هـيـئـة الـبـيـئـة - أبـوظـبـي
Environment Agency - ABU DHABI

System Deployment Document

UAE-NFIS

Date: 26 September 2018

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Abbreviations

A	Accuracy in %
Artfish	Approaches, Rules and Techniques for Fisheries Monitoring
CE or C/E	Catch/Effort
CPUE	Catch Per Unit Effort
CV	Coefficient of variation in %
DB	Database
DGC	Data Group Code
EAD	Environment Agency Abu Dhabi
EU	European Union
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
FIS	Fisheries Information System
FS	Frame Survey
GIS	Geographic Information System
IT	Information Technology
NFIS	National Fisheries Information System
PBA	Probability Boat Active
SF	Standardization factor
SUI	Sampling Uniformity Index
UAE-NFIS	EAD Fisheries Information System

Executive summary

Fisheries provide a source of income, employment and recreation to inhabitants while contributing to the cultural heritage of the Emirate of Abu Dhabi. Fishing is primarily conducted from open fibreglass dories and wooden dhows. Dome shaped traps are the most commonly used gear type although a variety of other methods exist. Catches are typically diverse and characteristic of multispecies tropical fisheries, target species primarily being composed of representatives of the families: Carangidae, Lethrinidae, Haemulidae, Epinephelidae and Scombridae.

Catch and effort data form the foundation of fisheries management. The outputs of effective fisheries information systems enable resource status to be monitored and evaluation of fisheries performance to be made, crucial aspects for informed management planning and decision making. In this context, the Terrestrial and Marine Biodiversity Sector of the Environment Agency – Abu Dhabi (EAD) is implementing the 'Fish Landings and Population Dynamics Project' the principal objectives of which include the collection of catch, effort and economic data and the production of fisheries statistics for the Emirate of Abu Dhabi. The project responds directly to the EAD's goal of developing a management regime for the fisheries of Abu Dhabi.

Since the inception of the Fish Landings and Population Dynamics Project in 2001, a stratified catch and effort data recording system for the Emirate of Abu Dhabi was set in place. Starting in 2005 a fishery data collection system was launched for the recording of species landed and of gear types used. A tailor-made fisheries database application was developed capable of storing the primary data, performing catch/effort estimates and producing fisheries statistical reports.

Experience gained during the aforementioned system implementation period had revealed that although it was well conceived there were several application areas that needed improvement, notably:

- Estimation of fishing effort by boat-gear category: Effort has been extrapolated on the basis of boat movements registered by the coast guard. This method cannot provide effort estimates by boat-gear since the latter is not reflected in the recordings. Furthermore the estimation of catch and fishing effort heavily depends on the cooperation of third parties and cannot be performed on a regular (e.g. monthly) basis.
- Estimation of fishing effort is not synchronized with the monthly collection of landings since it involves laborious screening of coast guard records in order to calculate total boat days for active boats. Such being the case the old NFIS system cannot provide instantaneous catch/effort estimates that are essential for regular and effective fisheries statistical monitoring.
- The data collection procedures are well conceived and the enumerators have no difficulty in implementing the data collection protocols in use. The latter however are not based on strict statistical criteria; this means that the reliability of the resulting estimates is generally not known and not indicated in the reports (a prerequisite set-up by international and regional fisheries bodies).

- At present the utility of the statistical outputs is limited to the production of annual reports. To be sure the database can be interrogated at any moment but in the absence of ready-made statistical procedures users have to formulate themselves database queries; such a practice requires a certain extent of database query knowledge that is generally not mastered by the average user.
- Certain standard analytical procedures have yet to be integrated into the current database such as standardization of fishing effort and CPUE, multi-variate analysis of catch/effort variables, etc.

In view of the above methodological and operational constraints the Environment Agency of Abu Dhabi is upgrading its current NFIS in order to respond better to current and future needs. Such an upgrade is carried out by means of the following twofold action:

(a) Revision of the data collection procedures (specifically those concerning fishing effort) and introduction of statistically sound data collection protocols for sampling landings and fishing effort.

(b) Adaptation and customization of the internet system ArtFishWeb Beta version (introduced by FAO in 2017) in a manner permitting its eventual expansion to the entire UAE.

A new system (UAE-NFIS) will replace the current NFIS starting in January 2019. The new system is being implemented through a 2-year contract involving four field missions of an international consultant expert in fisheries statistics and web-based database development. The terms of reference of the contract are given in Annex A.

UAE-NFIS functions are intended for four user groups: System Administrators, Data Operators, Privileged Users and Public Users.

The first group of operations is performed with the purpose of setting-up, maintaining and diffusing system standards, primary data and catch/effort estimates using basic internet services.

Routine inputting of catch/effort samples collected in the field is done by Data Operators on a decentralized basis. Data Operators use the functions of UAE-NFIS to input samples and formulate monthly catch/effort estimates of local scope. Such data is instantly reflected on the database using internet connections and services.

Privileged users (EAD managers and researchers, authorized institutions and regional/international bodies) have read-only access to system standards, primary data (samples) and to all statistical reports, including electronic publications. It should be noted here that administrators and data operators are automatically privileged users.

Public users have limited read-only access to monthly reports and only for periods authorized by EAD management. This is the only user group that can access UAE-NFIS without login credentials.

UAE-NFIS is already in an advanced state of implementation. Its deployment is summarized in Table 1. Most of the deployment phases have been completed. Of specific importance is the post-project phase in which EAD will act autonomously by phasing out the old NFIS and by putting the new UAE-NFIS in regular production.

This document was prepared during the third mission of the author. This mission is described in Mission Report 3 that will be handed over to the Client upon its conclusion on 27 September 2018.

Table 1. Deployment phases of UAE-NFIS

PHASES	PERIOD	STATUS
1. Adaptation of statistical methodology developed by FAO.	November 2017 – April 2018	Completed
2. Adaptation of ArtFishWeb beta version (FAO, 2017)	November 2017 – April 2018	Completed
3. Basic statistical and computer training for UAE-NFIS administrator, data supervisors and data collectors.	November 2017	Completed
4. Finalization of operational platform (WAMP 5.6)	April 2018	Completed
5. Pilot phase (data collection and computer operations)	July 2018 - present	In progress. To be completed by December 2018.
6. Basic and advanced statistical training	September 2018	Completed
7. UAE-NFIS consolidation and final review. Final report with recommendations	November-December 2018	Planned
8. Post-project period. Technical backstopping using the contract warranty. System in full production. Old NFIS phased out.	January-December 2019	Planned

1. Adaptation of statistical methodology developed by FAO.

In early 2001 FAO has issued a number of guidelines concerning a uniform approach for sample-based data collection operations aiming at effective fisheries statistical monitoring (Figure 1). These guidelines were published in two manuals (FI/TP/425 and FI/TP/454) that have since been the reference documents for developing and implementing large-scale fisheries statistical monitoring programmes.

In essence the generic approach illustrated in Figure 1 indicates that catch/effort monitoring needs a maximum of four surveys, namely:

- Sampling of landings
- Sampling of boat activities
- Frame survey
- Determining active days during a month

Moreover the generic formula does not specify the specific scenarios to be used for collecting data on catch and fishing effort. Instead it leaves this operational responsibility to users to decide, depending upon operational and logistical criteria.

In the case of UAE-NFIS it was decided to make use of stratified random sampling for landings and to use the weekly activity approach for boat-gear activity. The advantage of this choice lies in the fact that landings and effort samples can be integrated into a single form (Figure 2).

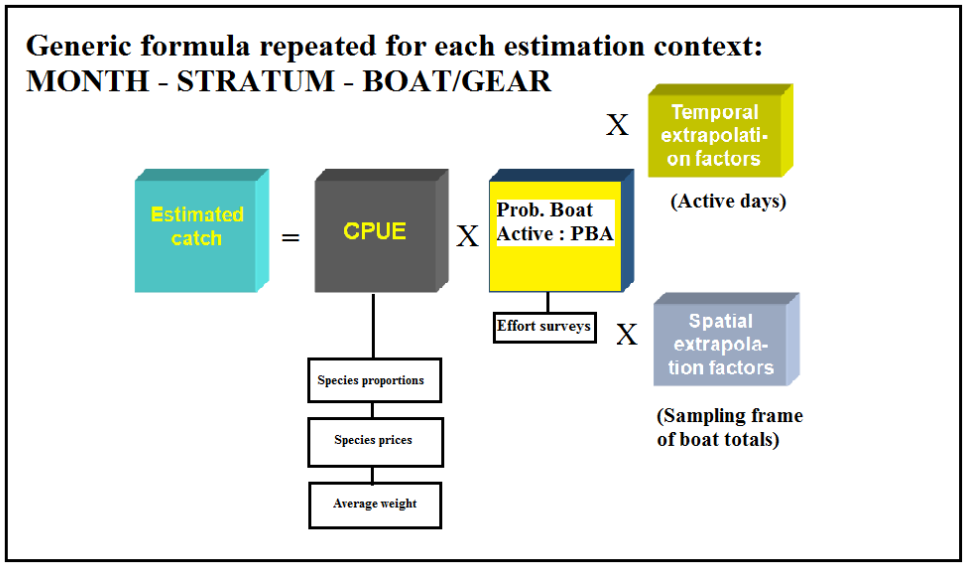
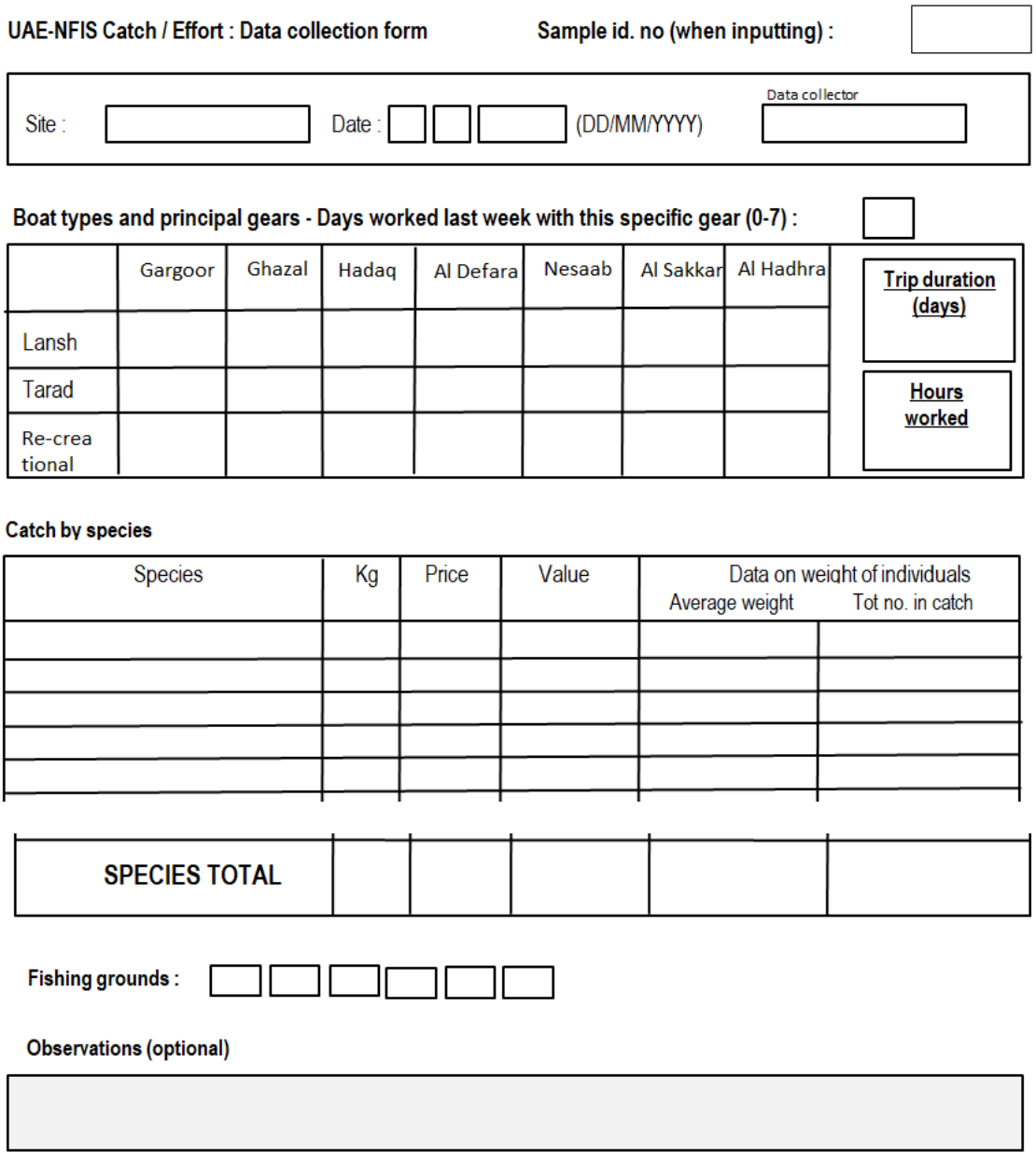


Figure 1. Uniform catch/effort estimation process that is applicable to all sampling programmes for catch/effort (FAO, 2011).



UAE-NFIS Catch / Effort : Data collection form **Sample id. no (when inputting) :**

Site : Date : (DD/MM/YYYY) Data collector

Boat types and principal gears - Days worked last week with this specific gear (0-7) :

	Gargoor	Ghazal	Hadaq	Al Defara	Nesaab	Al Sakkar	Al Hadhra
Lansh							
Tarad							
Re-crea tional							

Trip duration (days)

Hours worked

Catch by species

Species	Kg	Price	Value	Data on weight of individuals	
				Average weight	Tot no. in catch
SPECIES TOTAL					

Fishing grounds :

Observations (optional)

Figure 2. UAE-NFIS data collection form integrating landings with boat activity.

2. Adaptation of ArtFishWeb beta version

2.1 Background

FAO (2014) has introduced a web-based application (ArtFishWeb) for catch/effort in Lebanon and Egypt under the EastMed project. The project was sponsored by the EU, Italy and Greece. The system has been fully operational over the last four years. The same generic system was adapted for Algeria in 2017 under an EU-funded statistical development project.

There are several benefits for the Client in using the adaptation approach to national needs. To develop a similar system from point zero it should require 5 years of development-testing-documenting-implementing. The adapted ArtFishWeb system is error-free and fully documented. It is already operational in Lebanon, Egypt, Algeria, Tanzania and Zanzibar. It uses an open source operating platform (PhP-MySQL) and complies with all software requirements spelled out in Annex A.

UAE-NFIS was adapted to operate in Arabic and English and to integrate numerical data with information media such as documents, presentations, videos, etc. Its architecture guarantees constant performance levels irrespective of data growth (Figure 3).

Over 100 statistical reports will be available once the system has been populated with sample data covering several periods. In addition to simple statistical tables the system can perform complex analytical functions such as effort and CPUE standardization using the latest methodology (Stamatopoulos and Abdullah, 2016). Other statistical analyses concern cluster analysis and multi-variate analysis. Most importantly it is at present the only system in the region that can produce spatial catch/effort statistics by statistical rectangle (Figure 4).

Compliance with FAO and RECOFI norms and standards: FAO, RECOFI and other international and regional bodies pay particular attention to data quality indicators accompanying statistical outputs. UAE-NFIS displays data quality indicators in all of its reports. These indicators are formulated on the basis of sample size and sampling frequency of the collected data on catch and fishing effort.

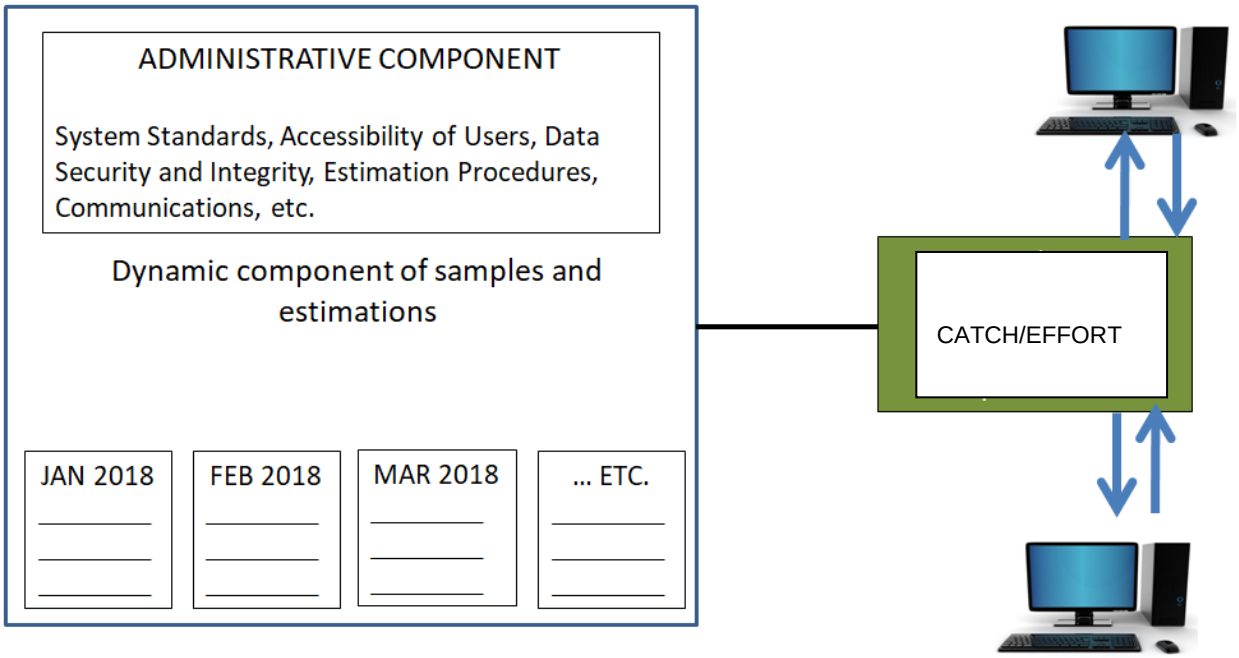


Figure 3. UAE-NFIS system architecture

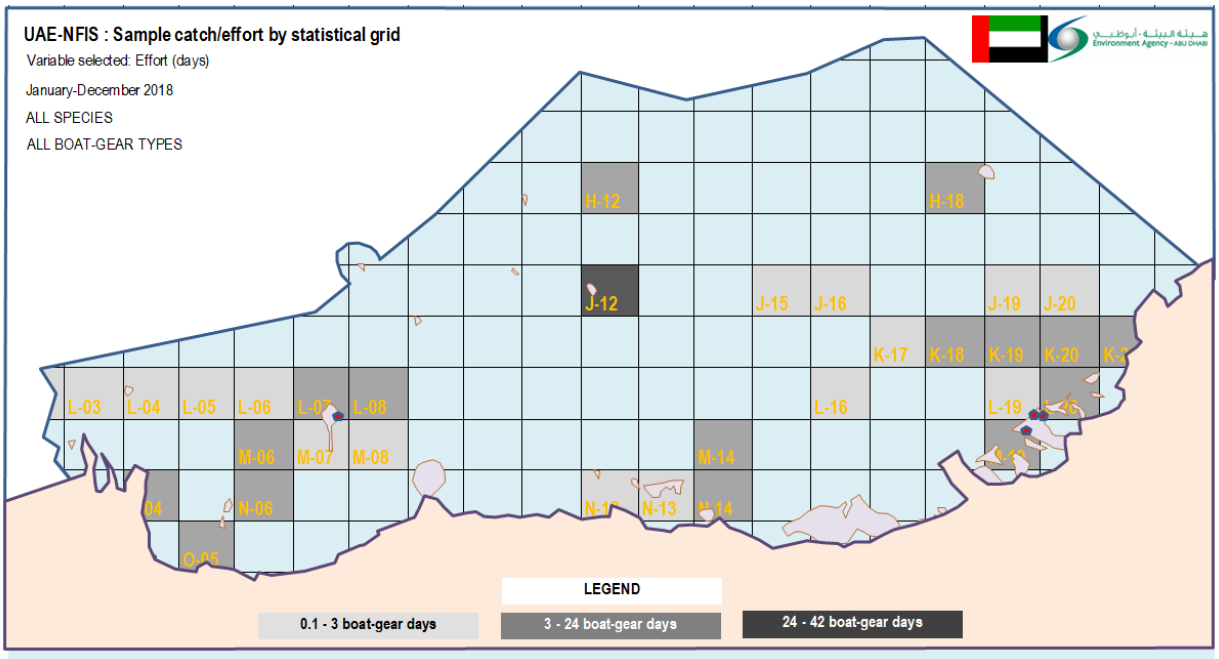


Figure 4. UAE-NFIS catch/effort analysis by statistical rectangle

2.2 Parametrization (system standards)

As mentioned earlier the advantage of using a generic system such as ArtFishWeb is that the system can be adapted to national needs without any intervention to the source code or database structure. Parametrization of UAE-NFIS was done entirely by the Client and involved:

1. Editing about 800 system messages and translating them into Arabic.
2. Setting-up a stratification scheme of one major stratum (Abu Dhabi).
3. Four minor (e.g. statistical strata).
4. Seven landing sites and home ports.
5. Eight boat-gear categories.
6. 139 species.
7. 267 statistical rectangles.

It should be noted here that all referential data (1)-(6) have links to information media such as documents, presentations, videos, etc. All this constituted a large extent of work that was carried out by the Client with the view of adding value to the numerical outputs of the new system.

3. Preliminary (basic) training

Preliminary training of EAD technical staff was conducted as follows:

(a) Practical training on sample-based data collection on 7,8 and 9 November.

(b) UAE-NFIS system administrator(s) training on 15 and 16 November.

(c) Hands-on training on UAE-NFIS data inputting operations on 19 November.

Materials used in training involved:

- PowerPoint presentations on fisheries statistics as a fisheries management instrument.
- Catch/effort generic estimation approaches described in FAO Fisheries Technical Paper FI/TP/425.
- A prototype UAE-NFIS running locally on the consultant's laptop.
- A pilot version of UAE-NFIS running on an EAD server.
- A new data collection form for landings and weekly fishing effort.

Training sessions alternated frequently with workshop-type consultations during which valuable feedback was obtained from field staff concerning the applicability of the presented approaches.

Twelve EAD staff (including the system administrator) were trained during this mission. The experience gained from training indicates that UAE-NFIS operations are sustainable and can be totally mastered during the pilot phase of UAE-NFIS implementation.

Training gave due importance to the appropriate use of data collection protocols by means of which frequency of sampling and sample size are determined on the basis of statistical criteria.

Training of the UAE-NFIS administrator was conducted as follows:

(a) Administration functions

- Table of users
- Table of agents
- Reporting workload of agents
- Progress report using data collection automatic protocols
- List of databases
- Storage plan of all databases
- Total backup
- Total recovery
- Communications
- Create a database
- Carry forward tables from previous databases
- Set-up tables manually

- Major strata
- Minor strata
- Sites and ports
- Boat-gear types
- Species
- Fishing grounds
- Fleet data

- Delete a database
- Release a database
- Block a database
- Finalize a database
- Single backup
- Single recovery

(b) Data Operators' functions

- Inputting of effort
- Inputting of landings
- Estimation process

(c) Privileged users' functions

- Working reports on primary data
- Monthly statistics
- Annual statistical reports

UAE-NFIS contains a comprehensive set of online HELP screens for all three categories of users.

Three manuals for the UAE-NFIS administrator, Data Operators and Privileged Users respectively have been submitted to the Client.

4. Finalization of operational platform (WAMP 5.6)

4.1 System / Application Overview

Effective storage, processing and diffusion of data on catch, fishing effort, first-sale prices and average fish weight are key factors for providing appropriate services to users involved in fisheries statistical studies. This means that a statistical programme that operates on a regular basis must be based on robust statistical methods and self-sustaining computer operations.

The author has established a set of best practices for installing UAE-NFIS and for training EAD staff on its use. It is expected that UAE-NFIS users will rapidly become productive with the database and use its services in a wide variety of applications sectors.

The UAE-NFIS data model uses commonly adopted statistical and IT standards. From the statistical viewpoint, the UAE-NFIS database uses the FAO standards relating to data collection schemes for catch and fishing effort and for estimating total production by means of a generic approach.

With regards to IT standards the database has been conceived along the FAO and EU guidelines which favor open-source applications. The operational platform of UAE-NFIS is PhP-MySQL.

4.2 Functional Description of the System / Application Areas

The figure below provides a schematic description of UAE-NFIS functions. What is not shown is the capability of the system to handle automatically English and Arabic in all of its user interfaces, as well as its capacity to integrate numerical data with information media, such as documents, pictures, videos, etc.

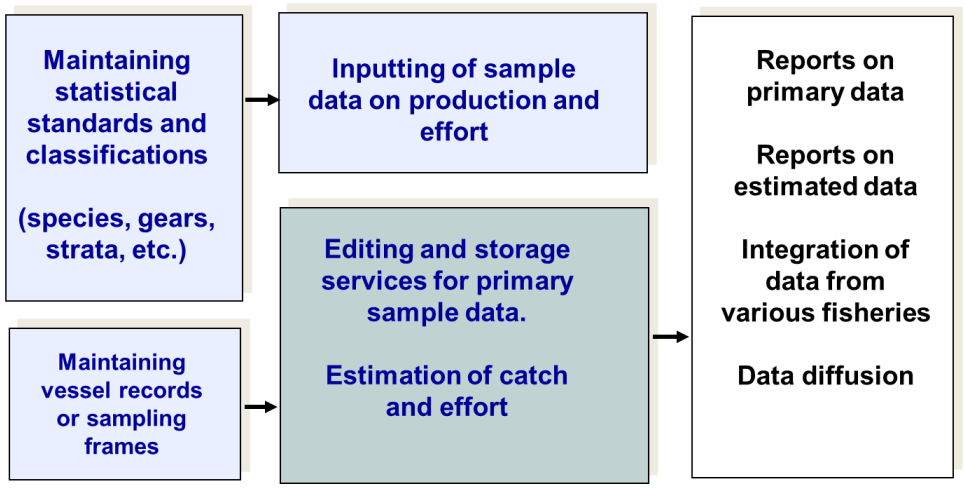


Figure 5. General functions of UAE-NFIS.

4.3 Project Technology Overview

The following table provides the Server hostnames. This includes other systems to which access is required for providing support to this application.

	Aeadvsa135-ead
Server Brand	VMware, Inc.
Server Model	VMware Virtual Platform
Server Name	Aeadvsa135-ead
Processor	Intel(R) Xeon(R) CPU X5690 @ 3.47GHz
Memory	8 GB
Hard disk	150 GB
O/S	Microsoft Windows Server 2016 Enterprise
Service Pack	1
Application Server IP address	10.10.25.185
Domain	Erwda.int
Software Installed (prerequisite software)	Apache/2.4.29 (Win32) PHP/5.6.30
Other System Software	
Database Software	MySQL 5.7
Anti-Virus	McAfee
Backup server	aeadsvb002-ead.erwda.int
Associated Database Server IP address	10.10.25.185 (Aeadvsa135-ead)

Because of its architecture that uses segments (periods) UAE-NFIS will have the same performance throughout its life. WAMP platforms tend to be slower than VPS ones; however the response times currently experienced are very good and are expected to remain as such.

The system is fully operational and free of errors. Interventions on the source programs should not be needed. All system parameters and messages are handled externally in a very simple fashion. However:

- Regular total backup operations ought to be performed on a weekly basis in order to ensure extra data security on top of the server backup. These functions are easy to perform (just a click by the administrator) and only last seconds.
- Practical training on system operations should be conducted internally every year, with the twofold purpose of: (i) train new staff and, (ii) discussing points that need improvement such as editing of messages and descriptors, adding infomedia links, etc.

4.4 Application / System Inventory

Most of the UAE-NFIS programs are PhP scripts with few exceptions that concern programmed Excel modules.

At present there are over 300 PhP scripts, each with an average size of 300 lines, thus totaling 90 000 lines of coding.

All PhP modules reside on the EAD server right under the WAMP 5.6/WWW main directory.

There are also the following sub-folders:

- BACKUP_RESTORE containing .csv backup copies of the admin database and all database segments (periods) that have been archived.
- EXCEL containing all system messages as well as programmed workbooks for data analysis and graphics.
- HELP containing all online tutorials.
- PICTURES containing all information links and media associate with the system standards.
- STARTUP_RESET containing the seed MySQL databases and PhP scripts for initializing the system.
- PUBLICATIONS containing codes of documents and media for download.

UAE-FIS operates by means of two physically different sets of tatbles. The first set consitutes an administrative database that controls the contents of the system and its accessibility. The second set consists of “periods” each of which contains autonomous data and information for each reference month. With this architecture the system has online access only to periods requested; in this manner its performance is not affected by progressive data volume increases.

5. Pilot phase (data collection and computer operations)

Based on the finalized system set-up (adapted software and definition of referential data) EAD has commenced a systematic data collection and data processing programme with actual data collected from the field. Good quality data have been collected systematically for September 2018 (Figure 6). Pilot operations will continue throughout the remaining months and starting in January 2019 the UAE-NFIS system will be in regular production.

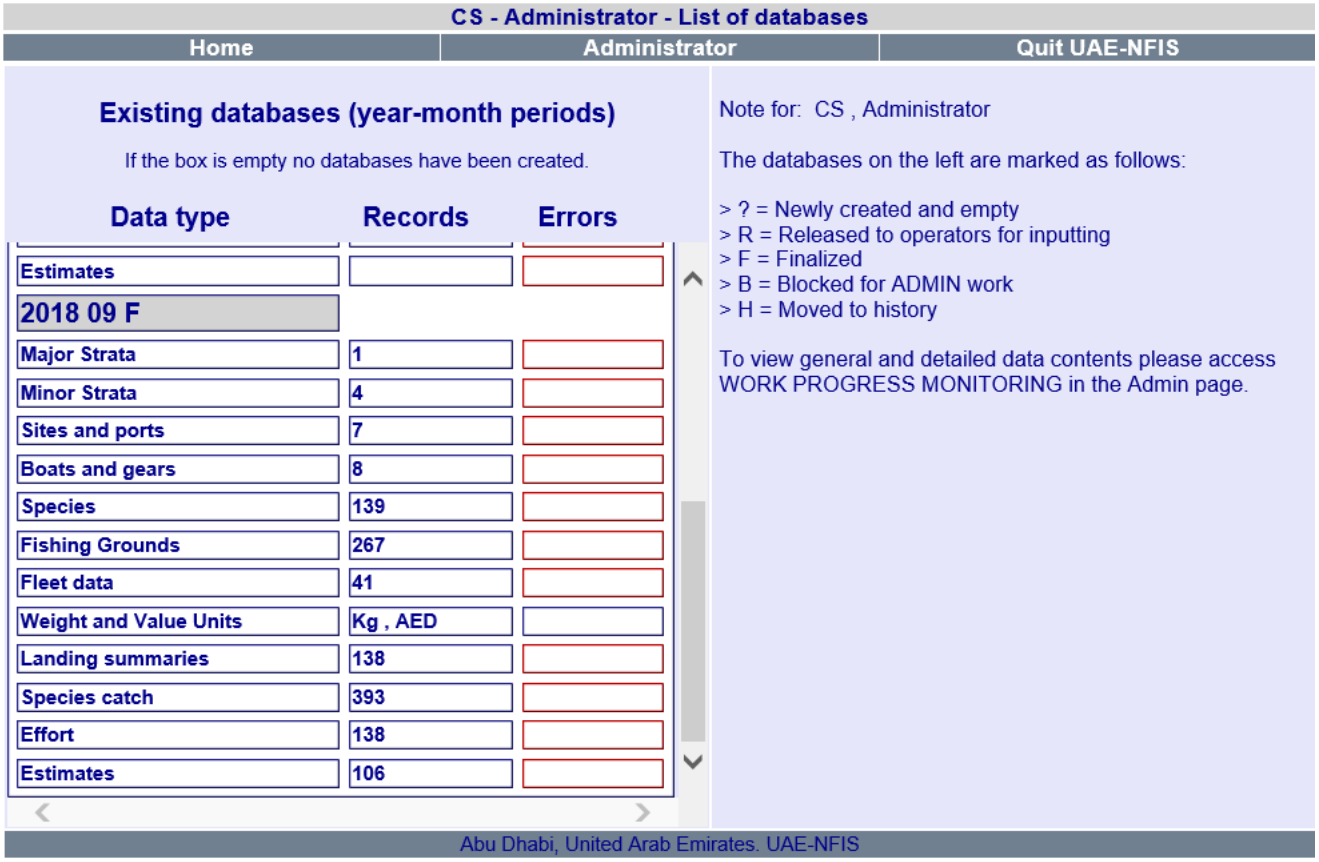


Figure 6. Present state of UAE-NFIS

6. Basic and advanced statistical training

This statistical training was held during 23-26 September 2018 with the purpose of familiarizing users with the statistical contents of the UAE-NFIS outputs.

Training was organized with two types of audience. The first involved data collectors and supervisors who were presented with a wide variety of basic reports for monitoring the quality of the primary data and for obtaining monthly estimates (Figures 7,8).

The second training module mainly focused on analytical reports produced by the system and specifically those pertaining to effort and CPUE standardization and multi-variate analysis (Figure 9).

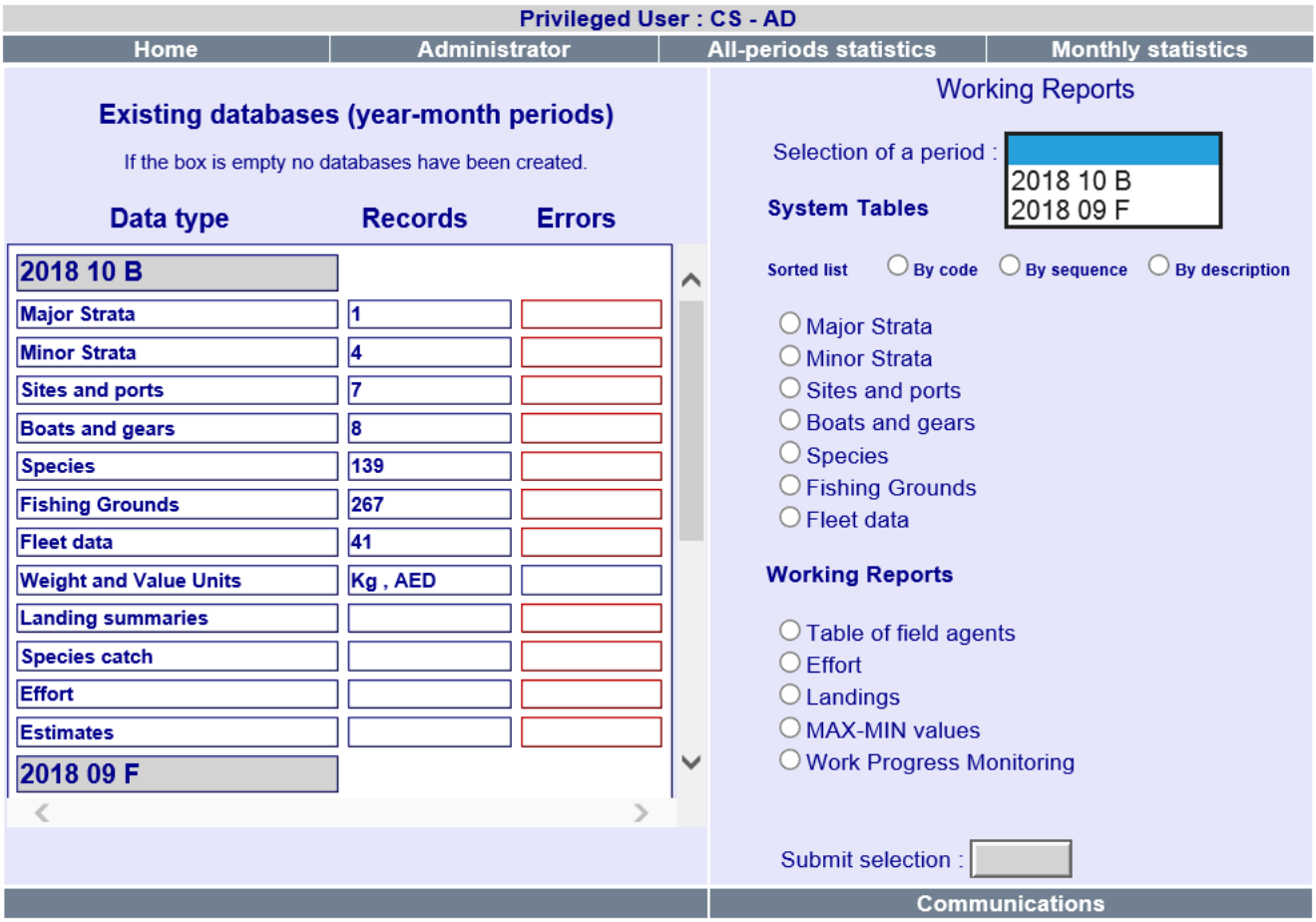


Figure 7. Reports on referential and primary data (samples)

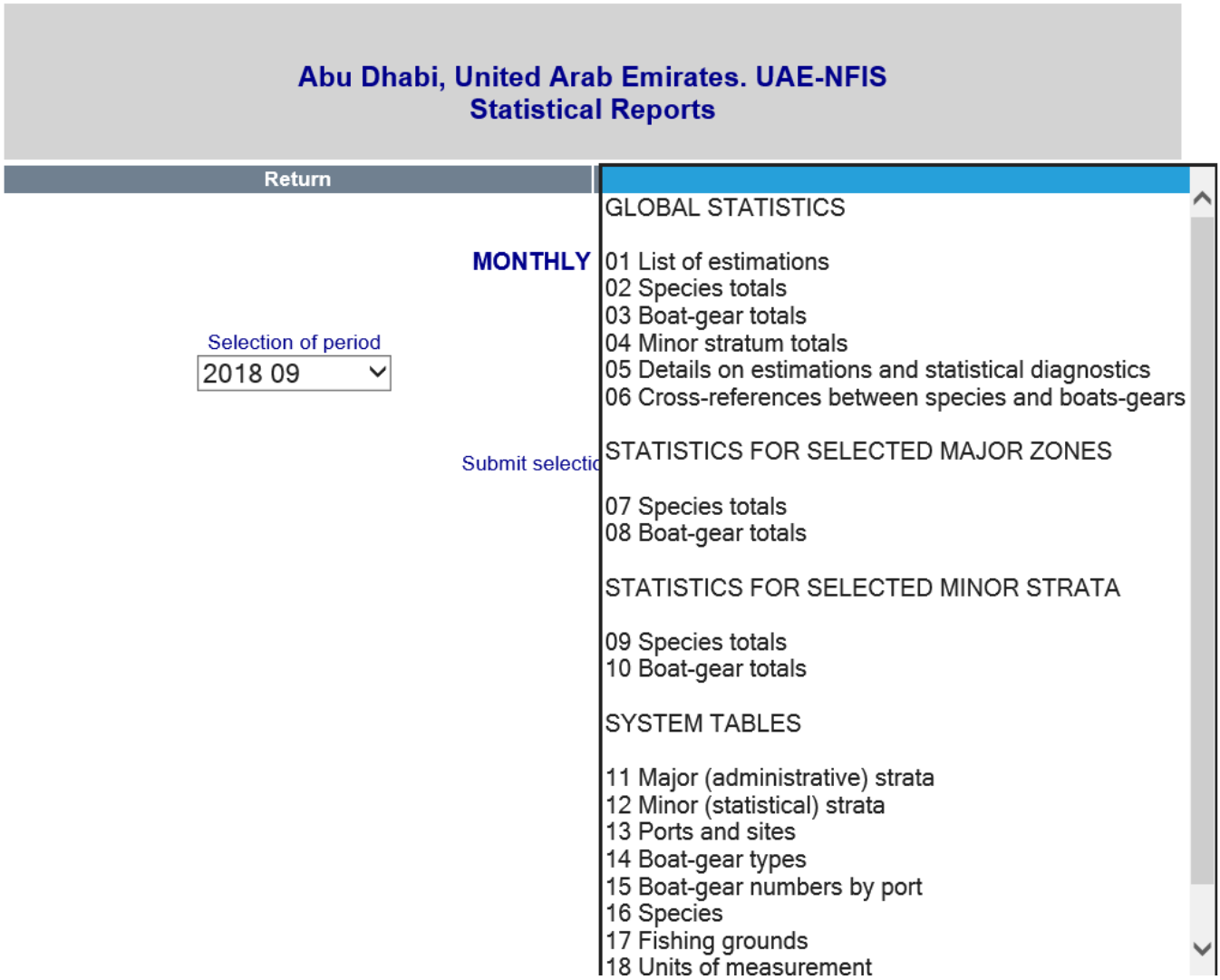


Figure 8. Reports on monthly estimates

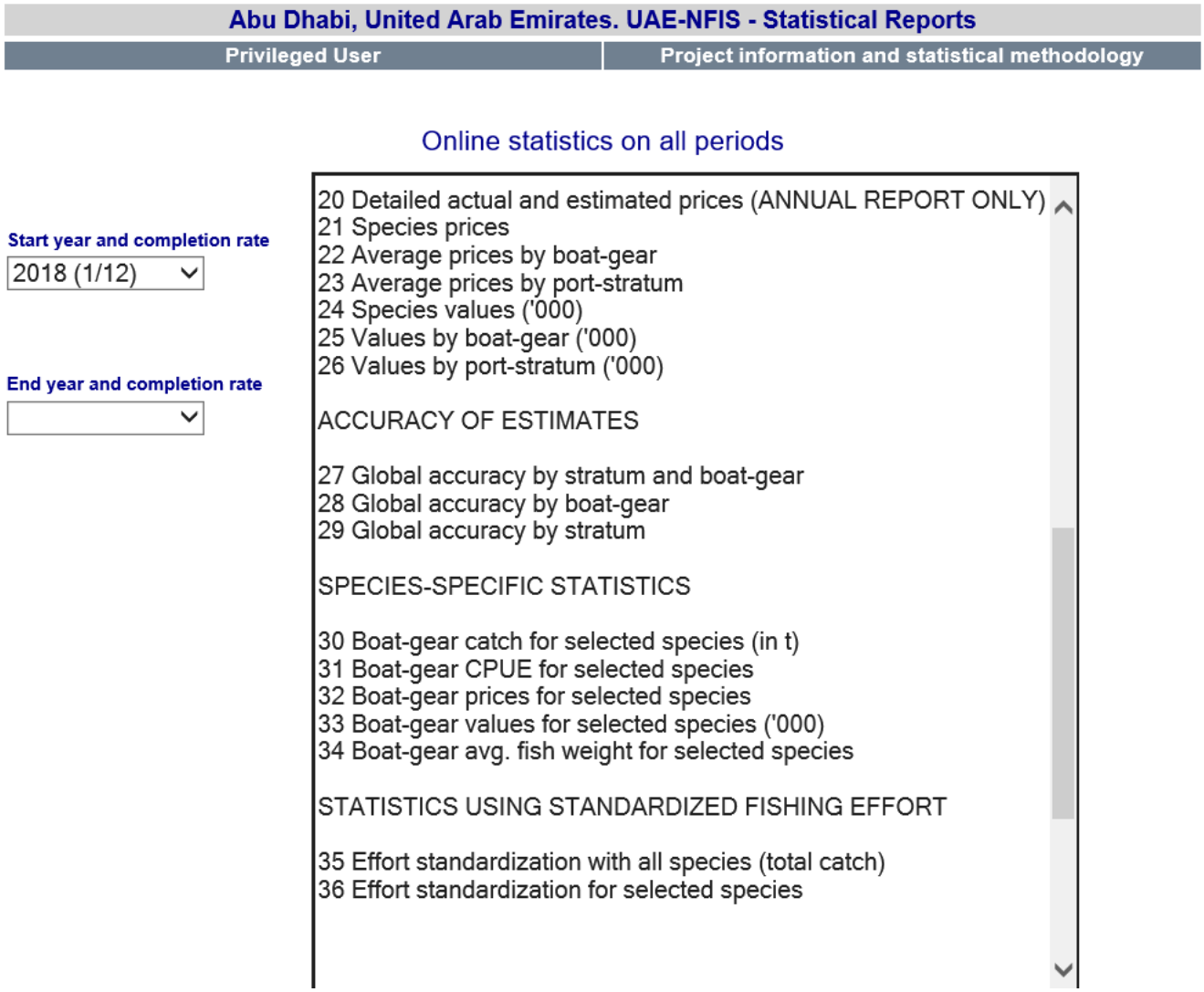


Figure 9. Analytical Reports (last two concern standardization of fishing effort and CPUE)

7. UAE-NFIS consolidation and final review

This phase will be completed during the fourth (and last) mission of the consultant that is scheduled to take place in November-December 2018.

The following tasks are envisaged:

1. Finishing touches on system messages, particularly the Arabic version.
2. Improvement of some of the information media.
3. Finalization of the UAE-NFIS module that handles catch/effort indicators by statistical grid.
4. Eventual revisions to data collection schemes (frequency of sampling) with the view of improving the overall accuracy.
5. Formal presentation of UAE-NFIS to stakeholders.
6. Preparation of a detailed deployment plan for the post-project period.
7. Preparation of Mission Report 4.
8. Preparation of a Final Report describing the project outcomes and containing a special section with conclusions and recommendations.

8. Post-project period

As stated in earlier section 7 a detailed post-project plan will be prepared during the fourth mission of the consultant. At this early stage no details can be easily given; it is envisaged however that the post-project plan will deal with the following issues:

1. Role of the consultant during the 6-month warranty period for technical backstopping and eventual trouble shooting.
2. Routine administration operations with emphasis on frequent (daily?, weekly?) system backup.
3. Establishment of a small steering committee to meet twice a year with the purpose of monitoring system progress and eventually revise the system standards (these should not be altered during an operational cycle).
4. Define types of regular statistical publications such as statistical highlights and bulletins.
5. Organize refreshment training courses for data collectors and supervisors.

Annex A : Terms of reference

1 Summary

This Proposal concerns the implementation of a fully operational internet system for the statistical monitoring of fisheries in the UAE. The system will be delivered in its entity (field operations and manuals, computer modules, database, training, documentation) within a twelve (12) months period, and starting with the first mission of the consultant. The project cycle consists of four phases, each of which the consultant works 15 days in the UAE (mission) interspersed in a 2-3 months period when the national staff will be collecting and entering data. See Chapter 8 for the detailed Work Plan. The total input of the consultant will span 70 working days of which 60 in four missions of 15 days each.

The objectives of this Proposal are:

- Strengthening the technical capacity of the Environment Agency - Abu Dhabi (EAD) by means of training in applied fisheries statistics and in operating internet-supported databases;
- Setting-up a robust and sustaining statistical work frame for field and office operations for the effective statistical monitoring of fisheries in the Emirate of Abu Dhabi (UAE);
- Implementing a web-based and integrated Fisheries Information System (FIS) to be used for the fulfillment of statistical commitments to national user groups as well as to regional and international fisheries bodies.

2 Profile of the Consultant

The consultant is the holder of an MSc in Mathematics and Statistics and of a Doctorate in Numerical Analysis and Computer Sciences. His PhD thesis on automated combinatorial techniques awarded him in 1971 the 2nd Prize of the PHILIPS European completion for young scientists.

In 1971 he joined FAO and became Senior Fisheries Officer in 1980. Since then he worked in more than 50 countries worldwide in the sector of fisheries statistical development. Several of the methods he developed for stock assessment and sample-based statistical programmes became international standards. His functions and responsibilities have been manifold, covering a wide area of applications such as project formulation, backstopping and evaluation, technical support, training, etc. A major product that has been widely used in more than 30 countries was the ArtFish software that initially operated under Windows (local mode).

The consultant retired from FAO in 2005 but continued to work as freelance consultant, always in the sector of fisheries statistical development. His employers include FAO, the EU, the World Bank and National Governments.

In 2011 the Consultant foresaw the need for an ArtFish supported by internet, thus catering for decentralized operations. The first ArtFishWeb prototype was developed for Qatar and became fully operation in 2013. In 2014 ArtFishWeb was adapted for Lebanon and in 2015 for Egypt. At present ArtFishWeb is being adapted for Algeria, Zanzibar and Tanzania Mainland.

3 Statistical outputs

- A sample-based fisheries statistical monitoring programme which will be tailored to fit with existing human and financial resources;
- A fully trained group of national experts trained in all aspects of basic statistics, field operations and computer functions;
- A fully operational Catch/Effort database that will be 100% internet-supported;
- The Catch/Effort database will subsequently be upgraded to a National Fisheries Information System (NFIS) by incorporating information media automatically linked to numerical data;
- Statisticians and researchers will be trained in the use of the database, selective extraction of statistical data and preparation of statistical publications, including analytical applications;
- A guarantee period of six (6) months will be granted to the Client upon termination of the contract.

4 Training specifications

- Three manuals for computer operations (for the administrator, data operators and privileged users respectively;
- Automatic HELP screen for all system functions;
- Computer simulators for easier learning of basic statistical concepts in sampling;
- Statistical textbooks adapted from FAO standard literature (FI/TP/388-425-454).
- Training to be conducted at three levels: Field operations (sampling catch and effort), computer operations, statistical analysis. Each level will address different audiences.

5 The NFIS: General Features

The National Fisheries Information System will be used by partners to independently store, analyze and report catch and effort data, and other basic statistical monitoring variables such as prices, values, CPUE’s, average fish weight, etc. The internet front-end database application will become an integral part of the Database Systems of EAD and hosted on its servers. The system shall:

- Have an appropriate archiving mechanism;
- Have an Arabic/English interface;
- Be capable of recording and maintaining statistical standards (species, boat-gear types, stratification schemes, etc.);
- Record and maintain sample data using data forms;
- Perform statistical estimation procedures with controlled accuracy;
- Run predefined queries and produce predefined reports;
- Run ad hoc queries and produce ad hoc reports;
- Exporting data and information using popular commercial packages (i.e. Excel);
- Incorporate standard methodological tools as recommended by FAO and RECOFI.
- Contain data security and data integrity functions;
- Be capable of eventually becoming a component of a larger-scope application together with other statistical sectors.
- Have advanced accessibility features and accommodate several levels of users such as Data Entry Operators, Data Supervisors, Application Administrators, Privileged Users, etc.

6 NFIS Database Technology

- The NFIS shall be web enabled, so that it is functional to run from all standard Internet browsers.
- It shall be optimized for web retrieval / updates. Its performance will remain the same over its entire life, thanks to the special database architecture employed in its development.
- Users will operate completely autonomously, even if the same user re-opens the system from the same computer (or laptop or tablet or smartphone).
- Uniform color, character and format shall be maintained in all the forms, following EAD portal standards. The reports shall bear standard titles and formats.
- It shall be user-friendly with smooth movement among forms to complete the desired task and smart tips / error messages to help users.
- It shall follow Windows application standards like cut, copy & paste to minimize typing in all text fields, enter / tab key to move to next field, Windows sorting methods and standard controls.

7 Technical reports (in addition to mission reports and final report)

- Project plan and structure document;
- Database Design and Data Dictionary Documents;
- Technical specifications document;
- Deployment plan;
- Users' manuals at all levels (administrator, data operators, privileged users, etc.);
- PhP source code with detailed documentation.