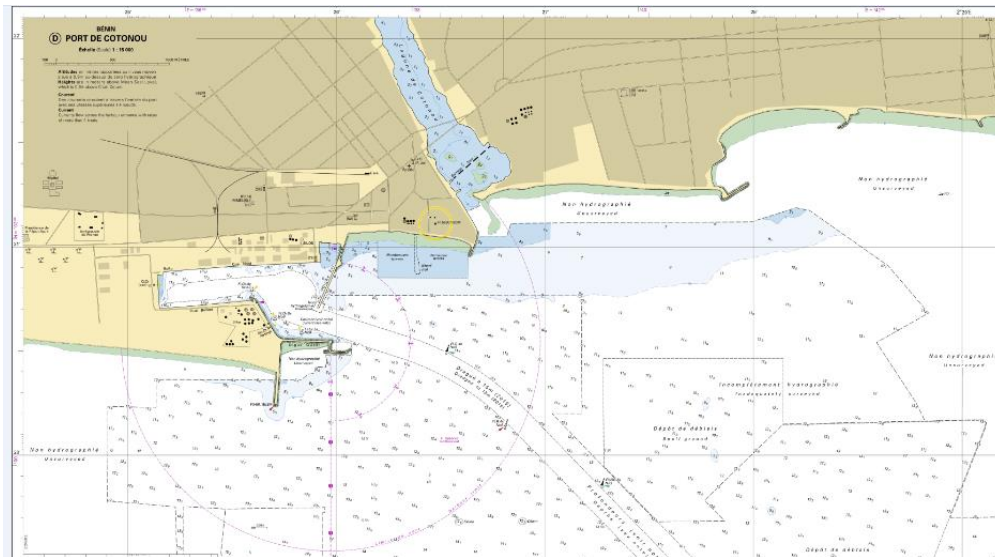




# IHO - Capacity Building Work Programme TECHNICAL VISIT TO BENIN REPORT 31 January - 04 February 2022



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maritimes et fluvio-lagunaires**

(DMM : Direction de la Marine Marchande)



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**ANCAEM : Autorité Nationale  
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CHARGÉ DE LA DÉFENSE NATIONALE  
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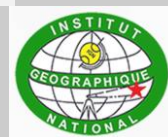
**MN : Marine Nationale**



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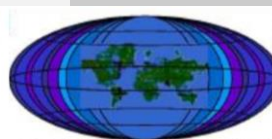
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## ABSTRACT

The development of Benin in terms of hydrography and nautical cartography is quite contrasting:

- a Department of Topographic, Hydrographic and Oceanographic Studies (DT/SETHO) at the Technical Direction of the Autonomous Port of Cotonou (PAC), but the absence of a dedicated operational structure at the national level;
- with competent actors - no doubt looking for unifying projects - in fields related to hydrography (oceanography, geodesy, geomatics, navigation, cartography, etc.) but, dispersed, not pooling their human and material potential to provide a complementary response for the needs of the country as a whole: safety of navigation (hydrography and cartography) but also support for public policies, particularly in terms of coastal management and resilience, the blue economy and finally State Action at Sea, without forgetting the lagoon issues;
- with a state structure of the Ministry of Infrastructure and Transport (MIT) in charge of sovereign responsibilities such as the organization of aids to navigation and maritime safety information: the new Department of Port, Maritime and River-Lagoon Affairs;
- with the National Authority for State Action at Sea (ANCAEM): the Maritime Prefect who, within an interministerial framework, will be able to promote the interdisciplinarity set out above;
- with the reconstitution of a National Committee for Hydrography, Oceanography and Marine Cartography (CNHOC) which would bring together inactive committees, namely the CHN (National Hydrographic Committee) and the CNO (National Oceanographic Committee) by adding cartography Marine;
- by being a member of international organizations such as the IMO, but not (yet) the IHO;
- by having ratified international conventions, in particular SOLAS (providing hydrographic services in order to establish and distribute the information and nautical documentation necessary for the safety of navigation in its waters), but without completely satisfying the requirements (apart from PAC);
- by having promulgated a law on climate change including numerous articles relating to maritime transport, coastal climatic risks, the importance of data and their management in databases, the qualification of personnel, etc.

This report does not claim to be exhaustive, there are certainly potentialities which have not been inventoried and which should have been considered, it nevertheless offers some recommendations which are based on successful experiences elsewhere in Europe and Africa.

Regarding maritime navigation, Benin's capacities are in terms of development:

- **acquired for phase 1:** collection and transmission of **maritime safety/nautical information (MSI)** to NAVAREA II, transmission of corrections to nautical publications, in particular nautical charts to Shom. However, there is a need to consolidate the process at the national level beyond the current geographical limits of the PAC;
- **partially acquired for phase 2: hydro-oceanographic surveys** through data acquisition and archiving. The function should be extended to all Beninese waters and not just its main port;
- **not acquired for phase 3**, namely the **production of official nautical charts** (provided by Shom).

This report includes a set of findings and proposals for action. To make it more accessible, it can be divided to be the subject of targeted actions. The CNHOC will be able to distribute and plan the tasks between its various stakeholders.

## RECOMMENDATIONS AND ACTIONS TO BE FOLLOWED

The majority of the recommendations are to be followed within the CNHOC and therefore to be included on the agenda of the first meetings.

Object	Comments - Recommendations
	<b>Phases 1,2,3 of development</b>
<b>Phase 1 development Maritime Safety Information (MSI)</b>	<ul style="list-style-type: none"> <li>• Properly identify all the players in the maritime sector who can provide nautical information and benefit from it (PAC, MN, etc.)</li> <li>• In accordance with international regulations (IMO-IHO) and national texts, specify by an interministerial instruction the methods of collection and dissemination (urgent, rapid, deferred) of nautical information (MSI: Maritime Safety Information)</li> <li>• Take steps to extend the services already provided at the port level to all waters under Beninese jurisdiction</li> <li>• PAC must be responsible for issuing local AVURNAVS</li> </ul>
<b>Phase 2 development Hydro-oceanographic surveys from data acquisition to archiving</b>	<ul style="list-style-type: none"> <li>• Identify all national needs in terms of surveys (PAC, MN, IRHOB, Coastal Environment, etc.) and prioritize them</li> <li>• Identify all the possibilities of pooling material resources (ships/boats) (GPS, echosounders, tide gauges) and human resources (geomaticians, hydrographers, oceanographers, cartographers)</li> <li>• Specify, execute, qualify, plan a first national hydrographic survey in 2022. Be simple on a first transversal project, for example the new marine protected area of the Donatin district in Cotonou (close to the PAC which have hydrographic resources), then make feedback to consolidate the sustainable conditions of a national organization</li> <li>• For the record: it is needed floating means, scientific and IT equipment, logistical support infrastructure and of course sufficient quality and quantity of personnel (all professions combined: hydro-oceanographers, IT specialists, logisticians, managers)</li> <li>• Training: that of a certified IHO category B hydrographer is strongly recommended</li> </ul>
<b>Phase 3 development Cartographic production</b>	<ul style="list-style-type: none"> <li>• The co-production of nautical charts with the Shom (Coordinator of INTernational cartography for Region G and cartographic authority) must continue within the framework of the Administrative Arrangement</li> <li>• It is nevertheless logical and necessary for Benin to be able to gradually gain autonomy and already respond itself to specific cartographic needs such as sovereignty maps of State Action at Sea</li> </ul>

	<ul style="list-style-type: none"> <li>• It is therefore necessary to clearly identify the already existing capacities in terms of geomatics in order to pool them through joint projects</li> <li>• Constitute a national database in charge of the collection, qualification, provision of hydrographic and oceanographic data (depths, tides, seabed nature, coastal topography, landmarks, beaconing, etc.). This database must be initialized with existing data (including historical data from Shom)</li> <li>• Designate one or more national referents by type of data</li> <li>• Produce a first support chart for maritime public policies: meet the needs of State Action at Sea (institutional limits, EEZ, continental shelf extension, fishing zones, marine protected areas, etc.)</li> <li>• Training: that of a marine cartographer certified OHI category B is strongly recommended</li> </ul>
	<b>International relations: IHO, Regional/EAtHC, France</b>
<b>Join the IHO</b>	<p><b>Be present at the international level</b></p> <ul style="list-style-type: none"> <li>• Join the international community like the IMO. Benefit from much more of the support of the IHO in terms of training. IHO Capacity Development actions are limited to Phase 1 for non-member countries</li> <li>• <b>MIT then MAEC (Ministry of Foreign Affairs and Cooperation) →</b> apply the simplified membership procedure (see the IHO website). Transmission to the Minister of Foreign Relations of Monaco</li> </ul>
<b>Involvement in the Regional Hydrographic Commission (EAtHC)</b>	<p><b>Be present at the regional level</b></p> <ul style="list-style-type: none"> <li>• Participate in the next EAtHC (17th) plenary of 2022 which will take place in September in Cape Verde <a href="https://iho.int/fr/commission-hydrographique-de-l-atlantique-oriental">https://iho.int/fr/commission-hydrographique-de-l-atlantique-oriental</a></li> <li>• In particular participate in the seminar which will precede at the same place on maritime safety information (MSI), the co-production of nautical charts with a third country, risk analyzes (cartography/navigation) and the specification of hydrographic surveys Point of contact: henri.dolou@shom.fr</li> </ul>
<b>Administrative Arrangement (AA) with France</b>	<ul style="list-style-type: none"> <li>• This arrangement dates from 2010 and allows Benin to comply with SOLAS</li> <li>• The work of the CNHOC may lead to adjusting the obligations of the parties currently limited to the Shom for France and the PAC for Benin.</li> <li>• AA which could evolve to promote the progressive autonomy of Benin</li> <li>• Beyond the topics of cooperation already indicated, it will be appropriate to address the subject of databases, the importance of which was mentioned during the Technical Visit.</li> </ul>



<b>Surveys - results:</b> Updating nautical charts	<ul style="list-style-type: none"> <li>• It is essential to provide Shom with all the available data accompanied by quality files (metadata on the means used during the survey) and not only the PAC surveys</li> <li>• Contact all operators who have survey data and send them to Shom with the metadata (archive these data in Benin)</li> <li>• It should be noted that without the explicit authorization of the owners of the data, their use by the Shom is restricted to updating nautical charts. They are neither disseminated nor used in other products without the express written consent of the owners.</li> </ul>
<b>Benin</b>	
Creation of one or more national <b>databases</b>	It is fundamental that Benin archives all the data mentioned above in a sustainable way for free and shared valorizations
<b>CNHOC</b>	Develop a national framework: the National Committee for Hydrography, Oceanography and Marine Cartography bringing together inactive committees, namely the CHN (National Hydrographic Committee) and the CNO (National Oceanographic Committee) by adding nautical cartography; <ul style="list-style-type: none"> <li>• Support and evolve the CNHOC</li> <li>• Benin (MIT): lead the drafting of its constitutive text (decree) then schedule the first inaugural meeting, ensuring:             <ul style="list-style-type: none"> <li>• to closely associate scientific and/or technical organizations</li> <li>• to launch concrete projects stimulating for all stakeholders: suggestions in appendix G</li> </ul> </li> </ul>
<b>Direction of port, maritime and fluvio-lagoon affairs</b>	<ul style="list-style-type: none"> <li>• Essential “regulatory” actor, in connection with its supervision MIT, approach the ANCAEM (Maritime Prefecture) to define above all the framework of the operational organization of the national coordination in terms of nautical information. In accordance with international regulations (IMO-IHO) and national texts, specify by an interministerial instruction the methods of collection and dissemination (urgent, rapid, deferred) of nautical information (MSI: Maritime Safety Information)</li> </ul>
<b>ANCAEM</b>	<ul style="list-style-type: none"> <li>• Promote and participate in the establishment of the CNHOC</li> <li>• Initiate the production of specific AEM maps, identify survey needs at sea, propose collaboration with IRHOB and PAC or even IGN</li> <li>• Promote the launch of interdisciplinary inter-agency projects: hydro-oceanographic surveys, cartography, hydrodynamic modelling, etc.</li> </ul>
<b>IGN</b>	<ul style="list-style-type: none"> <li>• Take advantage” of the creation of the CNHOC to promote its technical and human capacities and join national cross-cutting projects</li> </ul>

	<ul style="list-style-type: none"> <li>• Bring in particular capacities in geodesy, leveling and geomatics</li> </ul>
<b>Navy</b>	<ul style="list-style-type: none"> <li>• The Navy has nautical skills and sea intervention capabilities. It will be one of the first beneficiaries of the development of hydrography</li> <li>• Make available, according to rules to be defined, its nautical means of intervention at sea</li> <li>• Specify its needs in terms of nautical documentation and AEM</li> </ul>
<b>PAC/Hydrography</b>	<p><b>Department of Topographic, Hydrographic and Oceanographic Studies of the Technical Direction (DT/SETHO)</b></p> <ul style="list-style-type: none"> <li>• Have functional material means to comply with IHO specifications capable of updating official nautical charts. In particular, have an efficient tide gauge (radar) (see Appendix H)</li> <li>• Get closer to oceanographers and academics (IRHOB, Master of Physical Oceanography from UAC and UPS) to better understand sediment transport and its possible impact on the filling of the channel (optimization of surveys or even dredging)</li> <li>• Promote the needs of the PAC in physical oceanography and get closer to the heads of the Master 2 in Oceanography and Applications (OA) to guide the courses and specify internships (6 months) at the PAC</li> <li>• Study the conditions for a continuous long-term cooperation with the OA Master 2 (scholarship)</li> <li>• In terms of forward-looking management of skills and staff, consider having a new agent follow the training of a senior technician (Bachelor 3) in hydrography at the Shom school (scientific/computer profile). More effective solution in the long term than following short-term internships in France</li> </ul>
<b>PAC/Pilots</b>	<p><b>Pilotage –Harbormaster</b></p> <p>Specify the needs that can be met by the Topographic, Hydrographic and Oceanographic Studies Service</p> <ul style="list-style-type: none"> <li>• Basic data for PPU (dock topography, high density and precision bathymetry...)</li> <li>• Real time tides</li> </ul> <p>Participate in the technical meetings of the IHO to bring the competence "port navigation" and make known its requirements</p>
<b>PAPN/Aids to Navigation</b>	<p><b>Electrical and Mechanical Engineering Department DT/SGEM of the Technical Direction</b></p> <ul style="list-style-type: none"> <li>• Ensure that the nautical charts correctly reproduce the positions and characteristics (day and night) of the beaconing. Rely on the Topographic, Hydrographic and Oceanographic Studies Service to send Shom any updates to be made</li> </ul>
<b>IRHOB</b>	A structure that only asks to enhance its skills:

	<ul style="list-style-type: none"> <li>• To be proposed to the PAPN (sediment transport)</li> <li>• From now on, partner with the PAC, which will be equipped with a new tide gauge which will offer new opportunities beyond the processing of surveys: in particular, studies of mean sea level in connection with climate change</li> <li>• Participate in the work of the CNHOC by defending in particular the need for "marine geoscience" data</li> <li>• Participate in the inventory of existing maritime data (including meteorology) (France, ORSTOM/Ird), promote their acquisition and sharing</li> <li>• Always within an inter-agency framework, take part in responses to international calls for tender (climate studies, resilience of coastal zones, etc.)</li> </ul>
	<b>Formation</b>
<b>Basic training (CAT B) for senior technicians in hydrography or cartography</b>	<p>Training in hydrography (data acquisition) remains fundamental.</p> <p>However, it is now necessary to develop, in the country, its own capacity to produce products and services directly to users without necessarily going through a third country.</p> <p>It is therefore also necessary to train marine cartographers, considering the needs at sea and in inland waters.</p>

**MAIN CONTINUING ACTION**

The main harbor (Cotonou) must above all maintain permanent relations with the NAVAREA II coordinator, who is also the primary chart authority for the waters of Benin (France / Shom), so that MSI (Maritime Safety Information) are distributed on time to mariners (e.g. via SafetyNet in case of emergency) and that nautical documents (e.g. nautical charts) are updated at the appropriate frequency (e.g. nautical instructions, new chart editions).

**Transmission of MSI**

coord.navarea2@shom.fr or coord.navarea2@gmail.com (Emergency email address)

Tel : +33 2 56 31 24 24 (D7 - H24) Fax: +33 2 56 31 24 84

**Non-urgent nautical information :**

Hydrographic surveys, port plans: bri@shom.fr / copy: na-om@shom.fr and dmi-rex-d@shom.fr

**Other nautical information:**

na-om@shom.fr / copy: bri@shom.fr and dmi-rex-d@shom.fr

**Postal address :**

Département « Informations et Ouvrages Nautiques »  
Service hydrographique et océanographique de la marine (Shom)  
CS 92803 - 29228 BREST CEDEX 2  
FRANCE

## INTRODUCTION

### 1 Preparation of the technical visit - Background

The visit was planned as part of the IHO Capacity Building Program for the year 2022:

- *CBWP 2022: action A-01 - « Technical visit to Benin».*

It was initiated by Henri DOLOU (Shom) in close relationship with:

- Ms. Fatimatou MAMA SAMBO Head of the topographic, hydrographic and oceanographic studies department at the Autonomous Port of Cotonou (PAC/DT/ETHO);
- Commander Laurent DESCAT Advisor to the Chief of Staff of the Beninese Navy, Advisor to the Maritime Prefect, Project Manager "Support for State Action at Sea";
- Mr. Alexis CHAIGNEAU, Oceanographer Physicist, Director of Research at the Research Institute for Development (IRD).

The maritime prefect (CV Ahoyo) made it possible to establish contact with the Ministry of Infrastructure and Transport.

The terms of reference for the visit are recalled in Appendix B.

### 2 Composition of the team.

The visiting team consisted of:

<u>Name</u>	<u>Role</u>
Henri DOLOU	Project manager at Shom for African affairs (France on behalf of the IHO)

Mrs. Fatimatou MAMA SAMBO from PAC participated in all the meetings.

## PART A - OVERALL ASSESSMENT OF THE SITUATION IN THE REGION

### 3 Effectiveness of the Technical Visit

The follow-up of actions resulting from drafted recommendations will make it possible to measure the real effectiveness of the visit. However:

- The technical visit could be prepared in detail prior to the trip through exchanges and analyzes of existing reports and texts;
- That the issues of hydrography, oceanography and cartography have been addressed in terms of maritime navigation, the environment, research and training and finally State action at sea;
- The following appointments were held (chronological order):
  1. Captain Maxime AHOYO, Maritime Prefect, National Authority for State Action at Sea (ANCAEM);
  2. Captain Albert BADOU, Chief of Staff of the National Navy (CEMN);
  3. the chief of staff (M Joseph AHISSOU) and the secretary general (M Roch HOUNDJE) of the Ministry of Infrastructure and Transport (MIT);
  4. the Technical Director of the Autonomous Port of Cotonou, Mr. Jan Louis M. DE VOGHT (PAC/DT);
  5. the Head of the Electrical and Mechanical Engineering Department in charge of aids to navigation, Mr Lucien DAZOGBO of the PAC (PAC/DT/SCEM);
  6. the Head of Department of Topographic, Hydrographic and Oceanographic Studies, Mrs. Fatimatou MAMA SAMBO of the PAC (PAC/DT/SETHO);
  7. the port commander and director of the harbor master's office (M Akim BAKARI) and maritime pilots;
  8. the Director of the Merchant Navy, Mr. Désiré Mouléro KOUTON (DMM);
  9. the Director General of the National Geographic Institute, Mr Roch Abdon BAH (IGN);
  10. the director of the Fisheries and Ocean Research Institute of Benin, Mr. Zacharie SOHOU (IRHOB);
  11. the president of the International Chair in Mathematical Physics and Applications (UAC), Mr Mahouton Norbert HOUNKONNOU (CIMPA partner of the master 2 in physical oceanography and applications);
  12. the research director, physicist oceanographer, Mr. Alexis CHAIGNEAU of the Research Institute for Development (IRD) in post IRHOB / CIPMA (master 2);
  13. the Director General of the Autonomous Port of Cotonou, Mr. Joris THYS (PAC/DG).
- That a “general public” conference was given on the theme “hydrography and nautical cartography”;
- That a restitution meeting (conclusions – recommendations) at the end of the visit was held at the Maritime Prefecture under the chairmanship of ANCAEM with the main stakeholders;
- That the actors able to collect nautical information were again made aware of the SOLAS obligations ensured by Benin in connection with France (NAVAREA II, cartographic

coordinator, producer of the nautical documentation in force in the waters under jurisdiction of Benin, capacity development coordinator).

The discussions were professional and constructive. Recommendations have been made. Some of them, shared during the summary meeting can be conducted in the short term such as (PRIMORDIAL):

- in accordance with international regulations (IMO-IHO) and national texts, specify by an interministerial instruction the methods of collection and dissemination (urgent, rapid, deferred) of nautical information (MSI: Maritime Safety Information) for all waters under Beninese sovereignty and not just the PAC;
- to replace the former CHN (National Hydrographic Committee), create and maintain a multidisciplinary, inter-ministerial National Committee for Hydrography, Oceanography and Marine Cartography (CNHOC);
- participate again in meetings, works and seminars of EAtHC (Eastern Atlantic Hydrographic Commission);
- join the IHO;
- mobilize to master the processes of data acquisition, qualification, storage, sharing, dissemination, etc.

It should be noted that the technical exchanges focused on the obligations of the SOLAS convention (chapter V) as well as on the expected economic benefits. As such, hydrographic investments can generate very substantial financial savings, in particular via:

- minimization of dredging operations;
- optimization of ship loading;
- the reception of new vessels with much greater capacities but with much more demanding dimensions in terms of navigation constraints.

They also focused on the expected benefits in terms of the marine environment, particularly at the land-sea interface (coastal development – coastal protection).

#### 4 International and regional cooperation - Defense

a. [International and Regional Organizations]

OHI/IHO Status	Regional Hydrographic Commission	OMI/IMO	AISM/IALA	OMAOC/MOWCA
Non Member	Associated Member CHAtO/EAtHC	Member	Member	Member

b. [Defense and security arrangements]

Subject not addressed during the visit.

## PARTIE B – BENIN –ASSESSMENT

### 5 Involvement in the Regional Hydrographic Commission (EAtHC)

Findings	Actions
Benin was able to participate in EAtHC meetings. He was then represented by the PAC	<ul style="list-style-type: none"><li>• Participate in the next EAtHC (17th) plenary of 2022 which will take place in Cape Verde (September 28, 29 and 30) <a href="https://iho.int/fr/commission-hydrographique-de-l-atlantique-oriental">https://iho.int/fr/commission-hydrographique-de-l-atlantique-oriental</a></li></ul>
	<ul style="list-style-type: none"><li>• In particular participate in the seminar which will precede (26 and 27 September 2022) at the same place on maritime safety information (MSI), the co-production of nautical charts with a third country, risk analyzes (cartography/navigation) and specification of hydrographic surveys</li><li>• Point of contact: henri.dolou@shom.fr</li></ul>

### 6 Preliminary liaison

The visit was mainly prepared through discussions with the PAC and the collection of open information on the Internet.

The Shom was consulted as:

- NAVAREA II Coordinator (permanent role);
- EAtHC Capacity Development Coordinator (permanent role);
- International chart Portfolio Coordinator for Region G (permanent role);
- Producer of hydrographic surveys (occasionally);
- Producer of nautical charts and nautical publications (permanent role).

The Shom provided copies (GeoTiff and paper on site) of the nautical charts:

- 7187 (INT 2087) : De Sassandra à Lagos Scale 1 : 1 000 000
- 7587 (INT 2881 : Port de Cotonou, De Cotonou à Sèmè-Kpodji Scales 1: 15 000 and 1: 75 000
- 7787 (INT 2807) : De Tema à Cotonou Scale 1 : 350 000

### 7 Technical Visit Contact Points - IHO Correspondents (P5-Yearbook) of EAtHC and Shom

The Technical Visit contact points are listed in Annex D. At this stage there is no need to modify (other than update the names) the representation of Benin at the IHO and EAtHC. Updated names for P5 (in list of non-member states):

- Directeur Général : Joris THYS
- Directeur Technique : Jan Louis M. DE VOGHT

Update for EAtHC:

- For subjects specifically related to navigation, add Akim BAKARI; Director of the Harbor Master's Office - Commander of the Autonomous Port of Cotonou (PAC) abakari@pac.bj

The fact remains that membership of the IHO and the appointment of state and technical officials to the new (to be created) National Committee for Hydrography, Oceanography and Marine Cartography (CNHOC) will eventually review these representations.

**IHO links:**

- Yearbook/P-5 : [https://iho.int/uploads/user/pubs/periodical/P5YEARBOOK\\_ANNUAIRE.pdf](https://iho.int/uploads/user/pubs/periodical/P5YEARBOOK_ANNUAIRE.pdf)
- CHAtO : <https://iho.int/en/basic-commission-documents-2>



## DESCRIPTION OF MARITIME ACTIVITIES

### 8 National Maritime Affairs - Stakeholders

The duration of the visit (5 days) made it possible to meet the main actors.

#### General context, levels of development

The talks focused on the issues associated with hydrography: beyond safety of navigation (international commitments – SOLAS), economic performance through port capacities for receiving ships (including larger ones) and the optimization of their loading (through the depths shown on the nautical charts). It was recalled that hydrography is an applied science dealing with the measurement and description of the physical elements of the seas and coastal areas. That its mastery necessarily intervenes in coastal protection (coastal development) thus underlining the transversal character of hydrography (physical oceanography is part of it) and consequently, at the governmental level, its interministerial ambition. In terms of capabilities, according to the development phases of the IHO, the following points of progress were noted:

Phase	Object	Level of development - Remarks
1	Collection and transmission of maritime safety information / nautical information (MSI) to NAVAREA II, transmission of corrections to nautical publications in particular nautical charts to the Shom	<b>Achieved.</b> <i>“The country fulfils its national obligations in a sustainable manner”<sup>1</sup></i> The actors (pilots, Navy, PAC) are well aware. The PAC is in contact with Shom and regularly sends it information. Persistent difficulties exist on the metadata of hydrographic surveys and aids to navigation reviews sent to Shom. It will be necessary to ensure that the collection and transmission of MSI covers all Beninese waters and not only those of the PAC. This should go through an inter-ministerial instruction where efficiency will have to count above all.
2	Hydrographic and oceanographic surveys through data acquisition	<b>Incomplete</b> <i>“The country is aware of its national obligations but does not have “national” means to do it”</i> Even if the PAC has sufficient means (through refurbishment and the acquisition of a new tide gauge), these are mainly implemented only in the port area of Cotonou. There are no real national capacities except some equipment limited to the IRHOB. Emphasis must now be placed on phase 2 for a response to "national" and not just "port" needs.

<sup>1</sup> Référence : <https://iho.int/uploads/user/Inter-Regional%20Coordination/CBSC/MISC/Templates%20Procedures/PDF/Procedure%2011.pdf>

3	Production of nautical charts and publications	<p><b>In the long term</b></p> <p><i>“The country fulfils its national obligations through a third party”</i></p> <p>An administrative arrangement currently organizes cooperation with France and in particular enables compliance with the SOLAS convention. It is nevertheless logical and necessary for Benin to be able to gradually gain autonomy and already meet specific cartographic needs such as sovereignty charts of State Action at Sea. It is therefore necessary to clearly identify the already existing capacities in terms of geomatics in order to pool them through joint projects. This is one of the first actions to be carried out within the CNHOC. Note: the PAC and the IGN have, at various levels of experience, such skills.</p>
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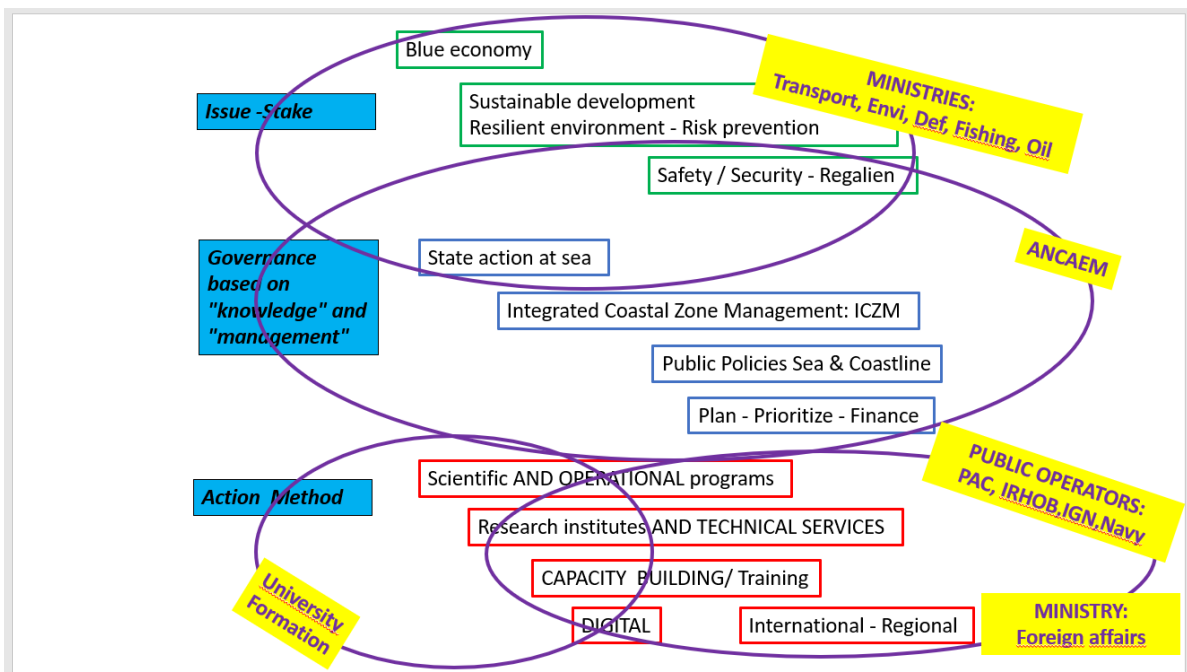
### **The Ministry of Infrastructure and Transport (MIT)**

The organizational chain of maritime transport is in place. It is made up of the MIT, the DMM (integrated into the new Department of Port, Maritime and River-Lagoon Affairs) and the PAC (the last two under the supervision of the MIT). Through the work of the CNHOC, it will be able to consider both the regulatory and operational measures necessary for the development of the country's capacities. In addition to the work of the CNHOC, membership in the IHO will “pull up”.

### **The National Committee for Hydrography, Oceanography and Marine Cartography (CNHOC, ex CHN and CNO combined)**

- National Hydrographic Committee as a National Oceanography Committee existed but are no longer active;
- It was unanimously desired to create a new committee which would integrate in addition to hydrography, oceanography (physical in particular) and cartography: the CNHOC (National Committee for Hydrography, Oceanography and Marine Cartography). Its necessity is widely accepted by all the services/actors encountered: many common needs, shareable skills, resources to be pooled (through agreements, budgetary compensation if necessary);
- Its multidisciplinary (transport/navigation, coastal environment, safety/security, maritime fishing, research and education in oceanography, etc.) and interministerial (MIT, MCVDD, MESRS, National Defense, etc.) nature was highlighted;
- As underlined at MIT and during the closing meeting of the visit, it will be particularly important to define its mode of operation, its sustainability will depend on it. In particular, beyond state governance, it will be necessary to involve the scientific and technical players in the "field". Reference for the record: the IHO publication M2 “The need for national hydrographic services”: [https://iho.int/uploads/user/pubs/misc/M-2\\_3.0.7\\_E\\_06142018.pdf](https://iho.int/uploads/user/pubs/misc/M-2_3.0.7_E_06142018.pdf);
- Concretely, it could be judicious to launch projects (including setting up resources) like those proposed in appendix G;
- Note: such a committee does not, however, constitute an operational national body for research, development and hydro-ocean-cartographic production. Do we need such an

operational organization that would require a heavy investment to study and set it up (status, governance, budget, material and human resources, etc.)? Rather than creating such a service ex-nihilo, it may be rather appropriate to rely on existing structures, including that of the PAC (Technical Department in charge of hydro-oceanography and aids to navigation) whose vocation does not, however, have not a national character. The implementation of structures and operational means is part of the "Action/Method" level of the following figure. The subject is obviously to be discussed within the CNHOC with the two actors that are the IRHOB for oceanography and the IGN for cartography. The CENATEL is probably also concerned.



**National Authority Responsible for State Action at Sea (ANCAEM)**

- The interdisciplinarity mentioned above could therefore be supported by ANCAEM,
- The maritime prefect (ANCAEM) is an authority reporting to the President of the Republic that is particularly well positioned to deal with inter-ministerial matters.

**Autonomous Port of Cotonou (PAC) (under management by Port of Antwerp)**

The PAC plays a major (but almost exclusive) role in terms of nautical information (corresponding to NAVAREA II) and transmission of new bathymetric surveys to Shom. According to IHO Publication P-5 (list of non-Member States), its Director General represents Benin at meetings of this organization. In the past, the Head of the Topographic, Hydrographic and Oceanographic Studies Service (DT/SETHO) of the PAC Technical Department was able to participate in IHO meetings and seminars. The PAC is in the process of quality certification. The definition of a process for the acquisition and processing of hydro-oceanographic data will make it possible to write the procedures that are missing from the PAC. In a process of continuous improvement, staff upgrades in terms of skills may be specified.

### **National Geographic Institute (IGN)**

This is an important organization whose skills could be essential for the development of phase 3 (charting) of capacities. To be noted more specifically, great professional skills in the management of geolocated data, leveling and geomatics.

### **Navy (MN)**

The sovereign missions (defense) of the Navy are known. It is worth recalling here the importance it now has in terms of AEM. Furthermore:

1. The NM can participate in the collection (it has a front row seat to observe) and the dissemination of nautical information;
2. The MN has ships which are supports (maritime platforms) for carrying (at least occasionally) portable hydrographic and oceanographic data acquisition systems which Benin does not currently have outside the PAC. The rapid development of phase 2 (data acquisition at sea, surveys) should also rely on these existing national resources;
3. Depending on its ambitions in terms of national hydrography (outside PAC), the MN could send one of its officers to follow a CAT B certified hydrography course.

### **Oceanographic research**

#### **The Institute of Fishery and Oceanological Research of Benin (IRHOB)**

#### **The Master 2 "Oceanography and Applications" of Cotonou (CIPMA, UAC, UPS)**

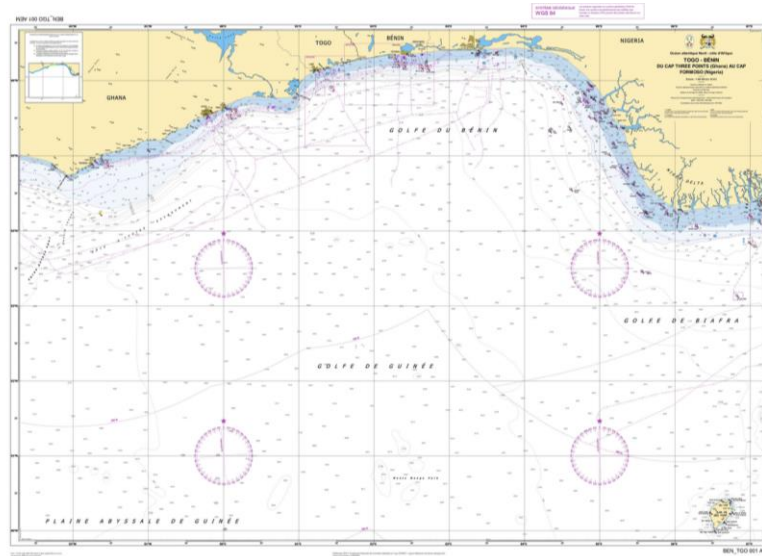
##### **IRHOB**

IRHOB is the Beninese institute with capabilities in oceanography. Its human potential (physical oceanography) must be known, developed and valued. IRHOB is home to the National Oceanographic Data Center of Benin (CNDO-Benin) which is an active member of the International Oceanographic Data Exchange Program (IODE) of the Intergovernmental Oceanographic Commission (IOC) of UNESCO. The IRHOB implements, online, a daily meteoceanic forecast model for the monitoring of extreme oceanographic phenomena.

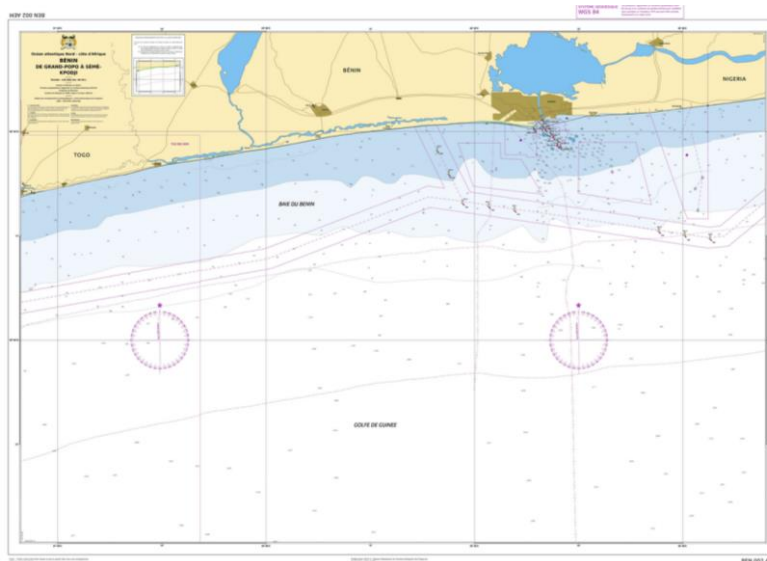
##### **Master 2 "Oceanography and Applications" (CIPMA, IRD, UPS)**

Particularly important, since 2008, the Master 2 program "Oceanography and Applications" of Cotonou is offered to students from different countries of West and Central Africa. This is a joint action between the Research Institute for Development (IRD), the UNESCO Chair in Mathematical Physics and Applications (CIPMA) at the University of Abomey Calavi (Cotonou, Benin), and the Paul Sabatier University of Toulouse in France (UPS). There is a reservoir of young people with two high qualifications (Benin/UAC, France/UPS) who will be able to extend their skills in hydrography and already respond to PAC issues during long-term internships (6 months).

For the record: Ministry of Foreign Affairs (map filed with the United Nations / DOALOS: Division for Ocean Affairs and the Law of the Sea):



<https://www.un.org/Depts/los/LEGISLATIONANDTREATIES/PDFFILES/MAPS/Ben243MZN154.jpg>

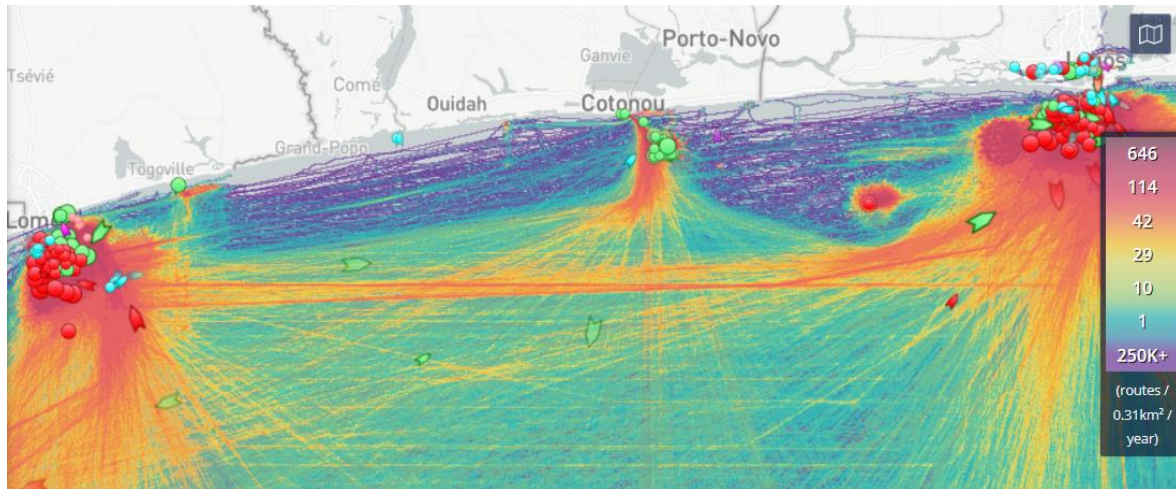


<https://www.un.org/Depts/los/LEGISLATIONANDTREATIES/PDFFILES/MAPS/Ben242MZN154.jpg>

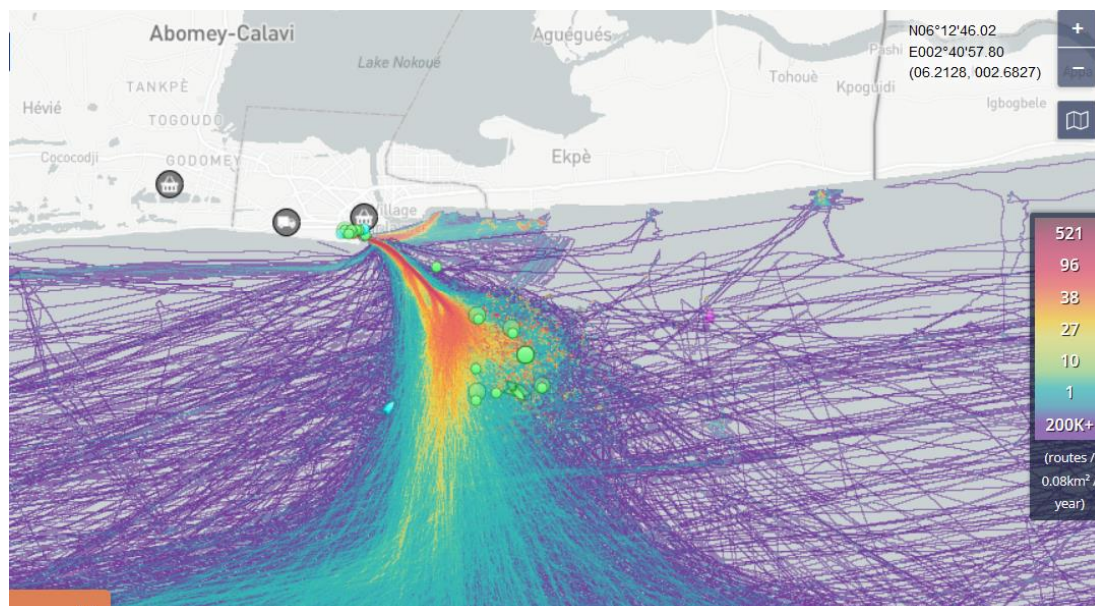
[M.Z.N.154.2021.LOS of 17 September 2021](#): Deposit of relevant baseline points and outer limits of the territorial sea, the contiguous zone and the exclusive economic zone as contained in Decree no 2021-253 of 19 May 2021, Fixing the Coordinates of the Nautical Chart of Benin

## 9 Maritime trade and traffic - Marine cartography / CATZOC

AIS data (source : <https://www.marinetraffic.com> )



**General situation of offshore maritime traffic in the Gulf of Guinea**



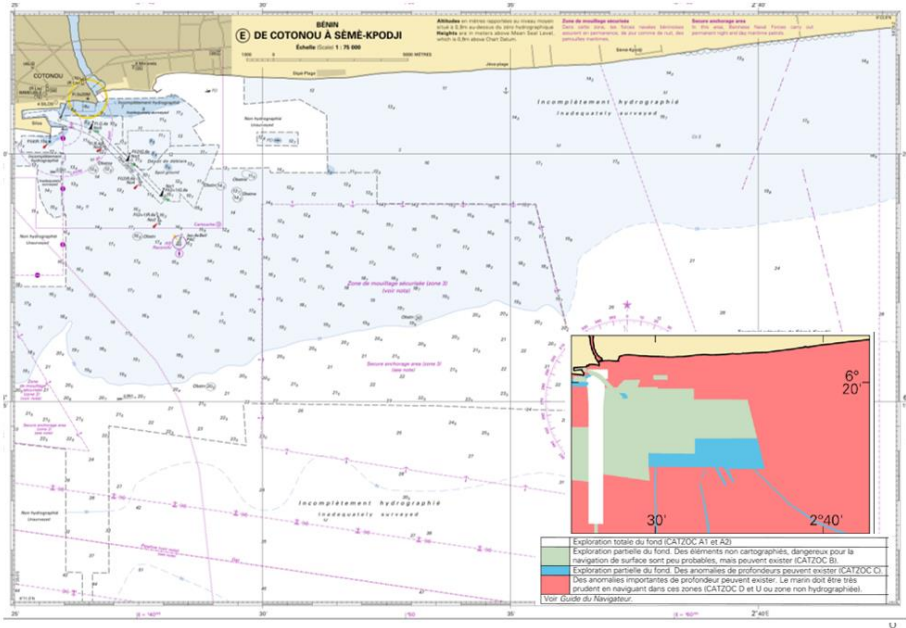
**Maritime traffic at the port of Cotonou**

### Official cartography of Benin

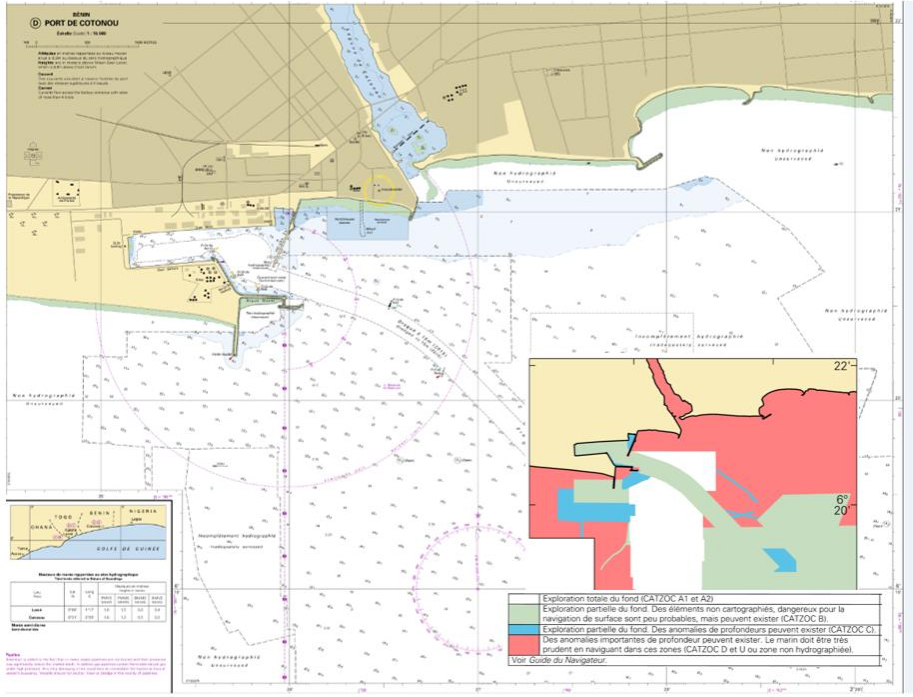
France ensures de facto (pending greater autonomy from Benin) the function of "Primary Chart Authority" through the production of nautical documentation made by the Shom on Beninese waters, this cartographic responsibility being defined by an administrative arrangement between France and Benin signed in 2010. Beninese waters are covered by a set consisting of paper charts, digital rasters in GeoTiff format and electronic navigational charts (ENC). These products cover the most important known navigation needs. The fact remains that the charts, in shallow water, are often based on very old information (years 1837 – 1846 lead lines). The environment may have changed, the hydrographic techniques of the time no longer meet current requirements, which is already the case in terms of geolocation in WGS84. If the immediate accesses to Cotonou have been the subject of recent hydrographic surveys, the rest of the territory is very poorly surveyed or not surveyed even near Cotonou.

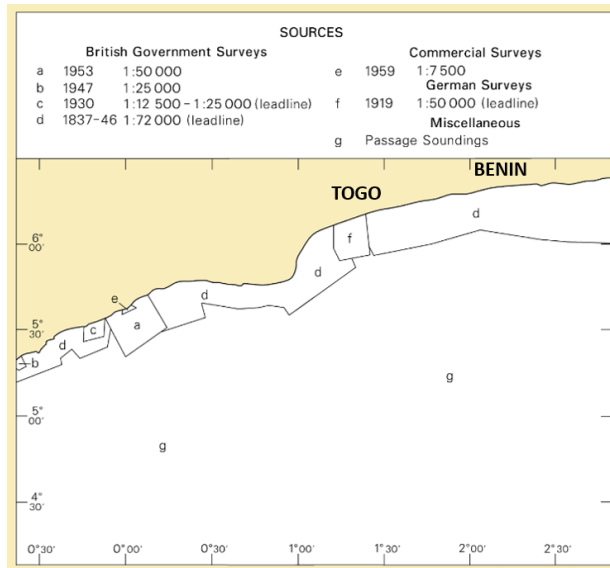
Knowledge status in Benin:

État connaissance Bénin



État connaissance Bénin





**Knowledge status: chart 7787**  
**Benin (G)**

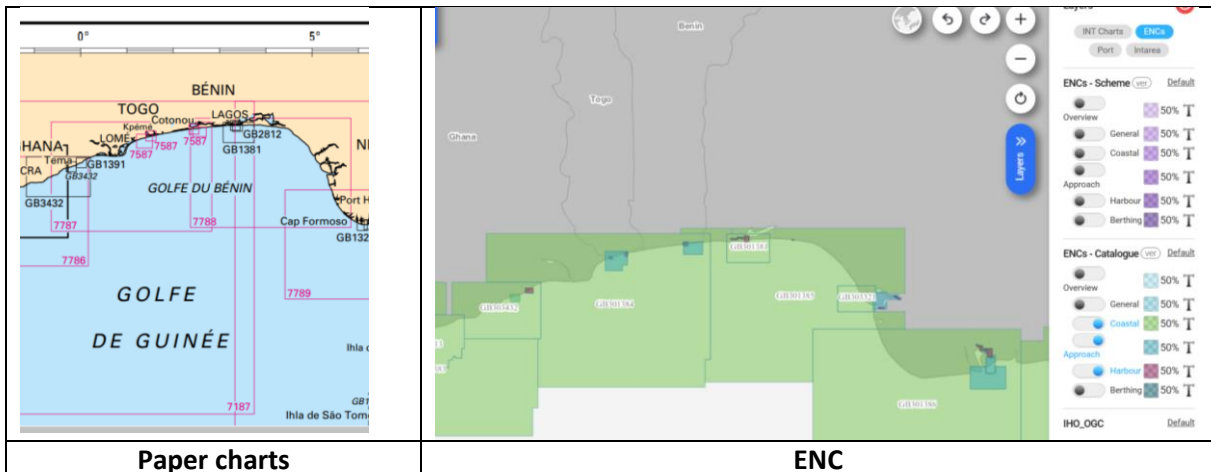
Nautical charting / Cartographie marine / Cartografía náutica		Offshore passage Navigation au large Pasaje offshore			Landfall and Coastal passage Atterrissage et navigation côtière Recalada y Pasaje costero			Approches and Ports Approches et ports Aproches y puertos		
Coverage of charts published Couverture des cartes publiées Cobertura de cartas publicadas		100	0	100	100	0	100	100	0	100
<p><b>100%</b> Covered by INT or other paper charts meeting S-4 Couvert par des cartes papier INT ou autres conformes S-4 Cubiertas por cartas de papel INT o otras cumpliendo S-4</p> <p><b>0%</b> Covered by RNC meeting S-61 Couvert par des RNC conformes S-61 Cubiertas por RNC cumpliendo S-61</p> <p><b>0%</b> Covered by ENC meeting S-57 Couvert par des ENC conformes S-57 Cubiertas por ENC cumpliendo S-57</p>		<p>INT RNC ENC</p>			<p>INT RNC ENC</p>			<p>INT RNC ENC</p>		
Paper charts showing depth in meters Cartes papier avec les profondeurs en mètres Cartas de papel con profundidades en metros		100 %			100 %			France		
Notes Notes Notas		<p>1. Data provided by France according to FR-BJ bilateral agreement</p> <p>2. Some large scale coverage needs modernisation.</p> <p>3. Data derived from EAHC visit</p>								

**Sources/ ENC :**

<http://chart.iho.int:8080/iho/main.do>

**Sources/ cartes papier :**

[https://diffusion.shom.fr/media/wysiwyg/catalogues/Grand\\_Catalogue\\_2021\\_Web.pdf](https://diffusion.shom.fr/media/wysiwyg/catalogues/Grand_Catalogue_2021_Web.pdf)





N° FR	N° INT	Title	Scale	Year publication or edition	Comment
7187	2087	De Sassandra à Lagos	1 000 000	2009	
7587	2881	Port de Lomé - Rade de Kpémé - Port de Cotonou A - Port de Lomé B - de Lomé à Kpémé C - Rade de Kpémé D - Port de Cotonou E - De Cotonou à Sèmè-Kpodji	15 000 75 000 25 000 15 000 75 000	2019	Redesign planned after 2022

### Electronic charts

N°	Title	Scale	Year publication or edition	Comment
FR271870	Abidjan à Porto-Novo (FR7187)	1 000 000	2016	
FR47587E	De Cotonou à Sémé-Kpodji	75 000	2019	Redesign planned after 2022
FR57587D	Port de Cotonou	15 000	2019	Redesign planned after 2022
GB301384	Cape Saint Paul to Cotonou	350 000		

Comment :

- This cartography must be enriched by all the surveys carried out in the waters under Beninese sovereignty or jurisdiction. The hydrographic surveys received by the Shom (metadata included) have so far only come from the PAC. The official cartography is therefore not enriched by all the surveys carried out, such as possibly the exploration seismic surveys or the surveys of oceanographic laboratories. This is a subject to be submitted to the CNHOC.
- It should be noted that bathymetric surveys carried out in the framework of oceanographic research should not be systematically discarded: even carried out with "general public" equipment, these data can only enrich the "white" areas of nautical charts or those containing only old data.
- There are areas where hydrographic knowledge is insufficient or even non-existent. By correlating this knowledge with the current (including cabotage) and especially planned navigation zones, it will be possible to conduct a risk analysis and prioritize the hydrographic surveys to be carried out. This is again a subject to be submitted to the CNHOC (navigational aids included).

## 10 Responsibility for the safety of navigation

At the state and regulatory level, this responsibility falls to the Ministry of Infrastructure and Transport (MIT) and the Port, Maritime and River-Lagoon Affairs Direction (new direction which has integrated the Merchant Marine Department: DMM).

## **11 Responsibilities of the defense forces (Navy)**

See the chapter “National Maritime Affairs – Stakeholders”: Navy. The “AEM” exercise requires support in terms of hydrography and nautical cartography.

## **12 Coastal zone management and environmental protection**



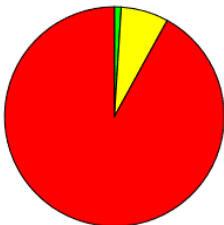
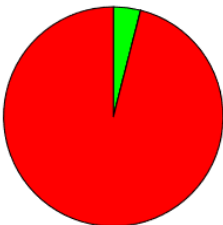

The subject was not specifically addressed except through discussions on accretions (including possible filling of the access channel to the PAC) and erosion in the Cotonou region. There are programs in West Africa such as WACA - MOLOA (West Africa Coastal Areas - Mission d'Observation du Littoral Ouest Africain) that have been launched and are now dealing operationally with the challenges of the coastal environment. These programs necessarily need marine geophysical data. It should be noted that the Shom, through a program financed by the FFEM (French Fund for the Global Environment) was able to digitize historical data from Benin, such as bathymetric charts and bathymetric fairsheets useful for studies of evolution in the time of the coastline (erosion rates). These data were not known by the organizations visited. They are probably with the Ministry of the Living Environment and Sustainable Development (MCVDD).

## C-55 INDICATORS

### 13 Status of hydrographic surveys in the national maritime area

Source : <https://iho.int/uploads/user/pubs/cb/c-55/c55.pdf>

#### Benin (G)

Hydrographic surveying / Levés hydrographiques / Levantamientos hidrográficos							
Survey coverage Couverture hydrographique Cobertura hidrográfica		Depth < 200m Profondeur < 200m Profundidad < 200m			Depth > 200m Profondeur > 200m Profundidad > 200m		
	Adequately surveyed Correctement hydrographié Adecuadamente levantado	1	7	92	4	0	96
	Re-survey required Nécessitant de nouveaux levés Requiere nuevo levantamiento						
	Never systematically surveyed Jamais hydrographié systématiquement Nunca levantado sistemáticamente						
Notes Notes Notas	1. Data provided by France according to FR-BJ Technical Agreement signed on May 7th 2010. 2. Depths fall away precipitately beyond the narrow continental shelf. 3. The coast is subject to erosion and depths inshore are constantly changing. 4. Routine re-surveys are required for Cotonou.						

**Note:**

- these indicators are solely based on the data available to Shom: there may be surveys carried out by oceanographic research organizations or by private companies, in particular offshore (surveys) which are not known by Shom and therefore not exploited on nautical charts and in the C-55 indicator;
- they clearly show the extreme weakness (apart from port accesses) of hydrographic knowledge in depths less than or greater than 200 m.

### 14 Collection and circulation of nautical information

It is appropriate for the PAC and any observer at sea (Navy in particular) to provide information to the Shom in order to issue NAVAREA notices (rapid dissemination on Inmarsat) and update the nautical publications in a timely manner, in particular by Notice to Mariners. The transmission should be based on a state organization to be put in place. The flow of information must relate to:

- nautical charts (eg: new depths, guaranteed dredging threshold, new quays, new navigational aids, wrecks removed, submarine cables, etc.);
- sailing directions;
- list of lights;
- tides (the harmonic constants used for the predictions to be made more reliable and precise using observations of water levels in Cotonou).

## 15 Hydrographic survey capacity

**General context:** At the PAC, the structure responsible for hydrography is the SETHO: Department of topographic, hydrographic and oceanographic studies of the Technical Direction.

### **The missions of SETHO:**

- Carry out periodic monitoring of depths in the basin, the access channel and the entrance pass by bathymetric surveys;
- Perform topographic surveys;
- Ensure the positioning of buoys and traffic lights of the Port of Cotonou;
- Carry out the study and monitor the evolution of the coastline and shallow waters in the area under the influence of the Port of Cotonou structures;
- Participate in the installation of various structures in the port area;
- Record and use the tide gauge recordings and publish the tide prediction;
- Collect and interpret data from the climatological and oceanographic station and ensure the proper functioning of this equipment;
- Participate in the specifications for dredging works (procurement);
- Ensure control of dredging works;
- Participate in carrying out sedimentological studies;
- Ensure continuity of service by monitoring software licenses and measurement equipment.

### **Equipment resources:**

If there are no national capacities, the PAC nevertheless has significant equipment listed in years

### **Human resources:**

The initial training of SETHO staff is essentially that of surveyors/topographers. There are no trained hydrographers in specialist schools, especially those whose curricula are IHO certified. Difficulties are reported in processing oceanographic data.

## 16 Independent nautical chart production capacity

There are no official capacities for the production of nautical charts, nor for their updating and distribution. This is entrusted to France (Shom) under an administrative arrangement with Benin signed in 2010.

## COORDINATION AND CAPACITY BUILDING PROPOSAL

### 17 National Committee for Hydrography, Oceanography and marine Cartography (CNHOC)

A National Hydrographic Committee (CHN) existed.

It was unanimously proposed to revive it by widening its scope and considering the administrative, scientific and technical structures of today.

His interest is vital.

This committee (inter-ministerial, inter-agency) will be an essential link in the operational organization of the Beninese State (technical services for study, data management, production, etc.) to be set up (and therefore to be financed) to the execution of development programs in hydrography, oceanography and nautical cartography (fluvio-lagoon cartography can be integrated into it).

The organization and execution of training in Benin and abroad is part of the development programs and therefore the subjects of the committee.

#### **Propositions :**

- First of all: gather around a table the potential actors of this future committee to first precisely define its mandate and its members. It will be possible to rely on the constitutive text of the former CHN as well as the CNO (National Committee for Oceanography). This report lists possible stakeholders. The IHO publication M2 also makes recommendations;
- It is a question of launching a dynamic at the institutional levels (technical departments of the ministries) and technical levels (by specifying the corresponding actors: hydrographers, oceanographers, hydrodynamicists, surveyors, geomaticians, cartographers without forgetting the support functions in particular in computer science);
- The collection of needs (navigation, environment, etc.) in products (eg charts) and services (eg tide forecasts, extreme coastal events, etc.) will naturally lead to specifying the needs for the acquisition of suitable hydrographic and oceanographic data. An essential step before prioritizing these acquisitions, and planning them by identifying the organizations (to be supported) or companies (to be contracted) that can carry them out;
- The collection of data is only economically conceivable if these are widely shared (one data - several applications – the SOLAS application through nautical documents being only one among others) and exploited. This raises the problem of archiving and disseminating data at the national level. Techniques and tools are better and better mastered with databases and communication and download portals. The fact remains that this requires IT structures and dedicated skills to be set up. This is a fundamental structural point to put on the agenda of the first meeting: setting up a marine geospatial data infrastructure (MSDI – Maritime Spatial Data Infrastructure).

## 18 Phase 1 Hydrographic capacities: MSI and GMDSS

Maritime Safety Information (MSI), as defined in International Maritime Organization Resolution A.705(17) and detailed in the joint IHO/IMO/WMO Handbook on MSI (IHO Special Publication S-53), consists of the collection and dissemination of navigational and weather warnings, search and rescue information and other urgent safety information, including nautical information relating to nautical documentation.

The dissemination of these MSI is based on the Global Maritime Distress and Safety System GMDSS: an international system that uses telecommunications means for search and rescue at sea (SAR) and the prevention of maritime accidents.

In addition, MSIs in their broadest sense include the updating of navigation charts and other nautical publications (list of lights, radio signals, sailing directions, etc.). The MSIs need an organization (procedures for collecting, transcribing and transmitting information, maintained equipment, trained personnel) with a national MSI coordinator in relation with the navigators, the cartographic authority (France /Shom) and NAVAREA II (France / Shom).

PAC disseminates information to the NAVAREA II coordinator (France / Shom). The Navy can also occasionally contribute.

However, this is not officially organized at the national level by the Beninese state.

The conditions for processing MSIs (NAVAREA II) and non-urgent nautical information are specified at the beginning of the report in the chapter: MAIN COMMENTS, RECOMMENDATIONS.

**Note: France reiterates its offer to use SafetyNet to make up for the lack of NAVTEX (possibility already offered to Nigeria, Togo and Ivory Coast and Congo during IHO technical visits)**

## 19 Phase 2 Hydrographic capacities: conducting surveys

The only existing capabilities (equipped boat that can meet the requirements of IHO standards) identified on site are those of the PAC. As long as they are in good working order, they are perfectly suited to harbor and coastal surveys in shallow waters.

However, these means remain dedicated to the needs of the PAC in its area of responsibility. They therefore do not cover other national needs, whether navigation or the environment.

**Proposal:** Be able to constitute, on shared projects (not necessarily permanently), the necessary capacities by relying on all the resources already available and therefore poolable at the PAC, in the Navy, the IRHOB, the IGN, etc

## 20 Phase 3 Hydrographic capacities: production of nautical charts

Benin does not yet have the capacity to produce (and distribute worldwide) official national charts. France (via Shom) acts as the charting authority for the waters under the country's jurisdiction. This is formalized in an Administrative Arrangement (07 May 2010) between Benin (at the time the Minister Delegate to the President of the Republic of Benin in charge of the maritime economy and port infrastructures) and France (Ministry of Defense, supervision of Shom) to comply with the SOLAS convention.

### Proposition

The co-production of official nautical charts must continue with the current cartographic responsible (France/Shom) for maritime navigation (SOLAS) while offering Benin the opportunity to gain autonomy. Due to less significant regulatory constraints (standards, updating and dissemination), cartographic documents (geomatics) for various applications such as coastal development, environmental monitoring or specific AEM maps, can already be produced by Benin.

## 21 Summary of the assessment of national hydrographic capacities - Table

OHI IHO	CHAtO EAtHC	NHC CNHC	Phase 1 Capacity	Phase 2 Capacity	Phase 3 Capacity
NON Membre	Associated Membre	YES	YES for Harbour	YES for Harbour	NO (1)

(1) (1) Co-edition with France (Shom) as part of an administrative arrangement

## FORMATION

### 22 Basic training of hydrographic technicians (not only!)

#### Initial training of hydrographers

**The PAC has skills, but the current executives have not had specific training in hydrography.**

It will be necessary to have a pool of qualified hydrographic senior technicians in sufficient numbers (at least one at the PAC). The recommended training is that offered by schools whose programs are approved by the FIG/IHO/ACI (International Federation of Surveyors, International Hydrographic Organization, International Cartographic Association) with Category B (CAT B). The practical training which supplements the theoretical training of the schools will be, for the port hydrographers, opportunely carried out in a port operating dredging and having a service in charge of hydrography. The Shom school (French-speaking) offers training approved in Category B: the Higher Hydrographer's Certificate, the program of which can be consulted (page 43) on: [https://www.shom.fr/sites/default/files/2020-10/Offre\\_formation\\_2020-2021\\_Web.pdf](https://www.shom.fr/sites/default/files/2020-10/Offre_formation_2020-2021_Web.pdf)

Point of contact at Shom: Ronan Le Roy, head of the Shom training division and director of education: [drh-for-d@shom.fr](mailto:drh-for-d@shom.fr).

This license level 3 training is very demanding in terms of initial knowledge of mathematics and physics. It can be followed by young people who already have experience in geomatics, geodesy, physical oceanography or even maritime navigation.

This training will give enough versatility to future students to meet almost all the skills needed for data acquisition at sea (rivers and lagoons as well) and on the coast. The CAT B hydrographer will be able on his return to his country to train the "aid-hydrographers" that the country needs ("CAT C").

Note - PAC: as part of a forward-looking management of staff and skills, it can already be envisaged to consolidate the Department of Topographical, Hydrographic and Oceanographic Studies (DT/SETHO) of the Technical Direction by training a senior technician category B hydrographer.

Note - Navy: depending on the role that the Navy wishes to take in national hydrography, the training of a category B executive may be considered.

#### Initial training of "marine" cartographers

This is a fundamental subject because the country needs cartographic products and services to cover both the sea and its lagoons.

It is moreover this "cartographic" desire that will generate the need for data and therefore for hydrographic surveys.

The progressive part that Benin will take in the production of nautical charts (therefore in connection with the Shom), its own capacity to produce sovereignty charts for the AEM (including boundaries), can only benefit from a solid training in cartography dedicated to maritime navigation (fluvio-lagoon included). Category B training (CAT B) is recommended.

The Shom school (French-speaking) offers such a CAT B training course: Marine cartography technician preparation course, the program of which can be consulted (page 48) again on [https://www.shom.fr/sites/default/files/2020-10/Offre\\_formation\\_2020-2021\\_Web.pdf](https://www.shom.fr/sites/default/files/2020-10/Offre_formation_2020-2021_Web.pdf).



It is however necessary to note that, unlike the Shom Category B certified hydrographer training, this cartographer preparation training is not open every year but irregularly depending on the internal needs of the Shom.

Point of contact at Shom: Ronan Le Roy, head of the Shom training division and director of education: [drh-for-d@shom.fr](mailto:drh-for-d@shom.fr).

### **Also have "support" and "managerial" skills - Apply**

To get off to a "good start" at the national level and have lasting skills, there is no escaping:

- a solid initial training (CAT B – Hydrographer). This is not acquired for the PAC (but it is not without qualification with engineer and technician level surveyors). This could be considered for the Navy;
- immediately followed by practical application: moving on to operations by conducting surveys that are immediately used by marine cartographers and environmental specialists;
- which presupposes also having additional skills/capacities which can be classified as follows:
  - "Support" function in specific equipment (GPS, echo sounders, tide gauges, etc.): maintenance in operational condition of equipment, IT (software, databases, webmaster, etc.). It may be noted here that this support function is not very different from that of land surveyor or cartographer;
  - "Navigation" function: provision of boats for work at sea (there are also many additional skills that should not be overlooked!);
  - without forgetting the management function
- All of this cannot be achieved without global management (and therefore having the corresponding skills):
  - it is necessary to organize the development of capacities in hydro-oceanography (even beyond training) as a project according to classic managerial practices (objectives, costs, deadlines);
  - it is therefore advisable to design the development objective in a global way, which can be entrusted to the CNHOC:
    - exhaustiveness of the needs (to be planned) to be satisfied (navigation, coastal development, coastal protection, etc.). Definition of the corresponding products (cards in particular);
    - identification of all stakeholders (public and private) who have an interest in cooperating to derive benefits (they come together to pool capacities);
    - definition of the production systems to be implemented: hydro-oceanographic, cartographic and support functions (logistics);
    - definition of the means of intervention at sea (boats, launches);
    - definition of onshore infrastructure;
    - definition of governance (supervision, contracts of objectives and means, therefore financing, agreements);
    - definition of human resources needs in sufficient quantity and quality for all structures and all qualification combined.

## 23 Continuous training in hydro-oceanography and related activities (navigation aids, port infrastructure development and coastal protection) - Management

### At the international level in hydrography

There are actually many opportunities and facilities to maintain knowledge in hydrography. It is still necessary to know them and be encouraged to follow them.

- IHO:
  - which offers training materials at: <https://iho.int/fr/publications-sur-le-renforcement-des-capacites>. In particular, there is a high-quality hydrography manual;
  - who organizes seminars. Those of the EAtHC are beginning to be known. The next will take place during the next EAtHC (17th) plenary of 2022 (September 2022) if possible face-to-face in Cape Verde: <https://iho.int/en/eastern-atlantic-hc>
- Shom (<https://www.shom.fr/>) which in addition to the statutory training of its school (CAT B) also offers opportunities for training in tide measurement (<https://www.sonel.org/>);
- AFHy: Association Francophone d'Hydrographie (<https://www.afhy.fr/>) where in particular hydro-cartographers of ports and rivers meet.

### Note :

- Also follow the e-learning opportunities that will develop;
- There is a need for regional training schools (West and Central Africa) in hydro-oceanography-cartography. It is necessary to get out of the current situation where there would be no other alternative than to enroll the agents to be trained in hydrographic schools outside the African continent. They may be French or English speaking. The contacts that IHO has been able to have so far on West and Central Africa have not really made it possible to identify the structures (schools, academies, etc.) immediately ready to host training courses for hydrographers and certified cartographers. The following have thus been identified as potentially suitable for training courses:
  - Two national hydrographic services - likely to offer complete training courses approved by the IHO/ACI/FIG (CAT B) - having recently considerably increased their hydro-oceanographic capacities, namely:
    - Nigeria: the NNHO (Nigerian Navy Hydrographic Office) which has a school in Port Harcourt (NNHS: Nigerian Navy Hydrographic School);
    - Morocco: DHOC (Hydrography, Oceanography and Cartography Division) of the Royal Navy;
  - Two maritime education centers more likely to offer more specialized training than approved, namely:
    - RMU (Regional Maritime University) in Accra (Ghana);
    - ARSTM (Regional Academy of Marine Sciences and Techniques) in Abidjan (Ivory Coast).

### Universities

It is remarkable that Benin organizes, with the help of IRD, a Master 2 "Oceanography and Applications": Universities of Abomey-Calavi in Benin and Paul Sabatier of Toulouse in France.

It can be followed by students from West and Central Africa.

It should also be noted that the Omar Bongo University of Libreville (UOB) and the universities of Yaoundé (UY) and Douala (UDo) offer a regional master's degree in "integrated management of coastal and marine environments" (GIELM with which IRD is associated) which also deals with hydro-oceanography subjects. There is certainly a pool of skills to be explored.

### **At the national level (Benin)**

There are certainly national skills (public, private) that the technical visit could not identify, in particular:

- qualified surveyors (land);
- specialists in remote sensing (a means widely used in hydrography) in particular at CENATEL (National Center for Remote Sensing);
- professionals in GIS (Geographic Information Systems) (in support of the professions mentioned above);
- computer specialists skilled in databases and dissemination websites;
- engineers and technicians from engineering companies.

These are transversal skills essential to the development of hydro-oceanography-cartography. They constitute a base of skills to be pooled on which Benin can count.

### **Management**

No development without managers who, beyond their administrative and human responsibilities, will also have to:

- know how to communicate with users (maritime pilots, shipping companies, developers, etc.), with Shom, with the IHO and finally with all the national stakeholders identified for the CNHOC;
- know how to specify hydro-oceanographic surveys and prioritize them according to the risks incurred;
- identify the best staff training courses;
- mastering all possible sources of funding at the national, regional (West and Central Africa) and international level (Donors)

These skills will be particularly important within the CNHOC.

Participation in IHO meetings and more particularly in EAtHC meetings and seminars allows exchanges with counterparts from other coastal States of the Gulf of Guinea and West Africa.

Editor



Henri DOLOU

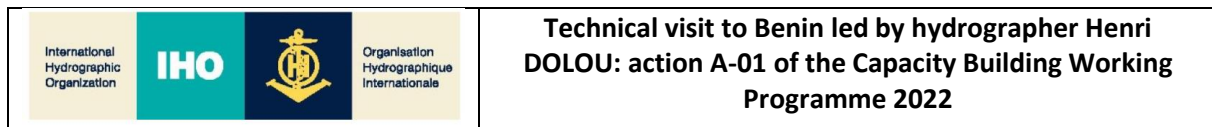
## ANNEX

### Annex A : Abbreviations

ANCAEM	Autorité Nationale Chargée de l'Action de l'État en Mer
ANPC	Agence Nationale de Protection Civile
ARSTM	Académie Régionale des Sciences et Techniques de la Mer <i>Regional Academy of Marine Sciences and Techniques</i>
CATZOC	<i>Category Zone of Confidence</i>
CBSC	<i>Capacity Building Sub-Committee (IHO)</i> Sous-comité de renforcement des capacités
CBWP	<i>Capacity Building Work Programme (IHO)</i> Programme de travail de renforcement des capacités
CENATEL	Centre National de Télédétection
CHN	Comité Hydrographique National
CIPMA	Chaire Internationale en Physique Mathématique et Applications de l'Université d'Abomey-Calavi (CIPMA/UAC)
ICMPA	<i>International Chair in Mathematical Physics and Applications (ICMPA - UNESCO CHAIR)</i>
CNDO	Centre National de Données Océanographiques (du Bénin)
CNO	Comité National Océanographique
CNHOC	Comité National d'Hydrographie, d'Océanographie et de Cartographie marine <i>(would include : CHN , CNO and marine cartography)</i>
« DAPMFL » (DMM)	Direction des affaires portuaires, maritimes et fluvio-lagunaires <i>Reintegrate : (Direction de la Marine Marchande)</i>
DPCE	Direction de la Protection des Côtes et des Écosystèmes de Direction Générale de l'Environnement et du Climat du MCVDD
DPH	Direction de la Production Halieutique du MAEP (Ministère de l'Agriculture, de l'Élevage et de la Pêche)
EAtHC CHAtO	<i>Eastern Atlantic Hydrographic Commission (IHO)</i> Commission Hydrographique de l'Atlantique orientale
ECDIS	<i>Electronic Charts Display Information System</i>
ENC	<i>Electronic Navigational Chart (sea)</i> Carte électronique de navigation
GMDSS SMDSM	<i>Global Maritime Distress and Safety System</i> Système Mondial de Détresse et de Sécurité en Mer
IALA AISM	<i>International Association of Marine Aids to Navigation and Lighthouse Authorities</i> Association Internationale de Signalisation Maritime
IGN	Institut Géographique International
IHO OHI	<i>International Hydrographic Organization</i> Organisation Hydrographique Internationale
IMO OMI	<i>International Maritime Organization</i> Organisation Maritime Internationale
IOC COI	<i>Intergovernmental Oceanographic Commission</i> Commission Océanographique Intergouvernementale
IODE	Programme International d'Échange de Données Océanographiques (COI)
IRD	Institut de Recherche pour le Développement
IRHOB	Institut de Recherches Halieutiques et Océanologiques du Bénin

MCVDD	Ministère du Cadre de Vie et du Développement Durable
MSI RSM	<i>Maritime Safety Information</i> Renseignement de Sécurité Maritime
MIT	Ministère des infrastructures et des transports
MN	Marine Nationale
MOWCA OMAOC	<i>Maritime Organization of West and Central Africa</i> Organisation Maritime de l’Afrique de l’Ouest et Centrale
MSDI	<i>Maritime Spatial Data Infrastructure</i> Infrastructures de données spatiales maritimes
NC CM	<u><i>Nautical Charts</i></u> Carte marine
NHC CNH	<i>National Hydrographic Committee</i> Comité National Hydrographique
NtMs	<i>Notice to Mariners</i> Avis aux navigateurs
OPJEB	Organisation Panafricaine de la jeunesse pour l’Économie Bleue
PAC	Port autonome de Cotonou <i>Autonomous Port of Cotonou</i>
PCA	<i>Primary Charting Authority</i> Autorité cartographique principale
RHC CHR	<i>Regional Hydrographic Commission (EAtHC)</i> Commission Hydrographique Régionale (CHATO)
SETHO	Service des études topographiques, hydrographiques et océanographiques de la Direction Technique du PAC
Shom	Service hydrographique et océanographique de la marine (France) <i>French Hydrographic and Oceanographic Service (French national hydrographic office)</i>
SMAN	Système mondial d’avertissement de navigation <i>Worldwide Navigational Warning Service (WWNWS)</i>
SMDSM	Système mondial de détresse et de sécurité en mer <i>Global Maritime Distress and Safety System (GMDSS)</i>
SOLAS	<i>[United Nations] Convention for the Safety of Life at Sea</i> Convention pour la sauvegarde de la vie humaine en mer
UAC	Université d’Abomey-Calavi, Cotonou, Benin
UPS	Université Paul Sabatier de Toulouse, France
WACA	<i>West Africa Coastal Areas Management program</i> Programme de gestion du littoral ouest-africain
WACA/FFEM	WACA/Fonds Français pour l’environnement Mondial <i>WACA/French Facility for Global Environment</i>
WACA/ResIP	Projet national d’investissement pour la résilience des zones côtières en Afrique de l’Ouest de WACA <i>WACA National Coastal Resilience Investment Project in West Africa</i>

## Annex B: Terms of reference of the visit team of the Regional Hydrographic Commission



### Context

The IHO (International Hydrographic Organization) Capacity Building Program aims to coordinate the development of the capacities of Member and Associate States in the field of hydrography and nautical cartography in order to meet the objectives of IHO and the obligations related to Chapter V of the SOLAS Convention, the United Nations Convention on the Law of the Sea and other international instruments.

It was thus decided:

- to promote regional cooperation in capacity building in West and Central Africa (EAtHC: IHO Eastern Atlantic Hydrographic Commission);
- to identify the potential of national and regional training centers;
- to study the possibilities of organizing regional seminars.

On the proposal of France, which coordinates the IHO capacity building program for EAtHC, the IHO Capacity Building Sub-Committee proposes to conduct a technical visit to the country.

### Goals

The general objectives of the technical visits are as follows:

- discussions with the decision-making authorities of the country visited, emphasizing the importance of hydrography for coastal states and therefore the need to include associated hydrographic and nautical cartography activities in national plans;
- support the development of a national system for the collection and diffusion of maritime safety information (MSI) integrated within the Worldwide Navigational Warning Service (WWNWS);
- assessment of national capacities in terms of planning and carrying out the collection and use of hydrographic data in order to allow the production and updating of the nautical documentation essential for the safety of navigation and in support of others uses (infrastructure management, environmental protection, development of the blue economy, etc.);
- development of recommendations with the actors of the visited country in order to strengthen these capacities in a long-lasting and sustainable manner;
- preparation of IMO audits (IMSAS) and follow-up of recommendations in connection with hydrographic services;
- promote the emergence of development projects in the field of hydrography and nautical cartography in conjunction with IHO secretariat, IMO and funding agencies in order to obtain the sustainable establishment of capacities.

### Report

A report on the activities and recommendations of the team will be submitted to the president of the CHR (Regional Hydrographic Commission) after the visits.

## Annex C : Reference texts

Note: this list (in French) is not exhaustive

### Textes de référence de la République du Bénin

Objet	Référence officielle
Loi sur les changements climatiques en République du Bénin De très nombreux articles relatifs au transport maritime, les risques climatiques côtiers, l'importance des données et leurs bases, la qualification du personnel	Loi N° 2018 – 18 du 06 Août 2018
Décret portant attributions, organisation et fonctionnement du Ministère des Infrastructures et des Transports (MIT) Parmi les directions techniques : Direction des Affaires portuaires, maritimes et fluvio-lagunaires	Décret N° 2021 -575 du 03 Novembre 2021
Décret portant création, organisation, attributions et fonctionnement de l'Autorité Nationale Chargée de l'Action de l'État en Mer	Décret N° 2014 -785 du 31 Décembre 2014
Arrêté portant création du Comité Hydrographique National	Arrêté 2014 N° 020 /MEMIP/DC/SGM/DRFM/DMM/SA

### Texte de référence de la France (Shom)

Objet	Référence officielle
<b>Ministère défense</b>	
Arrangement Administratif Coopération en matière d'hydrographie, d'océanographie et cartographie marine	Arrangement administratif bilatéral du 07 mai 2010 entre le ministre de la défense de la République française et le ministre délégué auprès du président de la République du Bénin chargé de l'économie maritime et des infrastructures portuaires

## Annex D : List of main contacts - Telephones - Mails


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## Annex E : Agenda – Events

Object – Event	Observations
<b>J1 : Monday 31 January 2022</b>	
➤ ANCAEM : Autorité Nationale Chargée de l'Action de l'État en Mer	Capitaine de Vaisseau Maxime AHOYO Préfet Maritime
➤ MN : Marine Nationale	Capitaine de Vaisseau Albert BADOU Chef d'État-Major de la Marine
➤ MIT : Ministère des Infrastructures et des Transports	M Joseph AHISSOU Directeur de cabinet Roch HOUNDJE Secrétaire général
<b>J2 : Tuesday 01 February 2022</b>	
➤ PAC/DT/SCEM : Direction Technique Chef Service Génie Électrique et Mécanique	(Balisage) M Lucien DAZOGBO
➤ PAC/DT/SETHO : Service des études topographiques, hydrographiques et océanographiques	M Jan Louis M. DE VOGHT Mme Fatimatou MAMA SAMBO
➤ Sortie en mer sur pilotine (Chenal d'accès)	
➤ PAC/Direction de la capitainerie -Commandant du port	M Akim BAKARI Directeur de la capitainerie Commandant du port M José SERIKI Pilote M Charles FAYOMI Pilote
<b>J3 : Wednesday 02 February 2022</b>	
➤ OPJEB : Organisation Panafricaine de la jeunesse pour l'Économie Bleue	M. Ernest TINDO
➤ DMM : Direction de la Marine Marchande	M. Désiré Mouléro KOUTON
➤ IGN : Institut Géographique National	M Roch Abdon BAH
➤ PAC/DT/SETHO	Mme Fatimatou MAMA SAMBO
<b>J4 : Thursday 03 February 2022</b>	
➤ IRHOB : Institut de Recherches Halieutiques et Océanologiques du Bénin	M Zacharie SOHOU
➤ CIMPA : Chaire Internationale en Physique Mathématique et Applications (UAC)	M Mahouton Norbert HOUNKONNOU
➤ Conférence donnée à l'initiative de CIMPA/ISBA : « hydrographie et cartographie marines »	M Henri DOLOU Introduit par Alexis CHAIGNEAU de l'IRD
➤ Contact lors de la conférence avec le directeur de la Protection des Côtes et des Écosystèmes	M Philippe ZOUMENOU
<b>J5 : Friday 04 February 2022</b>	
➤ PAC/Directeur Général	M Joris THYS
➤ Restitution (conclusions – recommandations) de la mission sous la présidence du Préfet Maritime en présence : ANCAEM, Marine Nationale, IRHOB, PAC/pilotage, PAC/DT/SETHO	Capitaine de Vaisseau Maxime AHOYO Préfet Maritime

## Annex F : Photos



### Préfecture Maritime

De gauche à droite : Capitaine de vaisseau Fernand Maxime AHOYO (ANCAEM), Henri DOLOU (OHI), Capitaine de frégate Laurent DESCAT Conseiller AEM du CEMN



Préfecture Maritime - MRCC (Maritime Rescue Coordination Center)



**Marine Nationale en présence de son chef d'État-Major : Capitaine de Vaisseau Albert BADOU deuxième à partir de la gauche**



**Ministère des Infrastructures et des Transports (MIT) en présence (à droite) du Directeur de Cabinet (Joseph AHISSOU) et du Secrétaire Général (Roch HOUNDJE)**



**PAC/ DT/SGEM (Balisage)**

**« Revue de balisage » dans le chenal d'accès à bord de la pilotine du PAC**

**De gauche à droite : Lucien DAZOGBO (PAC/signalisation maritime), Mme Fatimatou MAMA SAMBO (PAC/hydrographie), Henri DOLOU (OHI)**



**PAC/DT**

**Mme Fatimatou MAMA SAMBO (PAC/hydrographie), Jan Louis M. DE VOGHT (PAC/ Directeur Technique), Henri DOLOU (OHI)**



**PAC/DT/SETHO**

**Mme Fatimatou MAMA SAMBO (PAC/hydrographie) entourée de ses collaborateurs directs :  
Bernadin S AGBOKIN, Olivier TOMAWA, Cyfried HOUENOU**



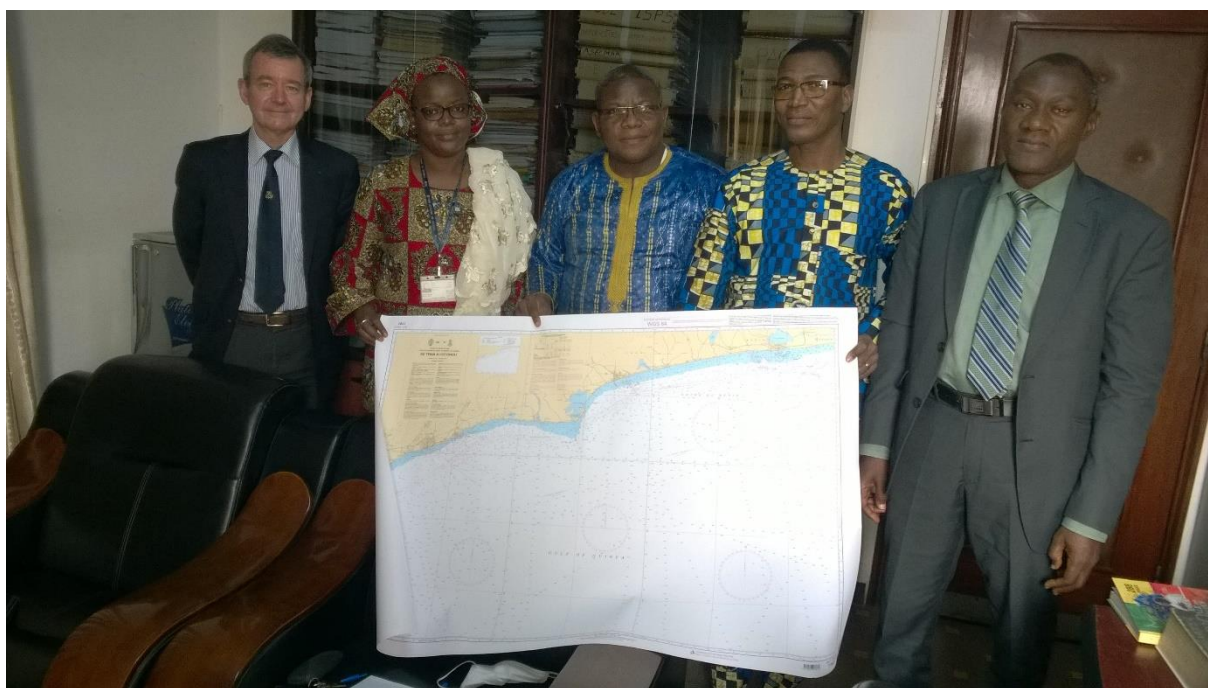
**PAC/DG**

**De gauche à droite : Joris THYS Directeur Général du PAC, Henri DOLOU, Fatimatou MAMA SAMBO**



**PAC Capitainerie**

**De gauche à droite : José SERIKI (Pilote), Akim BAKARI (Commandant du port, directeur de la capitainerie), Henri DOLOU (OHI), Charles FAYONI (Pilote), Mme Fatimatou MAMA SAMBO**



**Direction de la Marine Marchande (DMM)**

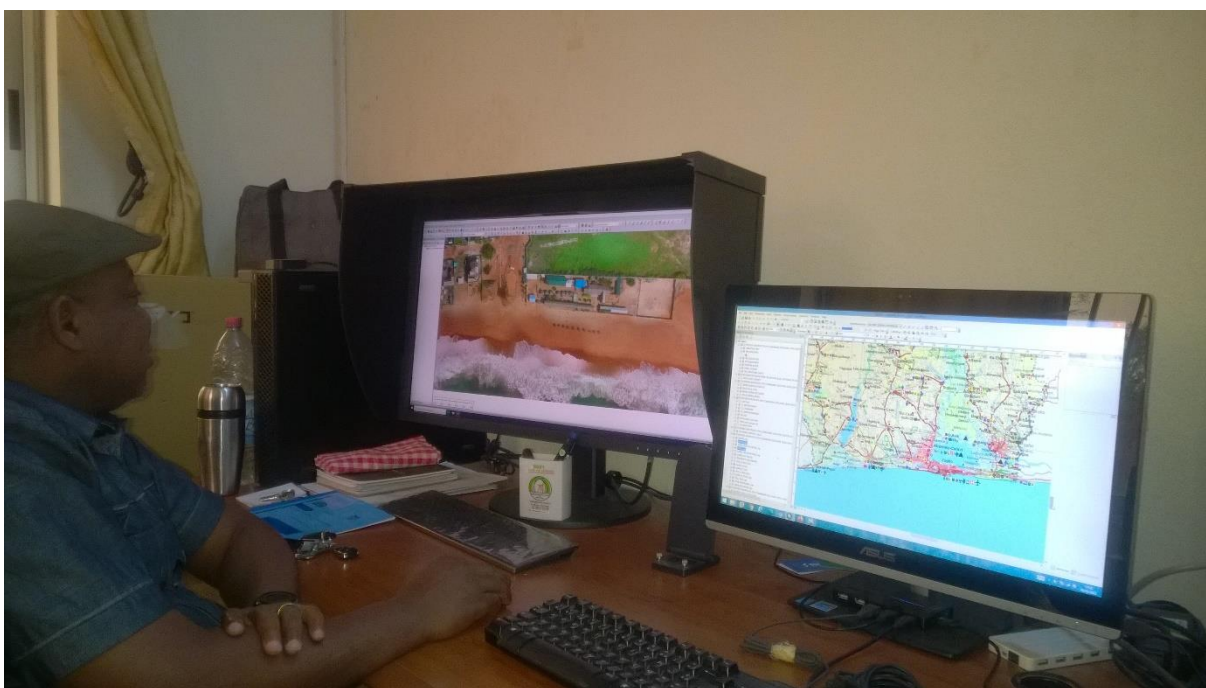
**De gauche à droite : Henri DOLOU, Fatimatou MAMA SAMBO, Germain AHISSOU, Guy AGUEHOUNDE et Désiré Mouléro KOUTON (Directeur)**





IGN

**M Roch Abdon BAH Directeur Général (3<sup>ème</sup> à partir de la gauche) accompagné de Eric K BOTON (cartographe spécialiste en SIG) et Séro K SAKA (Cartographe – Photogrammétrie)**



IGN

**Eric K BOTON et ses stations de travail**



**Le directeur de l'IRHOB (Institut de Recherches Halieutiques et Océanologiques du Bénin) et son équipe. Premier à partir de la gauche Alexis CHAIGNEAU de l'IRD.  
Au premier plan M Zacharie SOHOU, directeur**



**Le CIPMA dans le campus de l'Université d'Abomey Calavi**



**2<sup>ème</sup> à partir de la gauche : Le président Mahouton Norbert HOUNKONNOU du CIPMA, (Chaire Internationale en Physique, Mathématiques et Applications)**



**Conférence « hydrographie et cartographie marines » donnée à l'initiative du CIMPA avec la participation de : MCVDD, PAC, IRHOB, UAC, IGN, Marine Nationale, IRD, MIT/DMM, MAEP/DPH**

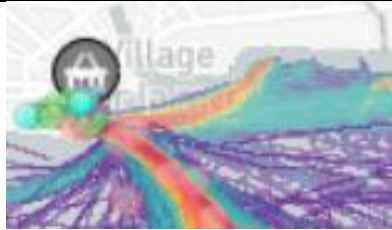

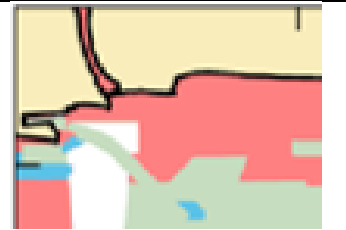
## Annex G : Possible interdisciplinary projects

This annex does not constitute an activity program. It only offers suggestions of action to be consolidated and then led by the stakeholders of the CNHOC.

### 1. Bathymetry: risk assessment in terms of cabotage

The first step would be to make sailors aware of the quality of the charts with regard to the routes followed. The superimposition of followed routes (AIS on Marinetraffic) on nautical charts (Shom, CM 7587), the quality of which can be assessed with the use of sources, would allow a first analysis.

Example in the east of Cotonou:

		
<p><a href="https://www.marinetraffic.com">https://www.marinetraffic.com</a> In red: intense navigation</p>	<p>CM 7587</p>	<p>Sources of CM 7587 : In red: zones to investigate (1)</p>

(1) Non-hydrographied areas or in which important anomalies may exist

It would then be possible to specify and then carry out the hydrographic surveys necessary to update knowledge of the area (updating the nautical chart) by associating not only the sailors but also those responsible for the marine environment (in the example the Marine Protected Area).

### 2. Hydro-oceanographic survey of the Marine Protected Area (AMP) of Donatin in Cotonou (other option: Bouche du Roy à Grand-Popo)

The example given above could go beyond a simple bathymetric survey to build a unifying multi-agency project around Donatin's AMP of Cotonou.

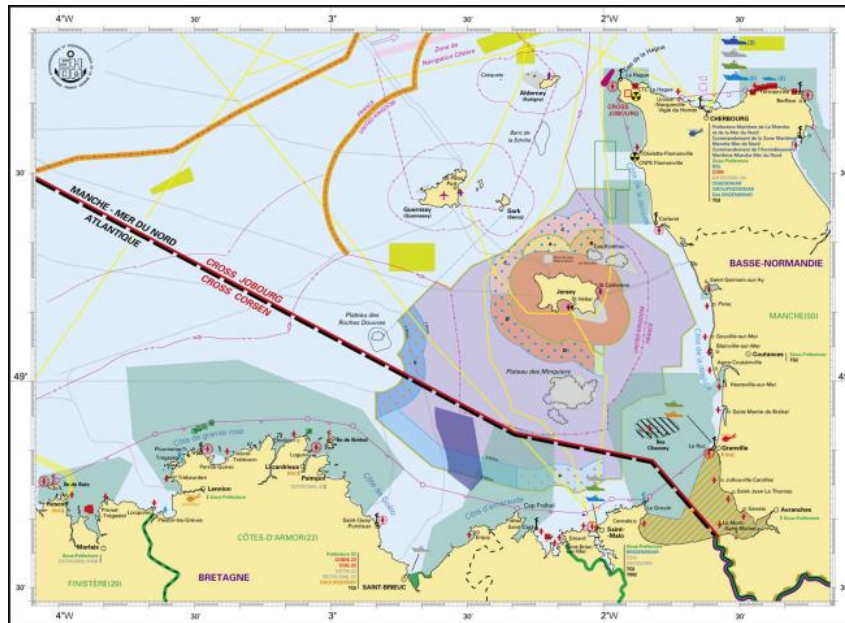
It would then be a question of completing the bathymetry by a more complete georeferenced initial physical description without which it will not be possible to follow up the ecosystem of the AMP: currents, description of the water column, coastline / erosion. Nothing more promising (IRHOB very concerned) to "encourage" to acquire, qualify, manage data in shared bases and operate GIS (geographic information systems).



Quartier de Donaten

### 3. National map of State Action at Sea

Continuing on from the previous project, the need for cartography arises. This cartography must be digital with georeferenced data (WGS84) usable by open source GIS (Geographic Information Systems) such as QGIS. These maps can target specific areas like the Donaten's AMP. However, the country also needs a general "AEM" (Action Etat en Mer) map of its waters where all the sovereignty (eg EEZ) and regulatory limits can be drawn. ANCAEM, ABeGIEF (Agence Béninoise de Gestion Intégrée des Espaces Frontaliers) and the Navy need it.



Example of a French AEM map in the English Channel

### 4. Tide gauge

This is a major topic:

- because "IHO" standards applicable to hydrographic surveys in channels, recommended channels and port cannot be respected without observation of the tides;
- to financially optimize dredging;
- to prepare for future huge container ship the draft of which will approach the actual depths of the channel. Safety then also depends on the water levels observed in real time;
- for hydrodynamic studies (tidal currents) including those necessary for sediment transport or even marine pollution;
- for studies on climate change, in particular the rise of the mean sea level.

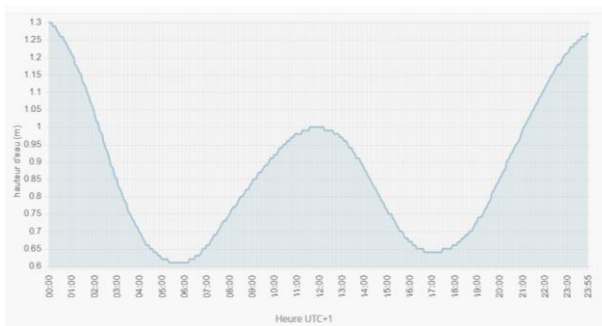
The acquisition of a new tide recorder at PAC will make it possible to cope with this concern. It is recommended:

- List the "functions / services" expected from users: hydrographers (accuracy), pilots (real time for the harbour's Vigie and PPU), oceanographers (databases);

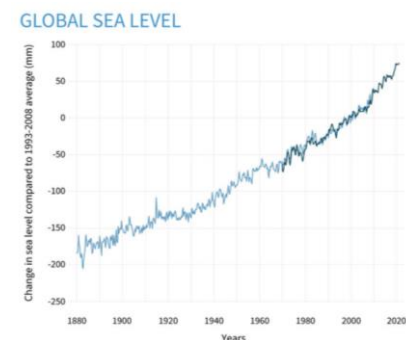
- To associate from the definition not only the users but also IGN that can bring its expertise (attachment of the hydrographic datum to the general leveling) in terms of leveling and geodesy.

Note: the acquisition of a new tide gauge must be accompanied by an inventory, recovery and then digital archiving of all the measurements that have already been carried out in Cotonou. If these are old paper records their digitization should be considered. As a result, this is very structuring for the country, the constitution of the Benin tide gauge database on which many studies will depend not only on the rise in sea level but also all those relating to extreme weather-oceanographic events. (surges) that the country may suffer.

For the inventory, think not only of PAC but also of IOC (Intergovernmental Oceanographic Commission).



**Tide at Cotonou**



**General sea level rise**

Note: The tide of Cotonou is very close to that of Lomé

### 5. Modeling of sediment currents and transport in the vicinity of Cotonou

This is physical oceanography including the tide. The applications would be for PAC which must control the depths of its channel and in general the operators needing to simulate the movements of water masses (eg in the event of pollution). It is certain that such models could explain the phenomena of accretions and erosions in the region.

Note : IRD implemented the TELEMAC-2D model at IRHOB. It would be necessary that in first, a student of the master 2 oceanography and applications immerses completely in this model to best represent the port area (+ channel) and get a realistic dynamic modeling. Could then be added the sedimentary transport module (ex: Sesiphe).

### 6. Digital cartographies and visualization systems at sea

Controlled navigation now involves electronic navigation charts ENC (Electronic Navigational Chart) at sea.

Coupled with a GPS, they must be able to be displayed on systems such as ECDIS (Electronic Charts Display Information System).

Shom produces the ENCs. Maritime pilots in Cotonou will soon need specific very high definition digital cartography for the PAC. Their display system will be a PPU (Portable Pilot Unit).

These specific charts will have to be produced.

## Annex H : Geodesy equipment / topography, hydrography / bathymetry and oceanography at PAC and IRHOB

PAC (Source : PAC/SETHO, Mme Fatimatou MAMA SAMBO)

Equipment	Observations
<p><b>A) La topographie :</b></p> <ul style="list-style-type: none"> <li>✓ Récepteur GNSS Leica GS 14 (base +mobile) + carnet CS15 ;</li> <li>✓ Drone leica Airbot AX20</li> <li>✓ station totale TS16 leica + carnet CS20 + accessoires ;</li> <li>✓ Niveau électronique Leica DNA03 avec ses accessoires ;</li> <li>✓ Amplificateur radio de type SATEL-TA18 model SATTELLINE EASyPro 35W</li> <li>✓ antenne de l'amplificateur radio SATEL (UHF)</li> <li>✓ Leica Infinity</li> <li>✓ Autocad - Covadis.</li> </ul>	<p><b>Topographie (action en cours) :</b></p> <p>Acquisition d'une station permanente GNSS CORS en cours</p>
<p><b>B) L'hydrographie :</b></p> <ul style="list-style-type: none"> <li>➤ Vedette hydrographique de type CATAMARA/classifié MCA class 4 ;</li> <li>➤ Sondeur multifaisceaux ODOM MB1 composé du processeur RTA, du transducteur et du Célérimètre de Coque ODOM Digibar V ;</li> <li>➤ Récepteur GNSS Leica GS 14 (base +mobile) ;</li> <li>➤ Récepteur GNSS (mobile) Chorus V2 et ses antennes (positions et Cap) ;</li> <li>➤ Centrale d'attitude SBG EKINOX2-A ;</li> <li>➤ Profileur de célérité SONTEK CastAway ;</li> <li>➤ Amplificateur radio de type SATEL-TA18 model SATTELLINE EASyPro 35W et son antenne UHF ;</li> <li>➤ Boitier PPS ;</li> <li>➤ Deux ordinateurs (logiciel Image et logiciel Hypack)</li> <li>➤ Logiciel Hypack et Hysweep</li> <li>➤ Autocad - Covadis</li> <li>➤ Marégraphe de type Valeport avec un capteur immergé</li> </ul>	<p><b>Hydrography (difficulties):</b></p> <ul style="list-style-type: none"> <li>➤ <i>Hydrographic equipment is obsolete (launch and sounder)</i></li> <li>➤ <i>No training in hydrography</i></li> </ul> <p><b>Hydrographie (actions en cours) :</b></p> <ul style="list-style-type: none"> <li>➤ Acquisition d'une vedette hydrographique et d'un sondeur tout en un de type NORBIT WINGHEAD i77h. Les TDR sont élaborés et transmis au marché public pour un montant global de 650millions de FCFA</li> <li>➤ Acquisition d'un marégraphe à radar de type CS475A de Campbell en cours</li> </ul> <p><b>Note pour le SMF :</b> l'intégration est à faire sur perche. Il faut choisir la version avec une centrale inertielle SBG intégrée</p>
<p><b>C) L'océanographie</b></p> <p>Bouée océanographique de type JET 5000 QIPF4HV</p> <p>Capteurs embarqués :</p> <ul style="list-style-type: none"> <li>➤ houlomètre ;</li> <li>➤ météo ;</li> <li>➤ courantomètre ;</li> <li>➤ température de l'eau.</li> </ul>	<p><b>Oceanography (difficulties) :</b></p> <ul style="list-style-type: none"> <li>➤ <i>The current meter was stolen,</i></li> <li>➤ <i>Interpretation of oceanographic data,</i></li> <li>➤ <i>Absence of training</i></li> </ul> <p><b>Océanographie (actions en cours) :</b></p> <p>Acquisition d'un turbidimètre et du capteur de salinité en cours</p>

IRHOB (Source : Dr. ADJE Christian Chercheur-Océanographe, Gestionnaire des ressources maritimes)

- quelques GPS portatifs
- un DGPS et un théodolite pour le suivi de l'érosion côtière
- deux échos sondeurs de marque Garmin pour la bathymétrie
- quelques capteurs de pression
- un courantomètre