SPAIN

NATIONAL REPORT

TO THE 16th MEETING OF THE EASTERN ATLANTIC HYDROGRAPHIC COMMISSION

(EAtHC)

LISBOA, PORTUGAL

29 September - 1 October 2021

1 HYDROGRAPHIC SERVICE

Instituto Hidrográfico de la Marina, Spanish Hydrography Office (IHM), did not have significant organization changes since last EAtHC meeting.

IHM Website http://www.armada.mde.es/ihm presents more detailed information about our mission, organization structure and assets.

The following report covers the period starting October 2018 up to August 2021.

2 SURVEYS

2.1 Coverage of new surveys

In the past three years and for the purpose of updating the bathymetry of our national nautical chart scheme in the Atlantic Ocean, IHM conducted 13 surveys in this area with the ships and small boats of the Hydrographic Flotilla. More specifically, five surveys were performed in the Gulf of Cadiz (west of the Strait of Gibraltar), three in the vicinity of the Strait of Gibraltar, three in Galicia, one in the Cantabrian Sea and another one in Tenerife and Las Palmas (Canary Islands).

Figure 1. Malaspina class Hydrographic Vessel

Figure 2. Antares class Hydrographic Vessel

Surveying the major ports of Spain and their approaches has been a priority for IHM. For this kind of works in shallow and very shallow waters where safety to navigation with heavy shipping traffic is a concern, IHM extensively used multibeam echosounders (MBES) and Phase Differencing Bathymetric Sonar Systems (PDBSS) to assure a complete exploration of the seafloor along with high precision positioning systems to minimize uncertainties in the soundings. This way the IHO standards for Special and 1a Order surveys were met. The same equipment and similar methodology were employed for IHO 1b and 2 Order surveys.

Figure 3. LHT Escandallo

Figure 4. Very shallow water bathymetry system operated from a small rubber boat

Besides the mentioned hydrographic surveys, IHM participated in the Spanish Exclusive Economic Zone (EEZ) exploration, leading the seafloor surveys. This is a long term multidisplinary project developed by IHM in cooperation with other national institutions and universities and conducted on board the Oceanographic Research Vessel *Hespérides*. This platform is usually assigned one month a year for this mission. In 2019 and 2021, *Hespérides* carried out researches in the Spanish EEZ surrounding the Canary Islands.

Figure 5. Spanish Navy Oceanographic Research Vessel Hespérides

Survey planning

IHM surveys were conducted in accordance with the current IHO standards (IHO S-44 5th edition) for the corresponding Order type and purpose of each navigational area. Detailing these general indications, specific instructions were regularly promulgated by the Hydrographic Division as a set of “Manuals” and “Hydrographic Permanent Instructions”. These directions help IHM hydrographers use the equipment, increase efficiency and reduce the time required to complete the

workflow from the planning of a survey, the at-sea works and the following processing and validation of data.

2.2 New technologies and / or equipment

During the past three years, IHM continued with the acquisition of new equipment and developing new procedures.

2.2.1 Echosounders

- Both Hydrographic Vessels *Tofiño* and *Malaspina* are currently fitted with two MBES each in full operation. This allows them to perform surveys in shallow and deep waters from 20 up to 5000 meters.
- *BH Malaspina* is fitted with *Kongsberg* EM302 and EM 2040 MKII MBES acquired in December 2020 with *Seapath 380 (*RTK positioning capable).
- *BH Tofiño* has the MBES EM300 and EM 2040 fitted in August 2020 with Seapath 380 (RTK capability)
- For very shallow water surveys, both vessels are provided with *Kongsberg Geoswath*+ PDBSS, EM 2040 *Portable* with *Seapath 130* (RTK positioning capable) and RESON T20P with *Applanix* (RTK positioning capable) to be fitted on their small launches.
- Coastal Hydrographic Vessel *BH Antares* was fitted in 2019 with a *Kongsberg* EM3002. This allows to achieve Full Sea floor Search from very shallow to shallow waters up to 300 meters. For very shallow water surveys, she was provided with *Kongsberg Geoswath*+ PDBSS, EM 2040 *Portable* and RESON T20P to be fitted on her small launches.
- All the *Kongsberg Geoswath*+ PDBSS, EM 2040 *Portable* and RESON T20P mentioned are shared among the vessels of the Hydrographic Flotilla. IHM has a total of two *Geoswath+ 500*, one *Geoswath+ 250*, two EM 2040P for waters and one RESON T20P.
- *LHT Astrolabio* is fitted with a *Kongsberg EM2040 Compact* MBES with *Seapath 330* (RTK positioning capable).
- *LHT Escandallo* was fitted with a *Kongsberg EM2040 Compact MKII* MBES in May 2019 with a *Seapath 330* (RTK positioning capable).
- *LHT Sondaleza* has no permanent echosounder installed and can be fitted either with a *Kongsberg Geoswath*+ PDBSS, EM 2040P or a RESON T20P when deployed.

2.2.2 Bottom mapping sonars

- IHM’s bottom mapping capability is based on several Side Scan Sonar (SSS) systems.

- TA *Klein 3900 and 4900* Side Scan Sonar, with the capability of being fitted with a magnetometer, was acquired in 2012 and is in operation ever since. This equipment is shared among the vessels of the Hydrographic Flotilla.
- For shallow waters, all three *Geoswath+* PDBSS available for the Hydrographic Flotilla small boats, have side scan imaging capability. Both bathymetry and side scan image is acquired during surveys with this equipment. This allows for precise georeferenced bottom images.
- Small boats are also fitted with pole-mounted *Starfish* SSS for very shallow water surveys.

2.3 New Ships

IHM has proposed to replace its hydrographic fleet with new survey vessels for modern, sophisticated and low-noisy vessels and boats by means of an operational requirements document. The submitted proposal consists of one oceanic vessel, two coastal hydrographic vessels and five survey boats.

3 NEW CHARTS & UPDATES

3.1 ENCs

3.1.1 Production

Up to 1st August 2021, IHM has produced 35 ENCs within the area of the EAtHC (out of a total of 134 published for all areas). Table 1 and 2 show the distribution according to their navigational purpose:

Purpose 2	Purpose 3	Purpose 4	Purpose 5	Purpose 6
General	Coastal	Approach	Harbour	Berthing
3	2	6	23	1

Table 1. Distribution of ENC production in the EAtHC area

EAtHC ENC Production until August 01, 2021					
Purpose	**Total**	**Published**	**Pending**	**% Published**	**% Pending**
2	3	3	0	100%	0%
3	11	11	0	100%	0%
4	38	38	0	100%	0%
5	97	81	16	83,5%	16,5%
6	14	1	13	7%	93%
Total	**162**	**134**	**29**	**82,7%**	**17,3%**

Table 2. Distribution of ENC production and percentage in the EAtHC area

Since the date of the last meeting (15th October 2018) 6 new ENCs and 29 new editions have been produced within the EAtHC area. This shows the increasing workload associated with maintaining and updating the ENC catalog, which slows the production of new ENCs.

Tables 3 and 4 show the new editions/ENC within the EAtHC published since the date of the last meeting.

NEW EDITIONS FROM 15/10/2018 TO 01/08/2021		
NUMBER	**TITLE**	**ED.**
ES604433	Puerto de La Base Naval de Rota	2
ES544001	Puerto de Isla Cristina y El Moral	2
ES504153	Puerto de Vilagarcía de Arousa	4
ES504071	Puerto de Ribadeo	2
ES504042	Puerto de Gijón	6
ES504162	Puerto de Marín	6
ES506010	Puerto de Arrecife, Naos y Los Marmoles	4
ES503931	Puertos de Mundaka y Bermeo	3
ES506120	Puerto de Santa Cruz de Tenerife	6
ES504165	Puerto de Vigo	5
ES504441	Puerto de Bárbate	2
ES504011	Puerto de Santander	7
ES504430	Puerto de Cádiz	6
ES504431	Puertos de Rota, Base Naval y El Puerto de Santa María	7
ES504437	Arsenal de La Carraca	3
ES506140	Puerto de Los Cristianos	2
ES504081	Puertos de Burela y San Cibrao	4
ES504421	Broa de Sanlucar de Barrameda	4
ES400412	Aproches de las rías de Ferrol y La Coruña	6
ES400445	Aproches de Algeciras	8
ES400392	Aproches de San Sebastián y Pasajes	2
ES400444	Aproches de Bárbate	2
ES400416	Aproches de las rías de Pontevedra y Vigo.	6
ES400407	Aproches de Ribadeo	2
ES300105	Estrecho de Gibraltar	8
ES30061A	Islas de Gran Canaria y Tenerife	3
ES201080	Golfo de Vizcaya	5
ES201082	De Casa Blanca a Cabo Yubi	4
ES201083	De Cabo Yubi a Ras Timiris	3

Table 3. New ENC editions produced since the date of the last EAtHC meeting.

NEW ENC's FROM 15/10/2018 TO 01/08/2021		
NUMBER	**TITLE**	**ED.**
ES540501	Puerto de Cudillero	1
ES541513	Puerto de Portosín	1
ES541301	Islas Sisargas	1
ES540401	Puerto de Candás	1
ES541201	Puerto de Malpica	1
ES506102	Puertos de Taliarte y Salinetas	1

Table 4. New ENC cells produced since the date of the last EAtHC meeting

Next figures show the new ENC cells and editions within the EAtHC published since the date of the last meeting (October, 15, 2018).

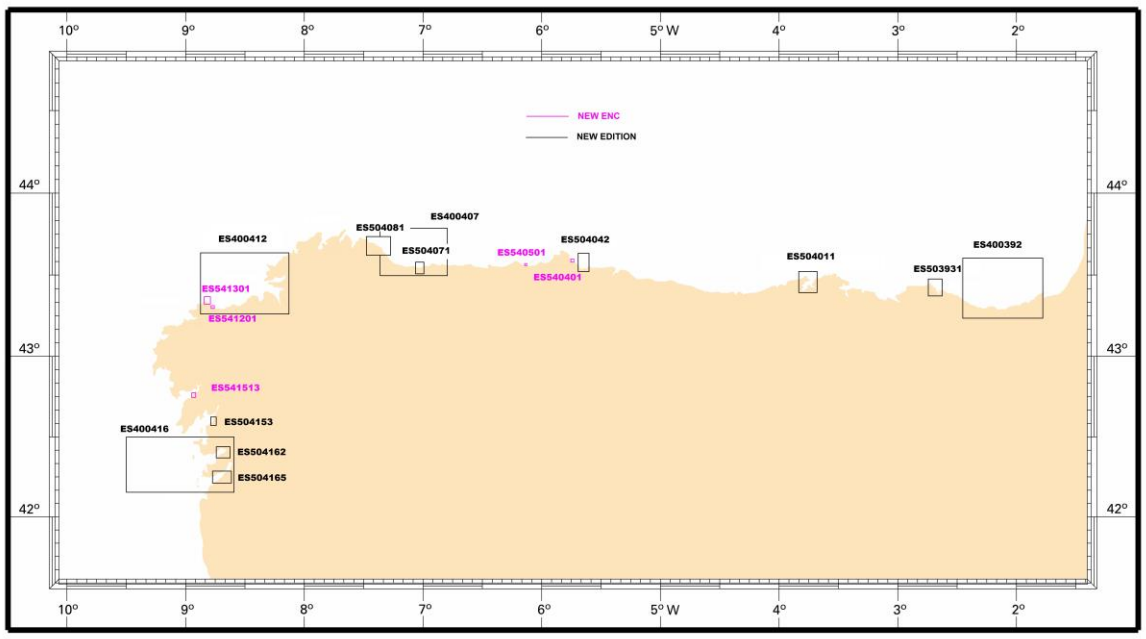

Figure 6. New ENC cells and editions produced in North of Spain since the date of the last EAtHC meeting (purposes 4, 5 and 6)

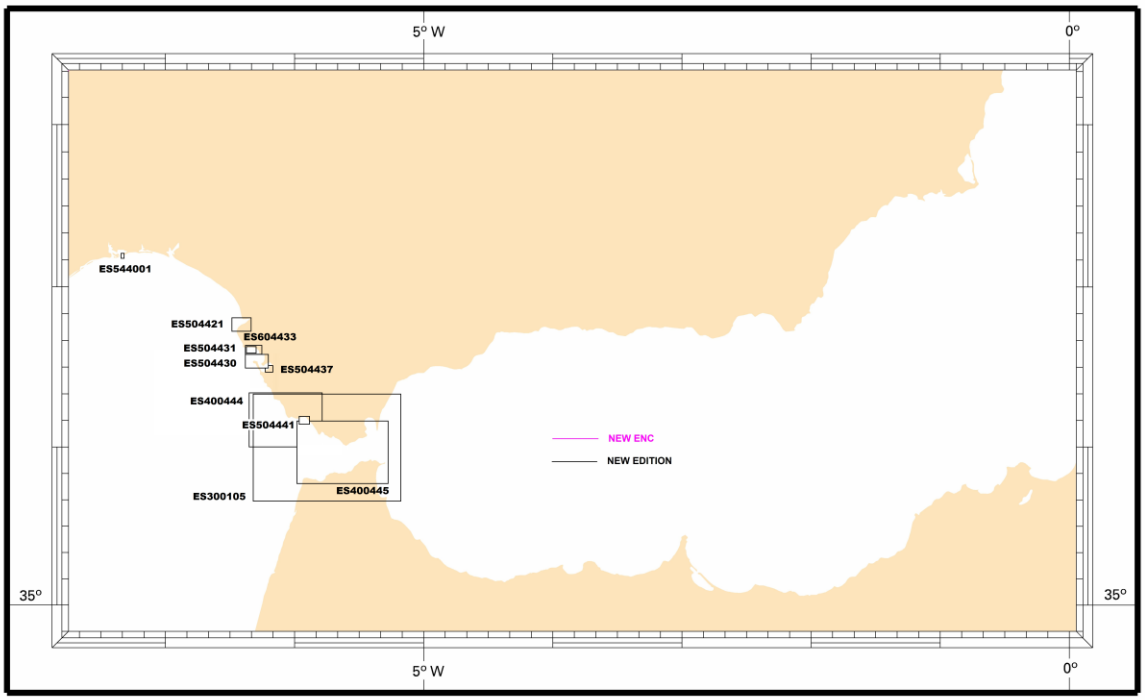

Figure 7. New ENC cells and editions produced in Gulf of Cádiz since the date of the last EAtHC meeting (purposes 4 and 5)

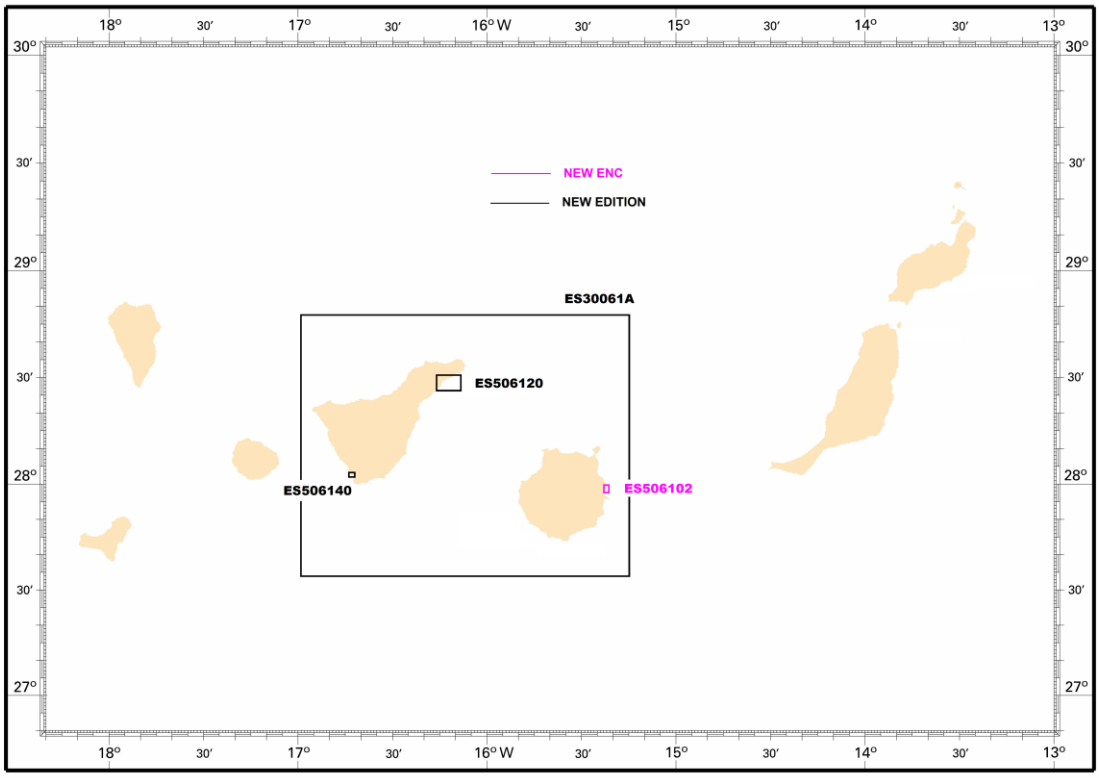

Figure 8. New ENC cells and editions produced in Canary Islands since the date of the last EAtHC meeting (purposes 4 and 5)

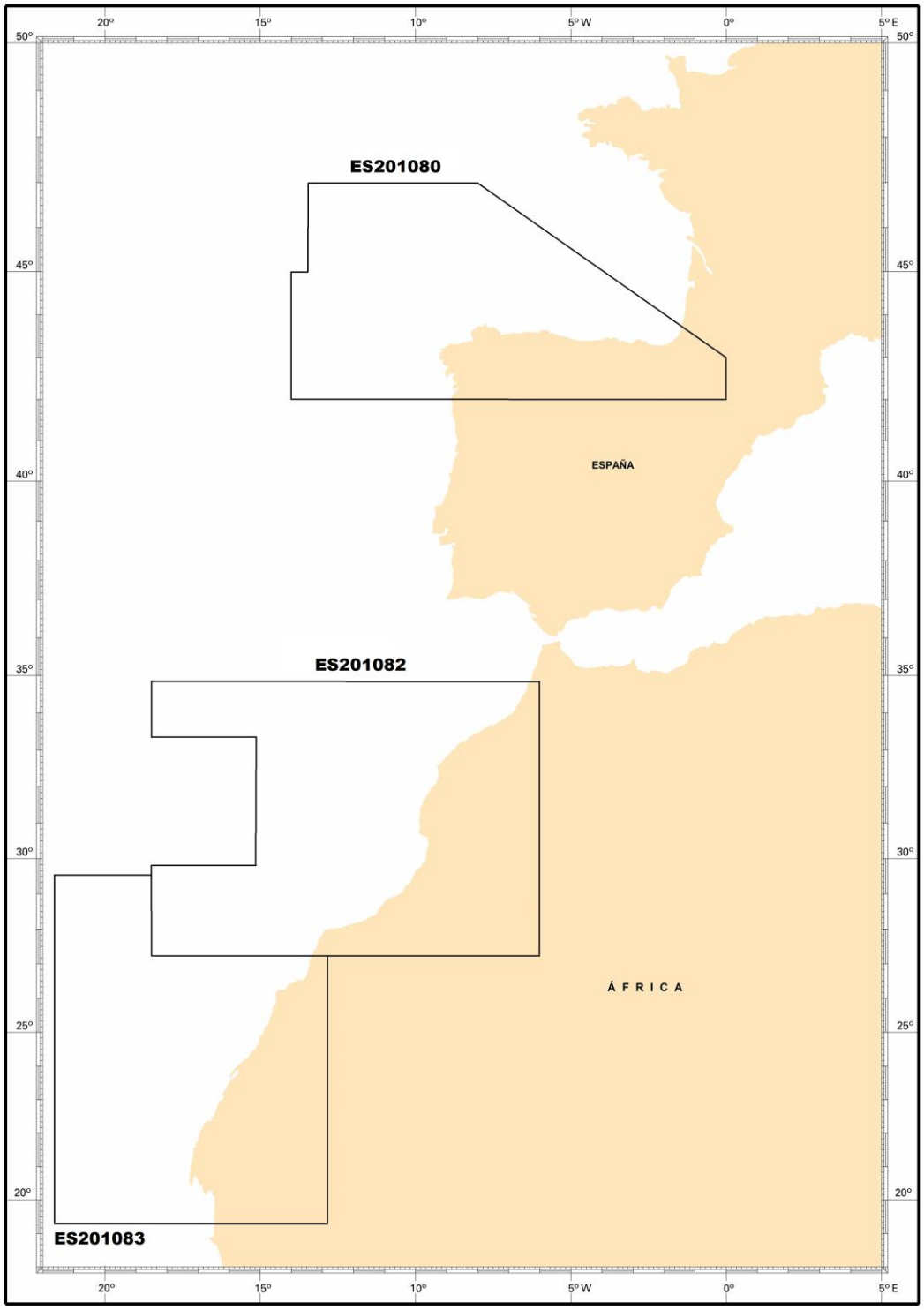

Figure 9. New ENC editions Purpose 2 produced since the date of the last EAtHC meeting

The objectives to be faced are to complete the project finishing Purpose 5 cells left, and continue with the Purpose 6 cells project to cover major Spanish ports.

3.1.2. Cooperation

Under the cooperation with the IC-ENC and PRIMAR RENCs, IHM continues to exchange all the ENC information needed with Portugal (IHPT), France (SHOM) and UK (UKHO) in order to accomplish with the IHO recommendations regarding horizontal and vertical consistency on the adjacent ENC.

3.2 ENC Distribution method

IHM is a member of the IC-ENC RENC, which carries out ENC validation and consistency checking before distribution, and distributes the ENCs via its chain of Value Added Resellers (VARs).

3.3 RNCs

NTR.

3.4 INT paper charts

Up to August 1st, 2021, the IHM has produced 7 new editions (NE) of INT paper charts within the area of the EAtHC (out of a total of 17 published for all areas). Table 5 and figure 11/12 show these NE.

NUM (INT)	SCALE	TITLE
445 (INT 1970) (NE)	1/50 000	Estrecho de Gibraltar. De punta Camarinal a punta Europa y de cabo Espartel a punta Almina
4011 (INT 1852)(NE)	1/15 000	Puerto de Santander
6120 (INT 1929) (NE)	1/12 500	Puerto de Santa Cruz de Tenerife
4165 (INT 1858) (NE)	1/12 500	Puerto de Vigo
4430 (INT 1903) (NE)	1/12 500	Puerto de Cádiz
4431 (INT 1904) (NE)	1/12 500	Puertos de Rota, Base Naval y El Puerto de Santa María
4123 (INT 1856) (NE)	1/10 000	Puerto de Ferrol

Table 5. INT paper charts published since the date of the last EAtHC meeting

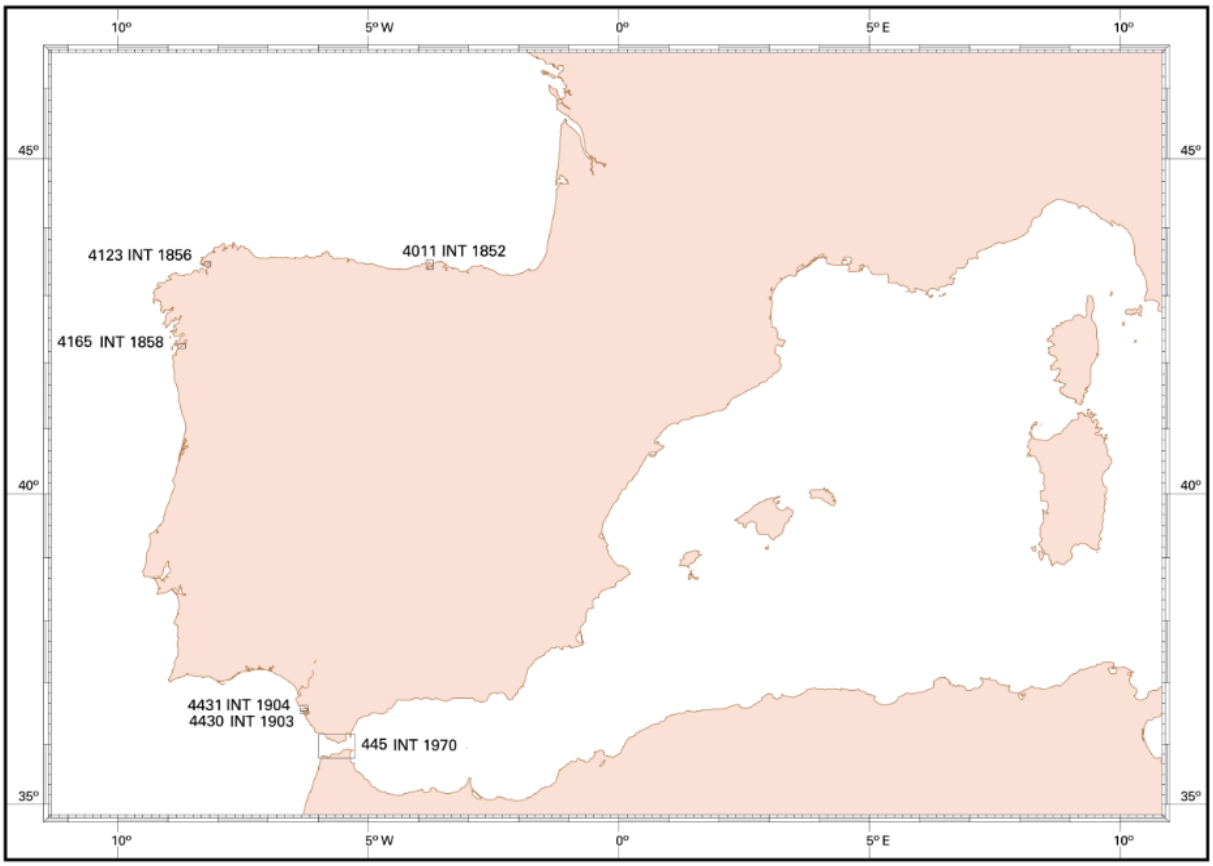

Figure 10. Iberian Peninsula.

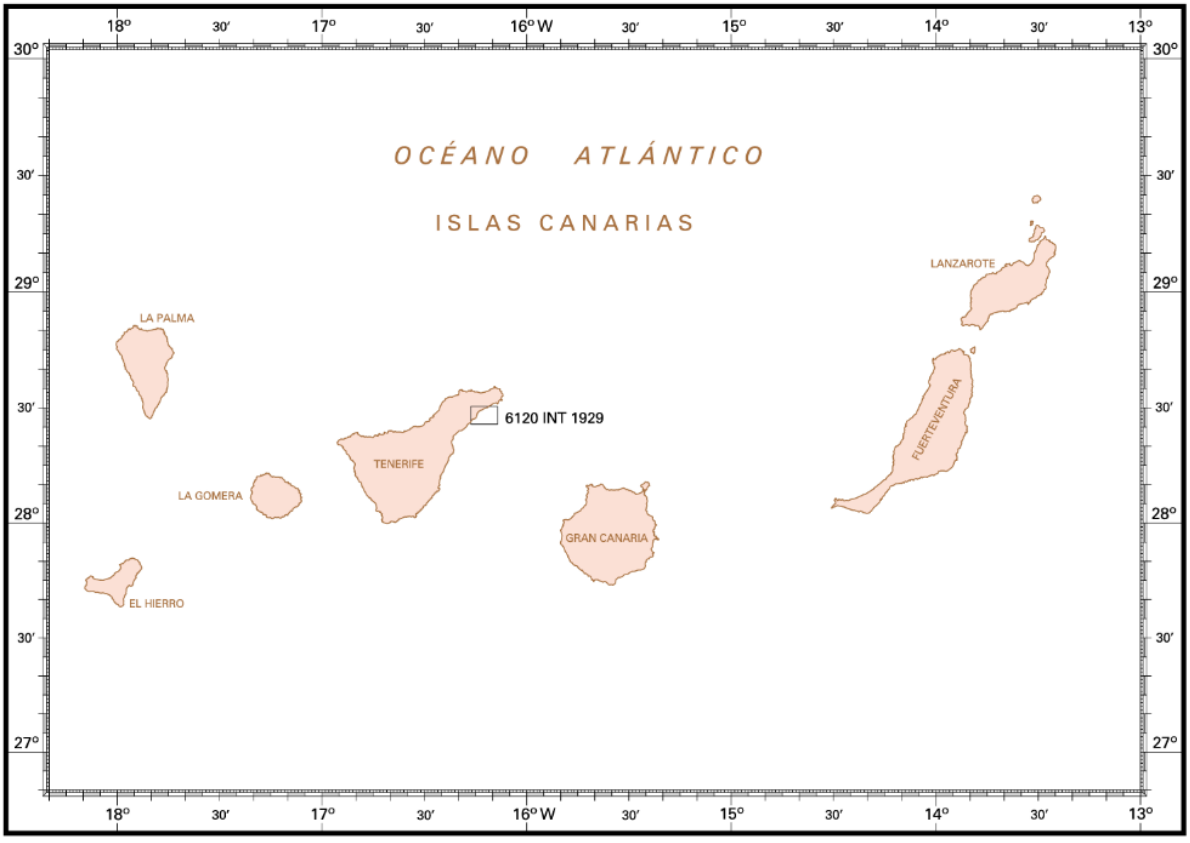

Figure 11. Canary Islands

3.5 National paper charts

Since the date of the last meeting (October 15th 2018), within the area of the EAtHC, 4 national paper charts have been published. These 4 new editions are either produced from national data or adopted from charts produced by other Hydrographic Offices. All of them are shown in Table 6 and figure 13.

NUM	SCALE	TITLE
6010 (NE)	1/10 000	Puertos de Arrecife, Naos y Los Mármoles
4441 (NE)	1/10 000	Puerto de Barbate
4433 (NE)	1/5 000	Puerto de la Base Naval de Rota
6140 (NE)	1/3 500	Puerto de Los Cristianos

Table 6: National paper charts published since the date of the last EAtHC meeting

Figure 12. Iberian Peninsula.

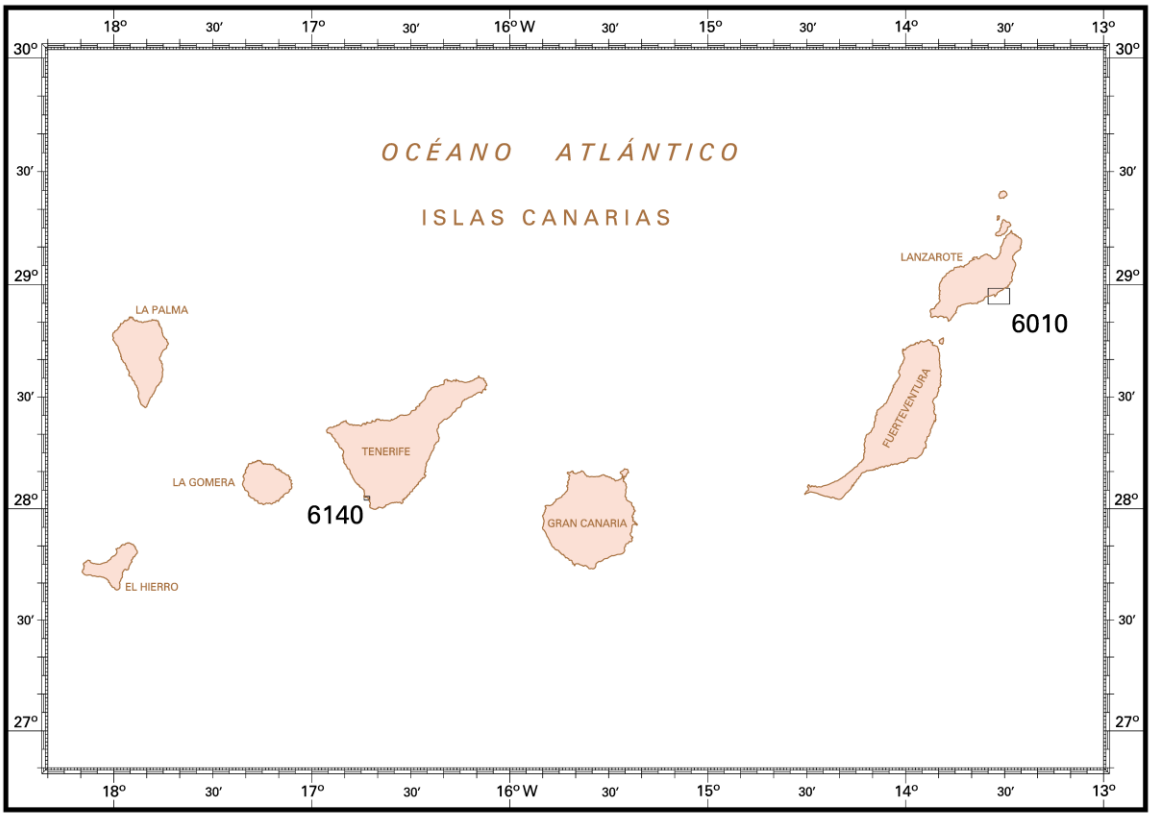

Figure 13. Canary Islands

3.6 Problems encountered

Even though the Spanish catalogue lists nautical charts covering part of the western African coast, no systematic surveys have been carried out by IHM in that area for decades, except for soundings of opportunity when vessels transit between the Iberian Peninsula and the Canary Islands. Therefore, no data are available for IHM to publish up-to-date editions of the existing charts.

3.7 Updates INT Catalogue.

During this period, cartographic updating of the INT charts assigned to Spain in the region G, according to the catalogue INToGIS, has been made.

4 NEW PUBLICATIONS AND UPDATES

4.1 New publications

NTR.

4.2 Updated publications

Edition in Spanish of the IHO S4 Publication, “Regulations of the IHO for International (INT) Charts and Chart Specifications of the IHO”, Edition, 4.8.0 (October 2018).

Edition of the Spanish Catalog of Nautical Charts and other publications, 2019, 2020 and 2021 editions.

Figure 14. Catalogue of Nautical Charts and other Publications

Radiosignals, 2020 edition.

Sailing Directions:

- Num.1, 2021 edition. North Coast of Spain, from Río Bidasoa to Ría de Ribadeo.
- Num. 2, 2020 edition. North and Northwest Coast of Spain, from Ría de Ribadeo to Cabo Finisterre.
- Num.3, 2019 edition. Northwest Coast of Spain, from Cabo Finisterre to Rio Miño.
- Num.4, 2020 edition. Coast of Portugal and Açores Islands.
- Num. 5, 2020 edition. Southwest and South Coast of Spain, from Río Guadiana to Cabo Sacratif including the North and South Coasts of Gibraltar Strait.
- Num. 9, 2019 edition. Northwest Coast of Africa, from Cabo Espartel to Cabo Verde, including Madeira, Selvagens and Cabo Verde Islands.
- Num. 10, 2020 edition. Canary Islands.

List of Lights:

- Part I, 2021 edition. Coasts of Spain and Portugal on the Atlantic Ocean, Africa West Coast from Cabo Espartel to Cape Verde (Senegal), Azores Islands, Madeira, Canary Islands and Cape Verde.
- Part II, 2021 edition. Gibraltar Strait, Balearic Islands and Mediterranean coasts of Spain, Morocco and Algeria.

4.3 Means of delivery.

A digital version of the publication List of Lights and Fog Signals is available online in the following internet address**:**

http://www.armada.mde.es/ihm/Aplicaciones/LibroFaros/V3/index.html

Figure 15. Screenshot of the List of Lights and Fog Signals interactive tool

5 MSI

5.1 Existing Infrastructures for transmission.

National Coordinator and NAVTEX Coordinator: Spanish Maritime Safety Agency (SASEMAR).

NAVTEX Stations:

- Las Palmas [I] English [A] Spanish
- La Coruña [D] English [W] Spanish
- Tarifa [G] English [T] Spanish.

NAVAREA III Coordinator: Spanish Hydrographic Institute (IHM).

There is a fluid exchange of NAVAREA warnings between NAVAREA III Coordinator and NAVAREA II Coordinator.

Portugal and Morocco exchange MSI with SASEMAR to promulgate coastal warnings mainly from Tarifa NAVTEX Station.

Likewise, the IHM receives MSI from Morocco, which is passed to SASEMAR to transmit as coastal warning from the NAVTEX stations, or is promulgated by the IHM as NAVAREA warning by SafetyNET**.**

5.1.1. SAR Organization

Coordinator: SASEMAR through its National Centre (CNCS) in Madrid, and 19 Maritime Rescue Coordination Centers (MRCCs) located along the coast line of the Peninsula Iberica, Canary and Balearic Islands.

5.2 New infrastructure in accordance with GMDSS Master Plan

NTR.

5.3 Problems encountered.

NTR.

6 C-55

6.1 Spain. Iberian Peninsula. Charting Region G

6.1.1. Hydrographic Surveying

Survey coverage:

	A	B	C
Dephts < 200 m	78	22	0
Dephts > 200 m	92	0	8

Where:
A = percentage which is adequately surveyed.
B = percentage which requires re-survey at larger scale or to modern standards.
C = percentage which has never been systematically surveyed.

6.1.2. Nautical Charting

Status of nautical charting within the limits of the EEZ

Purpose/ scale	A	B	C
Offshore passage/ Small	100	0	100
Landfall and Coastal passage/ Medium	100	0	100
Approaches and Ports/ Large	100	0	86

A = percentage covered by INT series, or a paper chart series meeting the standards in S-4.
B = percentage covered by Raster Navigational Charts (RNCs) meeting the standards in S-61.
C = percentage covered by ENCs meeting the standards in S-57.

Regarding the ENC large scale coverage is important to notice that current percentage (86%) has been calculated over the new ENC production project, which aims to cover all national, main and secondary, ports.

6.1.3. Maritime Safety Information (MSI).

NAVIGATIONAL INFORMATION (S-53)

SERVICE	Yes	No	Partial	Notes
Local Warnings	X			Via SASEMAR
Coastal Warnings	X			Via SASEMAR
NAVAREA Warnings	X			Via NAVAREA II Coordinator
Port Information	X			Port Authorities

GMDSS IMPLEMENTATION (IMO Publication 970–GMDSS Manual)

SERVICE	Yes	No	Partial	Notes
Master Plan	X			
Area A1	X			
Area A2	X			
Area A3	X			
NAVTEX	X			
SafetyNET	X			

6.2 Spain. Canary Islands, Charting Region G

6.2.1. Hydrographic Surveying

	A	B	C
Dephts < 200 m	50	50	0
Dephts > 200 m	85	0	15

A = percentage which is adequately surveyed.
B = percentage which requires re-survey at larger scale or to modern standards.
C = percentage which has never been systematically surveyed.

6.2.2. Nautical Charting

Status of nautical charting within the limits of the EEZ

Purpose/ scale	A	B	C
Offshore passage/ Small	100	0	100
Landfall and Coastal passage/ Medium	100	0	100
Approaches and Ports/ Large	100	0	94

A = percentage covered by INT series, or a paper chart series meeting the standards in S-4.
B = percentage covered by Raster Navigational Charts (RNCs) meeting the standards in S-61.
C = percentage covered by ENCs meeting the standards in S-57.

Regarding the ENC large scale coverage is important to notice that current percentage (94%) has been calculated over the new ENC production project, which aims to cover all national, main and secondary, ports.

6.2.3. Maritime Safety Information (MSI).

NAVIGATIONAL INFORMATION (S-53)

SERVICE	Yes	No	Partial	Notes
Local Warnings	X			Via SASEMAR
Coastal Warnings	X			Via SASEMAR
NAVAREA Warnings	X			Via NAVAREA II Coordinator
Port Information	X			Port Authorities

GMDSS IMPLEMENTATION (IMO Publication 970–GMDSS Manual)

SERVICE	Yes	No	Partial	Notes
Master Plan	X			
Area A1	X			
Area A2	X			
Area A3	X			
NAVTEX	X			
SafetyNET	X			

7 CAPACITY BUILDING

7.1 Offer of and/or demand for Capacity Building

The Spanish Hydrographic School, located within the facilities of the IHM, offers both hydrographic surveyor Category A and B courses. These courses are 10-month long and are taught in Spanish. Minimum academic enrolling requirements should be fulfilled.

In 2019, the Specialization Program in Hydrography & Oceanography for Naval Officers (Category A) was presented and defended to the FIG/IHO/ICA International Board on Standards of Competence for Hydrographic Surveyors and Nautical Cartographers (IBSC), getting its recognition.

In 2020 the Specialization Program in Hydrography & Oceanography for Naval Petty Officers (Category B) was presented and defended to the FIG/IHO/ICA International Board on Standards of Competence for Hydrographic Surveyors and Nautical Cartographers (IBSC), getting its recognition.

The virtual portal, as a supporting knowledge center for students including a repository for teaching documents, regulations, procedures, relevant links and various learning resources was implemented. The learning platform MOODLE is also used for both online training and complementing classroom courses, as it can be used as a basic repository of student resources as well as a network learning environment for students to interact, access content and complete tasks, monitoring their full performance online and in the classroom.

The list of students who have attended these courses in the last two academic years is as follows:

Academic year	Category A course	Category B course
2019-2020	4 Officers from Spanish Navy 1 Officer from Uruguay	4 Petty Officers from Spanish Navy 1 Petty Officer from **Morocco**
2020-2021	2 Officers from Spanish Navy 1 Officer from Argentina 1 Officer from Tunisia 1 Officer from **Morocco**	3 Petty Officers from Spanish Navy

Nowadays, all the students who take the aforementioned courses are military staff. Non-Spanish military students' attendance is also offered through a Collaboration Agreement (Collaboration Program with Foreign Countries regarding Military Training) signed between the Spanish Ministry of Defense and other countries. This agreement provides grants for students´ attendance to the above mentioned courses. The point of contact for these matters is generally the Defense Attaché to the corresponding Spanish Embassy.

7.2 Training received, needed, offered

Apart from the training received by Spanish Navy officers and petty officers in the courses reflected in paragraph 7.1 above, several Spanish officers have accomplished Master degrees:

- Master in Subaquatic Archaeological Heritage (University of Cádiz), from September 2019 to July 2020.
- Geospatial Information Course (Geodesy Department from the Spanish Army College), from November 2018 to July 2020, in Madrid.
- Master in Advanced Hydrography for Professionals (University of Plymouth), from May 2018 to July 2020.

It is planned to continue sending Spanish officers to perform Masters Degrees, in accordance with IHM needs.

7.3 Definition of proposals and requests to the IHO CBSC.

Specialization Course in Hydrography & Oceanography for Naval Officers (Category A) and Petty Officers (Category B):

As indicated in point 7.1 above, the attendance of non-Spanish students is offered though a collaboration agreement with regard to military training, signed between the Spanish Ministry of Defence and other countries, through The Collaboration Program with Foreign Countries regarding Military Training. This agreement provides grants for the attendance to the above-mentioned courses. The point of contact for these matters is the Defence Attaché to the corresponding Spanish Embassy

7.4 Status of national, bilateral, multilateral or regional development projects with hydrographic component.

IHM has an updated bilateral agreement with France signed and published in Spanish Official Bulletin in 2016.

IHM has two bilateral agreements in process to be signed with The Portuguese Republic and the United Kingdom.

8 OCEANOGRAPHIC ACTIVITIES

8.1 General

IHM has developed an internet access website that includes tidal information of national ports in order to facilitate its exploitation from the Internet. This web page is being continuously improved and it is not a substitute of Tide Tables.

Installation of permanent tide stations in locations that will improve the current coverage of the national tide gauge network is still in process. Once deployed, it is to share your data with other national bodies studying the tide, and also have their own permanent tide gauges.

The current measurement capacity of the Hydrographic vessel Tofiño has been recovered.

8.2 GEBCO/IBC's activities

IHM has been part of the EMODnet Project from 2013 to June 2016. Therefore, GEBCO grid is currently making use of IHM data, from this project.

8.3 Tide gauge network

There is a tidal gauge network all around Spain with more than 40 sensors distributed along the coast. Three out of them belong to IHM, and there is a project to install more in the near future.

8.4 New equipment

Works are being carried out to integrate all of our tide gauges the capability of transmit data in real time.

8.5 Problems encountered

Development of Tides web information has to be improved in order to include historical data as well as metadata.

9 OTHER ACTIVITIES

9.1 Participation in IHO Working Groups

IHM takes part in the following Hydrographic Commissions:

- Hydrographic Commission on Antarctica (HCA)

- East Atlantic Hydrographic Commission (EAtHC)
- Mediterranean and Black Sea Hydrographic Commission (MBSHC), as a Chair.and NAVAREA III Coordinator.
- Meso American - Caribbean Sea Hydrographic Commission (MACHC), as Observer.

And in a wide variety of working groups:

- Hydrographic Services and Standards Committee (HSSC)
- ENC Standards Maintenance Working Group (ENC-WG)
- S-100 Working Group (S-100 WG)
- Nautical Information Provision Working Group (NIPWG)
- Nautical Cartography Working Group (NCWG)
- Tidal and Water Level Working Group (TWLWG)
- World-Wide Navigational Warning Service Sub-Committee (WWNWS)
- Inter-Regional Coordination Committee (IRCC)
- Marine Spatial Data Infrastructure Working Group (MSDIWG)
- Capacity building subcommittee (CBSC).
- IHO-EU Network Working Group (IENWG)

It is important to highlight that IHM also takes part in the following NATO working groups:

- Geospatial Maritime Working Group (GMWG).
- Defence Maritime Geospatial Exchange Model (DMGEM).
- AML Co-Production Program (NACPP) (Additional Military Layers).
- Military Oceanography Working Group (MILOC).

9.2 Meteorological data collection

We currently have two weather station deployed. One of them in the Arsenal of Ferrol and the other one in training camp Sierra Retín, with internet access to data.

Additionally, we have three automatic tide gauge stations installed with meteorological sensors, also with internet access to data.

9.3 Geospatial studies

A new project is being carried out to develop a Hydrographic Vertical Reference Surface along the Spanish Coast using ellipsoidal heights. To achieve this goal, the ellipsoidal heights of all Spanish tide gauges are being measured. In addition, two new equipment have been built to measure the ellipsoidal height in different places and increase our reference stations, the DeepMotion GNSS_INS device, to deploy on a buoy in the sea and the DeepWaves acoustic tide gauge GNSS referenced to deploy in a fixed station along the shore coast.

Seven DeepMotion and seven DeepWaves have been acquired by IHM to increase the ellipsoidal heights grid, not only along the shore coast, but also the sea.

9.4 Disaster prevention

NTR.

9.5 Environmental protection

IHM continues feeding a database of whale watching with the information received from Navy ships.

IHM recommends noise policies to avoid risk to mammals in the areas of scientific studies where transmissions are made.

9.6 Astronomical observations

NTR

9.7 Magnetic/Gravity surveys

NTR

9.8 MSDI Progress

IHM is a participant in the working group on Infrastructure of Spanish Spatial Data (*GT-IDEE*) and in the Board of the Spanish Geographic Information Infrastructure *(Consejo Directivo de la Infraestructura de Información Geográfica de España – CODIIGE),* tasked with the integration via internet of geographic data, metadata, services and information produced in Spain, to help users locate, identify, select and access such resources via the Spanish Spatial data infrastructure (http://www.idee.es), which constitutes the MSDI.

The Spanish Central Archive of Cartography (Instituto Geográfico Nacional) has been provided with digital information produced by IHM, including the Spanish coastline at scale 1:50000, straight territorial sea baseline and the Spanish Exclusive Economic Zone in the North-western Mediterranean. This information is available to download freely in the following internet address:

http://centrodedescargas.cnig.es/CentroDescargas/index.jsp

IHM has developed its own SDI (IDE-IHM), with the purpose of giving an answer to the increasing demand of users to have access to nautical information.

http://ideihm.covam.es/index1.html

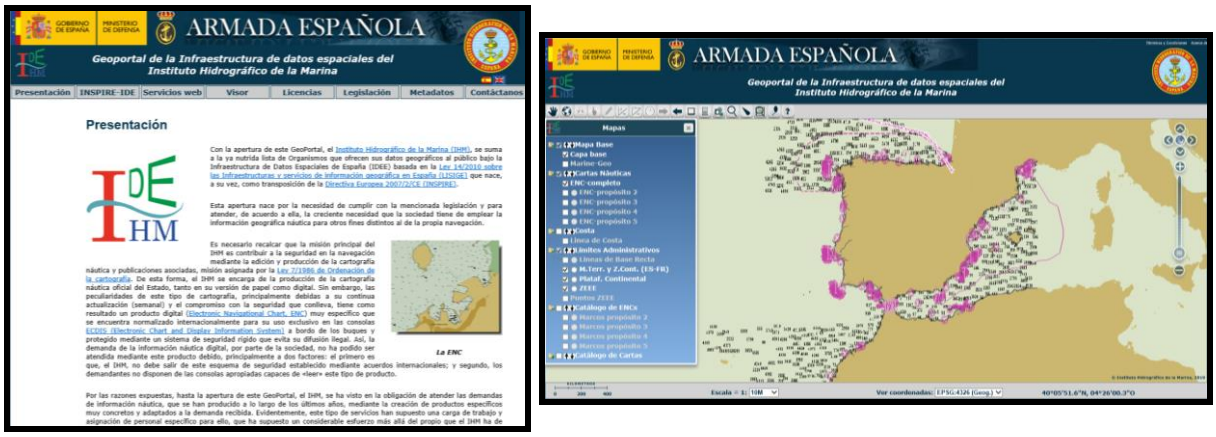

Figure 16. Screenshot of the Spanish MSDI (IDE-IHM)

Currently, this SDI is offering the following services:

Nautical Chart WMS Services.

These services provide access to some geographical information, which is included in the IHM official nautical cartography. Data are selected from Electronical Nautical Charts (ENC) already produced by IHM. The visual representation mimics the standard S52 of IHO, including information for the type standard, adding depths and obstructions.

WMS/WFS for Spanish Coast line.

This service provides capability to display and download the Spanish coastline included in the official nautical cartography (scale 1:50.000).

CSW Service of Metadata Catalog (Spanish IHM Nautical Chart).

This service provides capability of Catalog and the metadata files search, published in the IDE-IHM as WMS Service, WMS Layers, Electronic Nautical Chart (ENC) and Paper Nautical Chart (PNC).

WMS/WFS for straight territorial sea baseline.

This service provides capability to display and download the straight territorial sea baseline (LBR in Spanish language).

WMS/WFS for Maritime boundaries.

This service provides capability to display and download the maritime limits as national territorial waters, contiguous zone, continental platform and exclusive economic zone.

WMS/WFS for IHM nautical chart catalogue scheme.

This service provides capability to display and download the Spanish IHM nautical chart catalogue scheme, both for paper nautical chart and Electronic Nautical Chart (ENC).

WMS/WFS for military maritime practice areas.

This service provides capability to display and download the scheme with the assigned areas for military training (amphibious, aerial, surface and submarine areas).

WMS/WFS for List of Lights and Fog Signals.

This service provides capability to display, download and access to the data on maritime signalling existing in the publications "List of Lights and Maritime Signals, Parts I and II".

Application Programming Interface (API) for prediction of tidal data.

This service provides access to the Tidal Prediction Tables, published by IHM. This API is intended to offer users the possibility of importing data from IHM publication to their web pages and documents through an automatized licensing process. The service permits, in an intuitive manner, to build up the URL, step by step, to get the final data.

URL: https://ideihm.covam.es/apimareas