Tropical tuna acoustic selectivity studies and experimental new FADs ecologically designed (reducing by-catch) through experimental cruises in Spanish purse seiners in the Indian ocean.

by

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Abstract

At the present time it is developing, in the Indian ocean, a project in which participate four Spanish boats (two purse seiners and two supplies). It is a pilot project in which participate the shipowners' company ALBACORA S.A. and the Spanish Oceanographic Institute (IEO).

This pilot action mainly aims to make progress in improving the mode of fishing over objects where the impact on stocks of the most sensitive species (bigeye and yellowfin) and the ecosystem (bycatches) is concerned.

To this end, acoustic data will be collected using up-to-date devices (sonar and echosounders) and subsequently analysed to establish criteria that will enable a reduction in catches of juveniles tropical tuna (yellowfin, and essentially, bigeye), based on acoustic selectivity.

At the same time, experiments will be undertaken with several prototypes of artificial floating objects and their behaviour will be studied, to find a typology that will result in fewer bycatches (particularly focussing on the exclusion of accessory catches of turtles) without reducing catches of target species.

Data will be collected for six months, from May to November 2005.

1. - Pilot Action → Definition

The Spanish Fishing Administration destines part of its budget to subsidising specific projects called Pilot Actions. Each year a series of these projects covering various fishing issues is presented to the Administration by several shipowners' associations. The Administration chooses and finances the most interesting among them, based on a scientific report from the Spanish Oceanographic Institute.

Participating in this Pilot Action are the following: the Spanish Fishing Administration—through the Secretary General for Maritime Fishing—, the shipowners' company ALBACORA S.A. and the Spanish Oceanographic Institute.

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2. - Introduction and background

The Spanish tuna purse-seine fleet operates in intertropical waters in three oceans, with annual catches amounting to around 250,000 t. These catches are obtained in two ways: over artificial floating objects and in free schools. Both sets result in catches of the same species; however, there are differences in specific composition and size, as well as in volume and the number and type of species that constitute the accompanying fauna.

Fishery over free schools or with natural floating objects was traditional until the appearance of fishing over artificial floating objects, which developed from the mid eighties until the early nineties, depending on which ocean. Currently, the catches obtained with either mode of fishing are around 50% (bearing in mind catches from the Atlantic, Indian and East Pacific Oceans). Since the onset of large scale fishing over artificial floating objects the type of object used has not varied substantially (which is not the case for detection systems or the type of localizer borne by the objects). Although the fishery over floating objects has increased purse-seine efficiency and subsequently the catches (particularly of skipjack), the large scale use of objects has had effects on the fishery that were unusual prior to its introduction. On the one hand, catches of numerous accessory species (especially in specific cases and space-time strata) including: sharks, turtles and other fish species (none of which are useful species for purse-seine fisheries); and on the other, the presence and catches of juveniles yellowfin and bigeye tropical tuna (non-target species for this fishery and infrequently caught in free school).

The impact of this mode of fishing on the ecosystem and the exploitation profile generated have meant that fishing over floating objects with boys or FADs has become a cause for concern for the different RFMOs (Regional Fishing Management Organization) responsible for assessing and managing tuna stocks.
The RFMOs have provided recommendations about the need to increase knowledge about this mode of fishing, with a view to assessing its real impact on stocks and to devising appropriate management measures.

3. - Objectives

This pilot action mainly aims to make progress in improving the mode of fishing over objects where the impact on stocks of the most sensitive species (bigeye and yellowfin) and the ecosystem (bycatches) is concerned.

To this end, experiments will be undertaken with several prototypes of artificial floating objects and their behaviour will be studied. The aim is to find a typology that will result in fewer bycatches (particularly focussing on the exclusion of accessory catches of turtles) without reducing catches of target species. At the same time, acoustic data will be collected using up-to-date devices (sonar and echosounders) and subsequently analysed to establish criteria that will enable a reduction in catches of juveniles tropical tuna (yellowfin, and essentially, bigeye), based on acoustic selectivity.

4. - Innovations of this Pilot Action

First-time use of acoustic techniques, aimed at discriminating tropical tuna species and sizes associated with artificial floating objects. The objective of this study is two-fold: a) to examine the aggregation criteria of the different species and sizes and b) to discover school composition prior to the set. Both objectives converge with the final objective,

which is to achieve a reduction in catches of specific species and juveniles specimens that may be suffering overexploitation; in short, to improve purse seine selectivity.

Design and use of new artificial floating objects that are “more respectful” of turtles and other species that group and become entangled in nets hanging from floating objects, while also attempting to maintain the attraction of the tropical tuna that concentrate around them.

5. - Geographical area and duration

Given that the fleet’s most important catches are made in the Indian Ocean, this ocean is then the perfect place to carry out this pilot action. Data will be collected for six months, from May to November 2005.

6. - Methodology

The pilot action will be carried out from two Spanish tuna purse seiners (Albacán and Albacora Quince) and two supplies vessels (Zahara Tres and Taraska).

The vessels used in the experiment will perform different tasks. There are two teams, each composed of a purse seiner and a support vessel. The mission of one of the teams is essentially to collect acoustic data, using the echosounder and sonar installed in the purse seiner and support vessel, and to validate findings with the fisheries undertaken by the purse seiner. The other team will focus on following up objects designed to reduce accidental catches of species, mainly turtles. The catches obtained with “classic” objects will be placed and examined simultaneously in order to confirm the effectiveness of the new objects.

Tasks are separated so as to reduce acoustic data collection to just two vessels, since extensive and complex equipment is required for data storage and treatment. Data collection about the objects can be undertaken by the four vessels involved in the experiment.

The pilot action will be carried out in two three-month stages. After the first stage, the four observers will be changed and the activities may be reconsidered or modified if necessary.

The acoustic devices are those normally used by the vessels since, on principle, the results of this type of scheme must be immediately applied to the fishing sector. The only changes introduced have been to improve data storage to facilitate subsequent treatment.
During trips, the observers collect extensive information about all the vessel’s activities and store information from the echosounder and sonar in precise locations. To this end, they are equipped with a series of forms that can be divided into three groups:

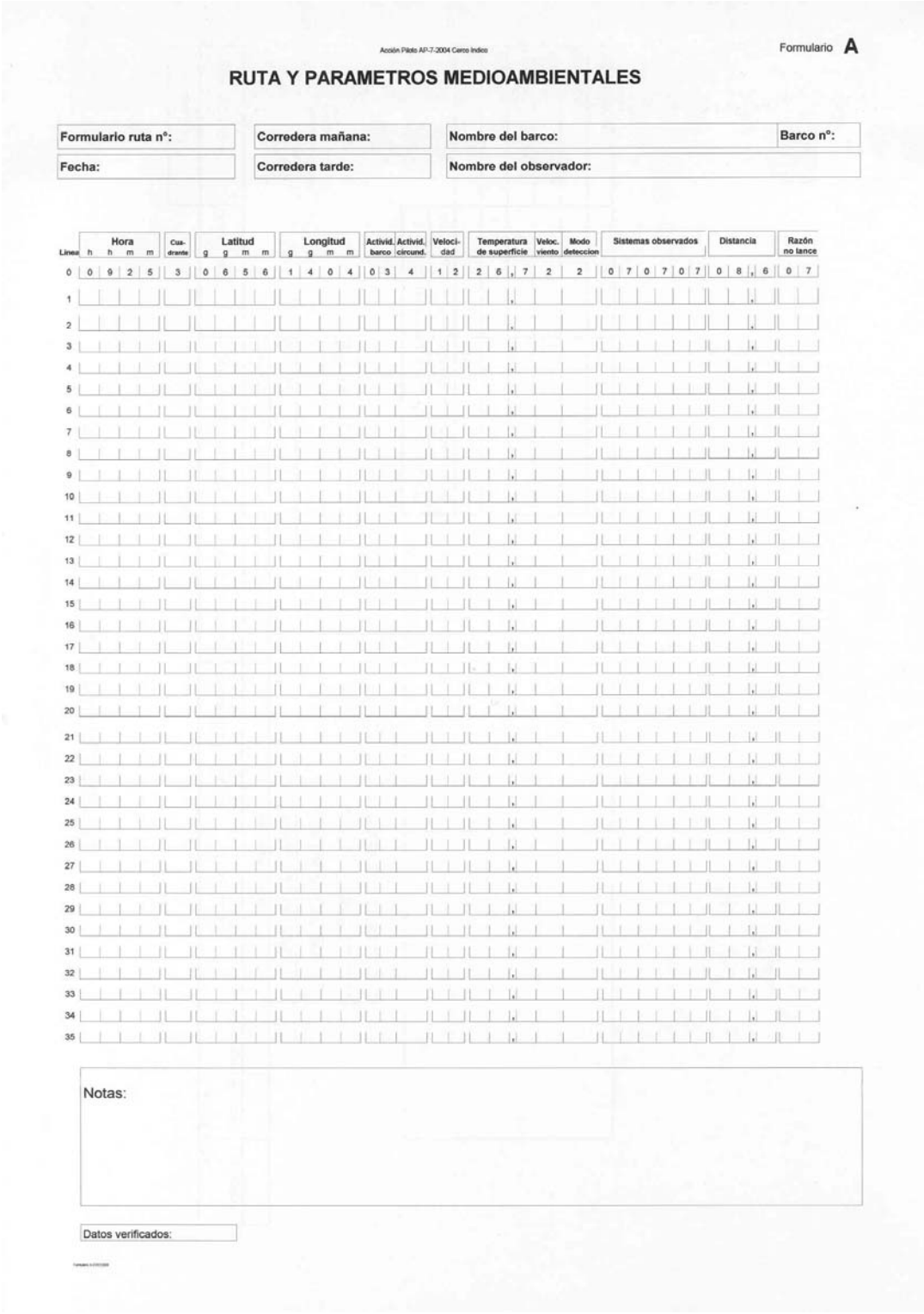
1. Vessel Activity
    a. Route form and environmental parameters (Figure 1): this will provide us with data for every hour and change of activity for each vessel.
    b. Fishing and sampling form (Figures 2, 3 and 4): the fishing form gives all information about the set, including catches of tuna and accessory species, in addition to discards.

2. Objects

a. Form containing the characteristics of traditional and experimental objects (Figure 5): this form is for collecting information about each object when it is deployed, visited or fished.

3. Acoustic Data
    a. Echosounder data form (Figure 6): used to note down the data for each sounder recording.
    b. Sonar data form (Figure 7): used to note down the data for each sonar recording.

Each vessel has a different protocol for collecting general data and acoustic sampling data, depending on whether the team is dedicated to acoustic data collection or not and to whether it is a purse seiner or support vessel.



Acción Piloto AP-7-2004 Cerco Índico

Formulario **A**

RUTA Y PARAMETROS MEDIOAMBIENTALES

Formulario ruta nº:	**Corredera mañana:**	**Nombre del barco:**	**Barco nº:**
Fecha:	**Corredera tarde:**	**Nombre del observador:**	

Linea	Hora (h h m m)	Cuadrante	Latitud (g g m m)	Longitud (g g m m)	Activid. barco	Activid. circund.	Velocidad	Temperatura de superficie	Veloc. viento	Modo deteccion	Sistemas observados	Distancia	Razón no lance
0	0 9 2 5	3	0 6 5 6	1 4 0 4	0	3 4	1 2	2 6 , 7	2	2	0 7 0 7 0 7	0 8 , 6	0 7
1								,				,	
2								,				,	
3								,				,	
4								,				,	
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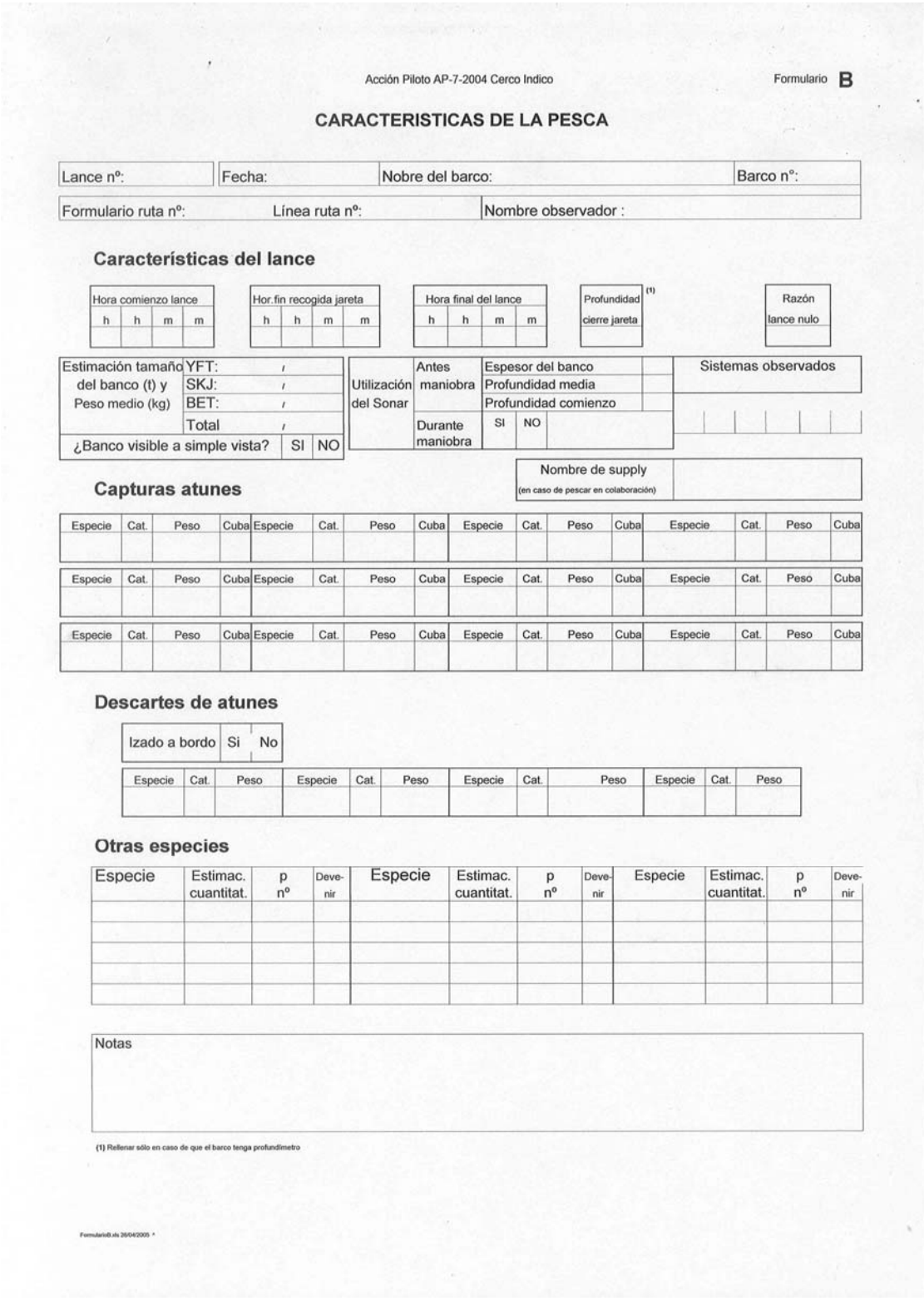
31								,				,	
32								,				,	
33								,				,	
34								,				,	
35								,				,	

Notas:

Datos verificados:

Figure 1. Route form



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Formulario **B**

CARACTERISTICAS DE LA PESCA

Lance nº:	Fecha:	Nobre del barco:	Barco nº:
Formulario ruta nº:	Línea ruta nº:	Nombre observador :	

Características del lance

Hora comienzo lance				Hor.fin recogida jareta				Hora final del lance				Profundidad cierre jareta (1)	Razón lance nulo
h	h	m	m	h	h	m	m	h	h	m	m		

Estimación tamaño del banco (t) y Peso medio (kg)				Utilización del Sonar				Sistemas observados
	YFT:	/			Antes maniobra	Espesor del banco		
	SKJ:	/				Profundidad media		
	BET:	/				Profundidad comienzo		
	Total	/			Durante maniobra	SI	NO	
¿Banco visible a simple vista?	SI	NO						

Nombre de supply (en caso de pescar en colaboración)	

Capturas atunes

Especie	Cat.	Peso	Cuba	Especie	Cat.	Peso	Cuba	Especie	Cat.	Peso	Cuba	Especie	Cat.	Peso	Cuba

Descartes de atunes

Izado a bordo	Si	No

Especie	Cat.	Peso	Especie	Cat.	Peso	Especie	Cat.	Peso	Especie	Cat.	Peso

Otras especies

Especie	Estimac. cuantitat.	p nº	Deve-nir	Especie	Estimac. cuantitat.	p nº	Deve-nir	Especie	Estimac. cuantitat.	p nº	Deve-nir

Notas

(1) Rellenar sólo en caso de que el barco tenga profundímetro

FormularioB.xls 26/04/2005 *

Figure 2. Fishing form

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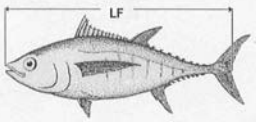
Formulario C1

MUESTREO ATUNES

Formulario muestreo n°:	Lance n°:	Fecha:	Nombre observador:
Formulario ruta n°: Línea ruta n°:		Nombre barco:	Barco n°:

Captura ☐

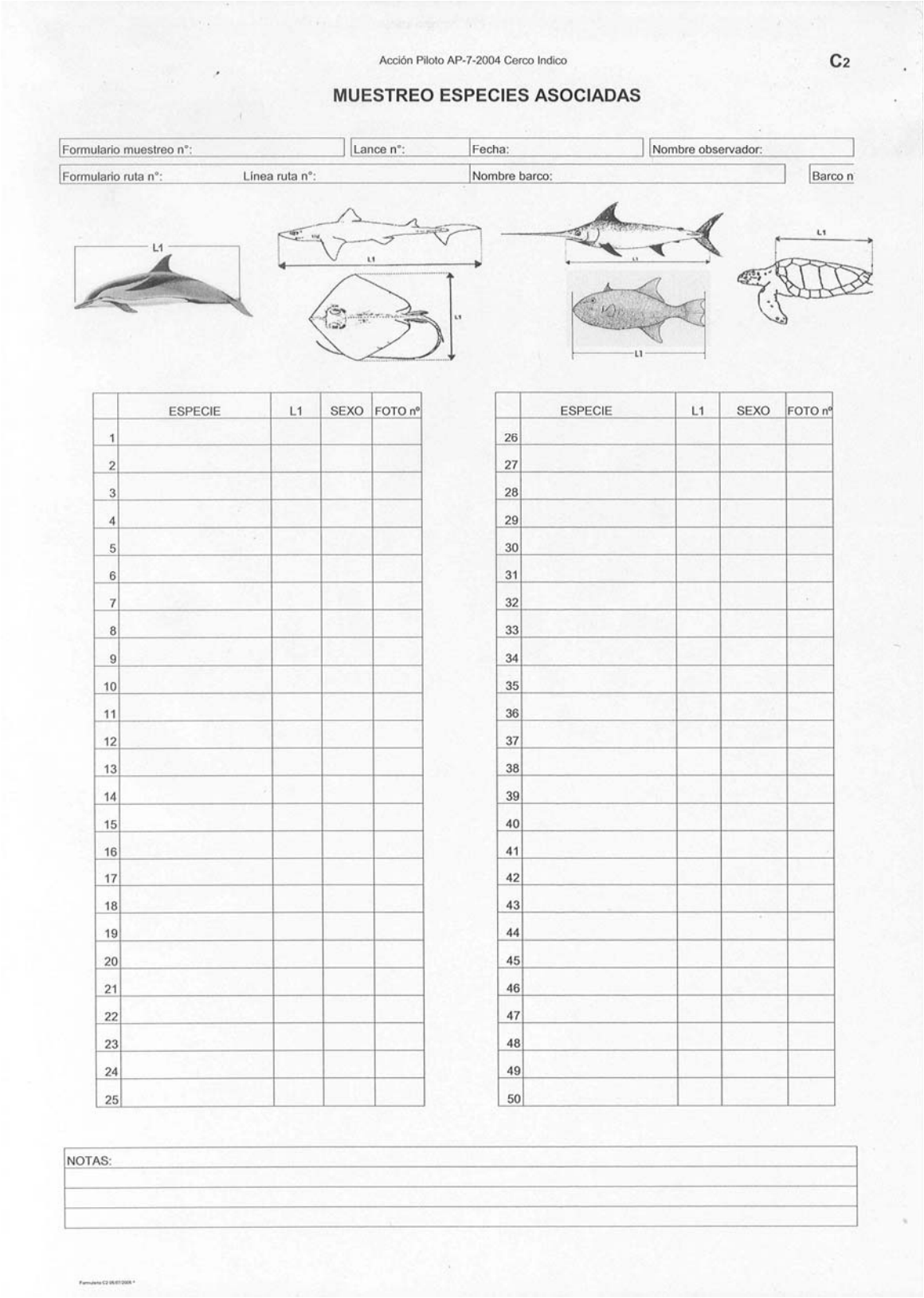
Descartes ☐



	RABIL		LISTADO		PATUDO		MELVA	BACORETA
	LF	LF	LF	LF	LF	LF	LF	LF
0		0	0	0	0	0	0	0
1		1	1	1	1	1	1	1
2		2	2	2	2	2	2	2
3		3	3	3	3	3	3	3
4		4	4	4	4	4	4	4
5		5	5	5	5	5	5	5
6		6	6	6	6	6	6	6
7		7	7	7	7	7	7	7
8		8	8	8	8	8	8	8
9		9	9	9	9	9	9	9
0		0	0	0	0	0	0	0
1		1	1	1	1	1	1	1
2		2	2	2	2	2	2	2
3		3	3	3	3	3	3	3
4		4	4	4	4	4	4	4
5		5	5	5	5	5	5	5
6		6	6	6	6	6	6	6
7		7	7	7	7	7	7	7
8		8	8	8	8	8	8	8
9		9	9	9	9	9	9	9
0		0	0	0	0	0	0	0
1		1	1	1	1	1	1	1
2		2	2	2	2	2	2	2
3		3	3	3	3	3	3	3
4		4	4	4	4	4	4	4
5		5	5	5	5	5	5	5
6		6	6	6	6	6	6	6
7		7	7	7	7	7	7	7
8		8	8	8	8	8	8	8
9		9	9	9	9	9	9	9
0		0	0	0	0	0	0	0
1		1	1	1	1	1	1	1
2		2	2	2	2	2	2	2
3		3	3	3	3	3	3	3
4		4	4	4	4	4	4	4
5		5	5	5	5	5	5	5
6		6	6	6	6	6	6	6
7		7	7	7	7	7	7	7
8		8	8	8	8	8	8	8
9		9	9	9	9	9	9	9
0		0	0	0	0	0	0	0
1		1	1	1	1	1	1	1
2		2	2	2	2	2	2	2
3		3	3	3	3	3	3	3
4		4	4	4	4	4	4	4
5		5	5	5	5	5	5	5
6		6	6	6	6	6	6	6
7		7	7	7	7	7	7	7
8		8	8	8	8	8	8	8
9		9	9	9	9	9	9	9

Notas:

Figure 3. Tuna sampling form



Acción Piloto AP-7-2004 Cerco Indico C2

MUESTREO ESPECIES ASOCIADAS

Formulario muestreo n°:	Lance n°:	Fecha:	Nombre observador:
Formulario ruta n°: Línea ruta n°:		Nombre barco:	Barco n

	ESPECIE	L1	SEXO	FOTO nº
1				
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	ESPECIE	L1	SEXO	FOTO nº
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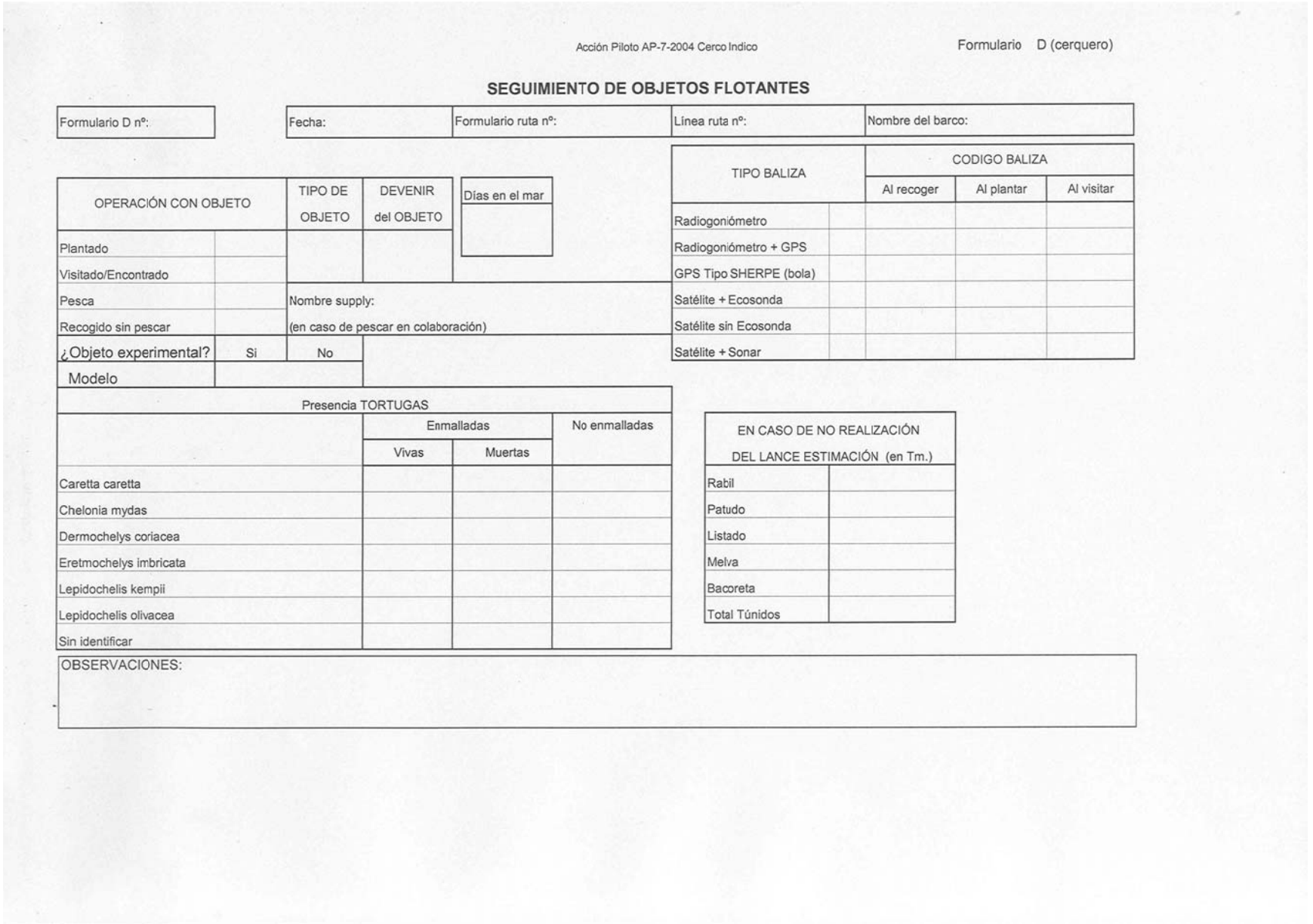
50				

NOTAS:

Figure 4. By catch sampling fomr



Acción Piloto AP-7-2004 Cerco Indico

Formulario D (cerquero)

SEGUIMIENTO DE OBJETOS FLOTANTES

Formulario D nº:	Fecha:	Formulario ruta nº:	Línea ruta nº:	Nombre del barco:

OPERACIÓN CON OBJETO		TIPO DE OBJETO	DEVENIR del OBJETO	Días en el mar
Plantado				
Visitado/Encontrado				
Pesca		Nombre supply:		
Recogido sin pescar		(en caso de pescar en colaboración)		
¿Objeto experimental?	Si	No		
Modelo				

TIPO BALIZA		CODIGO BALIZA		
		Al recoger	Al plantar	Al visitar
Radiogoniómetro				
Radiogoniómetro + GPS				
GPS Tipo SHERPE (bola)				
Satélite + Ecosonda				
Satélite sin Ecosonda				
Satélite + Sonar				

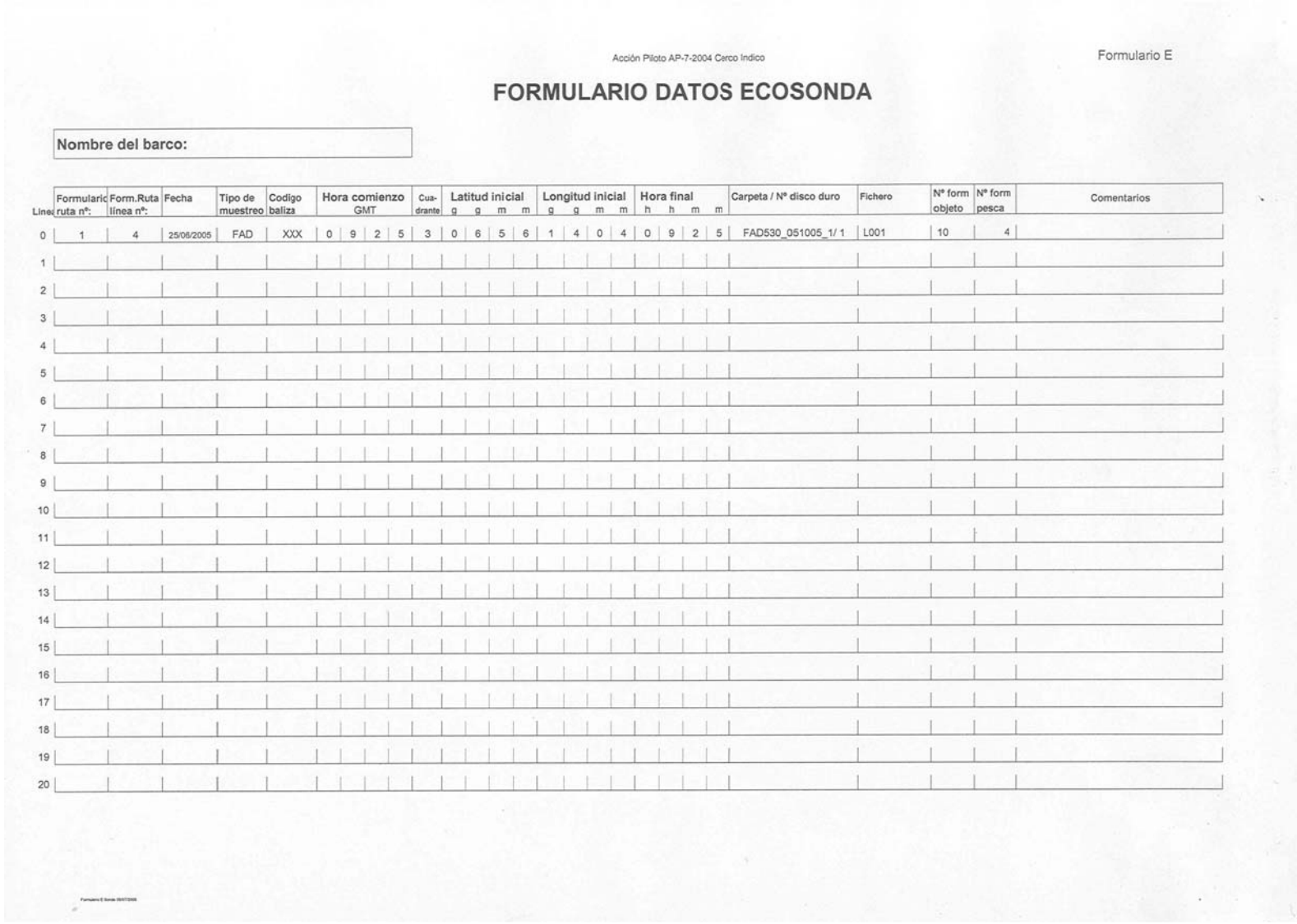
Presencia TORTUGAS	Enmalladas		No enmalladas
	Vivas	Muertas	
Caretta caretta			
Chelonia mydas			
Dermochelys coriacea			
Eretmochelys imbricata			
Lepidochelis kempii			
Lepidochelis olivacea			
Sin identificar			

EN CASO DE NO REALIZACIÓN DEL LANCE ESTIMACIÓN (en Tm.)	
Rabil	
Patudo	
Listado	
Melva	
Bacoreta	
Total Túnidos	

OBSERVACIONES:

Figure 5. Object form

Figure 6. Echo sounder form



Acción Piloto AP-7-2004 Cerco Indico

Formulario E

FORMULARIO DATOS ECOSONDA

Nombre del barco:

Linea	Formularic ruta nº:	Form.Ruta línea nº:	Fecha	Tipo de muestreo	Codigo baliza	Hora comienzo GMT	Cua-drante	Latitud inicial g g m m	Longitud inicial g g m m	Hora final h h m m	Carpeta / Nº disco duro	Fichero	Nº form objeto	Nº form pesca	Comentarios
0	1	4	25/06/2005	FAD	XXX	0925	3	0656	1404	0925	FAD530_051005_1/ 1	L001	10	4	
1															
2															
3															
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19															
20															

Acción Piloto AP-7-2004 Cerco Indico

Formulario **F**

Sonar omnidirectional

Mode:			
Lance nº:	Fecha:	Nombre del barco:	Barco n°:
Formulario ruta nº:	Línea ruta nº:	Nombre observador :	
Interface scientific: Yes / No	File name begining:	End:	
	Directory:		

Snap shot file name		
Step time:	Begining:	End:

Auto tracking:	

1 st FAD Position	
Mark : △	
Time sonar:	

Sonar Mode:	
Tilt:	
Range Horiz:	Vertic:
TVG type:	
RCG:	
PP:	
AGC:	
Video gain:	
Acoustic gain:	
Power TX:	
Pulse form:	
Ping sector:	

2 nd FAD Position	
Mark : △	
Time sonar:	

Fishing device sensor:	
Wind strenght:	**Direction:**

Notas:

Figure 7. Sonar form