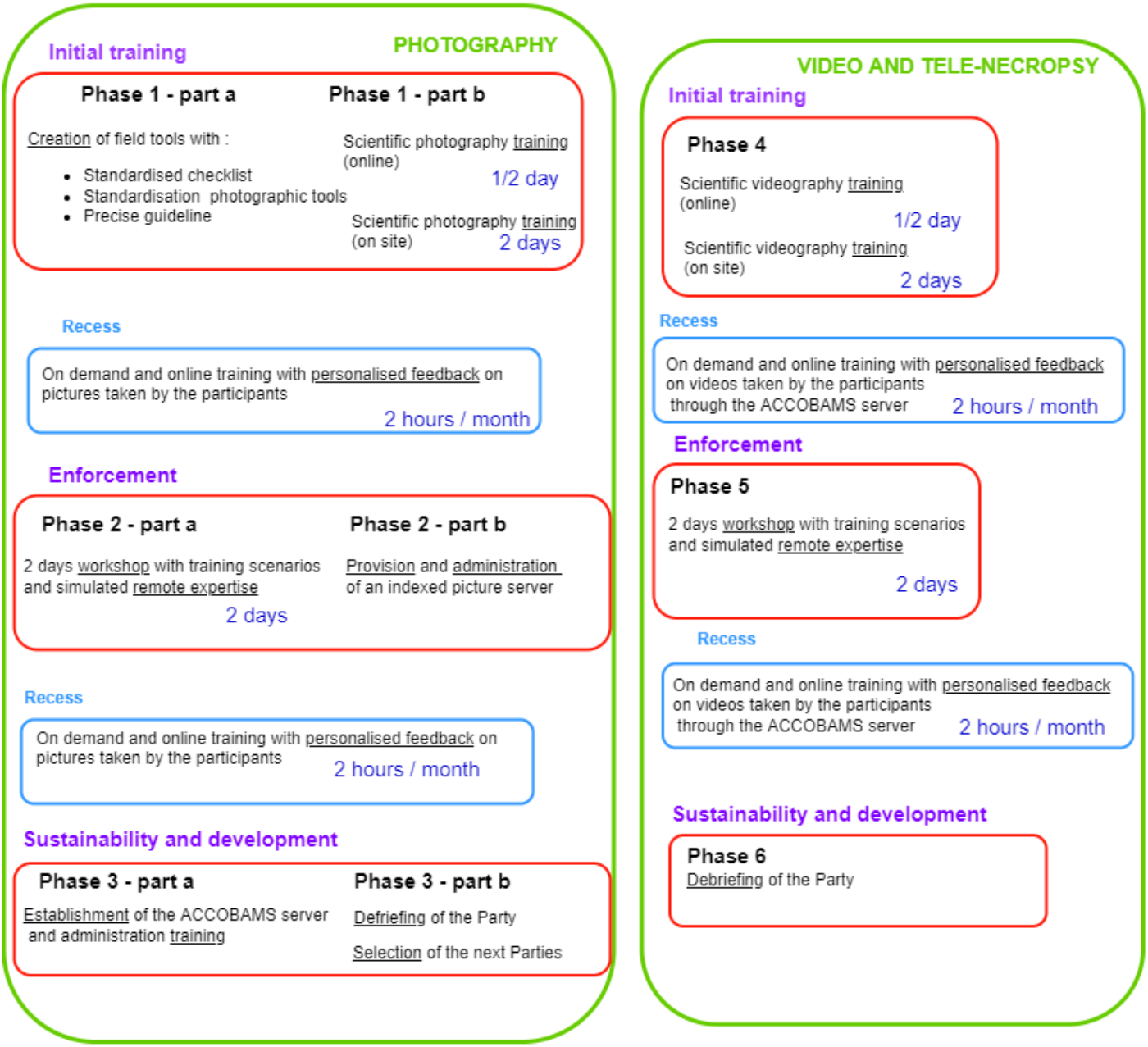


Figure 1: DAUPHIN initiative successive parts

If Phase 1 is successful, **Phase 2** is planned as follows:

- Organization of workshops in the Parties concerned in order to create realistic scenarios with the involvement of a "remote" expert on the basis of a photographically documented stranding/necropsy report;
- Pooling of photographs on a common server administered by the expert photographer.

Costs related to phase 2 concerning the rental of the server and its administration as well as the travel of experts and Parties for the workshop.
Further training is also possible on the basis of photographs taken by the learning party.
No specific material is yet committed.

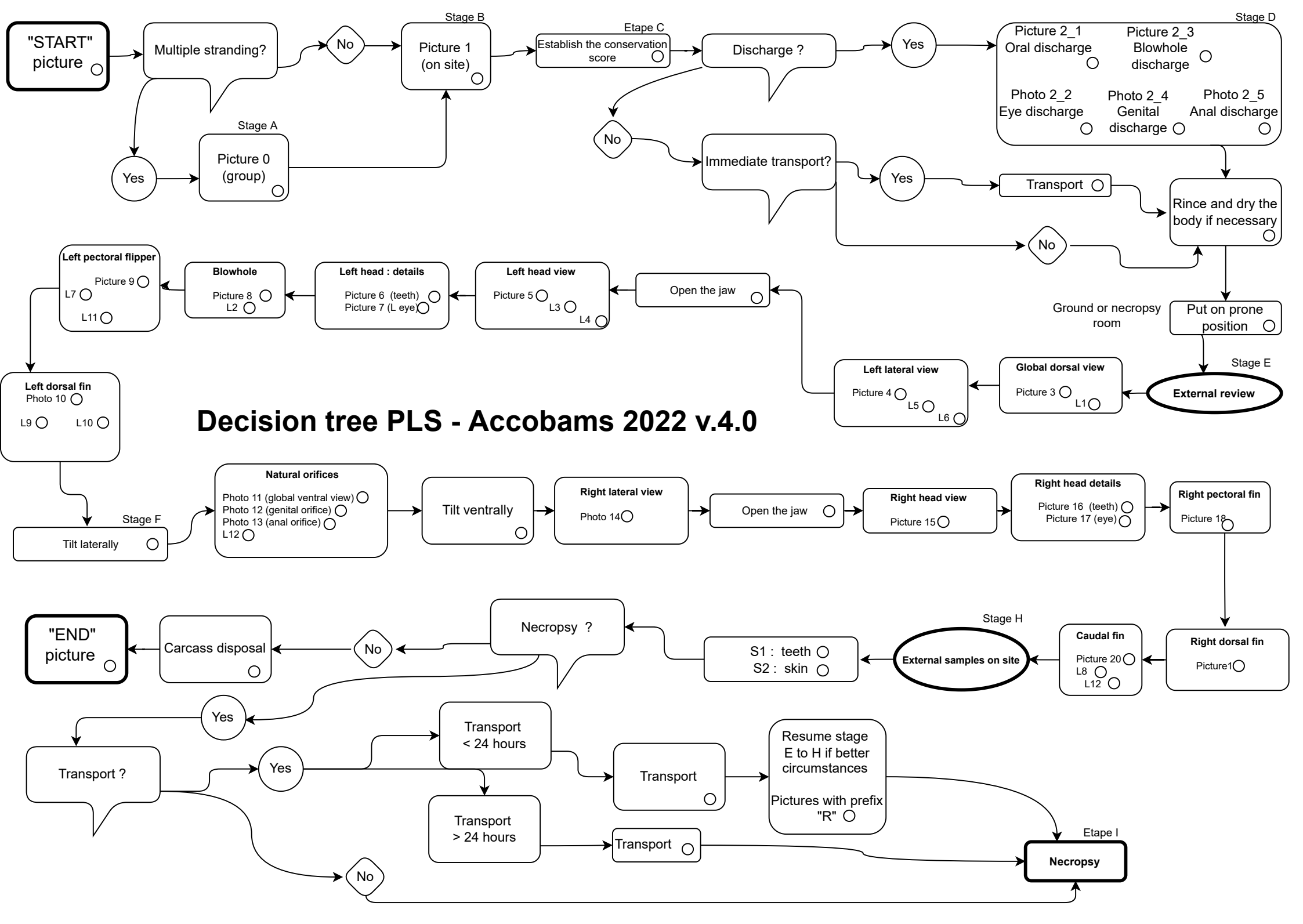
Phase 3 is activated if previous phases are successful.
It consists in perpetuating the file server by entrusting it to ACCOBAMS with the possibility of creating satellite servers in the Parties.
It will also be a question of debriefing the initiative with the party involved in order to define areas for improvement (training, equipment, etc.) and then to select the parties that will take part in the next training cycle.

Phase 4 to 6.

If successful, the Party who has completed the "photography" training will be able to move on to video by following the same training cycle structure (Figure 1, Phase 4 to 6). The integration of tele-necropsy will be the final step.
The initiative could be gradually expanded with the addition of new examinations (training in specimen collection with the University of La Rochelle, training in necropsy via the University of Liege workshop).
The closure of the initiative will be marked by the implementation of tele-necropsy devices that can be used nationally or internationally.
These tools will enable the Parties to respond to the concerns for harmonisation and standardisation that are contained in the recommendations of *Best practice on cetacean post mortem investigation and tissue sampling (Joint ACCOBAMS and ASCOBANS document, 2019).*

ANNEX 1

Checklist of photographs that must be included in the stranding reports


"START" picture
Multiple stranding?
No
Stage B
Picture 1 (on site)
Etape C
Establish the conservation score
Discharge ?
Yes
Stage D
Picture 2_1 Oral discharge
Picture 2_3 Blowhole discharge
Photo 2_2 Eye discharge
Photo 2_4 Genital discharge
Photo 2_5 Anal discharge
Yes
Stage A
Picture 0 (group)
No
Immediate transport?
Yes
Transport
Rince and dry the body if necessary
No
Ground or necropsy room
Put on prone position
Stage E
External review
Global dorsal view
Picture 3
L1
Left lateral view
Picture 4
L5
L6
Open the jaw
Left head view
Picture 5
L3
L4
Left head : details
Picture 6 (teeth)
Picture 7 (L eye)
Blowhole
Picture 8
L2
Left pectoral flipper
Picture 9
L7
L11
Left dorsal fin
Photo 10
L9
L10
Decision tree PLS - Accobams 2022 v.4.0
Stage F
Tilt laterally
Natural orifices
Photo 11 (global ventral view)
Photo 12 (genital orifice)
Photo 13 (anal orifice)
L12
Tilt ventrally
Right lateral view
Photo 14
Open the jaw
Right head view
Picture 15
Right head details
Picture 16 (teeth)
Picture 17 (eye)
Right pectoral fin
Picture 18
Right dorsal fin
Picture1
Caudal fin
Picture 20
L8
L12
Stage H
External samples on site
S1 : teeth
S2 : skin
Necropsy ?
No
Carcass disposal
"END" picture
Yes
Transport ?
Yes
Transport < 24 hours
Transport
Resume stage E to H if better circumstances
Pictures with prefix "R"
Transport > 24 hours
Transport
No
Etape I
Necropsy

ANNEX 2

Guidelines on how to take pictures to ensure standardization of the process

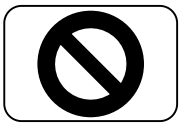
Guideline ACCOBAMS 2022

A. Check the quality of each picture

B. Interesting part centered and biggest as possible

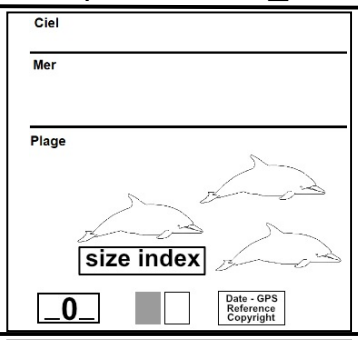
C. Replacing picture : R_number

D. Additional picture = A_number_increment

E. Impossible picture = 

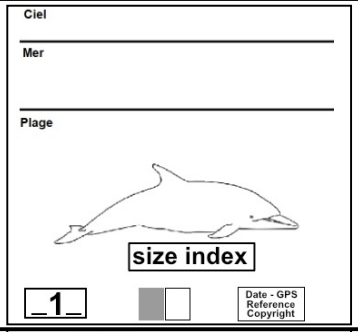
F. No tool on animal except very close shot

Picture 0



Tous les individus visibles entièrement

Picture 1



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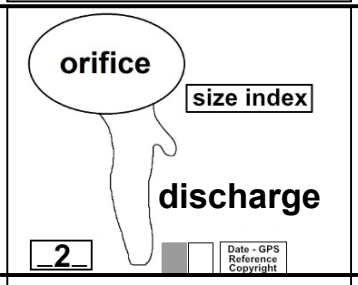
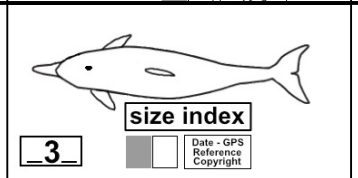


Discharge visible entirely

Picture 3



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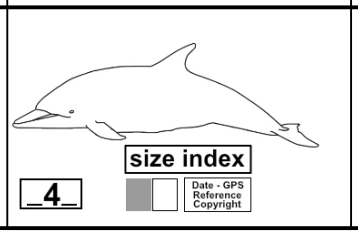

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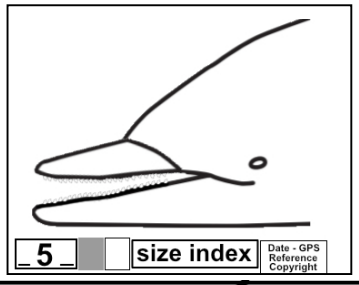
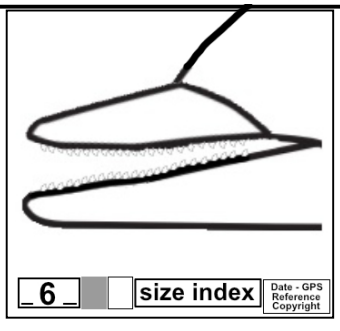


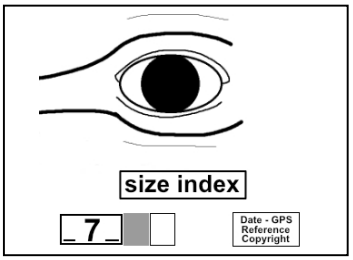
Open the jaw

Picture 6



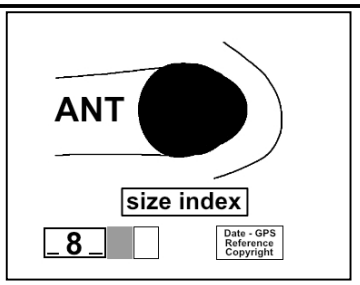
Take additional angles and close shots if necessary

Picture 7



Beware of reflections

Picture 8



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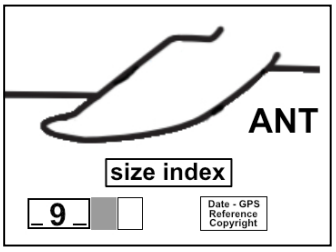

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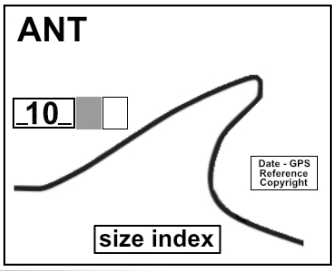

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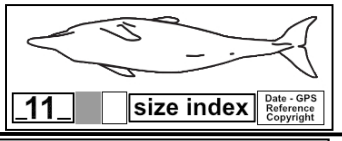

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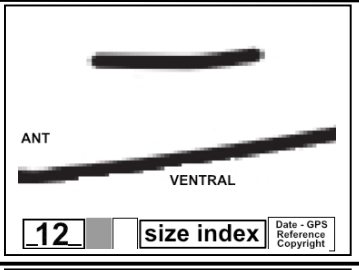

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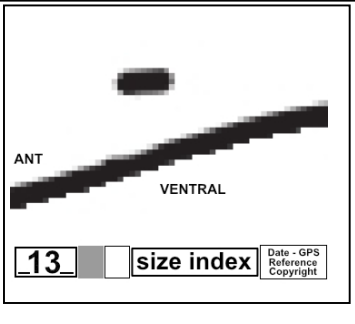

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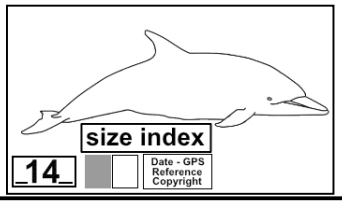

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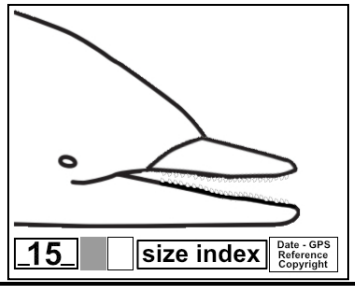
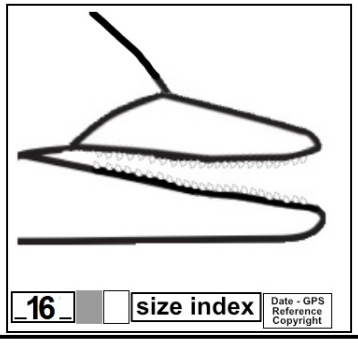


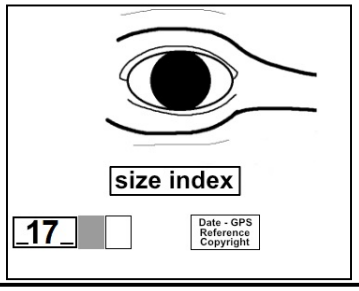
open the jaw

Picture 16



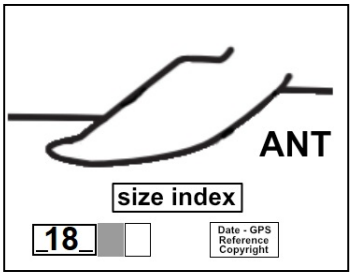
Take additional angles and close shots if necessary

Picture 17



Beware of reflections

Picture 18



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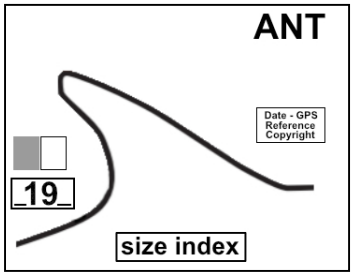

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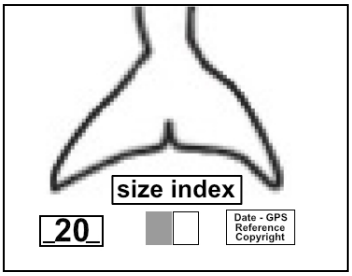
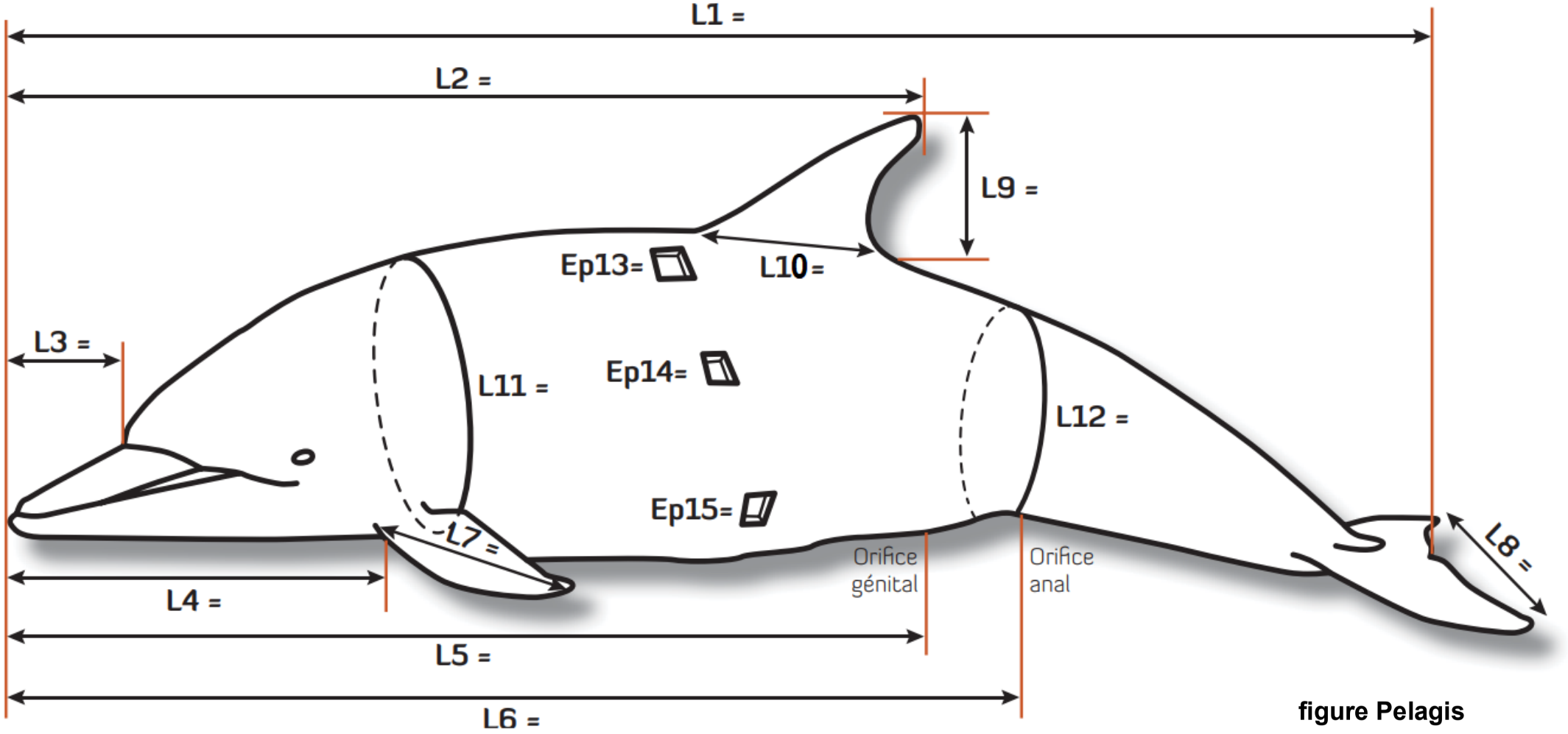


Lesion suspected ?
Don't forget to take section pictures

CUT OUT AND LAMINATE



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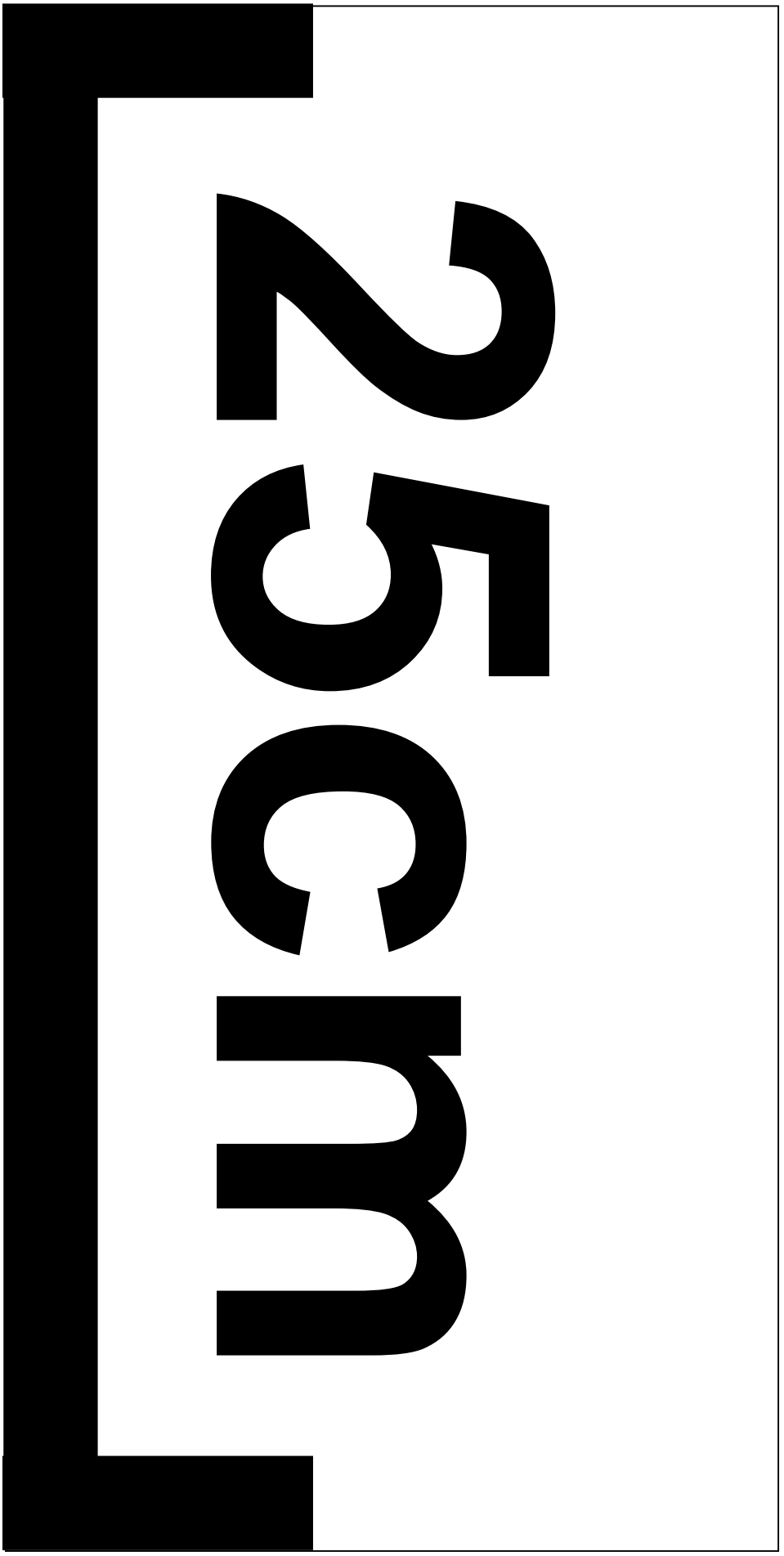
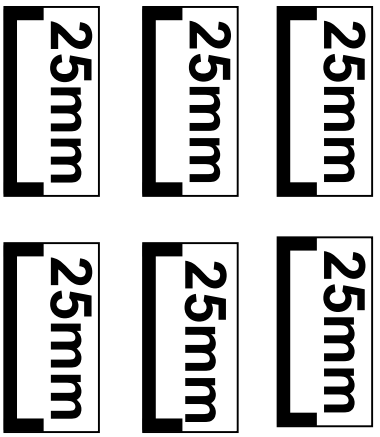
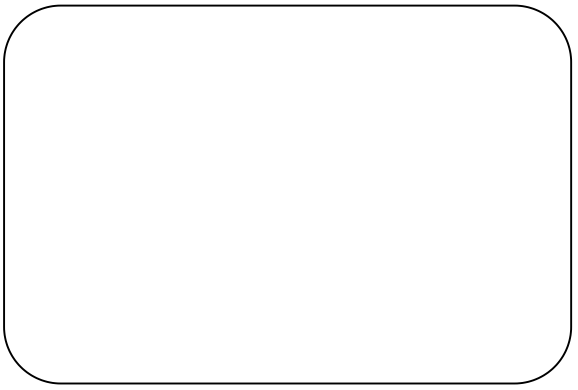
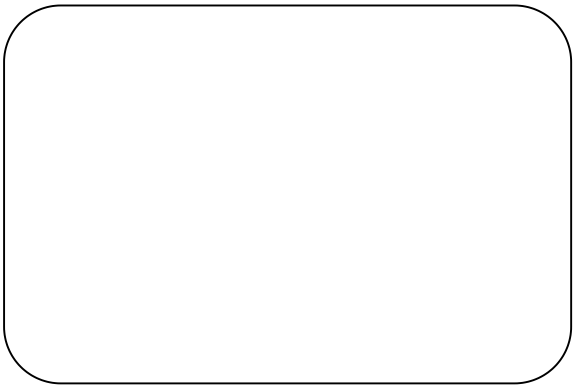
CUT OUT AND LAMINATE









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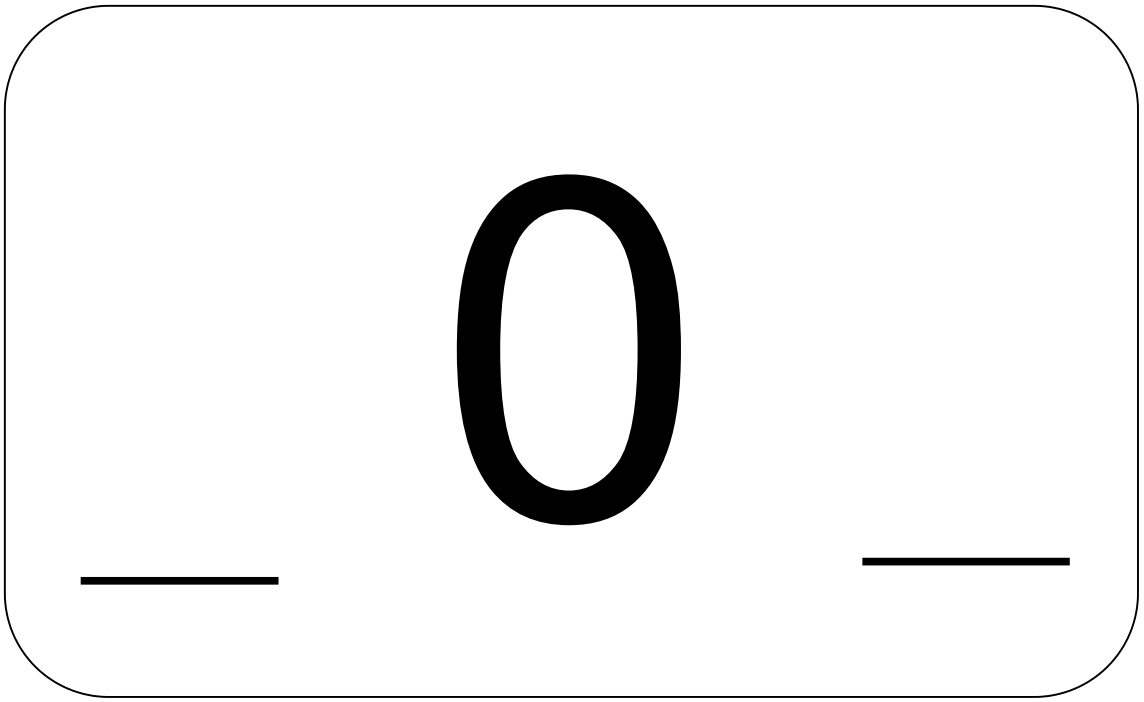
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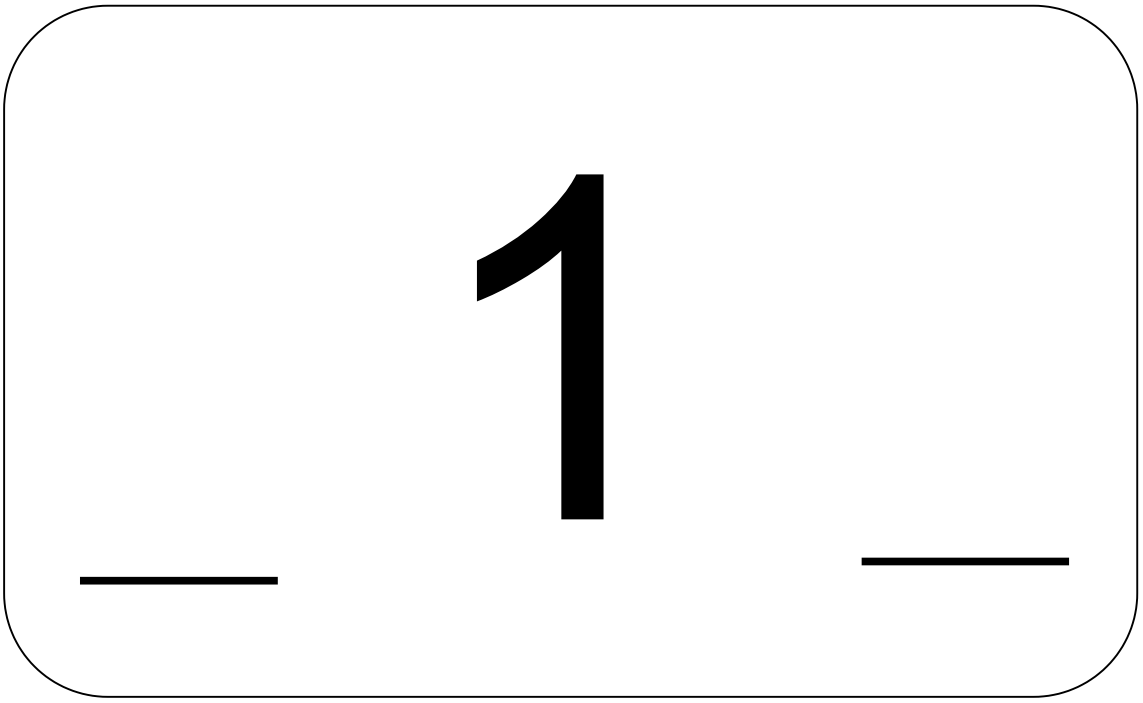
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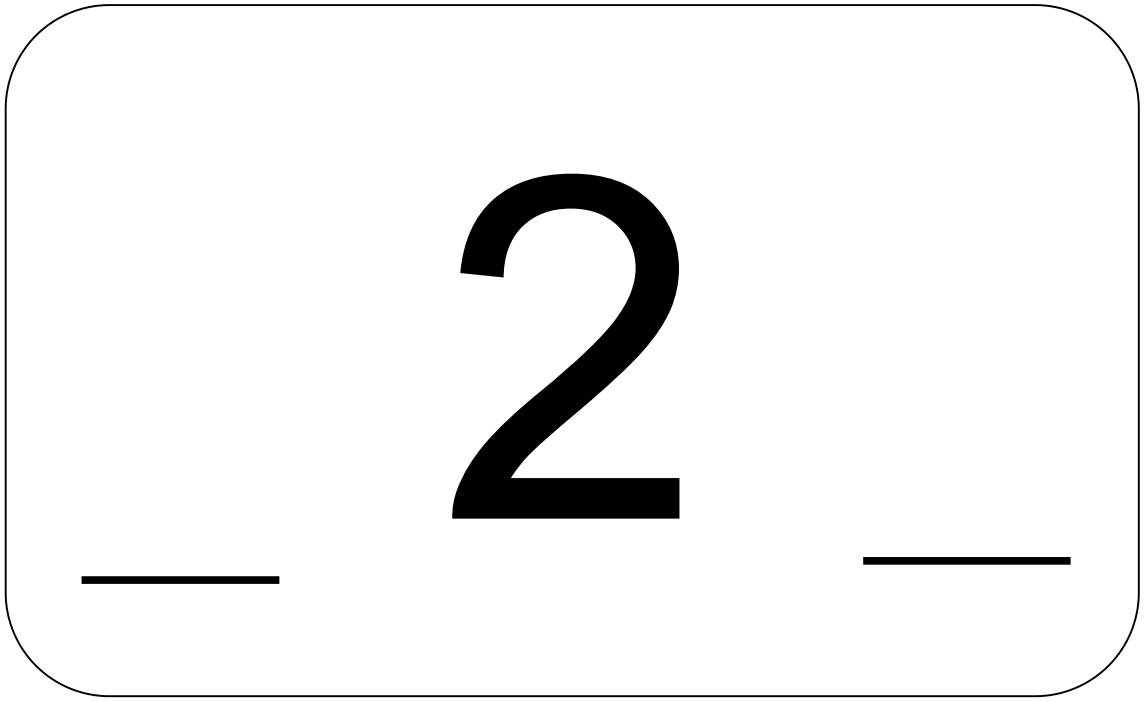
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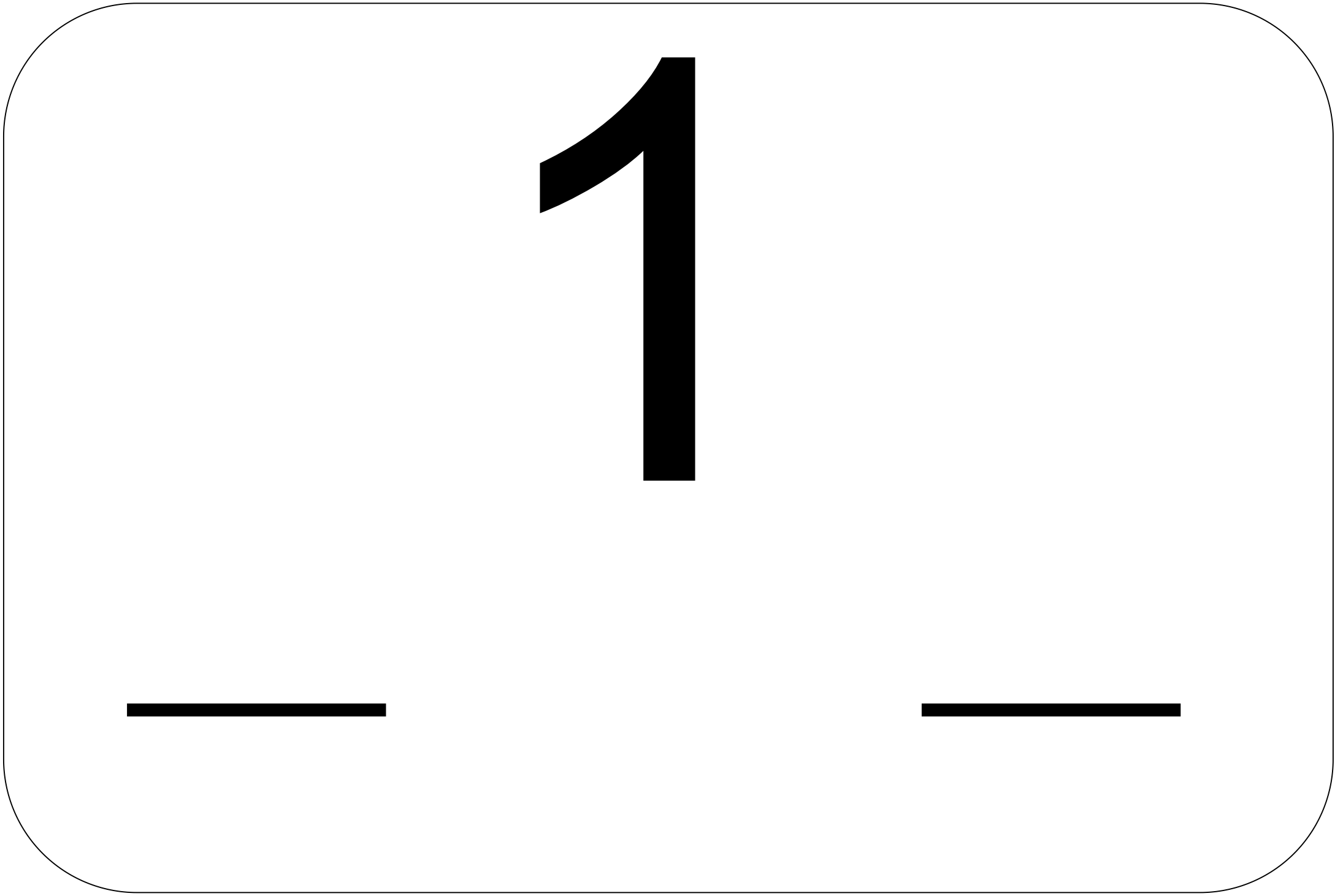
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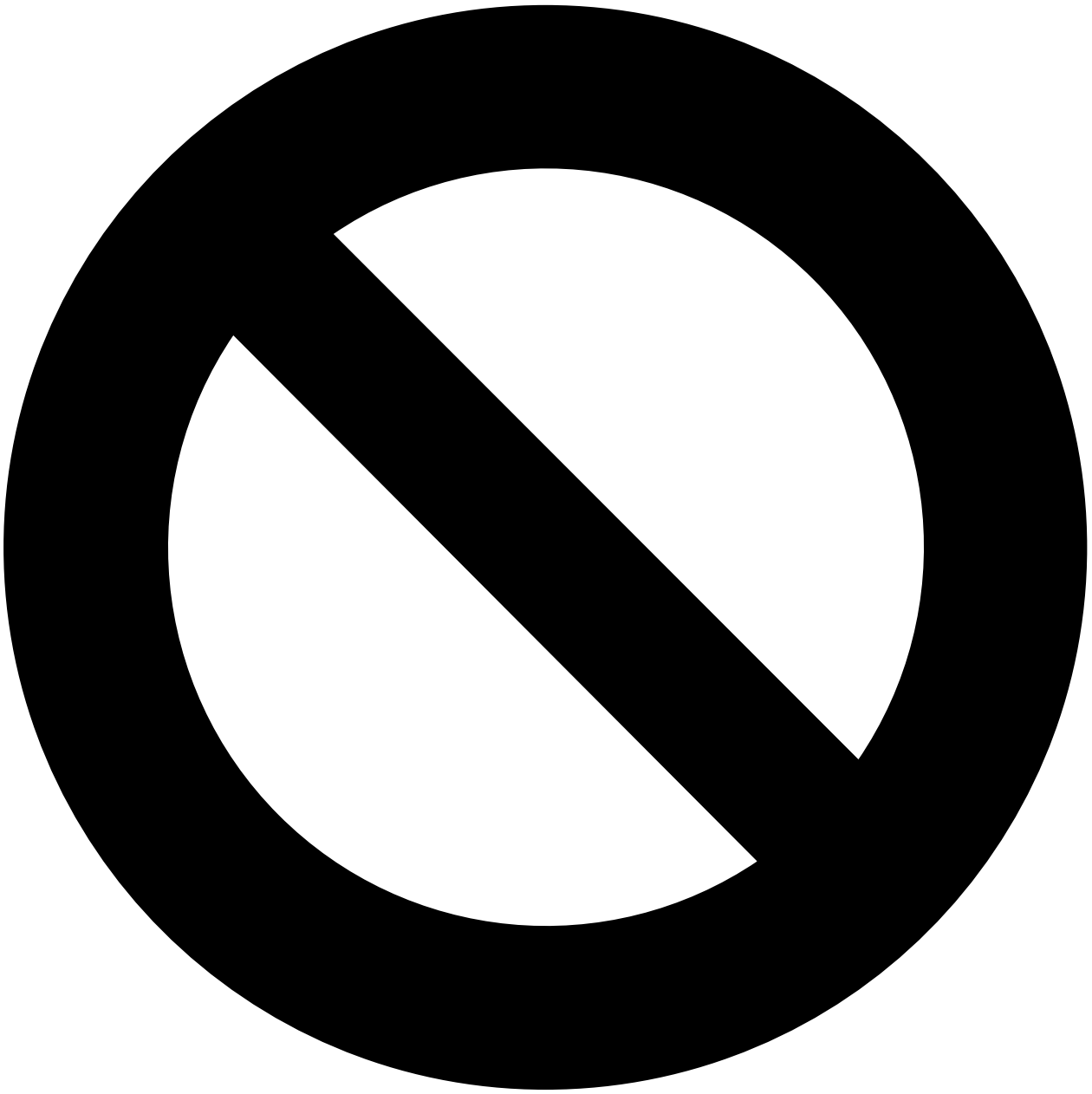

START

END