



Biohut®

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Report on the installation of the Biohut Polyvalent Industrial Terminal of San Pedro, Ivory Coast.

MAIN INFORMATIONS

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and photo credits

Date of writing

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Report on the installation of the Biohut in San Pedro, Côte d'Ivoire.
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SUMMARY

TABLE OF CONTENT

1. Background.....	4
2. Location choice.....	4
3. Biohut installation.....	8
4. Environmental awarness activities.....	11
5. Appendix.....	12



1. BACKGROUND

In March 2021, the TIPSP called on ECOCEAN to find solutions for ecological restoration in the Autonomous Port of San Pedro (Côte D'Ivoire).

This port is the second largest in Ivory Coast. Founded in 1972, it is today one of the largest seaports in West Africa.

A preliminary study of the context, using maps and aerial photos, allowed us to identify several potentially interesting areas for the installation of Biohut artificial nurseries.

After numerous exchanges with the people locally in charge of the project, the dismantled equipment was shipped in July 2022. The task of collecting locally sourced mollusc shells in order to provide the substrate necessary for the Biohut to function properly was taken on by the TIPSP staff.

After numerous postponements due to problems with customs clearance of the material, the arrival of the Ecocean agents was finally organised for February 2023.

2. LOCATION CHOICE

Thanks to the assistance of Mr KOFFI Hervé, Mr LOHOURE Jean Paul and Ms OUATTARA Maïmouna, from the QSHE department, we were able to visit the site and confirm its ecological interest.

Our attention was particularly focused on the southern end of the San Pedro multipurpose industrial terminal, for both ecological and technical reasons.

Following this expertise and in consultation with the General Manager of TIPSP, Mr. Sant KHARE, we were able to validate the choice of the area where the Biohut would be installed at the southern end of the terminal quay.





Figure 1 : TIPSP footprint and Biohut location

The installation site at the southern end of the quay was chosen for several reasons:

-First of all, its location facing the entrance to the port, which is favourable to the capture of young larvae coming from the open sea and seeking shelter. However, this area has been heavily artificialized since the creation of the port in 1972, and the recent construction of the TIPSP quay has accentuated this trend.



-The presence of an artificial riprap to the east and under the quay on which we were able to see some young fish stages seeking shelter. The nearby Biohut installation provides connectivity to this area.

-Furthermore, from a technical point of view, this quay built on pylons has the advantage of being able to be equipped with Biohut developed by Ecocean for this type of structure (Appendix p:12).



Figure 2 : view from the south of the pylons supporting the terminal

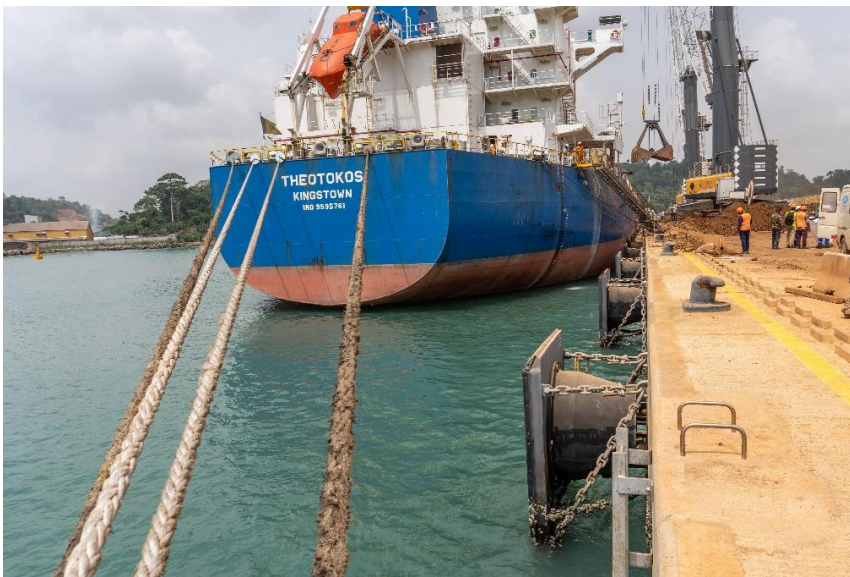


Figure 3 : cargo ship moored to the quay



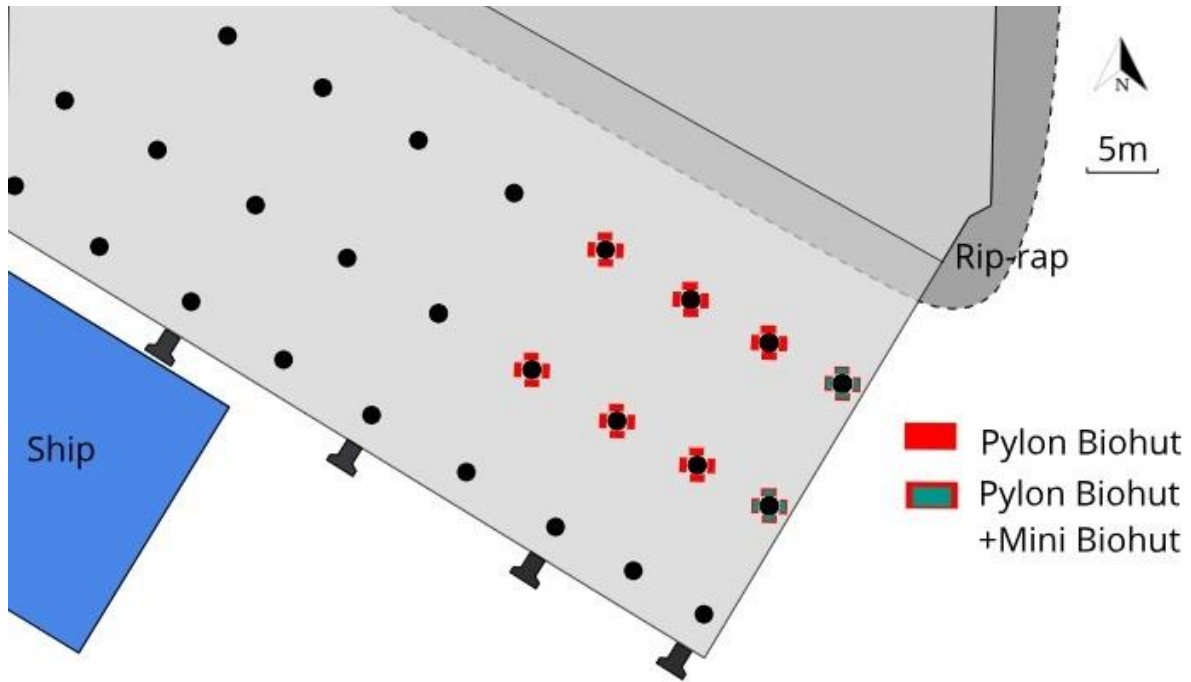


Figure 4 : location plan of the Biohut

The passage and mooring of cargo ships was also a criterion in the choice of the site. The site had to be far enough away from operating ships to reduce the amount of turbulence that could damage the Biohuts and the fauna in them. We therefore chose to equip the two rows of pylons furthest back from the western edge of the quay.

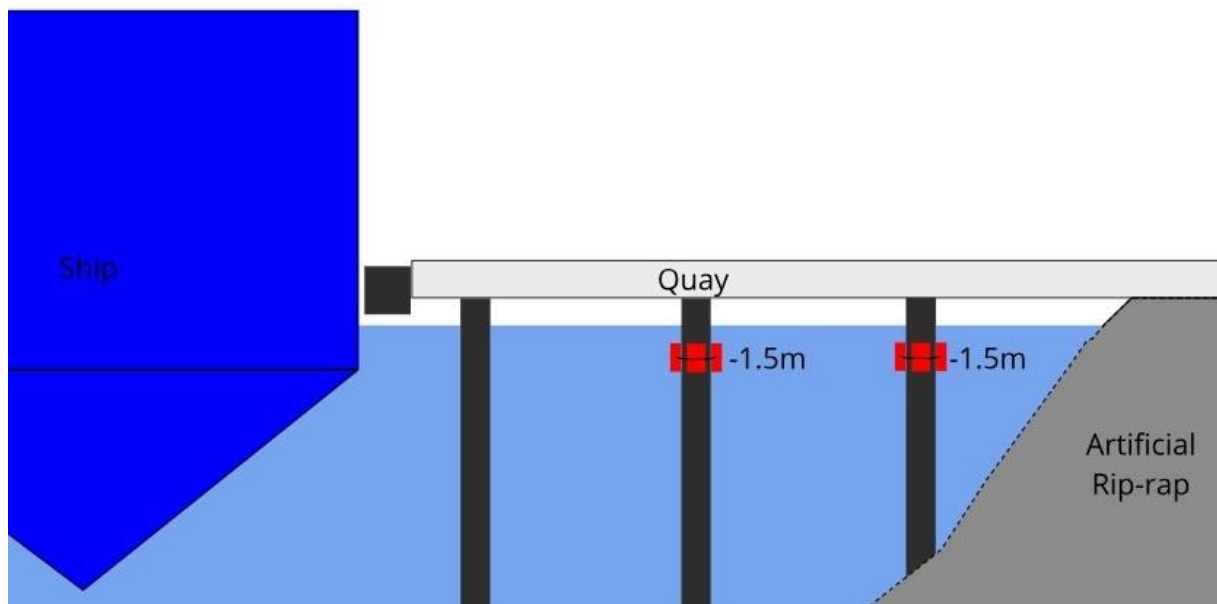


Figure 5 : sideview from the south of the Biohut locations



3. BIOHUT INSTALLATION

The assembly of the modules went smoothly and all the material delivered was in perfect condition. The bivalve shells for filling the Biohut provided by the TIPSP agents were in accordance with the quantity, however their calibre was a little small.

The diving cylinders were rented from GERSMA in Abidjan, which was responsible for delivery to San Pedro, and the 6 tanks were collected from a private individual.



Figure 6 : reception of materials (cages, shells, attachment systems, bio-ops material)

The installation depth of the Biohut was limited to -2m maximum for safety reasons, as visibility was very poor due to a one-off dredging operation in the port. Therefore, 4 Biohuts per tower are installed at the same depth of about -1.5m.

As the tidal range is about 2 meters, the installation took place during low tide hours to ensure that the Biohut remained constantly submerged. In addition, we were dependent on the arrival and departure of cargo ships, as diving was not permitted while the ships were docked.

The installation was carried out by two divers, one operator strapping the Biohut in and a second diver remaining on the surface, assisting and maintaining visual contact with the operator and being ready to intervene in case of problem.

Safety on the surface was provided by a fireman kindly provided by the TIPSP. Posted on the riprap to the south-east of the quay, he was able to monitor the operations and ensure our safety during the diving operations.



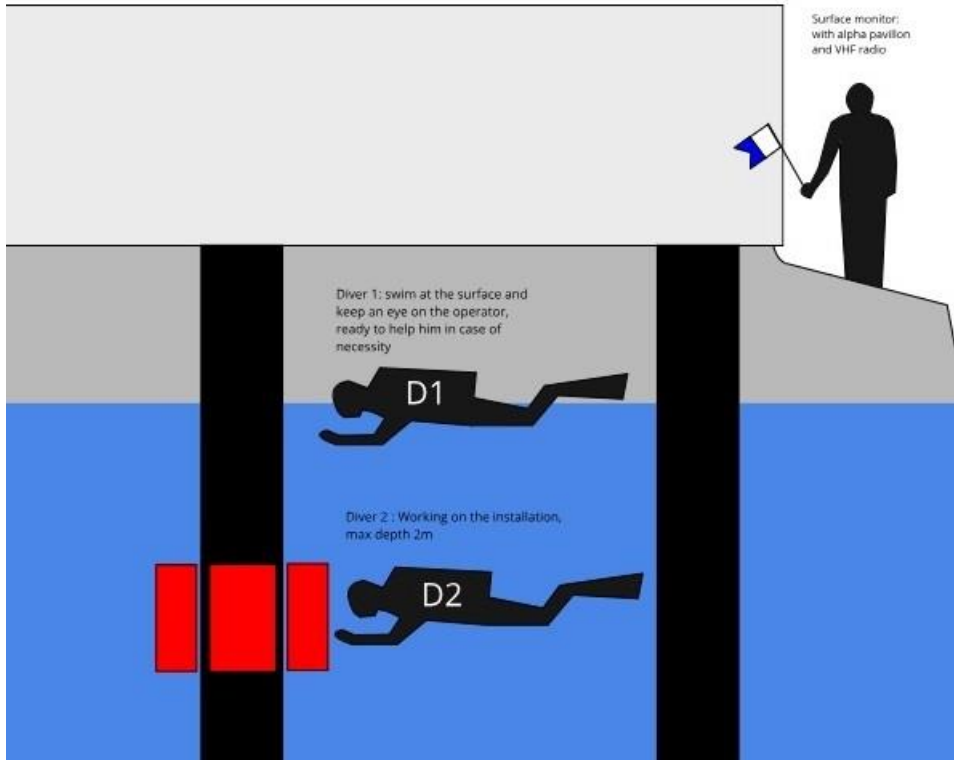


Figure 7 : diving procedure

Biohuts are installed in groups of four around each pylon. They are prepared on the surface and linked together in a "train" by a device of floats and ropes. Two 20l drums attached to the upper part of each Biohut by a 80cm long piece keep them positively buoyant. This "train" is then pushed into the water, after which the pylon to be equipped is encircled. The arrangement of the Biohut around the pylon is checked. The straps with turnbuckles are then passed through all the Biohuts and finally tightened with a ratchet.



Figure 8 : Biohut pylon installation system



Three straps with tensioners were used for the innermost Biohuts to ensure that the whole assembly was tight. We considered two straps to be sufficient for the assembly of the outer Biohuts.



Figure 9 : installation of the Biohut on the pylons

The Mini Biohuts were installed using the same technique on the two southernmost pylons of the quay, placed on top of the Biohut pylons previously installed and held in place with a strap. They can be easily dismantled and reinstalled for animations.



4. ENVIRONMENTAL AWARENESS ACTIVITIES

At the suggestion of Mr. Sant Khare and Mr. Koffi, our visit was also the opportunity to present in detail the ecological restoration solutions developed by Ecocean to the students of the San Pedro School of Management. This meeting allowed for many interesting exchanges as well as raising the students' awareness of local ecological issues.



Figure 10 : presentation of ECOCEAN's actions to ESG students

The visit of ECOCEAN for a new awareness-raising action one year after the installation would allow for a concrete presentation of the results obtained on the Biohut.

A Bio-obs animation, carried out thanks to the opening of a mini-Biohut, easily dismantled and easy to take out of the water to sort and count the species present.

We propose this activity as a complement to the educational games in order to make the workshop more concrete with a tactile and real animation. The workshop comes alive, the audience is overwhelmed with emotion and realizes the biodiversity present in the nurseries.

We measure, sort and count the species by involving the public. This action will also allow us to evaluate the efficiency of the submerged modules after one year.

We therefore propose to return to San Pedro during the winter 2024 to continue these awareness-raising actions and to evaluate the effectiveness of the Biohut installed.



5. APPENDIX



Biohut® Pylon

1 Description of the product

Ecosystemic Functions :

- Nursery for coastal fish juveniles.
- Support for fixed fauna and flora.
- Habitat for small mobile fauna (crustaceans, worms..).

Composition: empty mesh box (protection) next to a mesh box containing shells (food attachment), all fixed to a pylon.

Immersion height: 1m - 5m.

Price: quote on request.

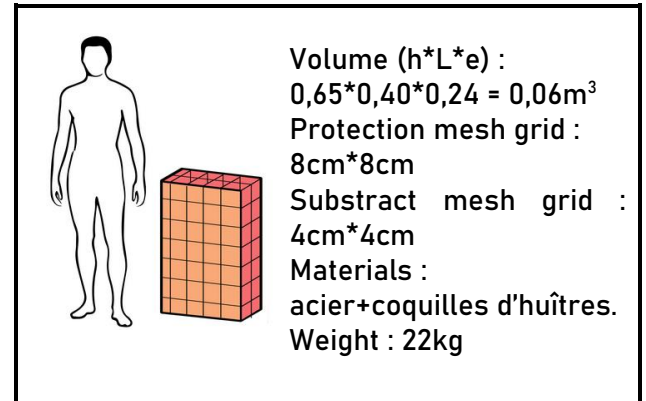
Ecological efficiency: proven.

Technological maturity level: TRL = 9

Production: industrial.

Existence of a proven biological monitoring protocol: yes.

Suitable for export: yes, unassembled Biohut® is suitable for stacking..



2 Installation of the Biohut®

D Description of operations: fixing the Biohut® with Kevlar straps.

Impact on infrastructure: none.

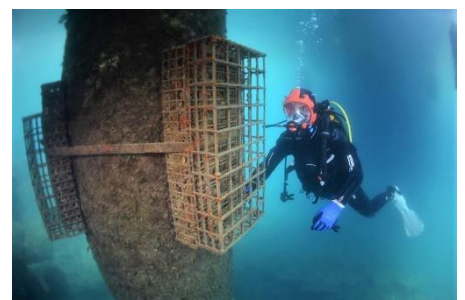
Human resources: 3 people including 2 class 1B divers.

3 Biohut® maintenance

None.

4 Project sizing

Number of modules: depending of the size and the configuration of the port



Patented solution: N° de brevet PCT/FR2014/051369