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REQUIREMENTS FOR THE OPERATIONAL VERSION OF THE FIRMS MODULES
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Note: This is a DRAFT document provided for information and in the hope of attracting comment at the FSC meeting and feedback afterwards. The FSC is invited to comment on the approach, particularly in terms of concepts and workflows.

Modelling the management of information on fishery resources in FIRMS

Discussion on high level Requirements for the FIGIS-FIRMS system

Referring to the recommendations of the FIGIS-FIRMS 2002 workshop, to the basic principles of the FIRMS draft information management policy, to the Stocks and Resources prototype and feedback from partners, to the experience gained through implementing the inventories of stocks, resources and fisheries, this document discusses a few key issues, the proposed answers, and their translations into system requirements. It is expected that discussion over this document will provide guidance to confirming/amending the proposed requirements for the FIRMS operational module to be developed, and highlight areas for strengthening of the FIRMS information management policy.

The issue comes from an initial intention to draw a clear boundary between resources and fisheries, in other words between:

- a biological view: fish populations within defined geographical areas, modelled as resources or stocks (when single species and if scientifically defined).
- an exploitation view: human intervention on fish populations based on fishing activity descriptors, modelled as fisheries.

When applying this "Boolean" view at global level, we were faced with two kinds of problems:

- from institutions having a management mandate, the need to consider management units instead of resources, stocks or fisheries (see examples in Table 1).

Table 1

Objects from inventories with FIRMS partners	initial categorisation (FIGIS team)	future categorisation	
		likely	possible
Tuna in the Western Central Pacific Ocean (SPC)	Resource	Fishery	Management unit Management system
Tuna purse seine fishery in WCPO (SPC)	Fishery	Fishery	
Yellowfin Tuna in South Pacific Ocean (SPC)	Stock	Stock	
Bigeye Tuna in Pacific Ocean (SPC – IATTC)	Stock	Stock	
Bigeye Tuna in Eastern Pacific Ocean (IATTC)	Resource	Management unit	Fishery
Bigeye Tuna in Western Central Pacific Ocean (SPC)	Resource	Management unit	Fishery
Tuna in the Atlantic (ICCAT)	Resource	Management unit	Management system
Albacore in the Atlantic Ocean (ICCAT)	Resource	Management unit	Fishery
North atlantic Albacore (ICCAT)	Stock	Stock	
South Atlantic Albacore (ICCAT)	Stock	Stock	

- from experience gained while implementing inventories of resources and fisheries, the need to be very flexible in the definition of a fishery, including the fact that an object defined by a [species x area] criteria may be called a resource (or stock), a fishery or a management unit, depending on the data owner. In the following examples extracted from the Fisheries and Stocks&Resources inventories of the FAO statistical area 34 (Eastern Atlantic), the first row shows that the [species x areas] key normaly used for a resource may also be the identifier of a Fishery.

Table 2

Extract of Resources&Stocks inventory	**Extract of Fisheries Inventory**
Céphalopods in the North West of Africa	Moroccan **Cephalopods** fishery
Octopus vulgaris in the North of the Eastern Central Atlantic	Artisanal fishery
Stock of Octopus vulgaris in Morocco	Coastal bottom trawl fishery
Stock of Octopus vulgaris in Mauritania	Freezer bottom trawlers fishery
Stock of Octopus vulgaris in Senegal	Spanish Freezer bottom trawlers fishery
Other cephalopods in the North of the Eastern Central Atlantic	etc…
etc…	

Our experience while developing inventories and cases studies with partners demonstrated the importance of workflow and validation steps:

- Inventories provide lists of objects, initially qualified at the basic level of Resource or Fishery, plus hierarchies between objects.

- Objects' categorisation refinements occurs together with confirmation on their ownership and clarification on the level at which management is implemented.
- Objects are then validated for internet dissemination.
- Reporting on objects (ie adding observations) will further help qualifying these objects and their relationships.

New approach recommended: therefore, it became obvious that static modelling associated with the aforementioned Boolean approach was not sufficient, and that sound definitions[1] together with a more dynamic process were necessary to complement static modelling and qualify appropriately the objects targets of reporting in FIRMS. This dynamic process includes:

a) in the initial inventory steps, the various review cycles implied by the inventory methodology; involving different actors (FIGIS team members, then FIRMS partners or regional experts)

b) at ownership assignment time, the principle perspective brought over the considered object by the data owner;

c) at reporting time, the types of topics developed to document the object;

Of noticeable interest, this approach still based on definitions but giving higher importance to review cycles and workflow is consistent with the real world where the perception of singularised components of fishery resources follows a process of growing awareness and step-by-step adjustments.

Figure 1 shows the various approaches considered until now in the inventory process, and the various qualifiers which a single object identified through one of these approaches may get. Definitions for the terms used in this figure are proposed in Annex.

It is of particular interest to establish that a fishery resource (an object defined by the [species x area] criteria) can be identified from both the resource and fisheries inventory approaches: in the first case (see table 1), one will initially identify a fish population unit which will subsequently be described in terms of its exploitation, therefore transforming it into an exploited resource (or fishery resource); in the second case (see table 2), we found it common that one willing to define a unit materialising fishing activity at a certain level of aggregation do so using a similar [species x area] criteria, yet again defining a fishery resource.

Likewise, from both approaches, the next logical step is to describe (if any) the management occurring over this fishery resource. At this stage, the object originally identified as aquatic resource or fishery, subsequently as fishery resource, is as well considered as a management unit.

[1] proposed definitions on the FIRMS core concepts are provided in the annex of this document

Table 3

	GFCM/SCSA[2]	GFCM/SAC[3]	GFCM Commission
Hake in Gulf of Lyon	Stock		
Spanish trawlers targeting shrimps and hakes in the Gulf of Lion	Fishery		
Hake in Gulf of Lyon		Fishery	
Hake in Gulf of Lyon			Management unit

Finally, the management unit is positioned within the framework of a management system, together with other management units sharing same management strategies under a single legal framework.

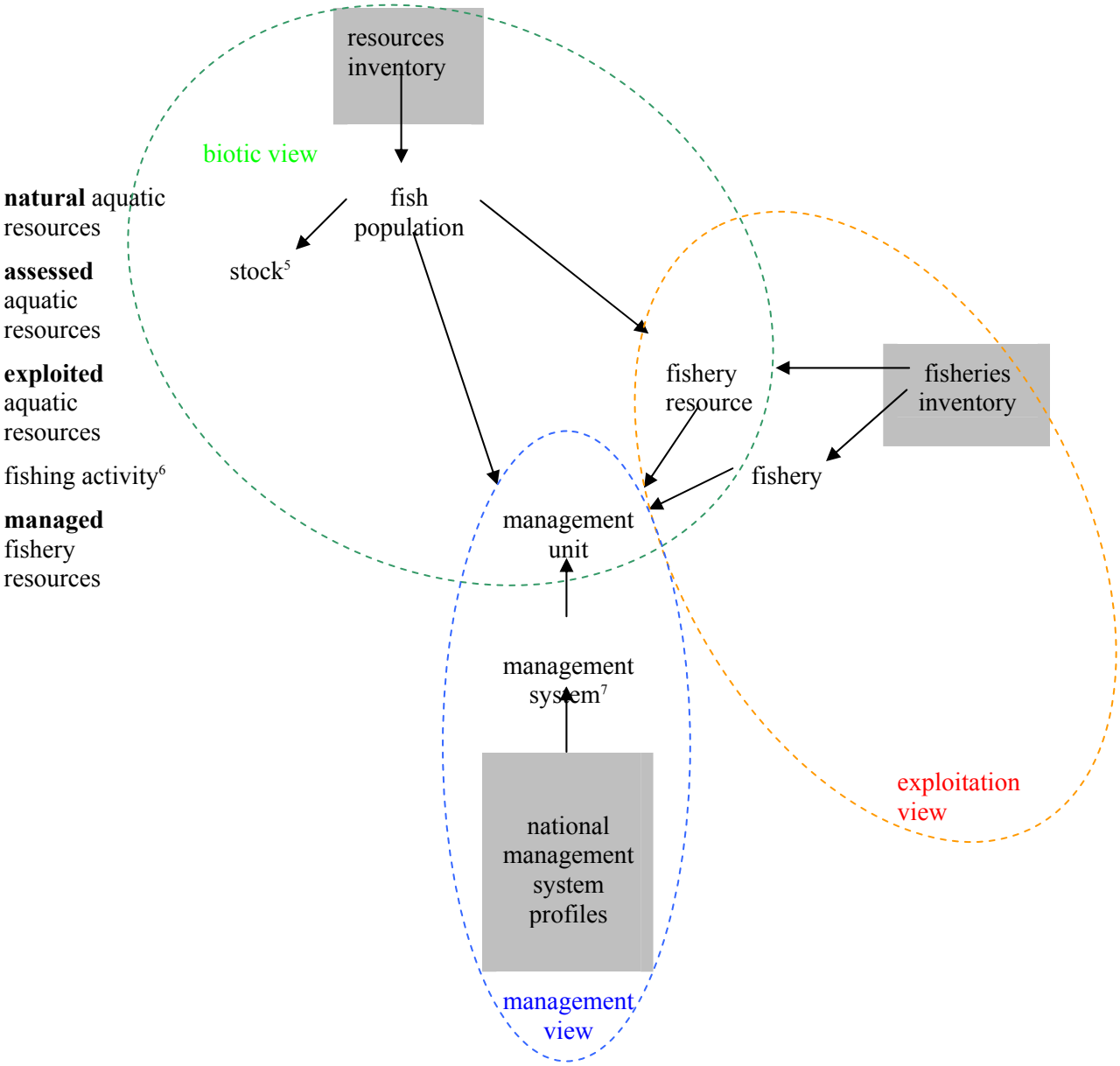
It is worth noticing that the responsibilities for reporting at various "qualifier[4]" stages may lie with various data owners. Considering also that data ownership in FIRMS provides the data owner with exclusive privileges over the owned object, it becomes necessary that objects going through different "qualifier" stages be duplicated thus allowing (if necessary) to assign eg 2 distinct data owners over the "Hake in Gulf of Lyon" stock and the "Hake in Gulf of Lyon" management unit.

[2] Sub Committee on Stock Assessment

[3] Scientific Advisory Committee

[4] with "qualifier" standing for Aquatic resource, Stock, Fishery resource, Fishery, Management unit, Management System

Figure 1: Approaches, concepts and qualifiers involved through perfecting knowledge on Fishery resources units



[5] scientifically defined, mono species

[6] human intervention on aquatic resources

[7] a framework governing decision making and measures over the management units

Requirements: this section may appear too technical to the FIRMS FSC audience, but it strives to translate into system requirements the above mentioned ideas.

However complex may be the real world, the FIRMS module should ensure simple mechanisms for its maintenance.

A first set of requirements should ensure the splitting of two processes: the creation of objects[8] over which a tight control is required, and the reporting on existing objects which consists of adding observations to these objects with the object's data owner having primary control over the content and the publishing process. The creation of new objects would fall under the inventory workflow control rules set by the FSC. Instead, each user with editing right in FIGIS can add observations to existing objects. Publishing approval for observations appended to any object can only be granted by the object owner.

- on the public site, queries composed by users will return only objects with a validated status. A non validated object cannot be queried in the public site. Direct queries on observations can only be performed by authorised users as defined by the FSC.

- objects void of observations give way to **identity sheets** (basic layout). For objects with observations, one of these observations (then called Main Observation) privileged by the owner is used to provide the up-front presentation of the object. Otherwise said, the object together with its main observation give way to the up-front **fact sheet**. The main observation is used by the search engine to see if an object fit a search criteria. Other observations attached to this object may be accessible from the fact sheet.

A possible layout for a query result over Aquatic resource objects could be:

	Name	Owner Acronym	Fact Sheet	Other observations from		
				data owner	Other	
MU, S	Hake in the Gulf of Lions	FAO-FI / GFCM	1998	1	2	List
R	Hake in the Tyrrhenian Sea	FAO-FI / GFCM	1993	2	0	List
F, S	Hake in the Adriatic Sea	FAO-FI / ADRIAMED	not available	0	2	List

MU: Management units
F: Fishery
S: Stock
R: Resource

A second set of requirements should ensure a logical association between objects qualifiers (resource, stock, fishery resource, fishery, management unit) and reported topics: in other words, for an object qualified as a stock, focus would usually be on the stock assessment topic, and just provide overviews on the stock exploitation, or the stock management; for an object qualified as a fishery, focus would instead be on the exploitation topic, but just provide overviews on the management topic; for an object qualified as a management unit, focus would be given on the management topic, and overviews only on the assessment and exploitation topics. Table 4 renders this idea in more details.

[8] one object would be one stock or resource unit listed in annex 2 of the FIRMS Partnership Arrangement

- from an object with qualifier ‘A’, an easy duplication of this object with qualifier ‘B’ should be enabled as soon as the data owner establishes the need to report on the topic corresponding to that qualifier ‘B’. For example, FAO-FI/GFCM as data owner of the object “Hake in the Gulf of Lion” will probably start reporting with a focus on Stock assessment, hence qualifying this object as a stock. If subsequently FAO-FI/GFCM is willing to report on management advice or management resolution, the same object will be duplicated with a “Management unit” qualifier under the same ownership. This would constitute an exception to the tight control over object creation. Note that this object duplication would as well provide for two distinct data owners if necessary.
- similarly, from an object with qualifier ‘A’, an easy creation of a related object with qualifier ‘B’ should be enabled as soon as the data owner establishes the need to report on the topic corresponding to this related object with qualifier ‘B’. Taking the above example, FAO-FI/GFCM may be willing to report on the exploitation of the “Hake in the Gulf of Lion”, providing details over the different fisheries fishing on this stock. This data owner would thus for example create as part of the report the fishery “Spanish trawlers targeting shrimps and hakes in the Gulf of Lion”, with this newly created object remaining with an invalidated status, ie not directly accessible to user queries but only through the “Hake in the Gulf of Lion”fact sheet. Turning it into a validated status would require undergoing the control rules of the inventory workflow.

- A third set of requirements is to avoid the brokering of a single report (eg status of Albacore Atlantic Management unit) across various objects invoked/involved within a this report (eg North Atlantic Albacore, South Atlantic Albacore), due to the risk of distorted information that such brokering would imply. Instead, associations should be established between the report and each of the 3 objects in such a way that the report remains one (for example constituting the main observation of the Albacore Atlantic stock) but at the same time that the sections of text associated with each of the objects involved (here North Atlantic Albacore, South Atlantic Albacore) be accessible from each object with layout artefacts highlighting these sections.

- A fourth set of requirements concerns the relationships between objects and observations, which will facilitate navigation across the data base content and should assist the user in understanding the overall logic governing the real world as reflected by the system:

1) associations are established between objects, they can be of hierarchical tree nature (from global resources to local stocks), or threads type (a same unit receiving different qualifiers, eg aquatic resource, fishery, management unit). Different hierarchies may coexist while involving the same objects: a global hierarchy would be maintained by the FIRMS secretariat in order to ensure overall consistency, while regional partners may be willing to set-up and maintain in parallel a regional hierarchy. Threads would be to a certain extent set-up automatically, but also maintained by data owners.

2) Logical associations are also established between the observations: for example the report on the state of two stocks (here North Atlantic Albacore, South Atlantic Albacore) together with the management recommendations specified for the single management unit (Albacore Atlantic) they belong to . These associations would reside entirely under the control of the data owner.

Table 4: Typical attributes for different types of objects handled by FIGIS-FIRMS

Object qualifier **Aquatic Resource**	**Fishery**	**Management Unit**
Identification		
Area	Area	Management System Ref
Species	Species	Fishery Ref
	Fishing Activity reference	Jurisdiction
	Exploitation unit reference	
	Production mean reference	
Profile		
Area		
Geographical distribution		
Species Habitat and Biology		
TOPICS		
Assessment		
Available data	Overview	Overview
Method	Aquatic Resource domain element	or use Aquatic Resource domain element
Assumption		
Methodology		
Available data		
Results		
Overall results		
Scientific advice		
Exploitation		
Overview	Available data	Overview
or use Fishery domain element	Exploitation indicators	or use Fishery domain element
	Stocks exploited	
Management		
Overview	Overview	Objectives
or use Management Unit domain element	or use Management Unit domain element	Strategies
		Management methods
		Resolutions
State and Trend	Status and Trend	Status and Trend
	Fishery Issues	
History	History	History

Annex 1: Source definitions

Aquatic Resource

Aquatic Resource: Biotic element of the aquatic ecosystem, including genetic resources, organisms or parts thereof, populations, etc. with actual or potential use or value (*sensu lato*) for humanity. Fishery resources are those aquatic resources of value to fisheries.

FAO Fisheries Glossary

Fishery Resource: In general, refers to elements of a natural aquatic resource (e.g. strains, species, populations, stocks, assemblages) which can be legally caught by fishing. May sometimes be taken as including also the habitat of such resources.

In FAO Fisheries Glossary. Modified from FAO (1998): Guidelines for the routine collection of capture fishery data. FAO Fish. Tech. Pap, 382: 113 p.

Stock

Fish Stock: The living resources in the community or population from which catches are taken in a fishery. Use of the term fish stock usually implies that the particular population is more or less isolated from other stocks of the same species and hence self-sustaining. In a particular fishery, the fish stock may be one or several species of fish but here is also intended to include commercial invertebrates and plants.

In FAO Glossary; FAO (1997): Fisheries management. FAO Technical Guidelines for Responsible Fisheries, 4: 82 p.)

Stock: A group of individuals in a species occupying a well defined spatial range independent of other stocks of the same species. Random dispersal and directed migrations due to seasonal or reproductive activity can occur. Such a group can be regarded as an entity for management or assessment purposes. Some species form a single stock (e.g. southern bluefin tuna) while others are composed of several stocks (e.g. albacore tuna in the Pacific Ocean comprises separate Northern and Southern stocks). The impact of fishing on a species cannot be determined without knowledge of this stock structure.

In FAO Glossary; Comonwealth of Australia (1997): http://www.brs.gov.au/fish/gloss.html

Stock: The part of a fish population which is under consideration from the point of view of actual or potential utilization.

Ricker W.E. (1975): Computation and interpretation of biological statistics of fish populations. Bulletin of the Fisheries Research Board of Canada, 191: 2-6

Fishery

Fishery: generally, an activity leading to harvesting of fish (sensu lato) from the wild using some fishing technology (capture fishery) as well as activities producing fish through aquaculture.

In FAO glossary.

Capture Fishery: The sum (or range) of all activities to harvest a given fish resource. It may refer to the location (e.g. Morocco, Georges Bank), the target resource (e.g. hake), the technology used (e.g. trawl or beach seine), the social characteristics (e.g. artisanal, industrial), the purpose (e.g. (commercial, subsistence, or recreational) as well as the season (e.g. winter).

In FAO glossary; modified from FAO (1997): Fisheries management. FAO Technical Guidelines for Responsible Fisheries, 4: 82 p.)

A *fishery* is an activity leading to the harvesting of fish, within the boundaries of a defined area. The fishery concept fundamentally gathers indication of human fishing activity, including from economic, management, biological / environmental and technological viewpoints.

FIGIS FIRMS July 2002 methodological workshop

Management System

Management: The art of taking measures affecting a resource and its exploitation with a view to achieving certain objectives, such as the maximization of the production of that resource. Management includes, for example, fishery regulations such as catch quotas or closed seasons. Managers are those who practice management.

Cooke, J.G. (1984), Glossary of technical terms. In Exploitation of Marine Communities, R.M. May (ed), Springer-Verlag

Management authority: The legal entity which has been assigned by a State or States with a mandate to perform certain specified management functions in relation to a fishery, or an area (e.g. a coastal zone). Generally used to refer to a state authority, the term may also refer to an international management organisation.

FAO (1998): Guidelines for the routine collection of capture fishery data. FAO Fish. Tech. Pap, 382: 113 p.

Fisheries Management authority: the body which makes the decisions on how the fishery is carried out, and is responsible for all ancillary services, such as statistics gathering, assessment, MCS, consultation with fishers and other users of the sea, and resource allocation or determining the conditions of access to the fishery.

FAO (1995a), Guidelines for responsible management of fisheries. In Report of the Expert Consultation on Guidelines for Responsible Fisheries Management, Wellington, New Zealand, 23-27 January 1995. FAO Fisheries Report, 519

Management System: functional system governed by an authority having a mandate to perform certain specified management functions focusing on a fishery or portion of a fishery organised around biological, geographic, economic, technical, social or ecological dimensions. This functional system can be formalised through a legal framework or not (practices).

FIGIS

Management Unit

Fishery Management Unit: a Fishery Management Unit (FMU) is a fishery or a portion of a fishery identified in a Fishery Management Plan (FMP) relevant to the FMP's management objectives."

FAO Glossary for Responsible Fishing

Management Unit: a Fishery focus of management within a management system.

FIGIS

Jurisdiction

No definition found in the FAO glossary. A jurisdiction includes concepts of area of competence, authority, and rights defined from legal or customary sources.