



Food and
Agriculture
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United Nations

*SCIENTIFIC COOPERATION TO SUPPORT
RESPONSIBLE FISHERIES IN THE ADRIATIC SEA*

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Developing a Regional Trawl Surveys Information System: ATrIS

Developing a Regional Trawl Surveys Information System: ATrIS

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This paper should be cited as follows: Gramolini, R., Mannini, P., Milone, N. Zeuli, V., (2005) Developing a Regional Trawl Surveys Information System: ATrIS. Paper presented at the GFCM-SAC Sub-Committee on Statistics and Information Transversal workshop on GFCM Statistical Framework and Databases (including IUU white list) (Rome, 26th October 2005). FAO-MiPAF Scientific Cooperation to Support Responsible Fisheries in the Adriatic Sea. GCP/RER/010/ITA/OP-17. AdriaMed Occasional Papers, 17: 10 pp. Available from the World Wide Web at <http://www.faoadriamed.org/pdf/OP-17.zip>.

Abstract

Through the FAO AdriaMed Project, a Trawl Surveys Information System (ATrIS) has been developed for the AdriaMed Adriatic countries (Albania, Croatia, Italy, Serbia-Montenegro and Slovenia), providing a flexible common environment to standardize the trawl survey data collected in the AdriaMed demersal trawl surveys. ATrIS was conceived as a simple tool to store and perform basic processing of the data collected, to facilitate and to standardize the data entry and retrieval of data. The ATrIS system offers some basic utilities to interface data with the Geographical Information System (GIS). This paper provides an overview of the approach, the background and the rationale used to develop the AdriaMed ATrIS.

1. Introduction

The FAO regional Project AdriaMed focused on the Adriatic Sea region with the participation of all the Adriatic countries (Albania, Croatia, Serbia-Montenegro, Slovenia and Italy) and has developed an application “The AdriaMed Trawl Information System” to organize, store and undertake the initial processing and analysis of the data available following the trawl surveys organized by the Project since 2001.

A common approach is needed at regional level when the key demersal resources are straddling stocks across the boundaries between territorial seas and international waters where open access conditions apply. The consideration that the most important commercial stocks of the Adriatic Sea are shared by the national fishing fleets makes it necessary that their monitoring and assessment be carried out over the whole Adriatic Sea.

Therefore the AdriaMed trawl surveys, one of the research activities of the Project, were regarded as being of prime interest among the participating countries. The research programme, adopted with the participation of the scientists from all the Adriatic countries involved (including Albanian, Croatian, Serbia-Montenegrin and Slovenian waters), has several objectives and among the principal intentions were: to collect, compile and process

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data following a common protocol prepared and agreed upon by all researchers involved; to carry out joint data elaboration and analysis and finally to make an appraisal of the status of demersal resources using stock assessment tools in order to describe the spatial and bathymetric distribution and pattern occurrence of target species, where possible the relationship of such patterns to observed environmental features (sea depth, sediments, temperature), and to estimate relative abundance and biomass indices. .

The first AdriaMed trawl survey took place in autumn/winter of 2001/2002 within national and adjacent international waters of Albania, Croatia and Slovenia (AdriaMed, 2001). With the second trawl surveys (2002/2003) it was evident that a system to store and jointly manage the data obtained was needed.

2. Background

Since the second AdriaMed trawl survey was carried out, the Project was asked to investigate and to propose a prototype of a single application to be designed and implemented to store and standardize the common data.

A first software application to hold and manage the resultant dataset, called “AdriaMed Trawl Survey Regional Databank” was developed on MS Excel[®] platform, thus demonstrating the feasibility of standardizing trawl survey data in the Adriatic area. It was made available to the relevant scientific institutions participating in AdriaMed starting from July 2002. A series of tests were carried out with the participating countries and suggestions and comments were included in the MS EXCEL versions.

During the 4th AdriaMed Coordination Committee (AdriaMed, 2003) it was agreed by all the countries participating in the surveys on the need and convenience to finalize the logical databank proposed by the Project to hold the whole data set obtained from the execution of the bottom trawl surveys. The “AdriaMed Trawl Survey Regional Databank” was then used as the application to store these data (Milone *et al.*, 2003).

The limits which MS EXCEL imposed on the application and the large data set expected to be available in the near future (starting with the third AdriaMed trawl survey, autumn/winter 2004) made necessary the translation of the “AdriaMed Trawl Survey Regional Databank” onto an MS ACCESS platform better suited to the scope. The MS EXCEL version was then used as trial version on which to test the performance of the new application.

The AdriaMed countries (during the 6th Coordination Committee meeting; AdriaMed, 2004) were asked to endorse the application migration and once again they jointly agreed to convert the data in a new software application. “AdriaMed Trawl Survey Regional Databank” was therefore migrate onto MS ACCESS and transformed in ATrIS (AdriaMed Trawl Information System).

The design of ATrIS (Gramolini *et al.* 2005) was largely based on the “AdriaMed Trawl Survey Regional Databank” (Milone *et al.*, 2003) and incorporates feedback from the experts of the participating countries. ATrIS was designed to create an essential and useful tool and also offers some basic utilities to interface data with the Geographical Information System (GIS).

3. System design and structure

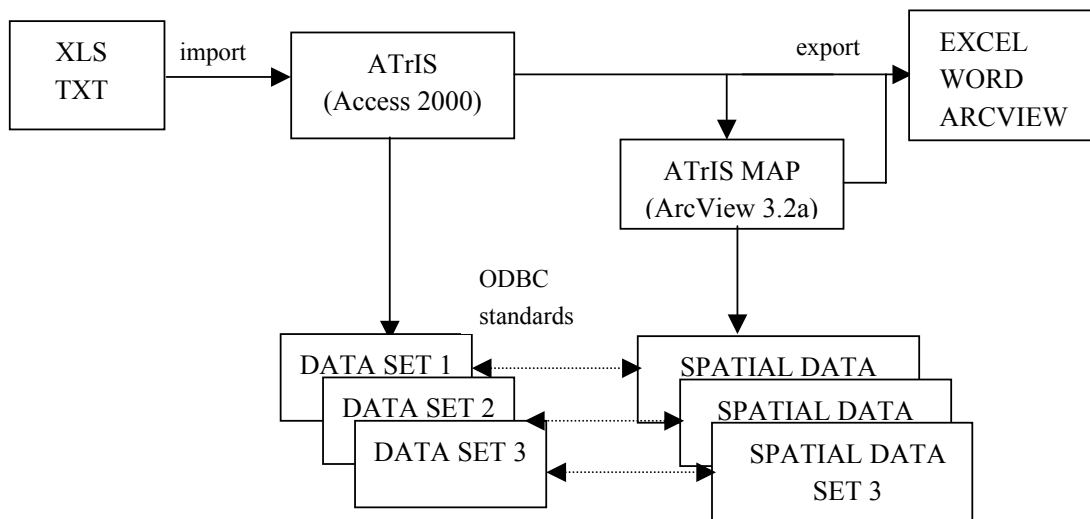
The structure of ATrIS was designed to be simple, yet flexible. The objective was to create a straightforward database structure that could accommodate a wide range of data types, and:

- Facilitate storage, retrieval, updating, analysis and manipulation of trawl surveys data including spatially referenced information;
- Build capacity to create, use and maintain a trawl survey inventory in each country; and
- Facilitate sharing of trawl survey data within and between countries in the Adriatic Sea.

The ATRIS consists of 2 parts:

- A database (ACCESS) for geo-referenced data storing and quality control for each survey, and
- A geo-referenced database that includes data stored directly within GIS (i.e. ArcView)

The software environment (Access) was chosen because it makes the import/export of data from one format to another very easy (e.g. between Access and ArcView, or between Access and Excel). The ODBC standards were used, a programming interface which enables applications to access data within database management systems that use SQL (structured query language) as a data access standards. This also allows seamless interaction with tables and queries from Access in ArcView.



Database design is the most fundamental step in developing a good and usable information system, in particular if it also contains a geographic information system. ATrIS was conceived and designed as a simple and common tool for the AdriaMed countries. During the design phase attention was paid to several characteristics that are considered important for a database: a good structure design, a simple and flexible interface, the choice of the software to be used. Taking in consideration that basic analysis of the rough data is the starting point for any stock assessment and resources appraisal work, the system was designed to be user-friendly even with non-specialized users. The user interface easily allows:




- Data input and retrieval
- Data analysis

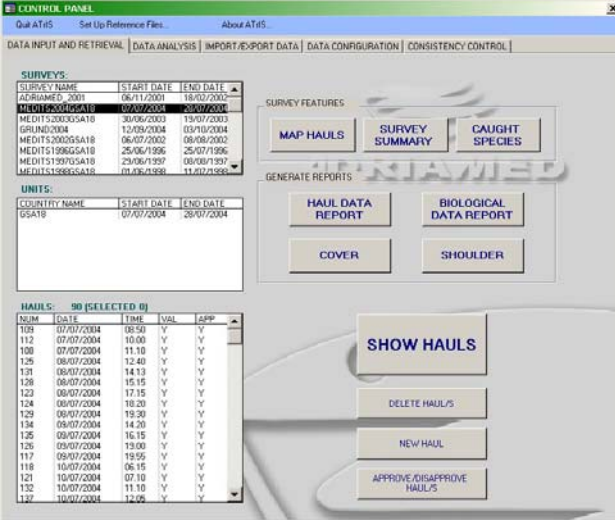
- Import/export data
- Data Configuration
- Consistency Control

The system offers few basic utilities to run simple queries; with a few steps it allows the user to visualize tables and charts of the data filtered and to perform spatial analysis through GIS application.

The creation of the data bank allowed for:

- Effective survey data sharing among the participating countries;
- Implementation of common data collection protocol;
- Standardization of the data entry procedures;
- Standardization of primary data compilation and reporting.

		
	<h1>ATrIS</h1>	<h2>AdriaMed Trawl Information System</h2>
		



4. Some key concepts of ATrIS

The creation of ATrIS followed a cooperative approach: throughout the development phase of the AdriaMed Trawl Survey Information System many valuable suggestions and comments were asked for and received from experts collaborating with AdriaMed and were duly taken into account. Together with the cooperation and assistance of regional experts, hereunder some other key concepts upon which ATrIS has been developed are summarized.

-- **Regional management structure.** It is vital that data access rules and procedures, and preferred data formats be developed or suggested by the countries rather than imposed by a third party. ATrIS was developed on request of the AdriaMed Adriatic experts network and taking into a consideration the problems arising in standardizing data collection and sharing, and in basic analysis work, this led to the creation of a very flexible application. Moreover the active involvement of scientists in the improving and testing phase gives a regional perspective to ATrIS.

-- **Database consistency controls.** The general objectives of designing data entry functions are to establish consistency of data entry transactions, ensure compatibility of data entry with data display and provide flexibility of user control of data entry. Data validation is developed based on the data management/data validation routine and data specifications. They include several types of listings as well as queries. They cover, though are not limited to, the verification of out-of-range values and inconsistencies between data and protocol compliance checks. In ATrIS checking data consistency is done in three steps:

- i) *Controlled data entry:* a validation programme that verified field consistencies to identify records with errors (range checks, internal and external table look-up, re-key verification...)
- ii) *Tracking of individual changes:* automatic attribution of individual IDs, verification of household and individual IDs, using message boxes for warnings.
- iii) *Illegal data checks:* Illegal data are variable values or combinations of values that are literally impossible for the actual phenomenon of interest; ATrIS uses several filters to detect illegal data (e.g. keypunch errors; illegal data filter programs; detection of outliers in samples; and detection of outliers and leverage points in simple linear regression).

The development and application of these methods for data quality and consistency management has great potential to improve the quantity and overall quality of data provided and of use in stock assessment and fisheries management.

--Capacity building for data analysis and GIS application

ATrIS provides basic querying, updating and reporting capabilities with the possibility to support a first basic GIS data analysis.

The technical capacity to analyse data is built up providing two main analysis types:

- i) *Data analysis:* a system of queries that allows the user to calculate biomass and abundance indices, to chart length frequency distributions and sex and maturity stages patterns;
- ii) *GIS map creation:* some basic GIS tools provide the visualization of survey data. These tools represent an approach to developing meaningful, quantitatively reliable and displayable thematic maps. The GIS component of ATrIS has been designed to:
 - Support data entry procedures when geographic visualization is needed;
 - facilitate data retrieval for a given sampling station (query by location option);
 - associate sampling station/s to a stratum defined by the user on the basis of the available cartography;
 - generate thematic map to represent the spatial distribution of the calculated indexes;
 - spatially analyze the calculated indexes;
 - generate survey reports with the data and the selected area.

The basic digitalized cartography included in ATrIS was realized by AdriaMed through the collaboration of the Italian Hydrographic Institute (IIM) and the Croatian Hydrographic

Institute. The entire Adriatic Sea region is now covered and available to the Adriatic countries, for the first time, with a map reference scale of 1:250.000.

--Enhanced reporting capacity

Database management systems are also developed for generating reports. A key function of ATrIS is the ability to generate tables and graphic reports of the selected data. Reports are available in a printer format and contain all fields and records that occur in the table or query that was used.

The possibility to create a report gives the opportunity to:

- give a general and quick idea of the activities carried out during the survey through summaries of the field work carried out
- facilitate the data storing
- facilitate data quality/integrity control
- support routine data recording and retrieval
- facilitate the organization of data.

This automation can also be remarkable timesaving tool for users who are required to produce regular data reports and to review or plan a new survey (Appendix 1).

The basic results of the last AdriaMed survey were given in a final report which details the survey execution logistics, catch records, description of the biomass spatial distribution patterns through the appropriate relative biomass and abundance indices by total and by depth strata, the species composition of the catch including the size structure of the target species as well as other relevant biological features and finally the data spatial analysis performed through the ATrIS GIS application.

5. Upgrade and future development

ATrIS ver. 1.1 is now the common database application for all the countries participating in the Project and has been extensively used by participating fisheries institutions; it is envisioned that the system will be routinely used to support the data storage and basic analysis. ATrIS is suitable to store not only data from the AdriaMed demersal trawl surveys, but also those from any other national or international surveys carried out in the Adriatic Sea.

Moreover while trawl survey data constitutes the bulk of the data held in trawl, they may not represent all the data. The database design allows for any data to be stored, for example, from a survey journey during which different kind of sampling gears have been deployed.

This constitutes further progress towards the establishment of a common, effective database shared by all coastal countries. As database systems should be based on current priorities, but with a clear upgrade path, or at least possibilities, to add new routines to implement the system, ATrIS, thanks to its modular structure, meets this necessity, allowing the insertion of new developed utilities to its basic structure. At present two new upgrade routines for

integration into the basic structure of ATrIS have been developed, responding to the need of some Adriatic research institutions. The management model used by AdriaMed to regulate the development of ATrIS in the future is to offer to the participating countries the possibility to request a new routine of analysis; the new routine, when developed and included in the structure of ATrIS is immediately made available, through the distribution of an upgrade of the system, to all the other partners.

6. Conclusion

Understanding the spatio-temporal pattern occurrence of target species is an essential element for fisheries management. Moreover, the inclusion of the space dimension in stock assessment is increasingly recognized as a necessary component. All this usually requires a great amount of data, and information systems can provide indispensable assistance in organizing, managing, understanding, and reporting this information. Together, relational databases and GIS are powerful tools for organizing, showing and analyzing trawl survey fisheries data. The AdriaMed Trawl Information System has been designed to be simple, yet flexible. The database structure allows for variation in the level of detail provided for each variable and country. In addition to the ability to view, query and report monitoring data, ATrIS also allows users to display the data spatially using a GIS. The design of ATRIS has been kept simple in an effort to ensure that the system can be easily supported and maintained beyond the FAO AdriaMed assistance and support phase.

7. References

- AdriaMed. (2001) Report of the Second Meeting of the AdriaMed Coordination Committee. FAO-MiPAF Scientific Cooperation to Support Responsible Fisheries in the Adriatic Sea. GCP/RER/010/ITA/TD-04. *AdriaMed Technical*
- AdriaMed. 2003. Report of the Fourth Meeting of the AdriaMed Coordination Committee. FAO-MiPAF Scientific Cooperation to Support Responsible Fisheries in the Adriatic Sea. GCP/RER/010/ITA/TD-09. *AdriaMed Technical Documents*, 9: 39 pp.
- AdriaMed. 2005. Report of the Sixth Meeting of the AdriaMed Coordination Committee. FAO-MiPAF Scientific Cooperation to Support Responsible Fisheries in the Adriatic Sea. GCP/RER/010/ITA/TD16. *AdriaMed Technical Documents*, 16: 49 pp.
- Gramolini, R., Mannini, P., Milone, N., Zeuli, V. 2005. AdriaMed Trawl Survey Information System (ATrIS): User Manual. FAO-MiPAF Scientific Cooperation to Support Responsible Fisheries in the Adriatic Sea. GCP/RER/010/ITA/TD17. *AdriaMed Technical Documents*, 17: 141 pp (in press).
- Milone, N., Zeuli, V., Mannini, P. 2003. AdriaMed Trawl Survey Databank: User Manual. FAO-MiPAF Scientific Cooperation to Support Responsible Fisheries in the Adriatic Sea. GCP/RER/010/ITA/OP-12. *AdriaMed Occasional Papers*, 12: 18 pp.

Appendix 1: Examples of ATrIS reports and maps



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SURVEY: **ADRIAMED_2002** UNIT: **CROATIA**
SELECTED STRATA:
21116, 21117, 21118, 21119

NUMBER	HAULS AVAIL.:	9	TOT. NUM.:	9
	TOT. SURFACE (km2):	31727		
WEIGHT	HAULS AVAIL.:	9	TOT. NUM.:	9
	TOT. SURFACE (km2):	31727		

SELECTION PARAMETERS LEN. INT.: CLASS SIZE: SEX: MAT: LW REL: MAT. SCALE CONV.:

SURVEY	SPECIES	DEPTH(m)				N/km2	ST.DEV.-C.V.	N/h	ST.DEV.-C.V.	DEPTH(m)			
		MIN	MAX	N/km2	ST.DEV.-C.V.					MIN	MAX	Kg/km2	ST.DEV.-C.V.
ADRIAMED_2002	LOPHBUD	10	500	14.19	4.09 - 28.80	1.00	0.29 - 29.31	10	500	6.87	4.88 - 70.98	.49	0.35 - 72.01
ADRIAMED_2002	GOBINIG	10	500	721.66	643.02 - 89.10	50.80	45.25 - 89.09	10	500	10.21	9.00 - 88.11	.72	0.63 - 88.09
ADRIAMED_2002	GOBIQUA	10	500	52.75	36.42 - 69.04	3.74	2.62 - 70.05	10	500	.41	0.21 - 52.13	.03	0.02 - 52.74
ADRIAMED_2002	HELIDAC	10	500	30.27	0.00 - 0.00	2.13	0.00 - 0.00	10	500	.28	0.00 - 0.00	.02	0.00 - 0.00
ADRIAMED_2002	ILLECOI	10	500	249.85	95.93 - 38.39	17.67	6.76 - 38.25	10	500	13.08	2.61 - 19.95	.92	0.18 - 19.99
ADRIAMED_2002	LEPICAU	10	500	82.46	0.00 - 0.00	5.80	0.00 - 0.00	10	500	18.03	0.00 - 0.00	1.27	0.00 - 0.00
ADRIAMED_2002	LEPMBOS	10	500	16.70	0.00 - 0.00	1.18	0.00 - 0.00	10	500	.69	0.00 - 0.00	.05	0.00 - 0.00
ADRIAMED_2002	LEPMWHS	10	500	19.84	0.00 - 0.00	1.40	0.00 - 0.00	10	500	1.31	0.00 - 0.00	.09	0.00 - 0.00
ADRIAMED_2002	PAGEACA	10	500	3.92	1.69 - 42.99	.28	0.12 - 42.99	10	500	.17	0.07 - 40.31	.01	0.00 - 40.31
ADRIAMED_2002	LOLIVUL	10	500	140.32	60.05 - 42.79	9.90	4.22 - 42.59	10	500	13.30	4.49 - 33.79	.94	0.32 - 33.62
ADRIAMED_2002	GADIARG	10	500	50.11	0.00 - 0.00	3.53	0.00 - 0.00	10	500	.21	0.00 - 0.00	.01	0.00 - 0.00
ADRIAMED_2002	MACOSCO	10	500	5.22	0.00 - 0.00	.37	0.00 - 0.00	10	500	.04	0.00 - 0.00	.00	0.00 - 0.00
ADRIAMED_2002	MAJASQU	10	500	6.87	4.88 - 71.04	.48	0.34 - 70.89	10	500	4.79	3.64 - 75.99	.34	0.26 - 75.85
ADRIAMED_2002	MERLMER	10	500	2064.97	465.20 - 22.53	145.84	33.61 - 23.04	10	500	139.80	36.63 - 26.20	9.87	2.64 - 26.72
ADRIAMED_2002	MICMPOU	10	500	21.92	0.00 - 0.00	1.54	0.00 - 0.00	10	500	2.44	0.00 - 0.00	.17	0.00 - 0.00
ADRIAMED_2002	MULLBAR	10	500	1156.90	547.05 - 47.29	81.76	38.33 - 46.88	10	500	41.30	20.15 - 48.79	2.92	1.41 - 48.24
ADRIAMED_2002	MULLSUR	10	500	11.04	7.54 - 68.24	.78	0.53 - 67.62	10	500	.84	0.40 - 47.56	.06	0.03 - 47.32
ADRIAMED_2002	MUSTMJS	10	500	8.47	5.43 - 64.10	.60	0.38 - 63.96	10	500	12.70	8.14 - 64.10	.90	0.57 - 63.96
ADRIAMED_2002	ABRAVER	10	500	126.81	55.56 - 43.81	8.97	3.91 - 43.63	10	500	9.36	8.02 - 85.73	.66	0.56 - 85.71
ADRIAMED_2002	LEPTCAV	10	500	1512.78	866.60 - 57.29	106.66	61.03 - 57.22	10	500	31.11	22.22 - 71.44	2.19	1.56 - 71.38
ADRIAMED_2002	DENTGIB	10	500	119.30	109.65 - 91.91	8.40	7.72 - 91.91	10	500	11.01	10.12 - 91.91	.77	0.71 - 91.91



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SURVEY	UNIT	NUMBER OF HAULS	NUMBER OF DAYS
ADRIAMED_2001	CROATIA	17	6

DATE: 14/01/2002

HAUL N.	VALID	STRATUM	VESSEL	GEAR	DUR.(min)	S.P.(kn)	LEN.(m)	DEPTH(m)	H.SPR.(m)	S.A..(km2)
1	<input checked="" type="checkbox"/>	2 1116	AND	TARTA	16	3.3	1630	37	10	0.0163
2	<input checked="" type="checkbox"/>	2 1116	AND	TARTA	40	3.3	4815	40	10	0.0481

DATE: 14/02/2002

HAUL N.	VALID	STRATUM	VESSEL	GEAR	DUR.(min)	S.P.(kn)	LEN.(m)	DEPTH(m)	H.SPR.(m)	S.A..(km2)
6	<input checked="" type="checkbox"/>	2 1117	AND	TARTA	60	3.7	6552	62	10	0.0655
8	<input checked="" type="checkbox"/>	2 1116	AND	TARTA	60	3.3	7038	49	10	0.0704
10	<input checked="" type="checkbox"/>	2 1117	AND	TARTA	57	3.3	6636	74	10	0.0669

DATE: 15/02/2002

HAUL N.	VALID	STRATUM	VESSEL	GEAR	DUR.(min)	S.P.(kn)	LEN.(m)	DEPTH(m)	H.SPR.(m)	S.A..(km2)
9	<input checked="" type="checkbox"/>	2 1117	AND	TARTA	60	3.3	7038	36	10	0.0704
13	<input checked="" type="checkbox"/>	2 1118	AND	TARTA	60	3.7	6852	134	10	0.0685
15	<input checked="" type="checkbox"/>	2 1117	AND	TARTA	55	3.7	6281	58	10	0.0628

DATE: 16/02/2002

HAUL N.	VALID	STRATUM	VESSEL	GEAR	DUR.(min)	S.P.(kn)	LEN.(m)	DEPTH(m)	H.SPR.(m)	S.A..(km2)
14	<input checked="" type="checkbox"/>	2 1117	AND	TARTA	62	3.3	7464	30	10	0.0746
20	<input checked="" type="checkbox"/>	2 1117	AND	TARTA	60	3.3	7038	64	10	0.0704
21	<input checked="" type="checkbox"/>	2 1116	AND	TARTA	58	3.3	6803	25	10	0.0680
22	<input checked="" type="checkbox"/>	2 1117	AND	TARTA	4	3.7	457	70	10	0.0046

DATE: 17/02/2002

HAUL N.	VALID	STRATUM	VESSEL	GEAR	DUR.(min)	S.P.(kn)	LEN.(m)	DEPTH(m)	H.SPR.(m)	S.A..(km2)
11	<input checked="" type="checkbox"/>	2 1119	AND	TARTA	62	3.3	7272	200	10	0.0727
12	<input checked="" type="checkbox"/>	2 1118	AND	TARTA	62	3.3	7272	173	10	0.0727

DATE: 18/02/2002

HAUL N.	VALID	STRATUM	VESSEL	GEAR	DUR.(min)	S.P.(kn)	LEN.(m)	DEPTH(m)	H.SPR.(m)	S.A..(km2)
3	<input checked="" type="checkbox"/>	2 1116	AND	TARTA	49	3.3	5747	48	10	0.0575
4	<input checked="" type="checkbox"/>	2 1117	AND	TARTA	61	3.3	7155	62	10	0.0716
7	<input checked="" type="checkbox"/>	2 1117	AND	TARTA	60	3.3	7038	83	10	0.0704

21116	1 2 3 8 21
21117	4 6 7 9 10 14 15 20 22
21118	12 13
21119	11

