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Report of the November 2016 Lima workshop on Fishing Vessels as Scientific Platforms

IREA

SPRFMO TASK GROUP ON FISHING VESSELS AS SCIENTIFIC PLATFORMS.

REPORT OF THE 2nd WORKSHOP, LIMA, 7-11 Nov. 2016

IREA, July 2017

INTRODUCTION

During the 2nd meeting of the SPRFM Scientific Committee, it was recommended to the Task Group on "Fisheries vessels as scientific platforms" to evaluate the values of target strength of the CJM and define a series of accepted equations to be used by all the members of the SPRFMO. In addition to this task, the question of the vast amount of data collected ant the needs of methods for analyzing them arose and it was decided to evaluate these questions in order to propose some solutions to SPRFMO.

Besides, another point arose and was considered worth a dedicated time for discussion: the need on specific research on pelagic ecosystem monitoring. Indeed the results of discussions during the SPRFMO Scientific Committee meetings showed that some knowledge is still lacking which prevent the SC to take final decisions on the population structure of the Chilean Jack Mackerel population. This knowledge cannot be obtained, neither by the catch data alone, nor by the scientific surveys as they observe a too narrow space/time window inside the wide distribution area of this species. The acoustic and environmental data from fishing vessels, in addition to the previous sources of data, may help to get more information. This set of data is likely to provide a good overview on the ecology of the CJM. This question was discussed during the last day of the workshop. The present document follows this structure and will report on the three themes: (1) definition of standard TS equations to be approved by SPRFMO; (2) data management; and (3) ecosystem monitoring.

The workshop was organized by IREA and hosted by IMARPE. Financial support was provided by the SNP (*Sociedad Nacional de Pesquerías* – National Fisheries Society) of Peru, and the manufacturers Robinson-SIMRAD and Seapix. The agenda of the workshop is given in annex. Participants came from Chile (IFOP, INPESCA), Peru (IMARPE, SNP, Univ. Federico Villareal), France (Ixblue, IREA), Canada (DFO).

I. REPORT ON THE DEFINITION OF A COMMON EQUATION FOR THE TARGET STRENGTH OF THE CHILEAN JACK MACKEREL (CJM) *Trachurus murphyi*

The CJM is largely distributed in the South Pacific Ocean and is exploited and studied by several countries in several separate parts of its overall distribution area.

As such each team and Institution has developed researches in order to establish a TS equation for converting acoustic data into density data (i.e. from acoustic SA to actual number of fish). In most of the cases the standard B20 equation (Foote, 1987) is applied:

$TS = 20 \log L - B_{20}$

B_{20} being a constant in dB and L the total length of the fish (in case data are provided in fork length FL, they must be converted into TL).

A bibliographic exploration gave the following list of equations (table 1):

Table 1. Bibliographical list of TS equations for CJM

Eq. nb	Equation	Authors
1	TS = 20 log L – 68.9	Lillo et al., 1996 (*)
2	TS = 20 log L – 74.9	Peña and Foote, 2008
3	TS = 20 log L – 71.1	Peña and Foote, 2008
4	TS = 20.11 log L – 68.67	Cordova et al., 1998 ; Cordova, 2008
5	TS = 20 log L – 71.9	Value adopted by IMARPE, 1992-1998 (**)
6	TS = 20 log L – 68.1	Value adopted by IMARPE since 1998
7	TS = 20 log L – 66	Peña, 2008
8	TS = 20 log L – 67	Torres et al., 1984
9	TS = 20 log L – 68	Gutierrez and MacLennan. 1998
10	TS = 11.28 log FL – 49	O'Driscoll et al., 2014 (***)

* All the calculations of CJM biomass have been made using this equation (Gutierrez et al., 2016)
** Value calculated from the bibliography and especially Cordova (1998); Simmonds and MacLennan, (2006)
*** Value calculated using fork length for a mixture of 2 species of *Trachurus* (including *murphyi*)

Some other equations were proposed, e.g. the measurement of TS per kilo (Robotham and Castillo, 2009)

$$TS = -32.5 \text{ dB.kg}^{-1} \qquad \text{(equation 11)}$$

This method is valid when no information can be obtained from the demographic structure of the fish, but should not be recommended. In this exercise we will almost exclusively focus on the B_{20} equations, i.e. discarding equations (4) and (10).

RESULTS

A more detailed study of the characteristics of each one of the equations was first achieved and the results are presented in table 2. From this table a series of points appear:

TS using 38 kHz frequency

- Equations (1) from Lillo et al. (1996), (2) from Cordova et al (2008), (9) from Gutierrez and MacLennan (1998), and (8) from Torres (1984) show a good consistency, all of them being in a range of -68.9<B20<-67, i.e. with a maximum difference of 1.9 dB.
- Equation (2) and (3) from Peña and Foote (2008) have not been included, as the author stipulates that the first one (B_{20} = -74 dB and B_{20} = -71.9 dB) was not calculated for abundance estimates but for specific application of theoretical models (Foote, 1995; Macaulay et al., 2013) which were later

acknowledged as not suitable for the specific case of CJM (characteristics of the swimbladder shape). Therefore these two equations were discarded from our analysis.

- Equation (7) from Peña (2008) shows on the contrary a higher value (-66 dB). This case was studied in details. The hypotheses explaining this difference were listed as:

Table 2. Details of the experimental conditions for each series of measurement

Author	Lillo 1996	:ordova 200	Peña 2008	Gutierrez MacLennan	O'Driscoll	Torres 1984	Gutierrez-Castillo
Mean depth	25-50		60-74			not appl.	
geogr. Location	oastal (<100NM	astal (<100NM	ffshore (migrating	coastal (<100NM)		not appl.	coastal (<100NM)
pulse length (ms)	1.024	1.024	0.512	0.512		0.6	1.024
frequency	38 kHz	38 kHz	38 kHz	38 kHz		38 kHz ?	120 kHz
day/night	night	night	night			not appl.	d/n
month	July-August	July-August	August-Sept.	March			1999-2009
fish size			27-30		28.5		
size range	22-40 cm		18-50	33-40			
length measurement	TL	TL	FL	TL	FL	TL	
mix. Spp	no		1 of 3 exp.	no	yes	not appl.	
method	in situ	in situ	in situ	in situ	n situ acoust-op	cage	in situ
samples	>500	>500	>500	139	898		>500
B20	-68.9	-68.7	-66	-68.15	-61.6	-67	-70.8
threshold			-55				
vessel	R/V	R/V	F/V	R/V		experiment	R/V
Echo sounder	EK500	EK60	EK69	EK500		EKS	EK500
Country	Chile	Chile	Chile	Peru	NZ	Chile	Peru

- Existence of one series of measurements achieved inside a multispecific concentration (CJM + mackerel *S. japonicus*) which TS are slightly lower than the CJM's (see below), but which fish were consistently bigger (M = 29 cm; CJM = 27 cm)
- Measurements were achieved in the phase of migration of CJM towards spawning grounds, and this could affect the TS values from two aspects: physiological (higher fat content, effect on the swimbladder) and behavioral (significant change of tilt angle.
- Measurements were performed using fork length instead of total length.

The fat contents and GSI were compared and it appeared that the GSI was not significantly different from the other periods of measurements (GSI during the survey = 0.59%; during spawning, GSI = 2 %). A re-calculation of this equation on single species data and applying TL instead of FL gave a B_{20} value of -67.6 dB, which fits inside the general group of values.

- The particular case of equation (10) by O'Driscoll *et al*. (2013) was discussed. The comparison was not easy as this equation is not expressed as a standard B_{20} formula. A first simple transformation of the values in standard B_{20} equation gave a value of -61 dB, which is far above the others. Nevertheless this equation was calculated for several *Trachurus* species, and more work is needed before to make the equation comparable. The group decided to wait for comments and analyses from the authors before to take the equation into consideration.

The conclusion of the SPRFMO task group was that considering the reasonable comparability of most of the equations calculated for converting acoustics in abundance estimates, the simplest recommendation is to accept the equation developed by Lillo et al. (1996) as the standard equation for CJM.

Besides, this equation is already the standard in Chile and Peru; therefore accepting it as the standard will avoid re-calculating all the historical results.

TS using 120 kHz frequency.

There was no TS equation for 120 kHz calculated so far. During the workshop it was decided to calculate one equation, on recorded data from a survey made in 2011 in the Pisco area in Peru (Castillo, pers. comm.), selecting a series of data around two sets where the catches showed an almost 100 % presence of CJM. 140 echoes were obtained, on fish 34 and 35 cm TL respectively. The proportion of CJM in the catch are given in the table 3.

Table 3. Details of catches in selected areas (from Castillo, pers comm)

Fish set # 62	CJM	Mackerel	Fish set # 68	CJM	Mackerel
Range	34-38 cm	29-33 cm	Range	29-37 cm	25-37 cm
Mode	34 cm	33 cm	Mode	35 cm	32 cm
Catch	87 kg	3 kg	Catch	1500 kg	80 kg
%	96.7	3.3	%	94.9	5.1

The final result was:

$$TS = 20 \log TL - 69.6$$

The result being the only one so far will be considered a provisional standard. Indeed some more experiments should be performed in order to have a more general confirmation (and particularly in other areas, e.g. Chilean waters).

RECOMMENDED EQUATIONS:

Equation for 38 kHz

$$TS = 20 \log TL – 68.9$$

Equation for 120 kHz

$$TS = 20 \log TL – 69.6$$

(TL = total length for both equations)

OTHER RECOMMENDATIONS

The workshop discussed the need of additional researches and agreed that there is need for:

- Designing and perform experiments using more updated equipment (particularly acoustic-optical methods);
- Studying the results from New Zealand which differ significantly from the others and clarify the reasons of these differences.
- Studying of the effect of differences in behavior on TS values (tilt angle, aggregation vs. dispersion, day/night…);
- Achieving coupled measurements 120 and 38 kHz (and other frequencies if possible) on existing recorded data bases where both frequencies are recorded, on areas where CJM represents more than 90 % of the fish. It is particularly important to review the 120 kHz data sets and add some new calculations and results.
- On these historical data, measuring the effect of physiological changes, and if any, a series of dedicated experiments could be performed;
- Measuring the effect of different settings (especially for fishing vessels data).
- Evaluating the possibility of using and/or adapting theoretical models (cf. Macaulay et al 2013) with existing swimbladder data.

II. DATA MANAGEMENT

During the SC meeting, the question of how to manage a huge amount of data from the fishery arose. This point was considered by the TG.

Indeed the flow of data when using modern equipment (e.g. EK80, sonars, multibeam echo sounders, etc.) and fishing vessels increases on several orders of magnitude. It becomes impossible to handle all of them and work separately on each variable. Some data collection, processing and management must be designed.

A first step in this work consists in evaluating the amount of data, detailing their origin, their use, their format and flow. This has been achieved during the workshop (annex 1). It was confirmed that the data base will represent the next priority, due to its dimension. For instance, the actual number of days of survey (when adding the fishing fleet data) in Peru is close to 7000 per year.
It was observed that some hierarchy must be defined for the different sources of acoustic data from fishing vessels (/e.g. standard surveys, standard fishing activities and fishing fleet monitoring).

The workshop agreed that this general question of data base management was critical and worth a dedicated research. Contacts will be taken with experts and recommendations submitted to the SPRFMO S.C. in 2017. Once this exercise achieved, the results will be submitted to the international community for analysis and recommendations. This will be done during the next ICES WGFAST (New Zealand, April, 2017) and the next SPRFMO Scientific Committee meeting (Shanghai, Sept., 2017).

III. ECOSYSTEM MONITORING

This point was not priority in the SPRFMO SC Terms of Reference, but the workshop decided that it was worth some analysis. Indeed it is acknowledged that an Ecosystem Approach to Fisheries is necessary for any fisheries, but more particularly in the case of stocks covering a wide area where the surveys cannot cover exhaustively the distribution area, as is the case of the CJM.

Moreover the analysis of the acoustic data bases (see point 2) showed that a high number of metrics that are collected aboard the vessels presented a great environmental interest, but were poorly exploited in conventional stock assessment research. Therefore it seemed interesting to study the question of ecosystem monitoring and how the data collected could bring useful information.

Information on the ecosystem comes from three sources:

- Catch data. Are used for assessment models, do not provide many information on the environment.
- Environment data (e.g. satellites, buoys, etc.). Used for describing ecosystems. Do not provide information on the stock and its interactions with the ecosystem.
- Acoustic (RV and FV). Provide both fish and a few environment information simultaneously (spatial and biomass), with some capacities to dynamic observations in the case of fisheries acoustic data and systematic frequent single transects (Institutes). But limited in coverage in space and time (limited number of RV surveys) and in providing continuous systematic samples of ecological data (FV)

POTENTIAL ACTIVITIES LINKED TO ECOSYSTEM MONITORING.

- It is admitted now that evolution of populations does not depend exclusively on the catch, and neither on environment: behavior and population strategies of the species play an important role.

- Acoustic information from the fishery is considered as valid for scientific analysis (under some conditions: calibration, equipment onboard, etc...).
- Also, the capacity of acoustics to provide hydrological information is recognized (e.g. oxycline).
- There is a need of permanent observations at sea of the major ecological patterns
- A group such as SPRFMO focuses on fisheries dynamics of the populations, i.e. requires to follow inter/intra annual variability
- results/knowledge from research vessels complement (are complemented by) results from fishing vessels
- Regime shifts increase the need of observations at several scales of time, and particularly at a more frequent range than yearly. This is particularly needed when studying moving populations, spp assemblage, behavior changes, etc. which require a more detailed understanding of the interactions between fish and environment
- One way to link the environment and the stock is through the analysis of the habitat.
- Habitat has been considered from different points of view by the different teams, and especially using ecological modeling (EU and SNP) and biophysical modeling (Inpesca). Comparing and integrating those models is not easy, and some synthesis is needed. The TG dedicated a consistent amount of time to discuss the question of habitat, and the conclusions are detailed below.

THE HABITAT

The concept of habitat presents a series of practical applications for ecosystem monitoring.

- Habitat can be considered as a way to synthesize the environmental information inside a single indicator.
- Habitat is specific to the target species. The environmental (or other) variables that have no impact on the specific habitat definition can be excluded from the study.
- Habitat is used for several objectives: delimitation of the potential habitat for defining the survey areas; evaluation of the 3D volume of habitat; extrapolation of the acoustic observation windows to the area of presence of CJM ; Analysis of dynamics in the distribution area (; Dynamics of habitat movements along the year; definition of populations structures; definition of impact of biophysical patterns, etc.

The task group suggests developing activities on the ecosystem approach and monitoring through a synthetic indicator, the habitat, e.g. creating a specific working group "HABITAT DEFINITION, DESCRIPTION, MONITORING" inside the SPRFMO SC.

POTENTIAL ACTIVITIES LINKED TO HABITAT STUDIES

A series of works have been performed on CJM, but also on other species, and particularly anchovy in the Peruvian waters: in particular, studies of the effect of El Niño years has been studied in details, as well as the interactions between anchovy habitat, ecological characteristics of the environment and the fishery. Studying these experiences should be of interest to evaluate how these methods could be adapted to the CJM.

There is an important quantity of historical data on the CJM fishery and ecology. Using this historical data set, added to the existing results and models, would allow to define more precisely the CJM habitat and use it for practical habitat monitoring.

Indeed several teams have already begun works on CJM habitat inside the SPRFMO area, under different points of view (Peru: SNP, IMARPE; Chile: INPESCA, IFOP; EU: IMARES, IRD). Integrating these different experiences would allow to produce a precise definition of the CJM habitat including fishery, ecology, behavior and biophysics).

OTHER GENERAL RECOMMENDATIONS

Recommendations referring to acoustic data

- The TS equations calculated by the workshop are considered as standard for SPRFMO.
- A series of experiments as listed above should be recommended to continue precising the equations
- To finalize the inventory of the acoustic instruments and characteristics of the ships exploiting CJM in the different fleets members of SPRFMO.
- To routinely transmit VMS/SISESAT information to SPRFMO
- To use the ecological information likely to be collected from the fishing vessel activity (using the routes of ships, ref. Rocio Joo)

Recommendations linked to large volume data management

To organize a workshop on data management at a date to be decided with the objectives to:

- Evaluate the data flow
- Define the relevant metrics to be collected
- Built synthetic indicators
- Organize the data collection, processing and management

Recommendations on Habitat monitoring

- Create a dedicated working group on the wide theme of “Ecosystem Monitoring” inside SPRFMO (Among other possibilities, one could be to transform the SPRFMO Task Group on Fisheries acoustics which will end its activities in 2017, into a working group on “Ecosystem monitoring” which could be organized/managed by IREA).
- Compare and integrate the different models developed inside the SPRFMO area

Bibliography

Axelsen , B.E., Bauleth-D'Almeida, G. and Kanandjembo , A.,2003 In Situ Measurements of the Acoustic Target Strength of Cape Horse Mackerel Trachurus Trachurus Capensis Off Namibia, African Journal of Marine Science, 25:1, 239-251, DOI: 10.2989/18142320309504013

Cordova, J., Bahamonde, R., and Catasti, V., 2008. Jack Mackerel (*Trachurus Murphyi, Nichols, 1920*) acoustic survey in the central coast of Chile. SPRFMO workshop on Chilean Jack Mackerel, 2008, CHJMWS pap #11

Foote K.G., 1987. Fish target strengths for use in echo integrator surveys. *J. Acoust. Soc. Am.*, **82**: pp. 981-987.

Francis R. I. C. C., 1985. Two acoustic surveys of pelagic fish in Hawke Bay, New Zealand, 1980, New Zealand Journal of Marine and Freshwater Research, 19:3, 375-389, DOI: 10.1080/00288330.1985.9516102

Gutiérrez M. & MacLennan D., 1998. Preliminary results of determination of in situ target strength of main pelagic species: Cruise of RV Humboldt 9803-05 from Tumbes to Tacna. *Inf. Inst. Mar. Peru*, **135**: pp. 16-19.

Lillo, S., Cordova, J., and Paillaman, A., 1996. Target-strength measurements of hake and jack mackerel ICES Journal of Marine Science, 53: 267–271. 1996

Macaulay GJ, Peña H, Fässler SMM, Pedersen G, Ona E (2013) Accuracy of the Kirchhoff-Approximation and Kirchhoff-Ray-Mode Fish Swimbladder Acoustic Scattering Models. PLoS ONE 8(5): e64055. doi:10.1371/journal.pone.0064055

MacLennan D., Fernandes P. & Dalen J., 2002. A consistent approach to definitions and symbols in fisheries acoustics. *ICES J. Mar. Sci.*, **59**: pp. 365-369.

O'Driscoll, R. L., and Macaulay, G. J. 2005. Using fish-processing time to carry out acoustic surveys from commercial vessels. ICES Journal of Marine Science, 62:295e305.

Peña, H. 2008. In situ target-strength measurements of Chilean jack mackerel (Trachurus symmetricus murphyi) collected with a scientific echosounder installed on a fishing vessel. – ICES Journal of Marine Science 65: 594–604.

Peña, H., and Foote, K. G. 2008. Modelling the target strength of Trachurus symmetricus murphyi based on high-resolution swimbladder morphometry using an MRI scanner. – ICES Journal of Marine Science, 65: 1751–1761.

Robotham, H., and Castillo, J., 2009. Selecting the number of transects in multispecies acoustic surveys in northern Chile using a surface occupation index. Aquat. Living Resour. 22, 265-272 (2009) DOI: 10.1051/alr/2009036

Simmonds E.J. and MacLennan D.N., 2005. Fisheries Acoustics. Theory and Practice. Blackwell publishing, Oxford, UK.

Annex 1

List of the data collected during acoustic survey

Grupo	Parametro	Formato	Observaciones
Características del equipo	Nombre de la nave	alfanumérico	Código
	Calibracion (RMS)	alfanumérico	Página de calibración
	Profundidad transductor	numérico	Posición del transductor (sección en el buque, tipo de bote, quilla retractil o fijo)
	Marca, modelo del transductor	alfanumérico	Split beam
	Ruido embarcación	numérico	Test manual del operador
	Tipo, marca y modelo de las ecosondas	alfanumérico	
	Frecuencias de las ecosondas	numérico	4 frecuencias
	Marca modelo sonar	alfa	
Datos acústicos	Sv peces	numérico	
	Sv plancton	numérico	
	NASC	numérico	
	Navegación	numérico	Posición, rumbo, velocidad del buque
	TS	numérico	
	Fecha hora	numérico decimal	Hora local
	Zona horaria	numérico	para estandarizar hora
	Categorías acústicas	alfa	Cardumen, estratos e individuales
	Profundidad deteccion (máxima y mínima)	numérico	
	Threshold	numérico	de -65 a -68 dB
	Velocidad-dirección del cardumenes (sonar)	numérico	
	Morfología del cardumen (sonar)	numérico	
	Sv sonar	numérico	
	Biomasa sonar	numérico	-
	Evitamiento de cardúmenes	numérico	
	Tipo de muestreo	alfa numérico	Biométrico; biológico
	Frecuencia de monitoreo anual	numérico	
	Objetivo del crucero	alfa	
	Area de estudio	alfa numérico	
	Duración del estudio	alfa numérico	40 días
Datos ambientales	SST	numérico	
	Salinidad	numérico	
	Oxigeno	numérico	
	Clorofila	numérico	
	Profundidad del fondo	numérico	
	Distancia de la costa	numérico	

	Información meteorológica Corrientes CTD Datos observadores de depredadores superiores	numérico numérico numérico alfa numérico	
Muestreo biológico	Pesca identificación Proporción de la especie Características del lance Características del muestreo Tipo de red Identificación plancton Estaciones Frequencia de tallas	alfa numérico alfa numérico alfa numérico alfa numérico alfa numérico alfa numérico alfa numérico	Muestreo biométrico y biológico Cerco, mediagua Desde estaciones Posición, equipo
Lance comercial	Hora y fecha Posición Especies SST, etc Captura total Frequencia de tallas Tipo de red Uso sonar/ecosonda	numérico decimal numérico decimal alfa numérico alfa numérico decimal numérico decimal numérico decimal alfa alfa	Tipo: arrastre ó cerco

List of data collected during fisheries activities

Grupo	Parametro	Formato	frecuencia colecta	unidades	Cantidad por año	Numero de barcos	Total anual	Comentario
Caracteristicas equipo	Calibracion	numerico			2	49	98	
	RMS	numerico			2	49	98	
	SA correction	numerico			2	49	98	
	Gain	numerico			2	49	98	
	Profundidad transductor	numerico			1	49	49	Profundidad promedio 5 m
	Ecosonda	numerico			1	49	49	
	Simrad ES60	alfanumerico				17	17	
	Simrad ES70	alfanumerico				31	31	
	Simrad Ek60	alfanumerico				1	1	
	Ruido embarcacion	numerico			1	49	49	
	Transductor ecosonda							
	ES120 7C, split beam	alfanumerico				49	49	
	Sonar							
	SP70	alfanumerico				2	2	
	SX90	alfanumerico				10	10	
	SU90	alfanumerico				3	3	
	FSV24	alfanumerico				22	22	
	FSV30	alfanumerico				1	1	
Datos acusticos	Sv peces	numerico	continua	dias	140	49	1470	140 dias promedio anual dias de pesca
	Sv plancton	numerico	continua	dias	140	49	1470	
	NASC	numerico	continua	dias	140	49	1470	
	Navegacion	numerico	continua	dias	140	49	1470	
	Fuerza de blanco	numerico	no se registra					
	Fecha hora	numerico	continua		140	49	1470	
	Referencia hora	numerico	no se registra					
	Categorias acusticas	alfanumerico	continua	dias	140	49	1470	
	Profundidad deteccion (max, min)	numerico		dias	140	49	1470	
	Threshold	numerico		dB				se exporta en -65 dB
	Velocidad-direccion cardumenes (sonar)	numerico	no se registra				0	
	Morfologia cardumen (sonar)	numerico	no se registra				0	
	Sv sonar	numerico	no se registra				0	
	Biomasa sonar	numerico	no se registra				0	

	Evitacion cardumen	numerico	no se registra				0	
Datos ambientales	SST	numerico	media hora/por cala		180	8820		media hora (Tasa) otras solo en cala
	Salinidad	numerico	continua		2			hasta 150 m profundidad
	Oxigen	numerico	continua		2			
	Clorofila	numerico	no se registra					
	Profundidad fondo	numerico	continua		140	49	1470	Desde data acustica
	Distancia de la costa	numerico	no se registra					no se calcula pero se puede hacer
	Informacion meteorologica	numerico	no se registra					
	Corrientes	numerico	no se registra					
	CTD	ver oxigeno y salinidad						
	Datos observadores	alfanumerico	por cala		180	14	2520	siempre en barcos de jurel y pocos en anchoveta (IMARPE)
								TASA (aves y mamiferos)
Muestreo biologico	Pesca identificacion	numerico	por cala		180	49	8820	tres lances por 60 dias por 49 barcos
	Proporcion de especia	numerico	por cala		180	49	8820	
	Caracteristicas lance	numerico	por cala		180	49	8820	
	Frecuencia de tallas	numerico	por cala		180	49	8820	
	Caracteristicas muestreo							
	Tipo de red	alfanumerico						Jurel 1,5 pulgada, anchoveta 9/11 pulgadas
	Identificacion plancton	alfanumerico	no se registra					
	Estaciones	alfanumerico	no se registra					
Lance comercial	Hora fecha	numerico	por cala		180	49	8820	
	Posicion	numerico	por cala		180	49	8820	
	Especies	numerico	por cala		180	49	8820	
	SST, etc	numerico	por cala		180	49	8820	
	Captura total	numerico	por cala		180	49	8820	
	Frequencia de tallas	numerico	por cala		180	49	8820	
	Tipo de red	numerico	por cala		180	49	8820	
	Uso sonar/ecosonda	numerico	por cala		180	49	8820	

Annex 2. Programme of the workshop

Día	*Horarios*	*Horarios*	*Programa*
Nov. 7	8:30 AM	9:00 AM	***Registro. Auditorio del Instituto del Mar del Perú - IMARPE***
	9:00AM	9:30 AM	***Palabras de Bienvenida del Valmte. AP (r) Javier Alfonso Gaviola Tejada, Presidente del Directorio del IMARPE***
	9.30 AM	9:50 AM	***Inauguración por el Calmte. AP (r) Héctor Soldi, Viceministro de Pesca y Acuicultura del Ministerio de la Producción.***
	9:50 AM	10:10 AM	***Palabras de introducción al Taller por el HDR François Gerlotto Director Científico del Instituto de Recursos Acuáticos - IREA***
	10:10 AM	10:30 AM	***Coffee-break***
	10:30 AM	11:00 AM	***Aprobación del Programa, nombramiento del Presidente del Taller y de los relatores.***
	11:00 AM	11:45AM	***Presentación a cargo del Dr. Gary Melvin,***
	11:45 AM	12:30 PM	***Presentación a cargo del Dr. Francois Gerlotto.***
	12:30 PM	2:00 PM	***Almuerzo***
	2:00 PM	2:45 PM	***Presentación a cargo del Dr. Christophe Corbieres***
	2:45 PM	3:30 PM	***Presentación a cargo del Dr. Héctor Peña.***
	3:30 PM	3:45 PM	***Coffee-break***
	3:45 PM	4:45 PM	***Mesa Redonda con los Doctores: Gary Melvin, Francois Gerlotto, Christophe Corbieres, Héctor Peña, Mariano Gutierrez y los asistentes.***
Nov. 8	9:00 AM	10:45 AM	***Primera Sesión: Análisis de los datos existentes.***
	10:45 AM	11:00 AM	***Coffee-break***
	11:00 AM	12:30 PM	***Continuación de la primera sesión.***
	12:30 PM	2:00 PM	***Almuerzo***

	2:00 PM	*3:30 PM*	***Segunda sesión: Análisis comparativo de las ecuaciones de TS***
	3:30 PM	*3:45 PM*	***Coffee-break***
	3:45 PM	*4:45 PM*	***Continuación de la segunda sesión***
Nov. 9	*9:00 AM*	*10:45 AM*	***Tercera sesión: Síntesis de los resultados, elaboración de ecuaciones comunes***
	10:45 AM	*11:00 AM*	***Coffee-break***
	11:00 AM	*12:30 PM*	***Continuación de la tercera sesión***
	12:30 PM	*2:00 PM*	***Almuerzo***
	2:00 PM	*3:30 PM*	***Continuación de la tercera sesión***
	3:30 PM	*3:45 PM*	***Coffee-break***
	3:45 PM	*4:45 PM*	***Continuación de la tercera sesión: conclusiones***
Nov. 10	*9:00 AM*	*10:45 AM*	***Cuarta sesión: Restitución y conclusiones sobre TS (incluyendo actividades comunes, experimentos y métodos de medición de TS)***
	10:45 AM	*11:AMM*	***Coffee break***
	11:00 AM	*12:30 PM*	***Continuación de la cuarta sesión***
	12:30 PM	*2:00 PM*	***Almuerzo***
	2:00PM	*3:30 PM*	***Discusión sobre próximas actividades del Task Group***
	3:30 PM	*3:45 PM*	***Coffee break***
	3:45 PM	*4:45 PM*	***Discusión sobre próximas actividades del Task Group (cont.)***
Nov. 11	*9:00 AM*	*10:45 AM*	***Reporte final, conclusiones y recomendaciones***
	10:45 AM	*11:00 AM*	***Coffee break***
	11:00 AM	*11:30 AM*	***Clausura a cargo del MSc. Renato Guevara-Carrasco, Director Ejecutivo Científico del IMARPE***