

***Nephrops* Sentinel Fishery in Functional Unit 25 (North Galicia) 2017-2019**

González Herraiz, I.¹, Gómez Suárez, F.J.¹, Fariña, C.¹, Rodríguez, J.² and Salinas, I.³

¹Instituto Español de Oceanografía. Centro Oceanográfico de A Coruña. Paseo Marítimo Alcalde Francisco Vázquez, 10. A Coruña, 15001. Spain

²Instituto Español de Oceanografía. C.O. Santander. Promontorio San Martín s/n, Santander, 39004. Spain

³Instituto Español de Oceanografía. C.O. Vigo. Subida Radio Faro, 50-52. 36390 Vigo, 11006. Spain

INTRODUCTION

Nephrops landings in FU 25 (ICES Division 8c, North Galicia) have decreased an 89% from 1975 to 2016. ICES advice for this stock is on the basis of a data-limited approach since 2006, meaning that no analytical stock assessment is conducted in this FU. According to this approach, FU 25 is considered as category 3.1.4 stock (ICES, 2012) and it is assessed mainly by the analysis of the LPUE series trend. Until 2019 there were no *Nephrops* discards in this FU, therefore catches were equivalent to landings (ICES, 2018a). In the FU 25 trawl fleet trips that catch *Nephrops* there are hauls directed and not directed to *Nephrops*. ICES recommendation for this FU has been zero catch since 2002. Results of the last assessments in 2016 indicated an extremely low abundance level and a zero TAC was recommended for 2017, 2018 and 2019. Following this recommendation, a *Nephrops* TAC zero was established in the 8c division, where the FU 25 is located, for that triennium (EU, 2017). The 2019 assessment obtained the same conclusions and the zero TAC was extended for 2020, 2021 and 2022 (EU, 2020).

Fishing industry presented abundance data of this stock for 2015 and 2016 in WGBIE 2017 (ICES, 2017) based on catches and effort information obtained from two trawler vessels based in the A Coruña port (Fernández et al., 2017). ICES 2017 WGBIE considered that “the LPUE data provided [...] could be used as an abundance index in a future Benchmark as long as the time series is continued and extended historically”.

In order to continue this time series, the fishing industry asked the Spanish General Secretariat of Fisheries (SGP) the possibility of carrying out a survey in 2017. This survey would be restricted to the two vessels used for the calculation of abundance indices submitted to WGBIE 2017 (Fernández et al., 2017) with the aim of obtaining comparable results. Spain requested a special quota for *Nephrops* in FU 25 to EU in order to carry out an observer’s programme in 2017 supervised by the Spanish Oceanographic Institute (IEO). EU conceded 4.2 tonnes for *Nephrops* in FU25 and this sentinel fishery for *Nephrops* was carried out in August and September of 2017. A permission to carry out a 2018 sentinel fishery was solicited later to DG-MARE by Spain. EU requested to ICES for advice on the level of catch and characteristics needed for the 2018 sentinel fishery, what was answered by ICES in February 2018 (ICES, 2018b). A Sentinel fishery with a special quota of 2 t per year was carried out in August and September of 2018 and 2019. The results of this Sentinel fishery of 2019 and their comparison with the results of the previous years are presented in this working document.

SURVEY OBJECTIVES

The main objective of the Sentinel fishery is to obtain an abundance index for *Nephrops* FU 25 in the period with *Nephrops* TAC zero. Other objectives are to obtain the *Nephrops* size composition and proportion of males.

METHODS

The survey was conducted between 1st August to 26st September 2019 by two commercial vessels on the fishing grounds at the Northwest of A Coruña (FU 25, NW of Spain) (Figure 1). The survey was designed and coordinated by IEO (C.O. A Coruña), the Association of owners of fishing vessels of Galicia, “Pescagalicia-Arpega-O Barco”, and the shipowners of “Ana Isabel” and “Burelés”. Conditions of the authorization of the 2019 observers survey in Annex I.

Study area

Figure 1 shows the fishing area covered in this survey (in green), ranging between 200 and 500 m depth. This area is where the *Nephrops* densities are highest in this FU (ICES statistical rectangles 15E0-E1 and 16E1, in red).

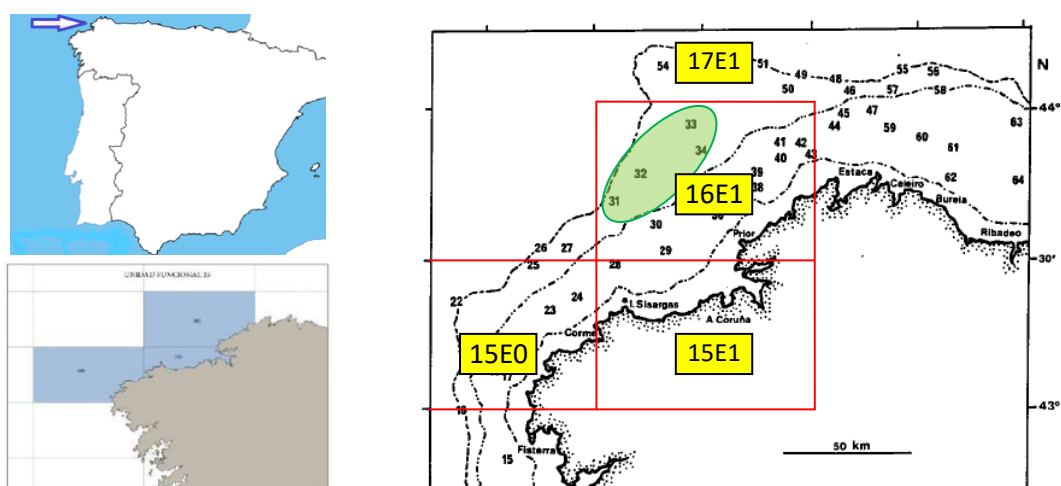


Figure 1. Statistical rectangles of *Nephrops* Functional Unit 25 (North of Galicia) in red, rectangles names in yellow. Study area in the observers survey in green.

Observation and data collection methodology

A total of 16 fishing days targeting to *Nephrops* were made in the 2019 survey, 33% less than in the 2017 survey and half of the 2018. The observers were on board all of the days. Table 1 shows the specifications of the vessels that participated in this programme and Table 2 shows the fishing calendar. The development of trips, schedules, and sets followed the normal commercial schemes in the bottom trawl fishery and there was not interference in the usual procedure of commercial fishing in order to commercial indices were comparable with the previously provided by the industry. The gear used was the usual with the regulatory 70 mm mesh size.

Table 1. Technical specifications of vessels participating in the survey.

	BURELÉS	ANA ISABEL
REGISTER	FE-2-1-97	VI-5-8-00
CATEGORY - FLEET CENSUS	Bottom-Trawl Cantábrico NW	Bottom-Trawl Cantábrico NW
GROSS TONNAGE (GT)	223.61	219.02
TOTAL LENGTH	28 m	28 m
POWER	625 cv	320 cv
GEAR	Otter Trawl (OTB)	Otter Trawl (OTB)
MESH SIZE	70 mm	70 mm

Table 2. Calendar of the fishing days by vessel of the survey.

Vessel	August	September	Total fishing days
Ana Isabel	2, 7, 13, 21 and 29	11, 18 y 26	8
Burelés	1, 8, 12, 22 and 28	12, 19 and 25	8

Nephrops shows daily and seasonal variations in its catchability, due to their behaviour (Aguzzi and Sardá, 2008). Individuals at more than 200 m of depth are inside their burrows during hours of low-light (Chapman, 1980). To avoid the effect of daily variations in the catchability of *Nephrops* according to Aguzzi et al. (2003), the hauls that were carried out in more than 50% of time between dusk and dawn were considered non-directed to *Nephrops*. 22 hauls were directed to *Nephrops* and 25 hauls were not (66% and 32% less than the previous year, respectively). The duration of each haul was calculated as the elapsed time in hours between the moments in which the gear makes firm in the bottom to the beginning of the turned. Effort unit was trawling hour. The observers followed the working protocol established, which consisted in:

1. General data collection of the trips and hauls, including latitude, longitude, depth and duration of the haul in hours.
2. For each haul, quantitative data of the total catch by specie, both landed and discarded.
3. Random sampling of *Nephrops* length (mm Carapace Length) by sex in each haul. Proportion of sex.
4. Size sampling of catch of other commercial species (hake, megrims, anglerfishes, and blue whiting).

All the information obtained by the observers was recorded in the IEO fishing database (SIRENO). *Nephrops* landings and size distribution are included in the FU 25 data uploaded in Intercatch.

Nephrops size composition by haul was obtained rising the sampling carried out on board using the length-weight relationship for males and females according to Fariña (1984).

RESULTS

Trips

16 trips (8 for each vessel) were undertaken during this survey, 11% less than in the previous year. All the trips had one fishing day. 49 hauls were carried out, 53% less than in the previous year. Information by haul (date, hour, duration, depths, total catch and *Nephrops* catch) in Annex II.

Total and Nephrops catches

A total catch of 12 469 kg of different species (fishes, crustaceans and molluscs) were caught, a 45% less than in the previous year. The percentage of catch discarded in the 2019 was 20%, the same than in 2018.

The total *Nephrops* catch obtained by the two vessels was 2 270 kg, 15% more than in 2018. *Nephrops* discard was 250 kg, in 2018 there was no discard.

Nephrops CPUE

The average yield was 142 kg/trip, 142 kg/fishing day, 46 kg/haul and 7.3 kg/hour, 135% more than in 2018. The mean CPUE during the survey was 7.3 kg/hour. The *Nephrops* CPUE of the whole survey in the hauls directed to *Nephrops* was 16.2 kg/hour, 125% more than in 2017 (7.2 in 2017 and 5.2 in 2018) (Table 3).

Table 3. FU 25 Sentinel survey. *Nephrops* CPUE in kg/hour (2017-2019). CPUE calculated as an average of the hauls CPUE.

Sentinel	Total hauls		Hauls directed to <i>Nephrops</i>			Hauls non directed to <i>Nephrops</i>		
	n	CPUE (kg/hour)	n	CPUE (kg/hour)	s.d.	n	CPUE (kg/hour)	s.d.
2017	79	5.1	54	7.2	3.0	25	0.5	0.8
2018	103	3.6	66	5.1	3.0	37	0.8	1.7
2019	49	7.3	22	16.2	11.1	27	0.0	0
Average		5.3		9.5			0.4	

Size composition and sex-ratio of the Nephrops catch

A total of 4 633 individuals were measured, 36% less than in the previous year, 2 934 males and 1 699 females. The percentage of males was 63%, the same than in 2018, in 2017 was 43%. Carapace length fluctuated from 26 mm to 71 mm CL in males and from 25 mm to 67 mm CL in females (Figure 4). Mean sizes decreased from 2018 to 2019 from 42.1 to 40.3 in males and from 40.3 to 38.7 in females (Table 4).

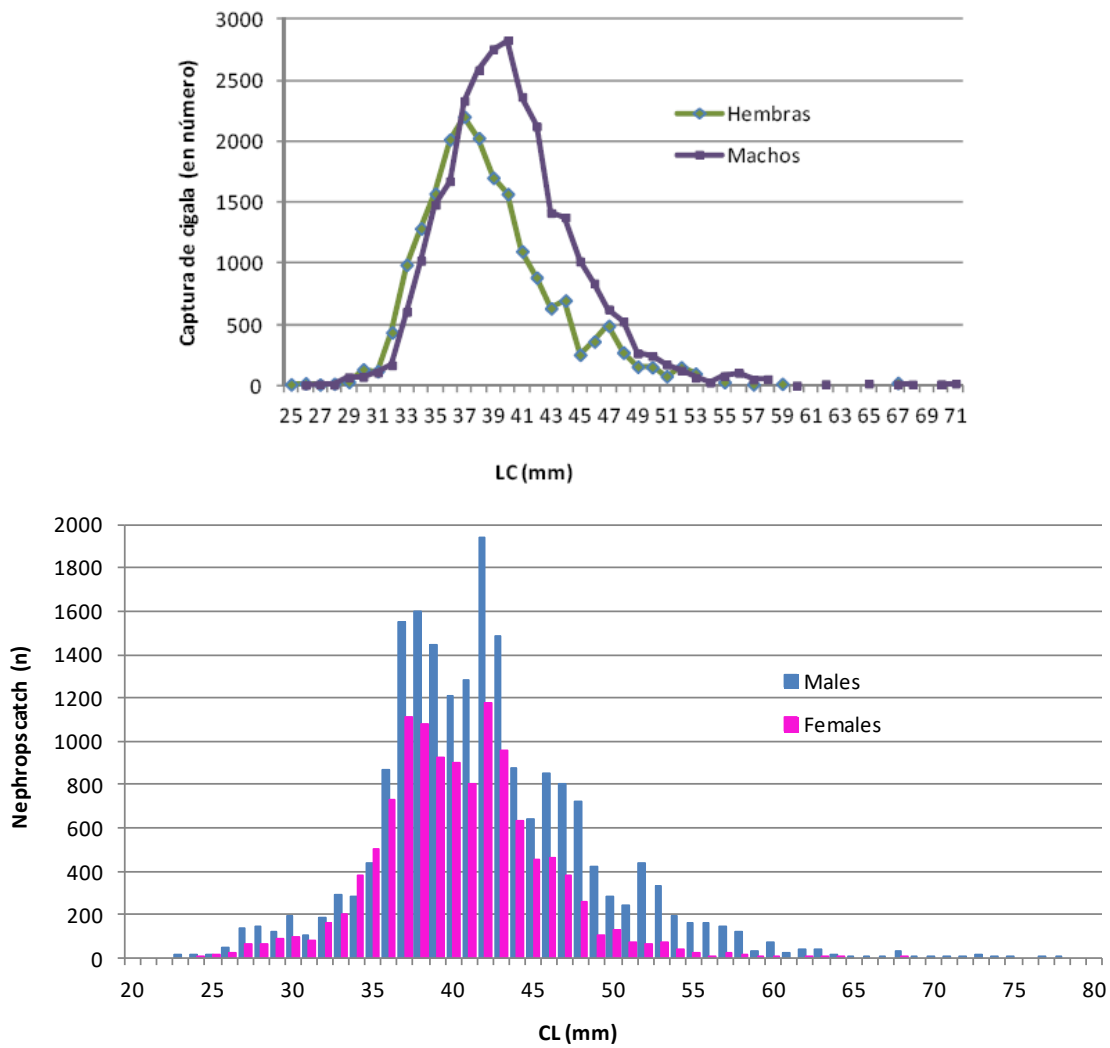


Figure 4. Length frequency distribution for *Nephrops* catch for males and females . Up: 2019, males in blue, females in gree. Down: 2017.

Table 4. *Nephrops* mean sizes for males and females in surveys 2017 and 2018.

	Mean size		
	2017	2018	2019
Males	41.7	42.1	40.3
Females	39.8	40.3	38.7

Nephrops weight in catch

The percentage of *Nephrops* in the catch in weight is shown in Table 5. In 2019, *Nephrops* catch represents 32% in the directed hauls and 0% in the non directed hauls.

Table 5. Percentage of *Nephrops* weight in total catch.

Sentinel	Total hauls		Directed to Nep		Non directed	
	N	% Nep	N	%Nep	N	%Nep
2017	79	15	54	15	25	1
2018	103	8	66	12	37	6
2019	49	14	22	32	27	0

CPUE associated species

Data concerning associated species were collected. Retained catch per effort unit (LPUE) and discard per effort unit (DPUE) were roughly estimated (Table 6) for the whole survey (hauls directed and not directed to *Nephrops*). The *Nephrops* LPUE and DPUE in Table 6 allow identify the *Nephrops* LPUE and DPUE positions among the other species data, but the suitable *Nephrops* CPUE data are those presented in Table 3.

Table 6. Landed and discarded main species catch per effort unit (LPUE and DPUE) in kg/hour (all hauls). *Nephrops* appears shaded. LPUE = $\sum \text{landings (kg)} / \sum \text{effort (hours)}$. DPUE = $\sum \text{discard (kg)} / \sum \text{effort (hours)}$.

Species	LPUE		
Merluccius merluccius	17.4		
Nephrops norvegicus	8.2		
Lepidorhombus spp	6.1		
Micromesistius poutassou	2.3	Species	DPUE
Lophius spp	1.6	Munida spp	3.4
Trachurus trachurus	1.5	Galeus spp	3.3
Scyliorhinus canicula	1.2	Nephrops norvegicus	1.0
Illex coindetii	0.6	Merluccius merluccius	0.5
Eledone cirrhosa	0.4	Micromesistius poutassou	0.5
Triglidae	0.4	Polybius henslowi	0.4
Phycis blennoides	0.4	Holothuria spp	0.4
Helicolenus dactylopterus	0.3	Trachurus trachurus	0.2
Trisopterus luscus	0.2	Lepidorhombus spp	0.2
Holothuria spp	0.1	Crustacea	0.1

DISCUSSION

Nephrops CPUE average obtained in the *Nephrops* directed hauls of the Sentinel fishery (Table 3, 9.5 kg/hour) is higher than the maximum of the FU 25 commercial fleet time series 1975-2016 (4.1 kg/hour) (Figure 5). In this commercial fleet there are hauls directed and not directed to *Nephrops* in the same trip and LPUE data are calculated on trip bases. If we take into account Sentinel *Nephrops* directed and no directed hauls the average is 5.3 kg/hour (Table 3), still being higher than the commercial series maximum (Figure 5). FU 25 CPUE estimations from “Demersales” scientific survey, and adjacent functional units (FUs 31 and 26) CPUE data (Figure 6, Table 7) corroborate commercial fleet CPUE data (Figure 5).

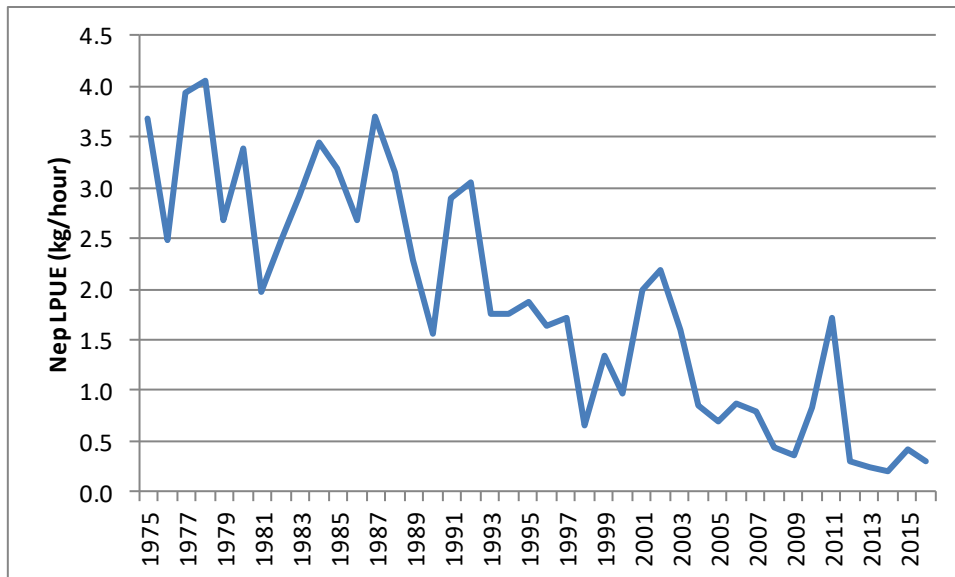


Figure 5. FU 25 *Nephrops* LPUE in kg/hour 1975-2016 from commercial fishery.

Table 7. *Nephrops* LPUE (kg/hour) from different sources and functional units.

	NEP LPUE (kg/hour)
FU 25 Sentinel (2017-2019 average)	5.3
FU 25 commercial fleet 2016	0.3
FU 25 “Demersales” trawl survey 2019	0.1
FU 31 commercial fleet 2016	0.2
FU 31 “Demersales” trawl survey 2019	0.1
FU 26 “Demersales” trawl survey 2017	0.02

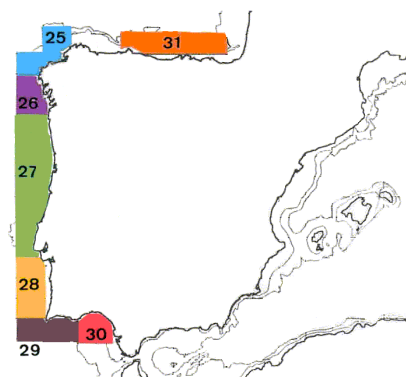


Figure 6. Location of different Functional Units of *Nephrops*.

CPUE values can remain high even when stocks are rapidly depleted (hyperstability) (ICES, 2019). This can happen if catches rates are derived from fishing activities that remain concentrated in areas or periods of relatively higher abundance, as it happened in the FU 25 Sentinel fishery (Figures 7 and 8). In both cases, the CPUE is not representative of the abundance of the the stock.

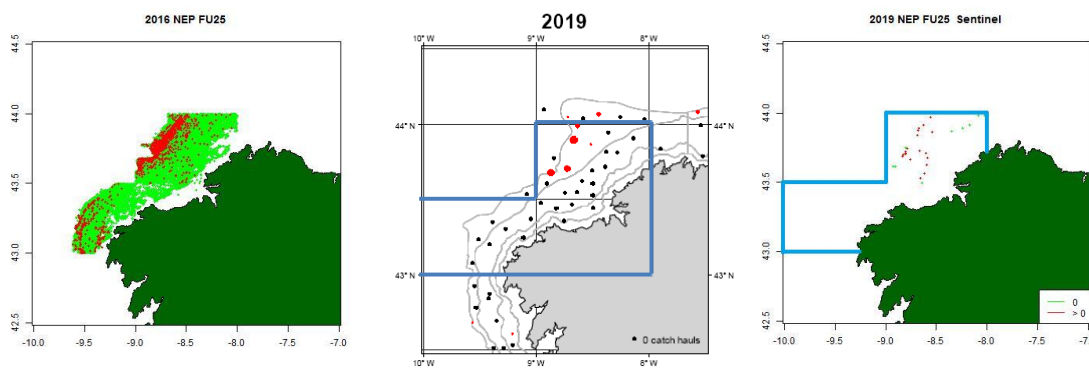


Fig. 7. *Nephrops* presence (red) in FU 25. Left: commercial fleet. Center: survey. Right: 2019 Sentinel. In blue FU limits.

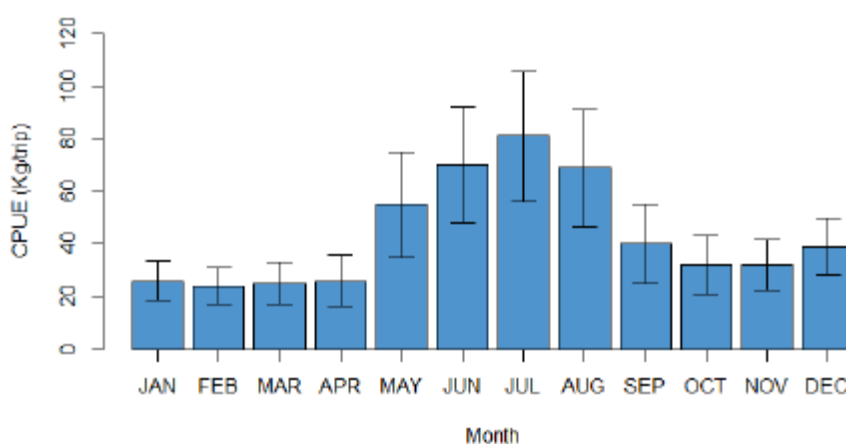


Figure 8. *Nephrops* CPUE in FU 25 (1980-2008) from commercial fleet (ICES, 2019).

CONCLUSIONS

- FU 25 CPUE rates obtained in the Sentinel fishery are higher than the maximum of the 1975-2016 FU 25 CPUE time series.
- The Sentinel fishery in the area and period of high abundance has led to a hyperstability of the catch rates.
- Therefore, *Nephrops* CPUE data from FU 25 Sentinel fishery (2017-2020) are not representative of the stock.

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Annex I

Observers Survey framework authorized by the General Secretariat of Fisheries (SGP).

 MINISTERIO DE AGRICULTURA, PESCA Y ALIMENTACIÓN		SECRETARÍA GENERAL DE PESCA DIRECCIÓN GENERAL DE ORDENACIÓN PESQUERA Y ACUICULTURA SUBDIRECCIÓN GENERAL DE CONTROL INSPECCIÓN	
DE:	SUBDIRECCIÓN GENERAL DE CONTROL E INSPECCIÓN		
A:	IEO - CENTRO OCEANOGRÁFICO DE A CORUÑA (fax: 981 229 077) DIRECCIÓN ÁREA FUNCIONAL DE AGRICULTURA Y PESCA DE A CORUÑA SUB. GRAL. DE PROTECCIÓN DE LOS RECURSOS PESQUEROS SUB. GRAL. DE CALADERO NACIONAL Y AGUAS COMUNITARIAS		
ASUNTO:	CAMPAÑA IEO - CENTINELA - CIGALA UF-25		
S/REF:	N/REF:	TMS/JAF	
FECHA:	26 de julio de 2019		
NUMERO PAGINAS INCLUYENDO PORTADA: 2			
<p>En el marco del estudio del IEO en relación a una campaña sobre el índice de población de cigala en la Unidad Funcional (FU) 25, se autoriza a los buques pesqueros "BURELES", "FE-2-1-97", Código U.E.: ESP000023450 y "ANA ISABEL", "VI-5-8-00", Código U.E.: ESP000024668 a realizar, esta campaña.</p> <p>La presente autorización queda subordinada a las siguientes condiciones:</p> <ul style="list-style-type: none"> • Arte de pesca autorizado: Arrastre de fondo, según Anexo I del Reglamento (CE) nº 850/98 del Consejo de 30 de marzo de 1998. • Periodo de validez de la autorización: 5 mareas por buque/mes del día 1 de agosto al 30 de septiembre de lunes a viernes. Total de mareas 20 (10 por buque). • Zona de actividad: Unidad funcional 25, correspondiente al Caladero Nacional del CNW (CIEM VIIIc). • Especies objetivo: Cigala. Con posibilidad de estudio de otras especies secundarias (gallo, rape, merluza, etc). El tope de capturas de cigala será de 2.000 kg para la totalidad de la campaña. • Será obligatorio por parte del patrón del pesquero, reseñar en el diario de a bordo que la marea se encuentra bajo campaña científica, para ello tendrá que cumplimentar en el DEA en "Salida de Puerto" el campo "Actividad prevista" con la opción "Investigación científica". 			
C/VALLESGUARDIA, 147 28071 MADRID TEL. 91 871988 FAX: 91 471112			

Annex I cont



- Las cantidades de capturas serán contabilizadas a parte de la cuota general asignada a España hasta el máximo del 2% sobre dicha cuota.
- Las capturas se deberán desembarcar en el puerto de A Coruña, puerto habitual de descarga de estos pesqueros, permitiendo su comercialización, excepto ejemplares de tamaño inferior al reglamentario.
- El pesquero deberá disponer de un equipo de localización de buques vía satélite (caja azul) que se encuentre activo y operativo durante su permanencia en la mar.
- Deberá encontrarse a bordo personal del IEO los días efectivos de investigación y solo se considerarán esos días dentro de la presente autorización.
- Se deberá cumplir con todo lo establecido por el Reglamento (CE) nº 1224/2009 del Consejo, de 20 de noviembre de 2009, por el que se establece un régimen comunitario de control.
- A fin de poder conocer los días concretos de actividad, será necesario comunicar a esta Subdirección General (inspecpm@mapama.es) con al menos 24h de antelación el día o días a llevar a cabo dicha actividad.

Esta autorización es complementaria a la licencia comunitaria y a las respectivas autorizaciones de pesca que disponga cada pesquero y por tanto deberá llevarse a bordo.

La presente autorización se concede exclusivamente para el ámbito de la actividad pesquera y, por tanto, está condicionado al cumplimiento de la normativa en materia de seguridad y demás aspectos de la navegación que exige la Dirección General de la Marina Mercante.

La Subdirectora General de Control e Inspección




Teresa Molina Schmid

Annex II

Characteristics of hauls carried out during observers survey, total catch retained catch and *Nephrops* catch by haul.

Haul	Starting date	Starting hour	Duration (hh:mm)	Mean depth (m)	Total catch (kg)	Nephrops catch (kg)
1	01-ago-19	4:30	7:00	198	439	196
2	01-ago-19	13:00	5:45	270	308	88
3	02-ago-19	5:26	6:34	395	305	150
4	02-ago-19	13:00	2:10	217	42	0
5	07-ago-19	5:40	6:52	367	253	220
6	07-ago-19	13:36	5:24	229	128	0
7	07-ago-19	19:30	2:36	224	127	0
8	08-ago-19	5:18	6:42	366	281	149
9	08-ago-19	14:35	2:59	234	103	0
10	08-ago-19	18:10	4:20	177	105	0
11	12-ago-19	1:15	4:25	362	143	0
12	12-ago-19	6:07	7:30	177	394	143
13	12-ago-19	14:45	4:11	192	370	0
14	12-ago-19	19:34	3:31	249	127	0
15	13-ago-19	6:57	7:31	382	448	270
16	13-ago-19	15:28	4:48	223	267	0
17	21-ago-19	1:02	5:28	394	145	0
18	21-ago-19	7:15	6:42	185	352	150
19	21-ago-19	14:40	3:57	282	117	0
20	21-ago-19	19:10	3:08	205	243	0
21	22-ago-19	6:30	7:00	360	352	117
22	22-ago-19	14:45	3:15	368	246	39
23	22-ago-19	19:53	4:08	162	265	0
24	28-ago-19	6:52	7:00	383	270	120
25	28-ago-19	14:50	3:30	372	131	31
26	29-ago-19	2:44	3:34	419	637	0
27	29-ago-19	7:25	6:20	463	510	270
28	29-ago-19	14:50	4:10	160	218	0
29	29-ago-19	19:30	4:25	148	194	0
30	11-sep-19	0:20	4:00	434	221	0
31	11-sep-19	5:00	3:58	221	211	0
32	11-sep-19	9:41	4:59	167	372	90
33	11-sep-19	16:25	5:49	185	171	0
34	12-sep-19	5:36	6:09	403	268	78
35	12-sep-19	13:00	4:34	194	187	0
36	12-sep-19	18:10	5:50	148	396	0
37	18-sep-19	0:50	5:25	442	190	0
38	18-sep-19	7:05	4:35	436	210	35
39	18-sep-19	12:25	4:30	160	178	45
40	18-sep-19	18:05	5:10	165	264	0
41	19-sep-19	5:42	6:03	392	286	37
42	19-sep-19	13:20	5:40	341	322	21
43	19-sep-19	20:10	4:00	161	219	0
44	25-sep-19	6:08	5:30	323	253	36
45	25-sep-19	12:35	5:25	417	235	21
46	25-sep-19	19:10	4:00	159	179	0
47	26-sep-19	6:33	5:57	452	357	45
48	26-sep-19	13:17	4:23	412	193	6
49	26-sep-19	18:50	4:08	160	239	0