



**INSTITUTO HIDROGRÁFICO**

<http://www.hidrografico.pt/>

2024

## ***PORTUGAL***

### ***National Report***

This report describes the main technical activities and developments at Instituto Hidrográfico (IHPT), the Portuguese Hydrographic Office, during the period from September 2022 to April 2024. It is to be presented at the 18<sup>th</sup> EAtHC Meeting in accordance with IHO Resolution 2/1997 as amended.



## **18th MEETING OF THE EASTERN ATLANTIC HYDROGRAPHIC COMMISSION (EAtHC)**

**Plenary meeting 01st to 03rd May 2024**



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## **1- HYDROGRAPHIC OFFICE**

Established in 1960, Instituto Hidrográfico (IHPT) is both an organization within the Portuguese Navy and a national marine research laboratory. It is the national hydrographic service, provides environmental support to naval operations and performs research and development activities in physical and chemical oceanography, marine geology, hydrography, safety of navigation and marine data management.

IHPT is focused on the ocean observation, mapping its several scientific dimensions and predicting its behavior in the short, medium and long term. It is committed to open data policies and sharing its capabilities with the society promoting faster research and development activities and ultimately leading to a greater knowledge of the ocean.

The main objectives of IHPT activities are the safety of navigation, the environmental monitoring and the protection of the marine environment. It is permanently involved in several R&D projects, which ultimately contribute to the climate change analysis and the development of the blue economy. It has established a Quality Management System recognized by an independent, credible and competent external entity, according to the normative reference (NP EN ISO 9001). The Quality Policy includes a commitment to meeting regulatory requirements and continually improving to meet customer needs. Among these activities, the training provided by the Hydrography and Oceanography School stands out, with FIG/IHO/ICA category A and B courses. Its students are Navy officers and civilian technicians, from Portugal and Portuguese-speaking African countries, as well as from other friendly nations.

Detailed information to update IHO Publication P-5 has been submitted using the online system, by Engineer Paula Sanches, Technical Advisor for IHO matters and nautical cartography ([paula.sanches@hidrografico.pt](mailto:paula.sanches@hidrografico.pt)).

In EAtHC region, IHPT is the Primary Cartographic Authority (PCA) for Cape Verde, Guinea-Bissau, S. Tomé and Príncipe and Angola.

## **2- SURVEYS**

### **a) Coverage of new surveys**

The main hydrographic program of IHPT, “SEAMAP 2030: Mapping of the Portuguese Sea” (<http://www.hidrografico.pt/iprojeto/16>) is in progress. This program, which is focused on high-resolution mapping of Portuguese waters of interest, has the objective of contributing to the conservation and sustainable use of the sea, supporting research, and promoting development. It is aligned with United Nations Decade of Ocean Science for Sustainable Development.

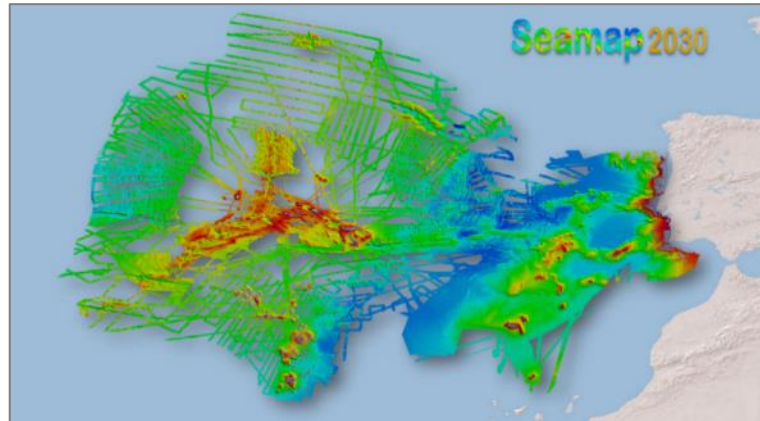


Figure 1 – SEAMAP 2030 actual coverage with multibeam surveys.

Portugal has focused its survey effort on the Portuguese maritime areas thus contributing to the goal of the long-term project SEAMAP 2030. Over this cycle, Portugal has executed several hydrographic surveys, within 30 campaigns, in harbors and port entrances, coastal and deep-sea areas and for specific projects, in Portugal-Mainland and Azores archipelago. Despite the focus on Portuguese waters, it was also possible to carry out hydrographic surveys in the Portuguese speaking African countries (PALOP), using the Portuguese Hydrographic ship NRP D. Carlos I.

All considered, Portugal has made significant efforts conducting hydrographic surveys, both for cartographic and for scientific purposes, endeavoring distinct objectives, such as adding new and updated cartography to existing folios, either in Portugal or in Africa’s Portuguese nautical charts responsibility areas, or maintaining an updated hydrographic scenario on most dynamic harbors or coastal areas, and also augmenting the hydrographic awareness in the Portuguese waters, expanding the already significant surveyed area.

All surveys conducted by Portugal are described in Table I and shown in Figures 2, 3 and 4.



Figure 2 – Surveys - Portugal

Table I – IHPT surveys (SET2022-APB2024)

		Harbour (Port and port entry)	Coastal and Deep-Sea		Special purposes surveys
Portugal	Mainland	Aveiro	SEAMAP2030	W and S - coast	Viana do Castelo submarine cable inspection
		Lisbon			
		Setúbal			
		Portimão			
		Sines			Sines seafloor monitoring jetty monitoring
	Inland	Douro River			
	Azores	Ponta Delgada - São Miguel Island		São Miguel Island	
		Lages - Flores Island		São Jorge Island	
		Angra do Heroísmo - Terceira Island		Graciosa Island	
				Pico Island	
	Faial Island				
	Flores Island				
Madeira	NIL	NIL	NIL		
Cabo Verde	Palmeira	Sal Island	NIL		
	Sal-Rei	Maió Island			
		Boavista Island			
Guiné-Bissau	Geba River	NW-Cost	NIL		
São Tomé e Príncipe	NIL	NIL	NIL		

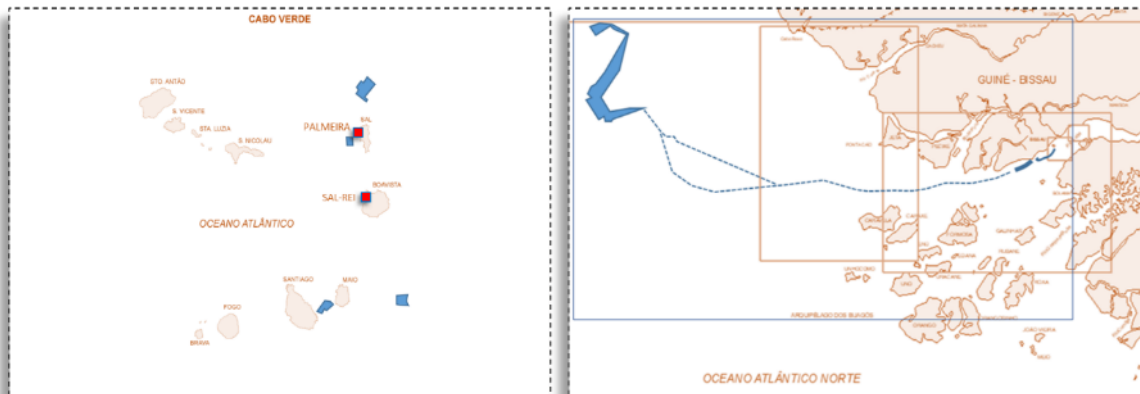


Figure 3 – Surveys - North African Portuguese Speaking Countries.

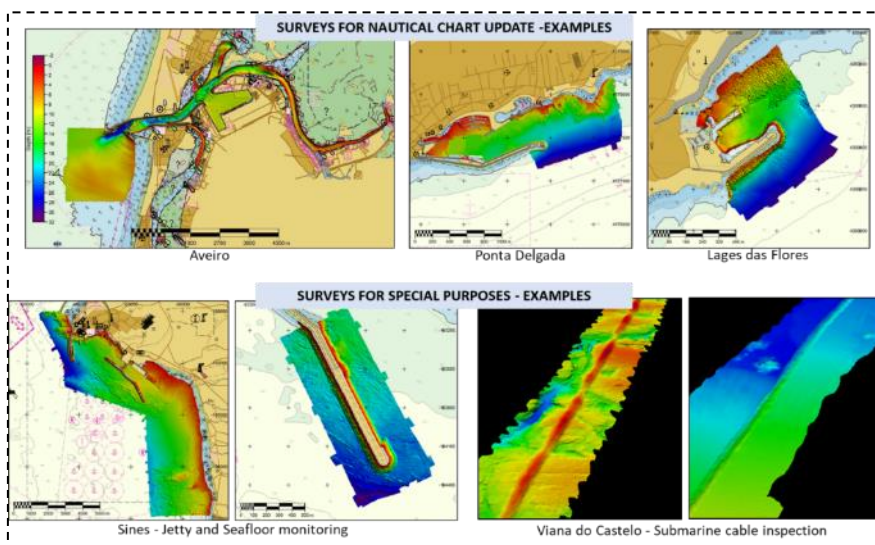


Figure 4 – Surveys - Examples

**b) New technologies and /or equipment**

Portugal is using top of the shelf acoustic systems for hydrographic surveys.

New methodologies based, both on satellite and low flying vehicles imagery are also being used and under ongoing research. Portugal is also using third party surveys data, which is appropriately being checked for quality control.

Table II – IHPT new equipment/systems

TECHNOLOGY	SYSTEMS/EQUIPMENT	DESCRIPTION
AUV (autonomous underwater vehicle)	GraalTech X-300 (acquired)	Operable down to depths of 300 meters, and equipped with camera, sidescan sonar and conductivity, temperature and pressure sensors.
USV (Unmanned Surface Vehicle)	USV Otter Pro (under acquisition)	Unmanned platform designed to acquire bathymetric data in sheltered waters.
USV (Unmanned Surface Vehicle)	USV Otter X (under acquisition)	Unmanned platform designed to acquire bathymetric data in sheltered and coastal waters.
LiDAR	DJI Zenmuse L1 (acquired)	Tailored for integration onboard unmanned aerial systems. Mainly used for topographical surveys.
Glider	Alseamar SeaExplorer (acquired)	Designed to profile the water column down to depths of 1000 metres, acquiring data on conductivity, temperature, pressure, turbidity and chlorophyll-a.
Positioning and attitude system	Seapath OEM i350 / miniMRU 50	Provides the determination and integration of a vessel’s position and attitude, essential for high-resolution mapping. Its small size and weight makes it suitable to be installed onboard small unmanned vehicles, with limited payload allowances.

TECHNOLOGY	SYSTEMS/EQUIPMENT	DESCRIPTION
Multibeam Sonar	Kongsberg EM2040C	Tailored for high-resolution bathymetry acquisition down to depths of 300 meters, from surface vessels.
Positioning and attitude system	Seapath 380 / MRU 5+	Provides the determination and integration of a vessel’s position and attitude, essential for high-resolution mapping.
Multibeam Sonar	Kongsberg M3	Usable on small platforms (vessels of opportunity, USVs, ROVs). It allows the acquisition of high-resolution bathymetry down to depths of 70 meters. It can also assume the role of a forward-looking sonar or an acoustic camera.
Multibeam Sonar	Kongsberg M3 HF	Usable on small platforms (vessels of opportunity, USVs, ROVs). It allows the acquisition of high-resolution bathymetry at short distances from the seafloor. It has a depth rating of 4000 meters.
Multibeam Sonar	Kongsberg EM2040P (under acquisition)	Tailored for high-resolution bathymetry acquisition down to depths of 300 meters, from surface vessels.

**c) New ships**

IHPT has recently acquired, two modern new vessels (UAM Roaz and UAM Orca (Figure 5)), tailored for inshore and coastal mapping operations, that are being fitted for survey campaigns.



Figure 5 – Orca and Roaz new manned survey vessels

**d) Crowdsourced and satellite-derived bathymetry - national policy**

The Portuguese national policy for crowdsourced bathymetry is currently under review. A regular updated service of coastal bathymetry is an objective for the coming future.

**e) Challenges and achievements**

The major challenge is related to the Portuguese program/project, SEAMAP2030 to fulfil the goal of high-resolution coverage by 2030. Also considered an achievement given the good progress achieved in recent years.

Obtaining funding for new surveys off Cape Verde, Guinea-Bissau, S. Tomé and Príncipe and Angola, in conjunction with those countries, is still considered the greatest challenge.

**3- NEW CHARTS & UPDATES**

All IHPT Electronic Navigational Charts (ENC) and updates are produced according to the S-57 standard. All new Nautical Charts and new editions are bilingual (Portuguese and English) and follow INT specifications, whether or not they belong to the INT scheme. IHPT provides its Nautical Charts using a Print-on-Demand system. All charts are continuously updated according to the published “Notices to Mariners”.

**a) ENC coverage, gaps and overlaps**

The Portuguese ENC portfolio has ninety-eight (98) cells organized in five (5) Usage Bands (UB) (Table III and Figure 6). Each ENC is broadly equivalent to a paper chart, both in terms of its coverage area and its content. There are no gaps or overlaps to be reported.

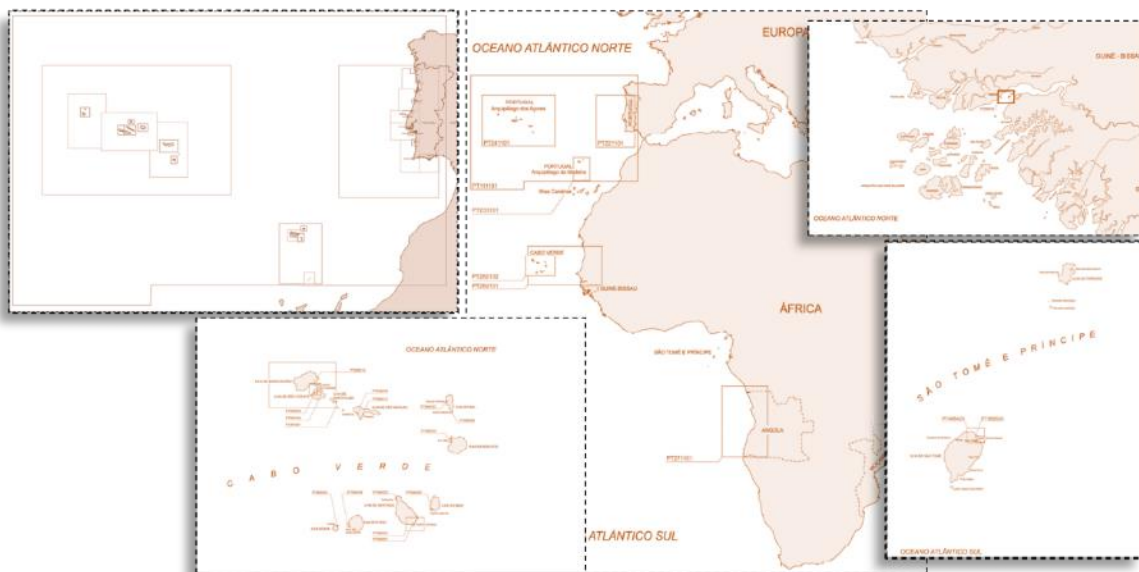


Figure 6 - PT ENC coverage

Table III – IHPT ENC Folio – Region G

	UB1	UB2	UB3	UB4	UB5	78	UB7	
	Overview	General	Coastal	Approach	Harbour		River	
Portugal	1	3	11	18	45		66	
Cape Verde	0	2	1	2	12	17	0	
Guinea-Bissau	0	0	0	0	1	1	0	
S.Tomé and Príncipe	0	0	0	1	1	2	0	
<b>TOTAL</b>	<b>1</b>	<b>5</b>	<b>12</b>	<b>21</b>	<b>59</b>	<b>98</b>	<b>66*</b>	<b>152</b>

\*Free download: <https://www.hidrografico.pt/vn.douro> & <https://www.hidrografico.pt/cart.guadiana>

Since the last EAtHC meeting, Portugal produced twenty one (21) new editions in the EAtHC Region, distributed by UB as shown in Table IV.

Table IV – IHPT ENC publication – Region G

	UB1	UB2	UB3	UB4	UB5	21
	Overview	General	Coastal	Approach	Harbour	
Sep2022-Dec2022	0	0	1	1	0	2
Jan2023-Dec2023	0	0	0	1	7	8
Jan2024-Apr2024	0	0	2	2	7	11
<b>TOTAL</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>4</b>	<b>14</b>	<b>21</b>

A list of the twenty one (21) new editions produced by IHPT during the report's period, is presented in the Table V and Figures 7A and 7B. Until the end of 2024, seven (7) new editions and two (2) new cells are planned to be published.

Table V – IHPT ENC New cells and New Editions List – Region G

ENC - New Editions (SEP2022 to ABR2024)						
Title	Cell number	UB	Scale	Status	Edition/ Year	
<b>PORTUGAL – Continental (Mainland)</b>						
Aproximações a Aveiro	PT426403	4	22 000	Published	3 <sup>th</sup> /2023	
Barra e Porto de Setúbal	PT526308	5	12 000		6 <sup>th</sup> /2023	
Porto de Setúbal (Da Carraca à Ilha do Cavalo)	PT526309	5	12 000		4 <sup>th</sup> /2023	
Barra e Porto de Portimão	PT526310	5	8 000		6 <sup>th</sup> /2023	
Porto de Aveiro	PT528506	5	8 000		3 <sup>th</sup> /2023	
Porto de Albufeira	PT528517	5	8 000		2 <sup>th</sup> /2023	
Baía de Cascais e Barras do Rio Tejo (Porto de Lisboa)	PT526303	5	12 000		10 <sup>th</sup> /2024	
Barra e Portos de Faro e Olhão	PT526311	5	12 000		7 <sup>th</sup> /2024	
<b>PORTUGAL - AZORES</b>						
Grupo Central	PT343102	3	180 000	Published	5 <sup>th</sup> /2022	
Ilha Terceira	PT446405	4	45 000		3 <sup>th</sup> /2023	
Ilha Terceira - Porto de Angra do Heroísmo	PT548514	5	8 000		4 <sup>th</sup> /2023	
Ilha do Corvo – Porto da Casa	PT548501	5	4 000		4 <sup>th</sup> /2024	
Ilha das Flores – Porto de Santa Cruz das Flores	PT548502	5	8 000		4 <sup>th</sup> /2024	
Ilha das Flores – Porto das Lajes das Flores	PT548503	5	4 000		4 <sup>th</sup> /2024	
<b>PORTUGAL - MADEIRA</b>						
Portos de Machico e Caniçal	PT538504	5	8 000	Published	4 <sup>th</sup> /2023	



ENC - New cells (planned to be published until DEC2024)					
Title	Cell number	UB	Scale	Status	Edition/Year
<b>CAPE VERDE and GUINEA-BISSAU</b>					
Ilhas Santiago, Brava, Fogo, Maio e Ilhéus Rombos	PT363203	3	180 000	Production QC	1 <sup>st</sup> /2024
Cabo Roxo ao Cabo Verga	PT363210	3	350 000		1 <sup>st</sup> /2024

Figura 7B

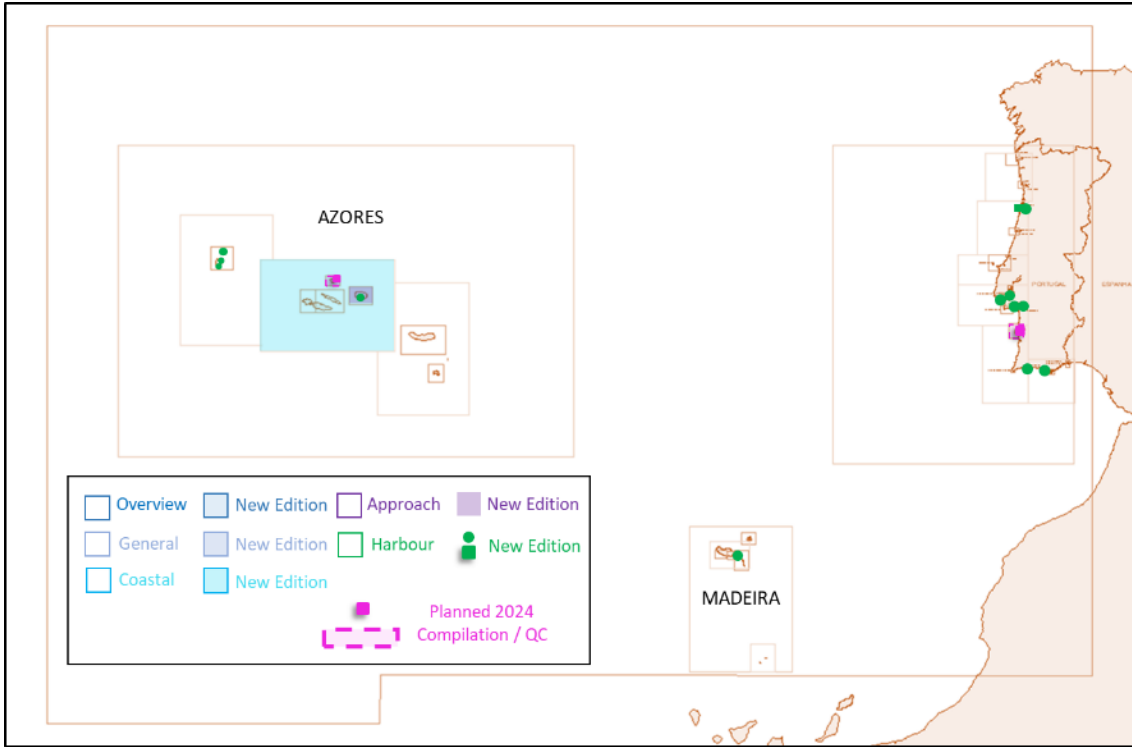


Figure 7A - PT ENC coverage and production (Set2022-Apr2024) for EAtHC region – Portugal.

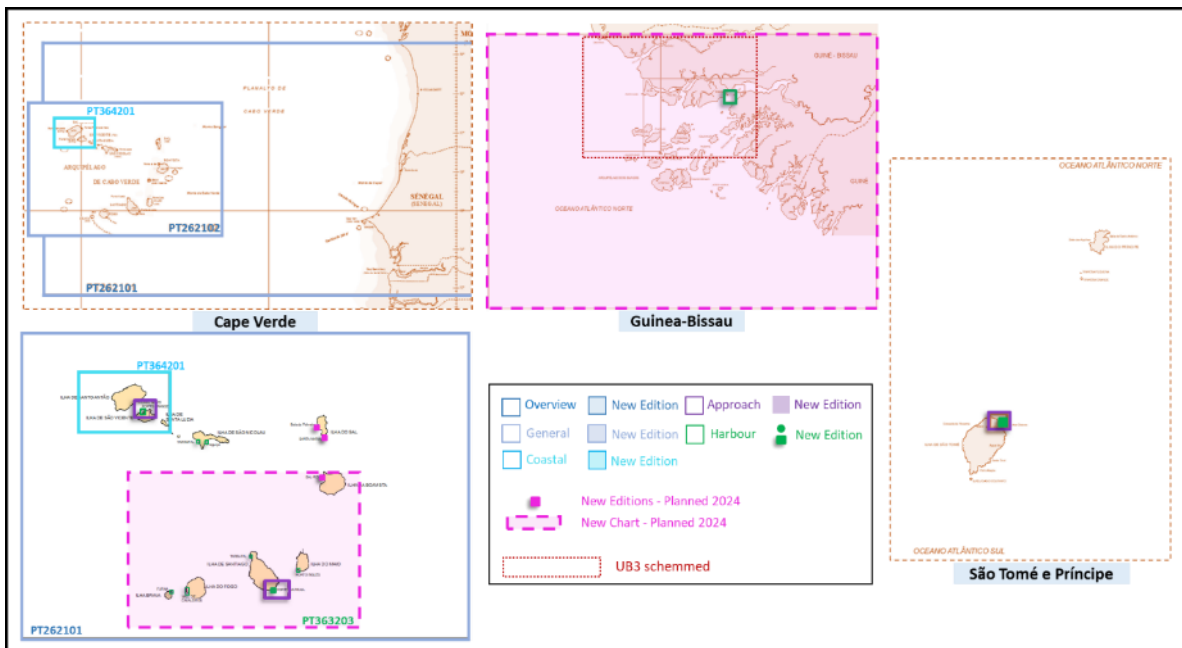


Figure 7B - PT ENC coverage and production for EAtHC region - North African Portuguese Speaking Countries.

## b) ENC Distribution method

All Portuguese ENCs are distributed through the RENC - IC-ENC.

IHPT is a member of the International Centre for Electronic Navigational Charts (IC-ENC), participating actively in its works, including their subordinate bodies.

Douro and Guadiana rivers cells (inland ENC) are available for free download on the IHPT portal.

## c) RNC

NTR.

## d) INT Charts

During the report's period, five (5) new editions have been produced depicted in Table VI. Until the end of 2024, six (6) new editions are planned to be published for Portugal-Mainland and Madeira areas and two (2) new charts are planned to be produced/published for Cape Verde and West coast North Africa (Table VII) as shown in Figures 8 and 9.

Table VI –INT charts produced or co-produced by IHPT – Region G

INT charts - New Editions and New Charts (SEP2022 to ABR2024)					
INT Number	PT NAC Number	Title	Scale	Edition	Status
1880	26308	Barra e Porto de Setúbal	15 000	5 <sup>th</sup> 2023	Published
1881	26309	Porto de Setúbal (Da Carraca à Ilha do Cavalo)	15 000	4 <sup>th</sup> 2023	
1875	26303	Baía de Cascais e Barras do Rio Tejo (Porto de Lisboa)	15 000	10 <sup>th</sup> 2024	QC
104	61101	Lisboa a Freetown	3 500 000	2 <sup>nd</sup> 2022	Published
1955	63210	Cabo Roxo ao Cabo Verga	350 000	1 <sup>st</sup> 2022	
2089	72101	Gamba a Luanda	1 000 000	3 <sup>th</sup> 2023	

Table VII - New INT charts under construction

INT charts - New Charts under construction (planned to be published until Dec2024)					
INT Number	PT NAC Number	Title	Scale	Edition	Status
1963	63203	Cabo Verde - Ilhas Brava, Fogo, Santiago, Maio e Ilhéus Rombos	250 000	1 <sup>st</sup> 2024	New chart Compilation
1084	62101	De Trimiris à Guiné-Bissau e Cabo Verde	1 100 000	1 <sup>st</sup> 2024	

The effort made on capacity building of Portuguese spoken countries in EAHC region has increased the production and/or co-production of INT charts in accordance with the IHO standards and specifications.

Also, in a joint effort with the authorities, IHPT has maintained the updates, through Notices to Mariners (NtM), of the published charts.

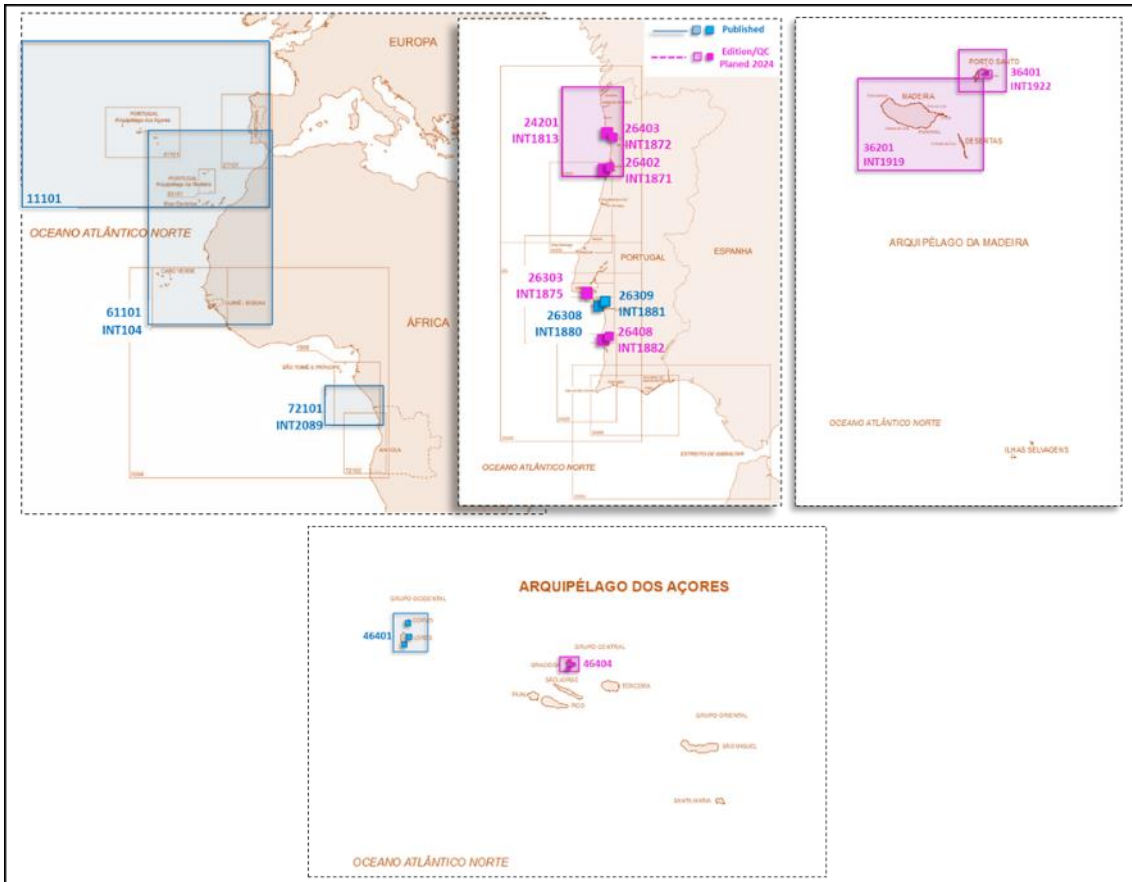


Figure 8 – INT charts/Nacional charts - New and new editions - Portugal.

**Gaps:**

INT charts not yet published are the ones presented in brown and orange in Figure 9.

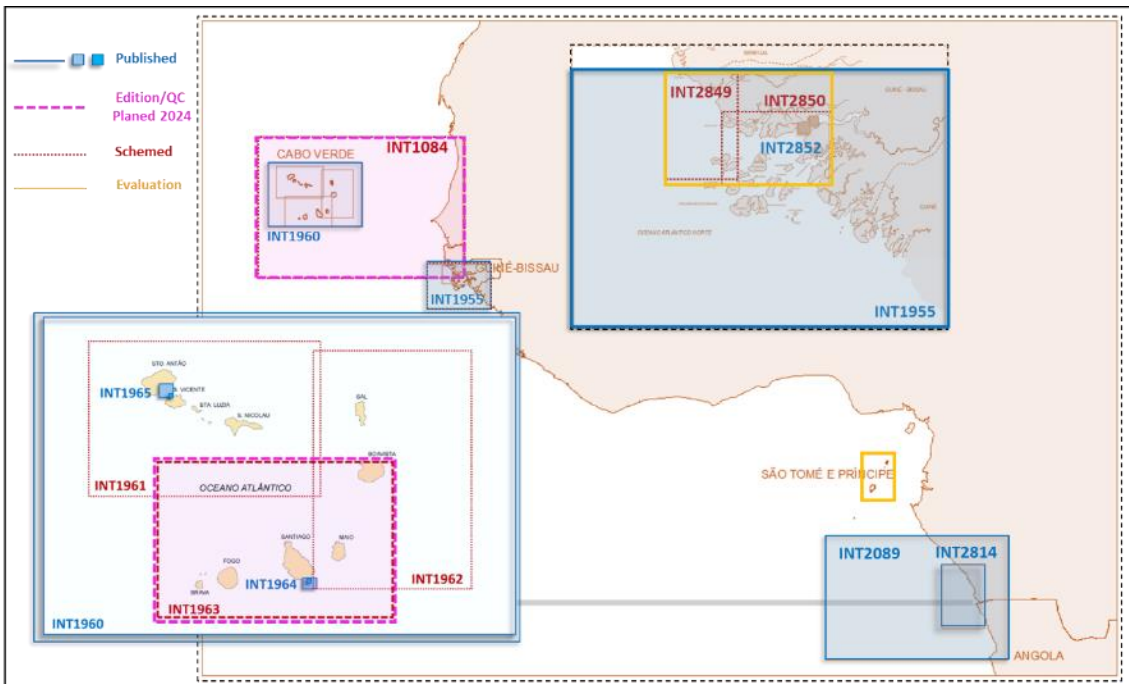


Figure 9 – INT charts gaps – North African Portuguese Speaking Countries (PALOP-EaHC).

### e) National paper charts

The existing nautical paper chart portfolio aims to meet the specific needs of mariners, being grouped according to their purpose. The number of the existing charts in the Portuguese nautical charts portfolio for EAthC region is mentioned on Table VIII. Since the last meeting, two (2) new edition have been produced by IHPT for the report's period, depicted in Tables VIII and Figure 8.

Table VIII – IHPT Paper charts folio – Region G

Country		NC (Portuguese folio)	INT	ENC	Old Folio (Portuguese folio)
<b>Portugal</b>	Mainland	53	24	40	-
	Azores	13	6	25	-
	Madeira	8	4	13	-
<b>PALOP* EAthC Region</b>	Cape Verde	<b>9</b>	<b>3</b>	17	<b>2</b>
	Guinea-Bissau	<b>20</b>	<b>2</b>	1	<b>18</b>
	São Tomé e Príncipe	8	0	2	7
	Angola	46	2**	1	38
<b>Overview</b>		5	2	-	3
*PALOP - Portuguese speaking African countries					
** Plus 6 in SAIHC Region					
OBS: New chart scheme under development for the PALOP to allow cancellation of the old folio.					

Table IX – IHPT National charts - New and New Editions List – Region G

National paper charts - New Editions and New Charts (SEP2022 to ABR2024)				
Title	Number National	Scale	Status	Edition/Year
<b>PORTUGAL</b>				
Portugal	11101	3 500 000	Published	3 <sup>th</sup> /2022
<b>PORTUGAL - AZORES</b>				
Ilhas das Flores e Corvo	46401	Main	75 000	Published
Porto das Lajes das Flores		Plan A	5 000	
Porto de Santa Cruz das Flores		Plan B	10 000	
Porto da Casa		Plan C	5 000	
12 <sup>th</sup> /2023				

Figure 9

Until the end of 2024, two (2) new editions are planned to be published, one (1) for Portugal-Azores and one (1) for Cape Verde (3 plans of ports) as shown in Figures 8 and 9.

### f) Other charts, e.g. for pleasure craft

IHPT produces other type of charts, namely the ones belonging to the series listed in Table X.

Charts for other purposes such as fisheries, Yachting, Sediments distribution, special training and Inland (Douro and Guadiana rivers) were produced for Portugal geographical area. All those charts are also in accordance with IHO specifications and were very well accepted by the users.

IHPT did not produce any other type of Charts for the PALOP-EAthC countries.

Table X – IHPT Other National charts

Series	Scale	Purposes
Fishery (Pescas)	Medium	Charts to support fishing activity
Recreational (Recreio)	Medium	Charts for pleasure crafts
Sedimentological (surface sediments)	Medium	Representation of the geographic distribution of the surface sediments of the submarine seafloor.
Training (Instrução)	Medium	For training in navigation exercises
Special (Especial)	Small/Medium	For scientific, administrative/jurisdiction or decision support purposes

### g) Challenges and achievements

Some cartographic coverage schemes relating to the geographical areas of Guinea-Bissau and São Tomé and Príncipe territories have been identified for analysis, and a proposal for rectification is being drawn up. IHPT intends to complete the INT charts coverage in order to eliminate the gaps that still exist. The gaps reported are directly linked to the difficulty of obtaining data.

IHPT sees the implementation of the S-100 as a major challenge, particularly concerning the production of S-101 ENCs as well as the establishment of S-101 ENCs schemes and the way during the transition period.

## 4- NEW PUBLICATIONS AND UPDATES

### a) New Publications

Since October 2023, the “Aids to Navigation - List of Lights, buoys, beacons and fog signals – VOLUME I – Portugal” is freely available, in PDF format, and monthly updated on [https://loja.hidrografico.pt/sdm\\_downloads/pn35-lista-de-luzes-boias-balizas-e-sinais-de-nevoeiro-vol-i-portugal/](https://loja.hidrografico.pt/sdm_downloads/pn35-lista-de-luzes-boias-balizas-e-sinais-de-nevoeiro-vol-i-portugal/)?



Figure 10 - Portuguese List of Lights – VOLUME I – Portugal (PN35).

The information contained in this publication, is also available in digital format, through a Geographic Information System background (webGIS) in *Hidrografico plus* platform and respective database (<https://geomar.hidrografico.pt/>). During the present year (2024), the List of Lights for the

Portuguese speaking African countries, namely Cape Verde, Guinea-Bissau, S. Tomé and Príncipe, Angola and Mozambique will be made available, in the same formats (PDF publication and WebGIS).

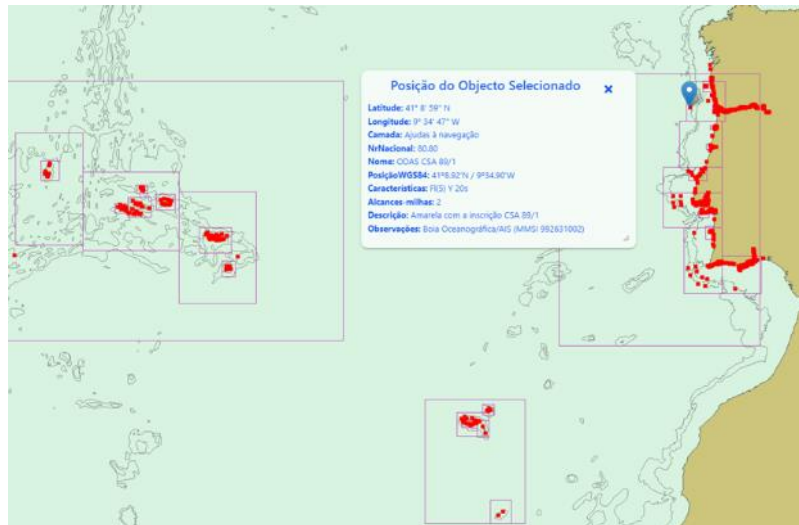


Figure 11 – WebGIS representation of the aids to navigation (list of lights) layer at the Portuguese territory.

## b) Updated publications

The “Charts and Nautical Publications Catalogue” is freely available online in PDF format to be consulted or downloaded and is kept up to date.

<https://loja.hidrografico.pt/?product=catalogo-de-cartas-e-publicacoes-nauticas-digital>.

The IHPT published the *Annual Group of Notices to Mariners*, every year, in January and, every month, the *Monthly Group of Notices to Mariners* is promulgated. Both publications are freely available on <https://www.hidrografico.pt/op/38> (or <https://geoanavnet.hidrografico.pt/notice-to-mariners>) in its digital format.



Figure 12 – Annual and Monthly groups of Notice to Mariners (published in 2024).

IHPT also publishes the Tide Tables for the main harbors of Portugal (Mainland, Azores and Madeira Archipelagos) and for the Portuguese-speaking African Countries which, in the EAtHC region, includes the main harbors of Cape Verde, Guinea Bissau, São Tomé and Príncipe and also Angola. Both digital publications can be downloaded from <https://loja.hidrografico.pt/>.



Figure 13 - Tide table for the Portuguese-speaking African Countries.

**c) Means of delivery, e.g. paper, digital**

Digital or paper, as requested.

**d) Challenges and achievements**

NTR

**5- MARITIME SAFETY INFORMATION**

**a) Existing infrastructure for transmission**

IHPT is the national coordinator for the Maritime Safety Information (MSI) and the navigational warnings are elaborated by COMAR (the Portuguese Centre for Maritime Operations – 24H service), under the supervision of IHPT and in cooperation with the NAVAREA II coordinator. IHPT have the responsibility over the MSI broadcast through the NAVTEX service, which is made simultaneously in English and Portuguese. The NAVTEX antennas (stations) are physically located in Penalva (near Lisbon), São Miguel Island - Azores Archipelago and Porto Santo Island - Madeira Archipelago, and broadcast the navigational and meteorological warnings in daily basis through 10 minutes slots duration, distributed by 6 distinct periods, internationally known. Figure 14 represents the range of the 3 VHF NAVTEX stations, and the red dots are the antennas' location.

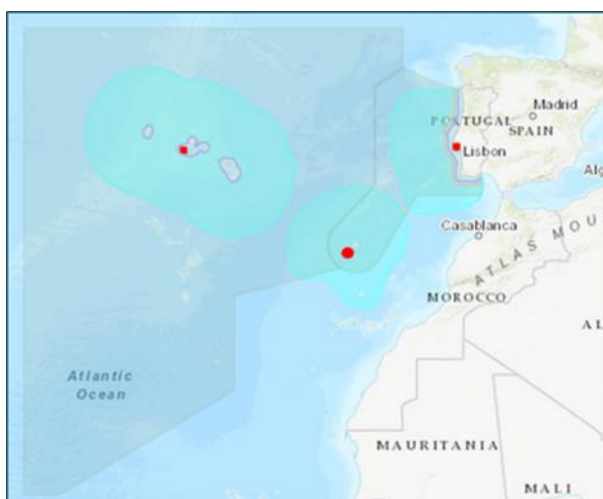


Figure 14 – Portuguese VHF NAVTEX stations range.

The dissemination of the MSI is also supported by an online platform (ANAVNET), where the data is all georeferenced and displayed in a WebGIS format (<https://geoanavnet.hidrografico.pt/>). Monthly, IHPT publishes the NtM monthly group, containing all permanent, preliminary, and temporary warnings in force for the corresponding period. This information covers all nautical charts (paper and electronic) and publications of Portugal, Cape Verde, Guinea-Bissau, S. Tomé and Príncipe, Angola and Mozambique, and is available on the web site (<http://www.hidrografico.pt>).

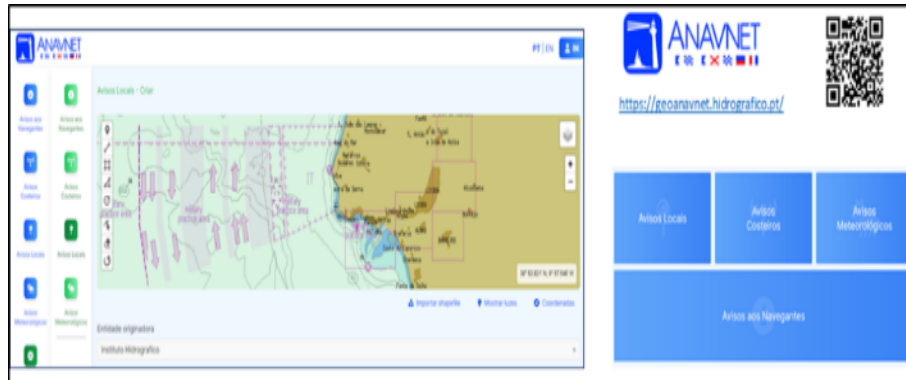


Figure 15 – ANAVNET application layout.

IHPT online application ANAVNET provides either entire NtM publications, or single NtM affecting individual documents; allowing in any case consultation and printing, including entire correction pages of nautical publications and graphical annexes to paste on charts. Regarding Navigational Warnings (including meteorological warnings and bulletins), ANAVNET allows consultation of warnings broadcasted by any of the Portuguese NAVTEX stations, both in Portuguese and English languages. The local warnings are also displayed in ANAVNET.

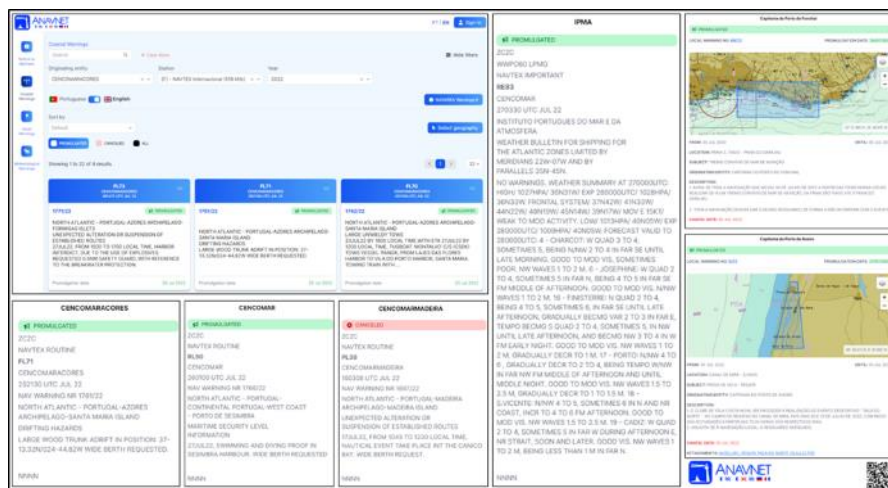


Figure 16 – ANAVNET navigational warnings and Notice to Mariners layout.

Portugal has also three AIS coastal stations in Mainland Portugal (Continental Portugal) and in Azores and Madeira Archipelagos.



## b) Statistics on work of the National Coordinator

IHPT is responsible for the broadcast of all MSI information throughout the maritime community. The following table presents the statistics of the coastal warnings (navigational and meteorological) broadcasted by the Portuguese NAVTEX stations for 2022 and 2023.

Table XI

PORTUGAL NAVTEX metrics		2022			2023		
COUNTRY and NAVTEX station	B1 Character [518 / 490] kHz	Total number warnings broadcast	Number warnings broadcast with URGENT priority (EGC) or vital (NAVTEX)	Total number of warnings broadcast, including repetitions	Total number warnings broadcast	Number warnings broadcast with URGENT priority (EGC) or vital (NAVTEX)	Total number of warnings broadcast, including repetitions
PORTUGAL AZORES S. MIGUEL	[F] [J]	1764	168	6845	1262	8	8643
PORTUGAL MADEIRA Porto Santo	[P] [M]	1148	57	3676	898	4	6519
PORTUGAL CONTINENTAL Penalva	[R] [G]	3015	146	12799	3710	74	18614

## c) New infrastructure in accordance with GMDSS Master Plan

The GMDSS coverage is not completed yet, but is planned to be operational until the end of 2024, covering all the Portuguese maritime territory. The Digital Selective Call (DSC) capability keep full-time watch on VHF DSC CH 70 in Sea Area A1. The operational and planned VHF DSC coast stations are distributed as follows:

- 7 stations in Portugal Continental;
- 3 stations in Azores archipelagos (2 more stations planned to be implemented until DEZ2025);
- 3 stations planned to be implemented in Madeira archipelago (DEZ2025).

Regarding the MF DSC coast stations for Sea Area A2, three (3) more stations are planned to be implemented until the end of 2025, namely:

- Apúlia (Tx) – MRCC LISBOA (DEZ2024);
- Sagres (Rx) – MRCC LISBOA (DEZ2025);
- Lajes da Flores (Tx) – MRCC DELGADA (DEZ2025).

## d) Challenges and achievements

To guarantee the *e-navigation* needs and required applicability by IMO, IHPT is developing efforts to drive MSI's digital transition as soon and smooth as possible. The first steps of transitioning the Navigational Warnings information, now available through ANAVNET, to the new S-124 format, are being taken. Likewise, all the ports navigation safety information available in the paper publications

known as “Pilots of the Portuguese Coast” (*Roteiros da Costa Portuguesa*), are now changing for a digital database-supported format, which will be later displayed and made available to the mariners through the *Hidrografico plus* portal, in WebGIS format (<https://geomar.hidrografico.pt/>).



Figure 23 – WebGis Pilots of the Portuguese Coast information.

6- **C-55**

The table with the latest information to update IHO Publication C-55 (Status of Hydrographic Surveying and Charting Worldwide) is under revision and will be sent using the IHO online system.

7- **CAPACITY BUILDING**

a) **Offer of and/or demand for Capacity Building**

IHPT School of Hydrography and Oceanography (IHPT-EHO) (<https://www.hidrografico.pt/op/23>) dedicated to the training of Navy officers, petty officers and civilian technicians offers FIG/IHO/ICA category A and B courses in hydrography and nautical cartography (Table XII).

Table XII

2023/2024	CAT A (Hydrographic Surveys and Nautical Cartography)	IHPT-EHO (Portugal)	Started/Ongoing September 2024
2024/2025	CAT A (Hydrographic Surveys and Nautical Cartography)	IHPT-EHO (Portugal)	Planned September 2025



Figure 24 - IHPT School of Hydrography and Oceanography (IHPT-EHO)

**b) Training received, needed, offered**

The last two years activity related to building capacity in the region is shown in the following Table XIII.

Table XIII – Activities and CB actions

Date	Actions/Activities	Place	Status
<b>IHO-CB Action</b>			
<b>Feb2024</b>	Technical Visit (A-08 2024) (A-06 2022; A-10 2023)	Guinea-Bissau	Executed
<b>Short Courses</b>			
<b>2023</b>	MSDI online training for Angola	VTC Angola - IHPT	Executed
<b>Long Courses</b>			
<b>2022/2023</b>	CAT B (Hydrographic Surveys and Nautical Cartography) Two (2) Angolan Technicians; One (1) Cape Verde Navy	IHPT-EHO (Portugal)	Executed
<b>2023/2024</b>	CAT A (Hydrographic Surveys and Nautical Cartography) OBS: No PALOP-EAtHC students	IHPT-EHO (Portugal)	Started/Ongoing September 2024
<b>Seminars and Conferences</b>			
<b>July 2022</b>	1st HYDROGRAPHY CONFERENCE OF THE PORTUGUESE-SPEAKING COMMUNITY	IHPT (Lisbon)	Executed
<b>November 2024</b>	2 <sup>nd</sup> HYDROGRAPHY CONFERENCE OF THE PORTUGUESE-SPEAKING COMMUNITY	Cape Verde - Mindelo	<b>Scheduled</b>
<b>On-job Training (IHPT Team)</b>			
<b>From 2022-</b>	Raise Awareness - S-100. Particularly S-101 ENC	IHPT	Ongoing
<b>From 2023-</b>	Data Readiness	IHPT	Ongoing
<b>Short Courses (IHPT Team)</b>			
<b>2022</b>	CARIS S-101 (One person)	Cadiz-Spain Teledyn-CARIS	Done
<b>Dec 2023</b>	CARIS S-101 (Ten persons)	Lisbon-Portugal Teledyn-CARIS	Done
<b>Seminars and Conferences (IHPT Team)</b>			
<b>Mar 2023</b>	IC-ENC TC23_1	UK	Done
<b>Mar 2024</b>	IC-ENC TC24_1	Athens-Greece	Done
<b>Other (Internships)</b>			
<b>2023</b>	Internship in Hydrography to Malaysian University of Technology	IHPT	Executed
<b>2024</b>	To Colombian Navy (Escola Naval de Cadetes “Almirante Padilla”) as part of the specialisation course in hydrography	IHPT	Planned

**c) Status of national, bilateral, multilateral or regional development projects with a hydrographic component.**

Bilateral cooperation agreements with the Portuguese-speaking African countries are in force, regarding hydrography, cartography, oceanography, R&D and training (Capacity Building).

In order to promote technical cooperation between the various entities in the countries of the Community of Portuguese-speaking Countries (CPLP) that have attributions in the area of Hydrography, IHPT organized a conference meeting, which took place in July 2022 in Lisbon - 1st HYDROGRAPHY CONFERENCE OF THE PORTUGUESE-SPEAKING COMMUNITY.

A 2<sup>nd</sup> Conference is scheduled to be held in Cape Verde (Mindelo), 04-08 November 2024, to bring together the needs, difficulties and recommendations of the countries of this community with several demonstrations and seminars, including survey demonstrations.

**d) Definition of proposals and requests to the IHO CBSC**

Two Technical Visits were requested PALOP-EAtHC countries, as listed in Table XIV.

Table XIV – Activities and CB actions

IHO-CB Action	Country	Generic Objective	Team	Status	Date
<b>Technical Visit (A-08 2024) (A-06 2022; A-10 2023)</b>	Guinea-Bissau	Advising on a way forward to the development of its hydrographic services (1 <sup>st</sup> concerning MSI), in accordance with the OHI standards for compliance with SOLAS obligations. Particular attention to the establishing an efficient MSI organization and defining a plan for updating nautical cartography.	IHPT; IALA	<b>Executed</b>	February 2024
<b>Technical Visit (A-02 2023)</b>	S.Tomé and Príncipe	Advising on a way forward to the development of its hydrographic services (1 <sup>st</sup> concerning MSI), in accordance with the OHI standards for compliance with SOLAS obligations. Particular attention to the establishing an efficient MSI organization and defining a plan for updating nautical cartography.	Not defined	Planned	During 2024; Eventually to be postponed to early 2025

**8- OCEANOGRAPHIC ACTIVITIES**

**a) General**

IHPT develops activities related to physical, geological and chemical oceanography, participating in national and European Union research projects in those fields and has been involved in several projects, which allowed to play an increasingly important role in the European scenario.

Besides that, IHPT acts as an oceanographic data provider among several organizations, such as COPERNICUS, IBI-ROOS, EMODNet, GEOHFRADAR and others. IHPT also has an important role on the discussion of the European strategy for the ocean, due to an active enrolment on initiatives such as JERICO-DS and JERICO-S3 or EOOS.

More locally, managing and co-managing some coastal oceanographic observatories, such as RADAR ON RAI, MONICAN and OCASO provides IHPT the expertise that a national observatory, such as MONIZEE (an IHPT EEZ environmental monitoring and predicting program), demands.

## b) GEBCO/IBC's activities

IHPT provides bathymetric data to IHO DCDB and GEBCO through EMODNet, the European Marine Observation and Data Network. With this participation in European multidisciplinary projects, IHPT learns and keeps their alignment with the best procedures in the MSDI research developments.

IHPT has been collaborating with this project providing bathymetric data in the Atlantic, Azores and Madeira regions.

In a similar way to the SEAMAP 2030 project, bathymetric grids were built at different resolutions with hydrographic data from Cape Verde. These data were incorporated into the IHO DCDB and are available at [https://www.ncei.noaa.gov/maps/iho\\_dcdb/](https://www.ncei.noaa.gov/maps/iho_dcdb/).

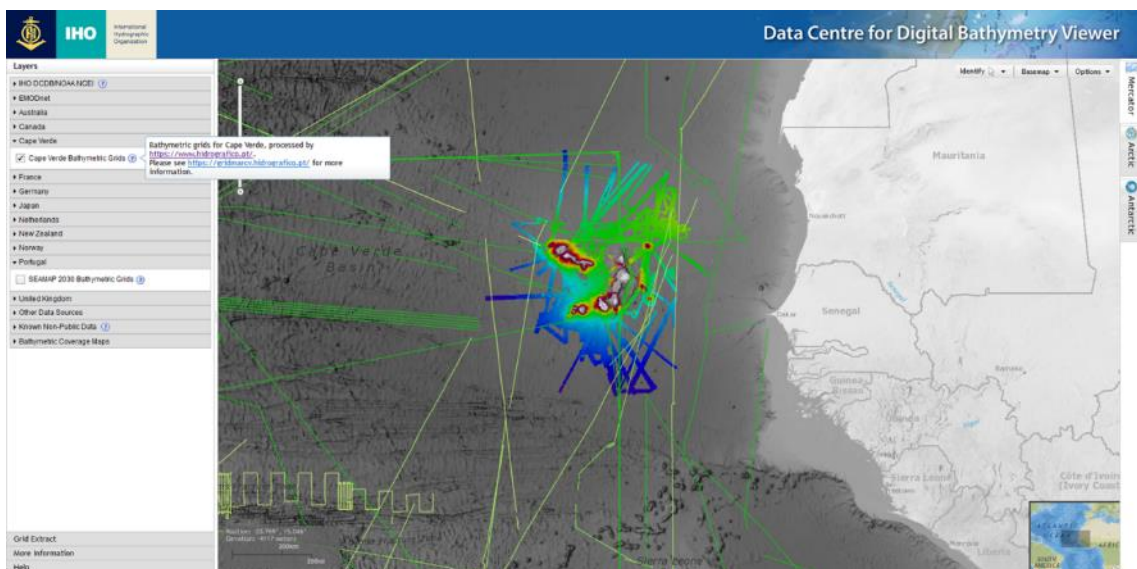


Figure 25 - IHO DCDB Viewer ([https://www.ncei.noaa.gov/maps/iho\\_dcdb/](https://www.ncei.noaa.gov/maps/iho_dcdb/))

## c) Tide gauge and other monitoring equipment network

The Portuguese Ocean Monitoring Network – MONIZEE (Portuguese EEZ Real-Time Monitoring and Operational Forecasting Integrated System), is composed by four (4) different networks:

- **National Tide Gauge Network** – more than 22 tide gauges distributed along the mainland coastline and both archipelagos, Madeira and Azores, some of them gathering data, for over 100 years. The present system configuration consists of acoustic or laser sensors to measure the water level and air pressure sensors, all of them with online communications. Some of them contribute to the National Tsunami Warning System, providing data every 30 seconds;

- **Wave Buoys Network** – In the early 80’s, the coastal wave buoy network, was implemented. Initially only in the mainland and a few years later expanded to Madeira and Azores with the collaboration of the local authorities and observatories that manage nowadays these insular observatories, with the purpose of monitoring the wave pattern in the middle/inner shelf;
- **Multiparametric Buoys Network** - in 2009, IHPT started a new buoy network. This new network, with the purpose of monitoring waves, currents, meteorological conditions and water quality outside the continental shelf, makes use of FUGRO WAVESCAN buoys with a very comprehensive payload. Beyond the basic wave monitoring sensors, the buoys are equipped with wind, air pressure, air temperature and air humidity sensors for the meteorological part, acoustic current profilers, thermistors along the mooring line and several water quality sensors such as oxygen, chlorophyll and hydrocarbons;
- **HF Radar Network** - At the same time, a HF Radar network started to be designed and implemented. For the 20 HF-Radar stations, six are already operational. For this network, IHPT decided to adopt the CODAR SEASONDE systems. From this network, one can obtain an hourly surface current map, a 10min wave information, and at one particularly station, at Alfanzina, a 2min tsunami probability index is also calculated.



Figure 26 – MONIZEE – Portuguese Monitoring Network.



Figure 27 – Networks

#### d) New equipment

Along the period covered by this report, some new equipment was updated such as Gliders, Wirewalkers, Spotter buoys, drifters, AUV and USV.

In the coastal buoy system, new receivers and new motion sensors replaced the outdated ones.

#### e) Challenges and achievements:

Regarding to the monitoring network, the IHPT main challenge is its sustainability.

Concerning the scientific challenges, IHPT is very focused on observing and measuring ocean acidity, micro plastics and noise. IHPT has submitted some projects to European Union financing, and is waiting the evaluation results, to allow us to develop tools and means to achieve those capabilities.

The harmonic constants used on Volume II of Tide Table are not updated since the 70's for Cape Verde, Guinea-Bissau and São Tomé and Príncipe. A process is ongoing to update the harmonic constants of Angola. Only a few harbors in Mozambique were updated in the 80's. This lack is due to the absence of data needed to be provided by the concerned countries' national authorities.

IHPT is collaborating with the MALMON DeSira project (<https://www.malmon-desira.com/>). One of the tasks to support this project is the installation of several tide gauges in Guinea-Bissau. IHPT hopes that the data obtained by this tide gauge network can be used to update tidal information in the area.

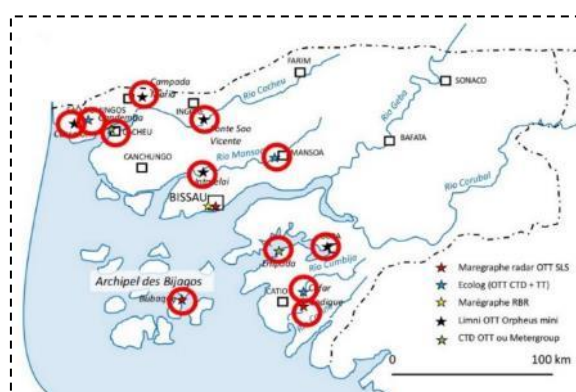


Figure 28 – MALMON DeSira project tide gauges network

## 9- SPATIAL DATA INFRASTRUCTURES

The Portuguese Hydrographic Institute (IHPT) is a data driven organization. The IHPT Marine Spatial Data Infrastructure (MSDI) is designated, “Hidrografico Plus” and it is aligned with the IHO, UN-GGIM, INSPIRE and, IODE principles in order to improve data and metadata management, as well as data discoverability and accessibility. The MSDI frontend is a centralized where users can find and explore several marine and hydrographic datasets.

#### a) Status of MSDI

*Hidrografico Plus* MSDI integrates several components. This service-oriented architecture implements the MSDI functionalities, principles and pillars. Human and machine actors can access

marine data through Open Geospatial Consortium (OGC) services and Application Programming Interfaces (APIs). The infrastructure presents a full integration between the geoportal and the metadata catalogue. This integration optimizes data access by the National Spatial Data Infrastructure (NSDI) and Infrastructure for Spatial Information in Europe (INSPIRE).

The MSDI has been designed to support blue economy sectors such as sailors, fisheries, aquaculture, renewable energy, etc. The available data has supported several scientific research projects and is harvested by several supra SDIs. The system architecture comprehends both proprietary and open-source technologies.

Notices to Mariners and Navigational Warnings are also available at “Hidrografico Plus” infrastructure, through a specific portal.

IHPT is currently expanding *Hidrografico Plus* data availability and data applications, specifically contributing to the three goals of IHO strategic plan.

#### **b) Relationship with the NSDI**

IH data is currently available through OGC web services in the Portuguese NSDI – *Sistema Nacional de Informação Geográfica* (SNIG). SNIG maintains a centralized metadata catalogue with all national data providers and is linked to INSPIRE. The metadata is shared between the different infrastructures through automatic harvesting processes. This approach assures data access and findability for different clients.

#### **c) Involvement in regional or global MSDI efforts**

IHPT is part of the SNIG Working Groups for a common effort in the INSPIRE implementation principles and provides geospatial data services to other portals like the Portuguese Sea Geoportal and [data.gov](http://data.gov).

#### **d) National implementation of the Shared Data Principles – including any national data policy and impact on marine data.**

Several Portuguese organizations have been implementing the common European directives and orientations such as INSPIRE, Marine Directive Framework, the European Strategy for Data Policy and the Directive on open data and the re-use of public sector information, also known as the ‘Open Data Directive’ (Directive (EU) 2019/1024).

The main driver in the SDI and MSDI has been the European Union (EU) and the regional initiatives. IH combined the needs to implement the INSPIRE directive with the IHO and IMO principles and requirements to build up the *Hidrografico Plus* MSDI capable of serving multiple users, needs and uses. Portugal does not have a national common marine data policy. However, data producers and



providers have their own organizational data policies aligned with national and European legislation and compliant with international data management best practices.

**e) MSDI national portal**

Currently there is no single portal considered to be the national MSDI. This encourages a federated approach, based on a network of marine data providers whose data catalogues can be seamlessly harvested by the national and supranational SDIs.

**f) Best practices and lessons learned**

The *Hidrografico Plus* MSDI follows the best practices and requirements identified from several sources: INSPIRE, IHO MSDIWG, OGC and Intergovernmental Oceanographic Commission (IOC). The main lessons learned are the need to maintain a good human resources capacity building program and internal competences and technical skills aligned with the MSDI principles and implementation models.

**g) Challenges and achievements.**

*Hidrografico Plus* MSDI components are used to support internal technical and scientific geospatial data management processes and to feed external clients with near real time data. This MSDI supports the organization mission as a state laboratory and hydrographic office. Being part of the Portuguese Navy, IHPT also supports naval operations.

*Hidrografico Plus* has several developments aligned with IHO Strategic Plan:

- Transformation of the current data model of navigational warnings into S-124 (Goal 1);
- Development of specific products addressing the issue of orca interactions with vessels, to improve mariners' awareness and the safety of navigation (goal 1);
- Digitalization of nautical publications like Sailing Directions and Aids to Navigation, including dissemination through mobile applications and new geospatial standards as OGC API Features (goal 1) (Figure 29);
- Alignment with EU Open Data Directive and the availability of High Value Datasets (goal 2);
- Publication of Electronic Navigational Charts (ENC) as Web Map Services (WMS) (goal 2);
- Use of survey data, for instance, sound velocity profiles to monitor ocean variables (goal 2);
- Engagement in several international initiatives: SEABED 2030, EMODnet; BlueCloud, DITTO (Digital Twin of the Ocean) programs (goal 3);
- Establishment of the Portuguese National Oceanographic Data Centre (NODC) and accreditation by International Oceanographic Data and Information Exchange (IODE) (goal 3).

The main challenges will be to keep the MSDI aligned with digital data strategies and policies at different levels. This digital environment requires fast adaptations and developments. Data harmonization and development of S-100 web based services will be a challenge.

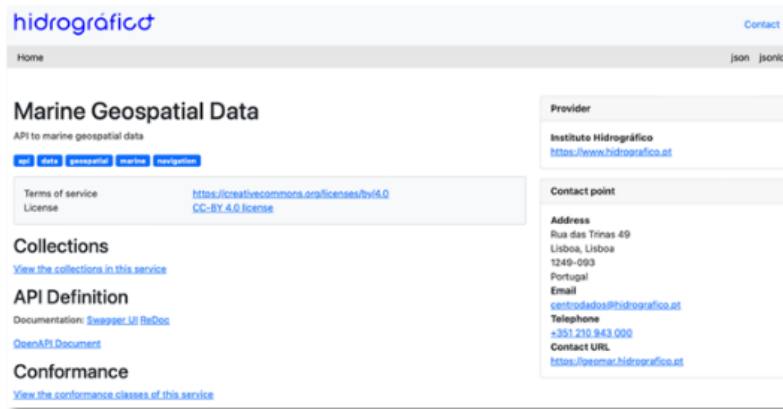


Figure 29 – OGC API Features web portal.

## 10- INNOVATION

### a) Use of new technologies

In accordance with the United Nations Ocean Decade, IH is actively engaged in producing a Digital Twin of the Ocean (DTO) to support decision-making and sustainable development (SDG 14) regarding the blue economy. In this sense, it is following several global initiatives (Destination Earth (<https://digital-strategy.ec.europa.eu/en/policies/destination-earth>), Iliad (<https://www.ocean-twin.eu>) and DITTO (<https://ditto-oceandecade.org>)) in order to learn and apply the best practices in developing its own DTO pilot.

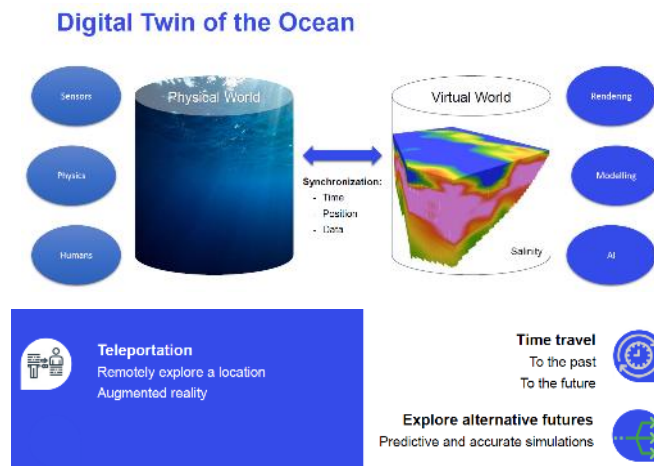


Figure 30 – DTO concept and benefits

IHPT is actively engaged in implementing methodologies for the routine utilization of satellite multispectral imagery to derive bathymetric data. Simultaneously, efforts are being made to perform depth estimation through imagery sourced from unmanned aerial vehicles (UAVs). This includes innovative approaches, such as using the multispectral content of aerial photographs, and more cutting-edge methods, like capturing sea wave propagation on video and inverting it to acquire bathymetric data.

IHPT is heavily invested in building the capability to perform unmanned ocean mapping. Presently, aerial drones, equipped with LiDAR and multispectral cameras, are operated on most campaigns. Simultaneously, autonomous underwater vehicles, featuring underwater imaging and water column profiling capabilities, are undergoing preparations for routine deployment. Additionally, the imminent inclusion of unmanned surface vehicles, to be fitted with multibeam echo sounders, will further extend IHPT hydrographic potential (Figure 32).

While the emphasis on unmanned assets serves as a clear step into the future, manned vessels represent a critical component of IHPT hydrographic capability. That being the case, two modern new vessels, tailored for inshore and coastal mapping operations, were recently acquired and are being fitted for survey campaigns.

Building upon previously developed platforms, IHPT is participating in the conception and testing of drifters that, besides being able to measure wave parameters, are also capable to perform environmental monitoring. This is accomplished by fitting the drifters with payloads such as echo sounders, underwater cameras or hydrophones.

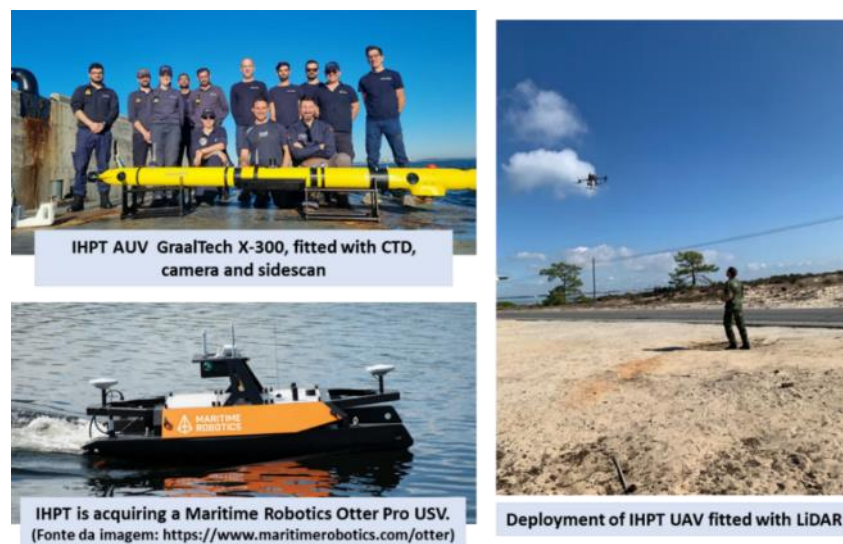


Figure 32

For oceanographic surveys, IHPT also used new technologies such as Glider, Wirewalker and Autonomous Underwater Vehicles (AUV). Glider is an autonomous sensing platform designed to collect water column data profiles with very wide spatio-temporal coverage. Driven by buoyancy changes, glides up and down on the water column collecting physical, chemical, biological and/or acoustic data depending on the fitted sensors. It is a very cost-effective solution for data collection as it reduces reliance on large vessels with high daily running costs, easy to operate and can be deployed and recovered by reduced crews in coastal waters using small boats.

Wirewalker is a vertically profiling instrumentation-platform, powered by ocean waves. Rapid profiling and able to integrate a wide variety of sensor payloads. It Enables a rapidly-evolving small-scale phenomena to be monitored on climatological time scales.



Figure 31 – Glider SEAEXPLORER (left) and Wirewalker (write)

Autonomous Underwater Vehicles (AUV) designed for carrying different kinds of underwater instruments up to 300 meters depth. Modularity payload making it a versatile platform that can comply with many different user needs. Its great maneuverability and the availability of multiple navigation modes enable the execution of a wide variety of missions in the fields of O&G, Defense & Security, Oceanography and Environmental Monitoring.

**b) Risk assessment**

IHPT is conducting Risk Assessment of some of the waterways, or in specific navigational areas, in order to identify areas of improvement for the safety of navigation, or to respond to navigational technical solicitation when requested. These assessments are performed in accordance with the recommendations and guidelines of IALA.

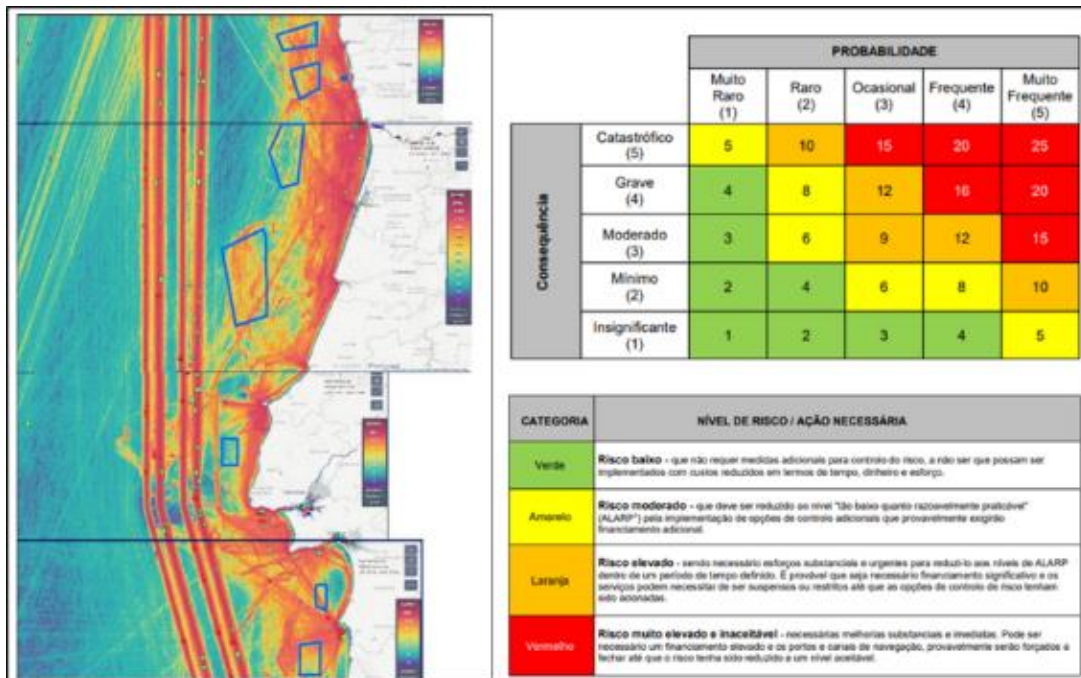


Figure 33 – Risk assessment for the implementation of new renewable energy areas.

**c) Policy matters.**

NTR.

## 11- OTHER ACTIVITIES

### a) Participation in IHO Meetings

Portugal participated in the IHO Assembly (A3) and in the IHO-Council meetings.

Due to its primary charting responsibilities, Portugal, represented by IHPT, is a member of EAtHC and Associated Member of SAIHC.

The detail of IHPT involvement in other IHO activities/working groups is listed in the table hereafter.

Table XVI – IHPT representation on IHO committees and working groups

	Description	IHPT representation
Council	IHO-Council	RAdm Ramalho Marreiros
EAtHC	Eastern Atlantic Hydrographic Commission	RAdm Ramalho Marreiros; CDR João Vicente; CDR Carlos Marques; Eng <sup>a</sup> Paula Sanches
SAIHC	Southern African and Islands Hydrographic Commission	RAdm Ramalho Marreiros; CDR João Vicente; CDR Carlos Marques; Eng <sup>a</sup> Paula Sanches
HSSC	Hydrographic Services and Standards Committee	CDR João Vicente; CDR Carlos Marques; Eng. <sup>a</sup> Paula Sanches
IENWG	IHO-European Union Working Group	CDR Paulo Nunes; CDR João Vicente; CDR Carlos Marques; Eng. <sup>a</sup> Leonor Veiga
CBWG	Capacity Building Working Group	CDR João Vicente
MSDI	Marine Spatial Data Infrastructure Working Group	LCDR Telmo Dias
S100WG	S-100 Working Group	Eng. <sup>a</sup> Paula Sanches
S101PT	S-101 Project Team	Eng. <sup>a</sup> Paula Sanches; CDR Carlos Marques
SCUFN	GEBCO Sub-Committee on Undersea Feature Names	Eng. <sup>a</sup> Paula Sanches
WENDWG	Worldwide ENC Database Working Group	Eng. <sup>a</sup> Paula Sanches
DQWG	Data Quality Working Group	Eng. <sup>a</sup> Paula Sanches
HSWG	Hydrographic Surveys Working Group	CDR João Vicente; CDR Carlos Marques (HSWG Secretary)
CSBWG	Crowdsource bathymetry Working Group	Eng. <sup>a</sup> Leonor Veiga
ABLOS	OHI - Advisory Board on the Law Of the Sea (ABLOS)	CDR Carlos Marques
ENCWG	ENC Standards Maintenance Working Group	Eng <sup>a</sup> Paula Sanches; Eng <sup>a</sup> Ana Moura; Helena Julião
NCWG	Nautical Cartography Working Group (NCWG)	Eng <sup>a</sup> Paula Sanches; Eng <sup>a</sup> Ana Moura

At the IHPT, the World Hydrography Day 2023 was celebrated through a session chaired by the Director-General Rear-admiral João Paulo Ramalho Marreiros, who gave a brief address alluding to this day, followed by several presentations.

Portugal also contributed to THE INTERNATIONAL HYDROGRAPHIC REVIEW volume 28, with the article “PORTUGAL’S CARTOGRAPHIC RESPONSIBILITY IN AFRICA”.

### b) Meteorological data collection

NTR.

### **c) Geospatial studies**

Since 2019, the IHPT is monitoring the evolution of the coastal area surrounding the harbor of Sines, the only deep-water port located in national protected areas, and which includes São Torpes beach. The 5 years monitoring plan for the beaches of São Torpes, requires frequent surveys to describe the morpho-sedimentary characteristics of the system (beach and inner shelf) after winter, spring, summer and autumn. The comparison of data acquired during the different seasonal situations allows quantifying and predicting the evolution in terms of topography and bottom sediments. In addition, the dominant oceanographic regime is characterized in order to understand the physical forcing of the observed changes.

### **d) Preparation for responses to disasters**

Regarding disaster response, IHPT has set up a multidisciplinary team within scientific/marine science capabilities (such as hydrography, physical oceanography, marine geology, marine chemistry and pollution and Data center) combined with the expertise in marine technology and ocean engineering.

The purpose of this team, the *Equipa Hidrográfica de Intervenção Rápida* (Quick Response Hydrographic Team) is to support the national emergency coordinator in case of a natural or manmade disaster or emergency and/or to support Naval Operations.

### **e) Environmental protection**

#### **EMODnet**

The European Maritime Observation and Data Network (EMODnet), an initiative of the European Commission's Directorate-General for Maritime Affairs and Fisheries (DG MARE), is composed of a partnership of more than one hundred of European organizations working together to gather marine data from a variety of sources, with the aim of making them more accessible and interoperable.

Part of the work involves linking to national, regional or thematic data repositories in which lies the basic information and the creation of outreach products. Thematic groups have been set up to organize the data available from various sources, assess their quality, ensure that they are accompanied by metadata and provide such data through thematic portals in the areas of bathymetry, geology, habitats, biology, chemistry, physical oceanography, and human activities.

The thematic portals are now centralized in a single portal in which the user can find information on the various disciplines in the common map viewer.

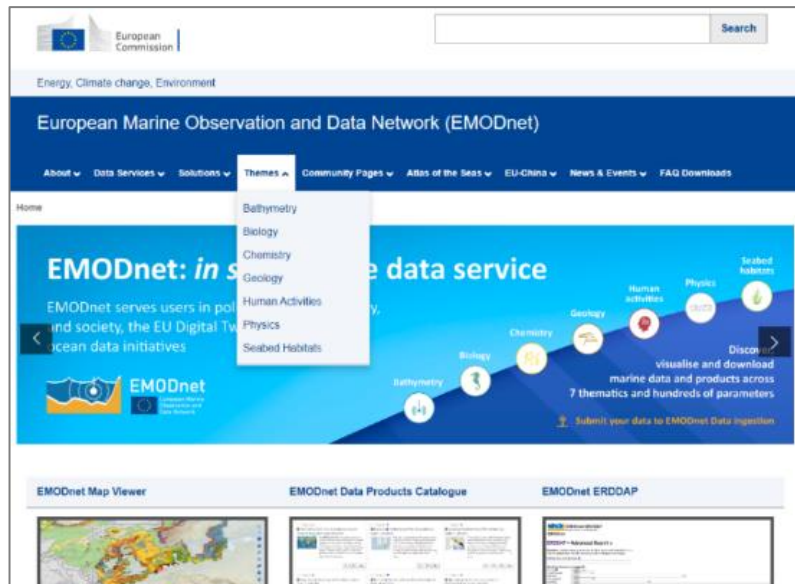


Figure 31 – EMODnet Central Portal (<https://emodnet.ec.europa.eu/en#> )

IHPT has been collaborating with this project for more than a decade, providing bathymetric and chemistry data in the Atlantic, Azores and Madeira regions.

The High Resolution Seabed Mapping (HRSM) project aims to create and maintain an operational service that provides free and open access to the seabed and coastal sea basin bathymetric models at the best resolution possible.

The overall objective is to bring together bathymetric surveys of European seas and to produce, publish and serve a harmonized and high-resolution Digital Terrain Model (DTM) of all European basins.

EMODnet Chemistry first goal is to provide interoperable, high quality and publicly available data and products on marine water quality issues. Its activity is firstly to collect, validate, and guarantee access to marine pollution data streams, and secondly generate and publish corresponding data products. EMODnet Chemistry is focused on eutrophication, ocean acidification, contamination, and marine litter issues which are relevant to the Marine Strategy Framework Directive and to global climate change. The data have been brought together for different group of variables in seawater, sediment and biota.



Figure 32 – EMODnet – Chemistry Portal (<https://www.emodnet-chemistry.eu>)

## SEDMAR

A sustainable use of the natural resources requires management policies founded in scientific knowledge. Knowledge of the nature of the seabed is mandatory for activities of environmental protection measurements, scientific and economic development linked to the sea, namely actions to preserve marine biodiversity (through the detection of any sensitive marine ecosystems or the harmful effects of human activity), inventorying, rational management of marine resources (energy, living and non-living), and other economic activities.

The aim of the seabed mapping in what concerns its physical properties (morphology and geology) grows on the need to increase the scientific knowledge of the coastal margins, so the proper measures to exploit natural resources, preserve marine biodiversity, and protect endangered ecosystems, can be adopted.


The ongoing “Mapeamento dos Sedimentos Marinhos – SEDMAR” project is the successor of the “Sedimentos Superficiais da Plataforma Continental - SEPLAT program” (1974-2010), executed at the Hydrographic Institute and fully financed by the MDN, which produced 8 sedimentological maps of the Portuguese continental shelf between the coastline and 500m depth, at scale 1 : 150 000.

These mapping programs are complemented with additional studies and projects that adopt multidisciplinary approaches, using acoustic and geophysical methods, such as sidescan sonars, high-resolution seismic reflection systems and magnetometry.

## PROJECTS – Technology and Environment

IHPT is involved in several projects related to the use of new technology as stated in Table XVII.

Table XVII – IHPT Projects-Technologies, Environment and Coastal Monitoring.

PROJECTS - TECHNOLOGY. ENVIROMENT and COASTAL MONITORING			
Project Name	Time	Goal	IHPT task
4-S	Nov2020 Oct2023	4S aims to achieve an online solution in the Cloud, using highly automated terrestrial observation algorithms to remotely map and monitor various parameters, including seabed habitats, morphology and bathymetry on low seabeds. Making use of artificial intelligence, physical models and satellite or UAV data, 4S will allow seabed properties to be analysed with minimal effort from personnel and equipment, making it an innovative tool for rapid characterisation in low-bottom areas.	IHPT will work on the various integration actions, and on the acquisition and utilisation of UAV data, with its hydrographers and research specialists evaluating this solution in specific pilot tests in Portugal.
 <b>SIM SHORE</b> <small>Towards a Service for the operational update of the littoral topo-bathymetry</small>	Nov2020 Oct2023	SimShore aims to build a prototype service for the operational updating of coastal topo-bathymetry using all available methodologies, essentially those based on remote sensors for observing the ocean surface. Special emphasis will be placed on bathymetric derivation by ocean colour as well as the inversion of the surface wave field observed at low altitude with autonomous vehicles.	IHPT will be involved in bathymetry estimation using wave field inversion and water colour analysis, with data acquired by UAV. IH hydrographers and specialists will assess various case studies at specific sites in Portugal.



<b>WAVY-NOS</b>	Jul2022 Apr2024	WAVY-NOS presents a fresh approach to monitoring coastal areas directly where they are. Instead of sticking to predetermined paths, numerous surface drifters are deployed simultaneously, each equipped with different sensing tools. By deploying multiple drifters either at the same time or in sequence, any uncertainty in their paths can be effectively addressed. These drifters come in various types: WAVY-Echo carries echosounders, WAVY-Listener is fitted with hydrophones, and WAVY-Imager has bottom-mounted video cameras. All the gathered data is stored onboard, with occasional position updates and alerts sent to a Mission Centre via GSM communication at a low rate. This initiative aims to make coastal monitoring more accessible to a wider audience, both in terms of technical capability and financial feasibility. The technologies and techniques developed through this project will eventually be made available for pre-commercial applications.	IHPT is the entity responsible for field testing the prototypes and validating the collected data, will also take the lead in engaging end-users through co-design workshops. IHPT will take part on the prototypes field testing and subsequent data validation, with emphasis on the bathymetry quality control.
<b>SMART DISTRIBUTED AI SYSTEM FOR MARINE PLASTIC DEBRIS MONITORING</b>	Mar2022 Feb2024	This project aims to establish a new paradigm in the study of the distribution of floating plastics. SMART is an artificial intelligence-based framework that combines the automatic identification and classification of floating plastics through satellite images with high-resolution spatiotemporal modeling to identify plastic accumulation zones and machine learning to combine information and create probability maps of marine litter occurrence. Validation of the final product will be carried out using sensors mounted on Autonomous Surface Vehicles (ASVs).	
<b>RADAR ON RAIA</b>		This project aims to update and extend beyond the Galician border the High Frequency Radar network that has been in operation since 2011, converting it into a transboundary observation infrastructure that will improve knowledge of ocean dynamics from a local level to a regional level in the northwest of the Iberian Peninsula. The project will allow the establishment of a cross-border collaboration framework beyond the physical infrastructure itself, developing procedures for maintenance, processing and validation of data common to both sides of the border, as well as simple and public access to all information. Additionally, new products will be developed that will take advantage of the potential of HF radar technology. These products, in addition to improving the management of maritime emergencies (search for castaways (Search and Rescue, SAR) and the management of accidental or intentional spillage of contaminants (Lucha Contra la Contaminación, LCC)), provide for an improvement in productivity and orderliness of the territory of the Galician-Portuguese region.	
<b>i-plastic</b>	Set2020 Set2023	The i-plastic project (Dispersion and impacts of micro- and nano-plastics in the tropical and temperate oceans: from regional land-ocean interface to the open ocean), in which IHPT is a partner, started in September 2020 and finished at December 2023. The project intends to assess the dispersion and impacts of micro- and nano-plastics in the tropical and temperate oceans, from the regional land-ocean interface to the open ocean, and to elaborate models of plastics dispersion at the Atlantic scale.	Between September 2020 and April 2022, five oceanic surveys were conducted.
<b>AQUIMAR</b>	Oct2018-	The project AQUIMAR (Marine Knowledge supporting Aquaculture, <a href="https://aquimar.hidrografico.pt/">https://aquimar.hidrografico.pt/</a> ), coordinated by IHPT, started in August 2018 with the main goals of characterizing the oceanographic, hydrodynamic and biogeochemical conditions of selected areas of the Portuguese coast (continental platform and estuaries); and to identify the best suited locations, in these selected areas, for the settlement of aquaculture infrastructures. Between October 2018 and February 2021, four oceanic surveys (each one covering the five areas marked in yellow on Figure 33) and 16 estuarine surveys (covering the four estuaries – Ria de Aveiro, Mondego, Mira and Ria Formosa – marked with red dots on the same Figure) were conducted.	The information collected during the surveys was processed and integrated. The final report of the project has been prepared.

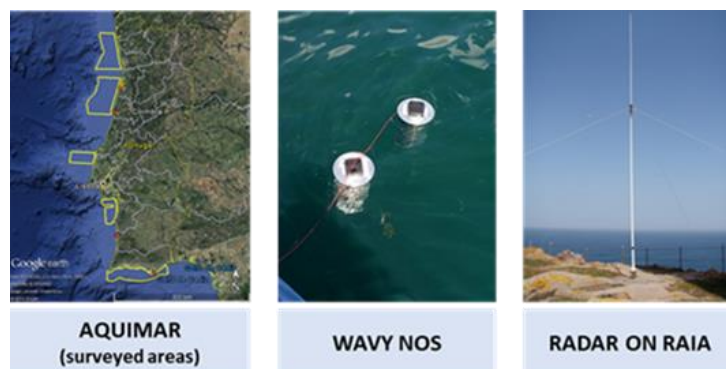


Figure 33 – Examples.

#### f) Engagement with the Maritime Administration

IHPT is working continuously with harbor administrations in order to keep charts updated with the most recent information.

#### g) Aids to Navigation matters.

IHPT participate every year in the IALA AtoN (Aids to Navigation) Requirements and Management (ARM) committee meeting, where work is being done to create documents, standards, recommendations, guidelines and manuals regarding navigational requirements, information services and portrayal and risk management issues. Is quite important that EAtHC members be present in these meetings and contribute with their governmental and national guidance.

#### h) Magnetic/Gravity surveys

NTR.

#### i) International engagements

IHPT has bilateral agreements with other Hydrographic Offices, namely: *Instituto Hidrográfico de la Marina* – Spain (IHM), *Service Hydrographique et Océanographique de la Marine* - France (SHOM) and United Kingdom Hydrographic Office (UKHO); and also with several institutions of the Portuguese-speaking African Countries (Table XVIII).

IHPT and IHM meeting that took place in September 2023 in Lisbon aimed, among others, to identify collaborative actions within the scope of Hydrography, namely the ones related to the 3<sup>rd</sup> joint Hydrography Conference - *Jornadas Luso-Espanholas de Hidrografia* to be held in October in Cadiz.

Table XVIII – IHPT – PALOP Bilateral Arrangements

Cape Verde	2017	<i>Instituto Marítimo e Portuário</i>	Formalize and reinforce cooperation in:	hydrography works; updating cartography; develop technical cooperation; institutional CB and training
	2021	<i>Instituto do Mar</i>		Coastal surveys and seamounts areas
Guinea-Bissau	2015	<i>Instituto Marítimo Portuário</i>	Formalize and reinforce cooperation in:	hydrography works; updating cartography; develop technical cooperation; institutional CB and training
São Tomé and Príncipe	2021	<i>Instituto Nacional Meteorologia</i>		hydrography; oceanography; safety of navigation

**j) Others - Naval Meteorological and Oceanographic Center**

IHPT has developed state of the art tools and operational systems in the field of meteorological and oceanographic forecast, in-situ ocean observation networks and remote sensing techniques, along the Portuguese margin and coastal areas. In November 2017, IHPT activated the new GEOMETOC center of the PRT Navy, named CGEOMETOC (Naval Geospatial, Meteorological and Oceanographic Center), under the direction of IHPT's Director-general.

**12- FINAL REMARKS**

IHPT supports any initiative aimed at improving hydrographic knowledge and navigation safety, for the benefit of cartographic authorities and updating of the nautical documentation of this region.

**a) Areas of significant achievement**

- SEAMAP 2030 – EEZ multibeam coverage - 66% achieved;
- New IHO members - Angola & Cape Verde; Cape Verde become a member in 2023;
- EAthC17 conference in Cape Verde;
- Capacity Building – Technical Visit to Guinea-Bissau (Feb2024);
- 1<sup>st</sup> Hydrography conference in Lisbon for Portuguese-speaking Countries Community (2022);
- Portuguese hydrographic vessels missions in the East Atlantic;
- Bathymetric Data Sharing - Portugal & Cape Verde.

**b) Areas of particular concern**

- Lack of establishment of robust hydrographic services depends on political situations in African Portuguese speaking countries;
- Personnel of African Portuguese speaking countries trained at IHPT, loose their skills due to the lack of establishment of robust hydrographic services;
- Logistic expenses are the major concerns for any partnership or support actions that IHPT can be involved in Cape Verde, Guinea-Bissau, S. Tomé and Príncipe and Angola;
- Access and share the data of the scientific cruises is a difficult task;
- S-100 implementation for ENC and non-ENC products and services (timetable, data, resources).

It would be of major interest that further CB actions could be taken into consideration to improve awareness, knowledge, data acquisition and the development of hydrographic capabilities, to make possible the production of up-to-date nautical charts and ENCs.

**c) Any other matters of interest to the EAthC**

NTR.