ID35- LANDERPICK, A REMOTE OPERATED TRAWLED VEHICLE TO COST-EFFECTIVELY DEPLOY AND RECOVER LIGHTWEIGHT OCEANOGRAPHIC LANDERS

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Abstract
LanderPick project consists of the design of a cost-effective system for deploying and picking-up lightweight oceanographic landers, not provided with recovery elements, but having a structure that facilitates their hitching (a capture mesh). The LanderPick vehicle prototype is a Remote Operated Trawled Vehicle (ROTV) specifically designed to operate a mechanical release that allows the placement at the sea bottom of landers carried as a payload, as well as their recovery by means of a triple hook. The vehicle mostly depends on the ship positioning system but has small propellers to aid in the final precision approach manoeuvres. First sea trials of the system in April 2021 are described.

Keywords
Landers, ROTV, sea-floor characterization, environmental monitoring

MOTIVATION
LanderPick concept is motivated by the need of sustaining oceanographic equipment, measuring continuously for prolonged periods, on the seabed. Recent technological developments in the form of remotely operated vehicles (ROVs), towed instruments, or even human-occupied submersibles have improved our capability of observing the seafloor. However, the only way to monitor the conditions of such inaccessible habitats between costly time-spaced ship cruises is by leaving autonomous systems at place. Landers are a generic name for modular structures, equipped with various sensors, which are positioned directly on the seabed to operate autonomously for a defined timeframe. The international community seeks new technological developments to improve the trade-off between spatial and temporal coverage of seafloor observation, bridging the gap between the large spatial but lack-of temporal coverage of ROV-like systems versus the large temporal but lack-of spatial coverage of individual landers [1]. Arrays or fleets of low-cost landers are a promising approach.

The use of lander systems is far from new. Examples of the use of deep landers date back to the mid-20th century [2]. The main drawback of medium-long term landers is the deployment and picking-up system. If a lander is to be abandoned for a prolonged period, it is not possible to leave a surface recovery buoy since it would be dragged by storms and/or could interfere with fishing and navigation. Other systems based on the release of an expendable ballast force to enlarge the lander and require expensive components. This fact prevents the deployment of several landers simultaneously with a reasonable cost, which is necessary to characterize a region.

II. LANDERPICK VEHICLE PROTOTYPE DEVELOPMENT AND FIELD TESTS
LanderPick underlying idea is to deploy and recover lightweight oceanographic landers aided by a specific trawled vehicle. Such idea arose from a accident during a ROV dive in 2014, when the umbilical cable connecting the ROV to its TMS (Tether Management System) caught on a rock and broke off, resulting in the loss of the ROV at a depth of 480 m. ROV operators desperately devised a rescue operation consisting of attaching a hook to the TMS and, relying solely on the dynamic positioning of the ship, it was possible to recover the ROV bringing it back on-board. From this experience, it was inferred that (i) if the ROV had had a mesh on top, the recovery manoeuvre would had been relatively easy and, as a consequence (ii) picking structures from the bottom aided by a trawled vehicle is achievable.

Based on this premise, a first LandrPick vehicle prototype was constructed in autumn 2020 and first field tests took place in winter-spring 2021. LanderPick vehicle is based on the principles of positioning and navigation of the ROTV Politolana developed at the Spanish Institute of Oceanography [3], combined with the capabilities of a Drop-Cam (underwater image-based deployment system). The LanderPick is operated through a standard coaxial electromechanical cable allowing real-time control from the vessel. Its main gadget is a mechanical release (an MR5000B model by InterOceans Systems), and navigation is aided by spotlights, laser pointers, a high definition camera with the ability to operate in low lighting conditions and small positioning propellers. It carries batteries instead of being powered through the cable, thus minimizing interference with the communication modems. Current prototype is devised to operate down to 2000 meters. A mini-fleet of 5 landers were manufactured, 4 were provided with low-cost instruments and one included standard oceanographic sensors plus a lapse-time image system. Landers for hard-bottom, away from trawlling fishing grounds, are cylindrical like rosette samplers. Landers for sites where trawling is a concern are truncated cone-shaped. Figure 1 shows the system at work.

CONCLUSIONS
Though some technical issues should still be fixed, the first LanderPick field tests were successful, allowing 6 deployments and 3 recoveries that demonstrated the system viability and cost-effectiveness. The LanderPick can be operated from regional mid-sized vessels equipped with standard cables, allowing to conceive (i) monitoring systems based on the simultaneous deployment of several landers with a contained cost and (ii) experiments associated with deep habitats such as coral reefs in which it is necessary to locate landers with great precision.

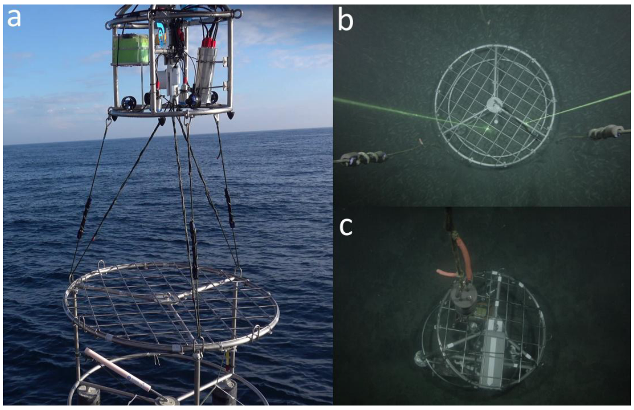

Fig 1.LanderPick vehicle in action, southern Biscay April 2021. a) The Landerpick ready to enter the water with a modestly equipped lander as a payload (include a tilt-current-meter, Lowell instruments TCM-3 and a thermometer, RBR SoloT). b) The lander just after being released on the seafloor of La Gaviera canyon axis at 801 meters depth. c) A fully equipped lander after being hooked by the LanderPick at Le Danois Bank summit (521 m depth).

ACKNOWLEDGEMENTS
This work has been developed in collaboration with the Biodiversity Foundation of the Ministry for Ecological Transition and Demographic Challenge, through the Pleamar Programme co-financed by the European Maritime and Fisheries Fund

REFERENCES
[1] Brandt, A.; Gutt, J.; Hildebrandt, M.; Pawlowski, J.; Schwendner, J.; Soltwedel, T.; Thomsen, L., "Cutting the Umbilical: New Technological Perspectives in Benthic Deep-Sea Research.", J. Mar. Sci. Eng.,vol 4, 36 2016.
[2] Guennegan, Y. and Rannou, M, "Semi-diurnal rhythmic activity in deep-

sea benthic fishes in the Bay of Biscay.", Sarsia, vol. 64, 1-2, pp. 113-116, 1979.
[3] Sánchez, F. and J.M. Rodríguez, "POLITOLANA, a new low cost towed vehicle designed for the characterization of the deep-sea floor", Martech 2013, 5th International Workshop on Marine Technology. SARTI, 2013