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TRENDS AND EMERGING ISSUES OF THE GULF FISHERIES: A REGIONAL PERSPECTIVE

BACKGROUND

The Gulf region is characterized by rich marine biodiversity and productive ecosystems, supporting valuable fishery stocks. Coastal countries benefit from the goods and services from the Gulf and Sea of Oman ecosystems, share many of the fishery resources as well as the responsibility for their sound management. In the region, fisheries may appear of low importance in economic terms. Marine fisheries production, however, in 2006 reached 700 000 tonnes. This is a substantial volume of fish contributing significantly to food security and employment.

It is of concern that there are reports indicating that Gulf fisheries are relying increasingly on low-value species, thereby concealing the slow degradation of demersal high-value resources. The depletion of fishery stocks in the region constitutes a loss of regional wealth.

The Gulf region has the characteristics of a semi-enclosed basin. Eight countries border the region and all are members of the Regional Commission for Fisheries (RECOFI) that was established in 1999 under the provision of Article XIV of the Constitution of the Food and Agriculture Organization of the United Nations (FAO). The FAO Code of Conduct for Responsible Fisheries further emphasizes the necessity, when in presence of shared stocks, for coastal states to cooperate for fisheries research and management.

The paper¹ analyses and discusses current fishery trends and indicators at the regional level including emerging issues of relevance to the Gulf fisheries. Particular emphasis is given to the need of regional cooperation for fisheries research and management. The establishment of an ecosystem approach to fisheries in the region is discussed and a set of recommendations is also proposed.

¹ Paper prepared by Piero Mannini, Food and Agriculture Organization of the United Nations (FAO), Regional Office for the Near East and North Africa, 11 Al Eslah El Zerai St., Dokki-Cairo, P.O.Box 2223 Cairo, Egypt. Tel: +202 33316000. Email: Piero.Mannini@fao.org; and Monica Barone, FAO, Fisheries and Aquaculture Division, Marine and Inland Fisheries (FIRF), Viale delle Terme di Caracalla, 00153 Rome, Italy. Tel: +39 0657054218. Email: Monica.Barone@fao.org

INTRODUCTION

The Gulf and the Sea of Oman are sub-systems of the Arabian Sea, classified as highly productive Large Marine Ecosystem (Sherman and Hempel, 2008). The Gulf is a semi-enclosed sea with relatively shallow depth and demanding natural conditions: high evaporation rate, high surface sea temperature, high salinity and low water exchange. The main source of freshwater into the Gulf is from the Shatt al-Arab River that is probably the dominating component of the region production (Al-Yamani et al., 2007). The Sea of Oman is mostly influenced by a monsoon regime with consequent intense upwelling of nutrient-rich water and seasonal variations in productivity (Wiggert et al., 2005; Sherman and Hempel, 2008).

Since the discovery of oil and gas reserves, the region has experienced a rapid economic development of the coastal areas. Among other things, it has been subject to impacts from drilling, refining, dredging, as well as from fisheries and maritime transportation. The major natural and human-induced threats affecting the regional marine environment include salinity, temperature extremes, habitat lost, pollution and climate change (Munawar et al., 2007).

As a result of its own distinct history, the Gulf region is characterised by a unique assemblage of species of Indo-Pacific origin, capable of withstanding both the prevailing natural conditions and the human interventions. About 500 fish and invertebrate species are considered of major ecological importance in the area (FAO, 1997), some of which are regarded as priority for their relevant commercial value (FAO, 2008a).

The contribution of the marine fisheries to the economy of the Gulf coastal countries may appear of low importance compared to the oil industry. Nevertheless, in these countries marine capture production reached 700 000 tonnes in 2006 and the fishery sector provides employment to more than 100 000 fishers, assuring livelihood for more than one million people (FAO, 2009a). The population expansion will continue to place increasing pressures on the marine resources and especially on demersal high value resources like shrimps, emperors, groupers, croakers and cephalopods, that are already reported as fully or overexploited in the area (De Young, 2006).

In view of the complex semi-enclosed nature of the Gulf ecosystem the marine resources are shared between coastal countries, as many marine species use different habitats at different stages of their life cycle, which may involve trans-boundary migration (Khan, 2007). The FAO Code of Conduct for Responsible Fisheries clearly emphasized the cooperation among coastal countries as unavoidable requirement for the responsible exploitation and conservation of shared stocks (FAO, 1995). Eight countries of the Gulf region (Bahrain, Islamic Republic of Iran, Iraq, Kuwait, Oman, Qatar, Saudi Arabia and United Arab Emirates) are members of the Regional Commission for Fisheries (RECOFI) that was established in 1999 under the provision of Article XIV of the Constitution of the Food and Agriculture Organization of the United Nations (FAO).

Since the 2007, the RECOFI commission initiated the effort to establish a regional strategy for fisheries management based on an ecosystem approach to fisheries (EAF; FAO, 2003; García et al., 2003) with the ultimate goal to ensure long term sustainability of a whole system, including fisheries resources, human communities and natural environment supporting them (FAO, 2009b). The purpose of this paper is to analyse and discuss current fishery trends and indicators at the regional level highlighting some emerging issues of relevance to the Gulf fisheries.

THE STATUS OF MARINE FISHERIES RESOURCES IN THE GULF AND SEA OF OMAN

Data included in the RECOFI capture database are available from 1986 to 2007 for the eight RECOFI countries and they are collected by two statistical divisions, namely Gulf and Oman Sea (FAO, 2009a) (Figure 1).

In the Gulf and Sea of Oman the total capture production increased from around 350 000 tonnes in 1986 to over 700 000 in 2006 with a decrease of about 30 000 tonnes in 2007 (FAO, 2009a) (Figure 2). The ranking of the producers countries in 2007 (Figure 3) shows that the Islamic Republic of Iran reported almost the half of the total capture production in the RECOFI area, greatly influencing the whole trend.

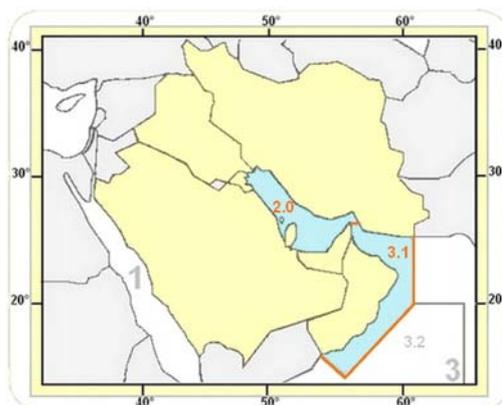


Figure 1. Map of the RECOFI statistical divisions: Gulf (2.0) and Oman Sea (3.1)

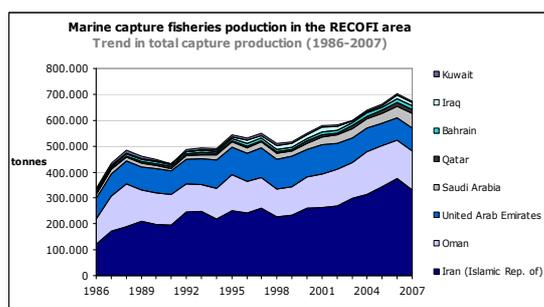


Figure 2: Trends of capture production in the Gulf and Sea of Oman. Source: RECOFI Capture Production (1986-2007) (FAO, 2009c).

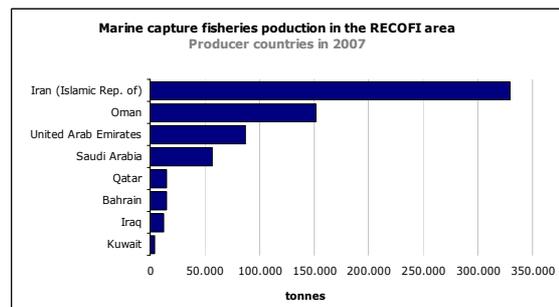


Figure 3: Capture production by coastal country in the Gulf and Sea of Oman in 2007. Source: RECOFI Capture Production (1986-2007) (FAO, 2009c).

Only two of the eight RECOFI countries report data from the two different statistical divisions, Islamic Republic of Iran and Oman. Regarding the trends in divisions, a periodic phase of inverse trends has been observed (Figure 4) (FAO, 2009d).

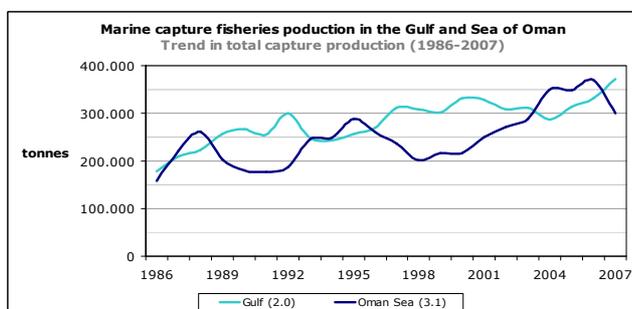


Figure 4: Trends of capture production by RECOFI statistical divisions (Gulf and Sea of Oman). Source: RECOFI Capture Production (1986-2007) (FAO, 2009c).

Nevertheless, the catch composition of the two division presented some noticeable differences. When the trend for the major ISSCAAP (International Standard Statistical Classification for Aquatic Animals and Plants) groups is analysed, in the Oman Sea division, tunas (Skipjack tuna,

Yellowfin tuna and Longtail tuna) represented more than 40% of the total landings. On the contrary, the Gulf capture production is characterized by coastal fishes (emperors, groupers and breams) reaching in average the 35% on the landings from 1997 to 2007 (Figures 5 and 6) and by relative high landings of shrimps (5%). It is worth noting that the change in total capture production of the RECOFI area observed in 2007 was mostly caused by the decrease of tuna landings in the Oman division from 203 240 in 2006 to 141 902 tonnes in 2007.

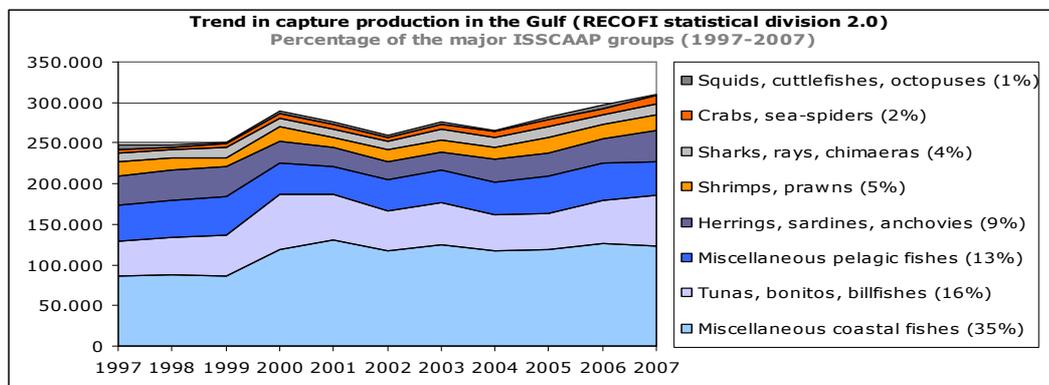


Figure 5. Trend of the capture production by major ISSCAAP groups in the Gulf division. Source: RECOFI Capture Production (1986-2007) (FAO, 2009c).

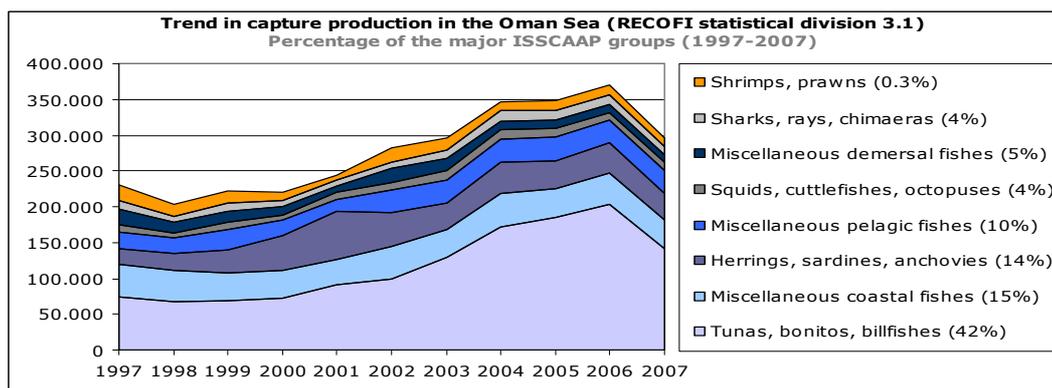


Figure 6. Trend of the capture production by major ISSCAAP groups in the Oman Sea division. Source: RECOFI Capture Production (1986-2007) (FAO, 2009c).

PRIORITY SPECIES

In order to achieve a minimum level of regional harmonization in data processing and reporting in the region, the RECOFI member countries compiled a list of 17 priority species whose stocks support fisheries of common interest. Actually, in the RECOFI Capture Production dataset, the priority species are mostly aggregated at higher taxonomic groups, thus often it is not possible to analyze complete time series for the single species (FAO, 2009d). The total landings of priority species remained relatively stable in the Gulf division, around 50% of the total landings from 2000 to 2007, whereas it decreased from more than 50% in 2001 to 30% in 2006 in the Oman Sea division (Figure 7 and 8). A simple Susceptibility Productivity Analysis (PSA) conducted in 2008 by the RECOFI Working Group on Fisheries Management revealed that shrimp trawls and driftnet were the two main gears that could give greater impact on priority species and that sharks were the most sensitive to gears used in the region, followed by groupers and emperors.

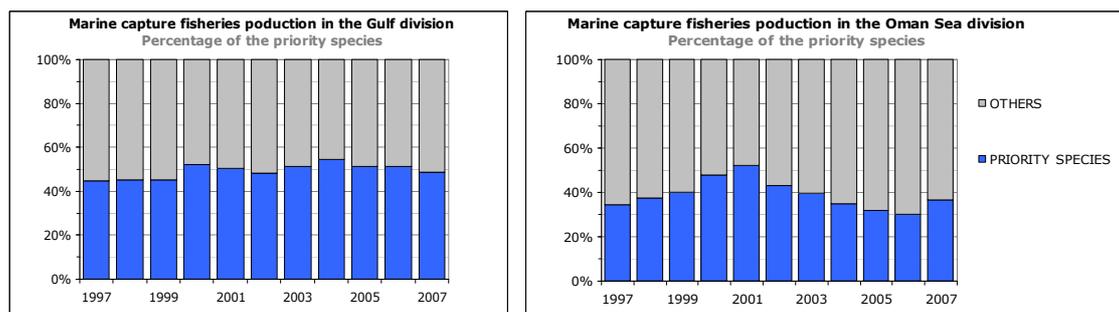


Figure 7 and 8. Percentage of the priority species in the Gulf and Oman Sea divisions. Source: RECOFI Capture Production (1986-2007) (FAO, 2009c). (When priority species series was not available the higher taxonomic group was selected).

SHRIMP FISHERIES IN THE GULF DIVISION

Shrimps are historically an high-value resources in the Gulf area, considered overexploited throughout the region (De Young, 2006). Shrimps are mostly recorded as *Penaeus semisulcatus* (Green tiger prawn), *Penaeus* spp or *Natantia*, including the species *P. semisulcatus* and *Metapeaneus monoceros* (Speckled shrimp). Landings reached 20 000 tonnes in 2007 and the major producer countries in the region were Saudi Arabia, Iran, Kuwait and Bahrain (Figure 9). In Saudi Arabia the trend in landings increased from 5 000 tonnes in 2001 to over 9 000 in 2007 and the species *P. semisulcatus* represent more then 90% of the annual shrimps landings. From 2000 to 2007 in Iran the landings of *Natantia* fluctuated around 5 000 and 8 000 tonnes, while in both Barhain and Kuwait varied between 1 000 and 2 000 tonnes.

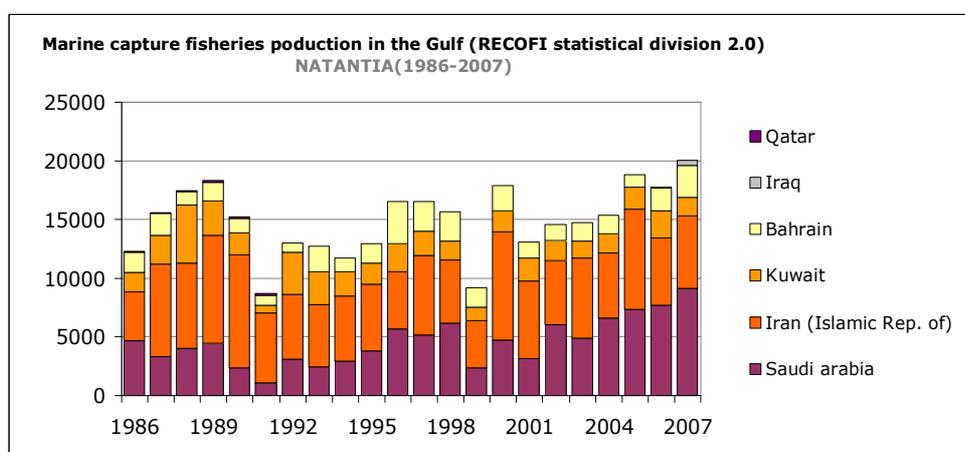


Figure 9. Capture production of *Natantia* in the Gulf division. Source: RECOFI Capture Production (1986-2007) (FAO, 2009c).

Several management measure are in place for the regulation of the shrimp fisheries in the aforementioned countries, including minimum mesh size, closed nursery areas and closed season (FAO 2009b). Shrimps are mainly caught by shrimps trawls and the high rate of by-catch (about 50%), broadly represented by juveniles of commercially important coastal species, is a common concern for the RECOFI countries (FAO, 2009b).

A shared resource: the Narrow-barred Spanish mackerel as case study *Scomberomorus commerson*, locally called chanaad (Arabic) and kingfish (English), is considered one of the most important pelagic commercial species, supporting substantial small scale fisheries. Greater part of landings come from selective gears like kingfish fixnet, gillnets and long-lines (FAO, 2009b). *S. commerson* is a highly migratory species and research on stock structure using genetic markers indicated that a single intermingling genetic stock is present in the Gulf and the Sea of Oman (Hoolihan et al., 2006). In addition, numerous studies on the life history parameters and

distribution of this species supported the existence of several local spawning grounds in the Gulf region. As this species is clearly a shared resource exploited by the fisheries of the coastal countries, joint studies addressing the issue of king fish assessment and migrations are strongly advisable (Grandcourt et al., 2005; Sadeghi et al., 2009). Therefore, in 2009, the narrow-barred Spanish has been selected by RECOFI countries as the first case study for a regional stock assessment.

In the RECOFI capture production dataset, the total landings of *S. commerson* shows a period of high landings reaching 36,000 tonnes in 1988, before stabilization at lower values around 20,000 tonnes from 1995 to 2007. In 2007, 44% of the total capture production was reported by Iran, followed by United Arab Emirates (21%), Oman (14%) and Saudi Arabia (12%) (Figure 10).

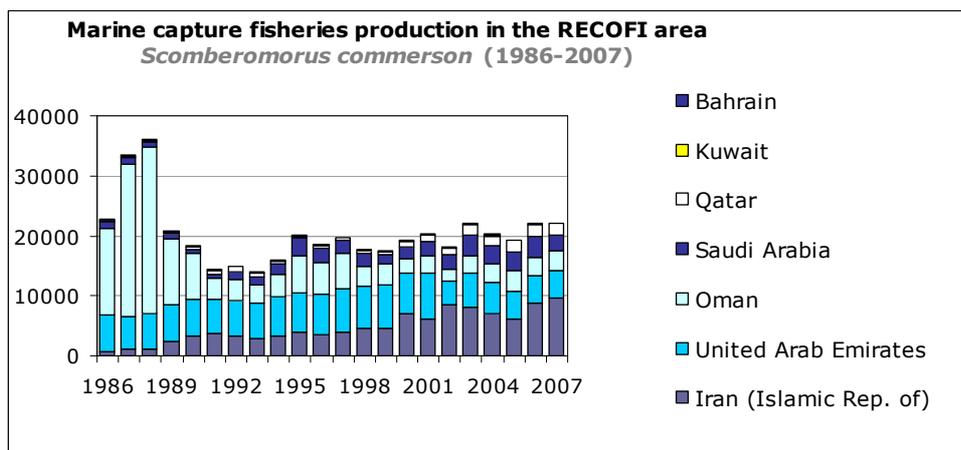


Figure 10. Capture production of *S. commerson* in the RECOFI area. Source: RECOFI Capture Production (1986-2007) (FAO, 2009c).

According to the method of Grainger and Garcia (1996) for the analysis of the rate of increase, the time series was shortened, from 1988 to 2006, by the processes of calculation and smoothing. The trend line of the rate of increase in the descending period, from 1993 to 2006, intercepts the axis in 2006, indicating that the maximum production under current exploitation regime has been approached. The maximum production according to the model is the value corresponding to the year when the rate of increase is zero, in this case corresponds to about 22 000 tonnes (Figure 11).

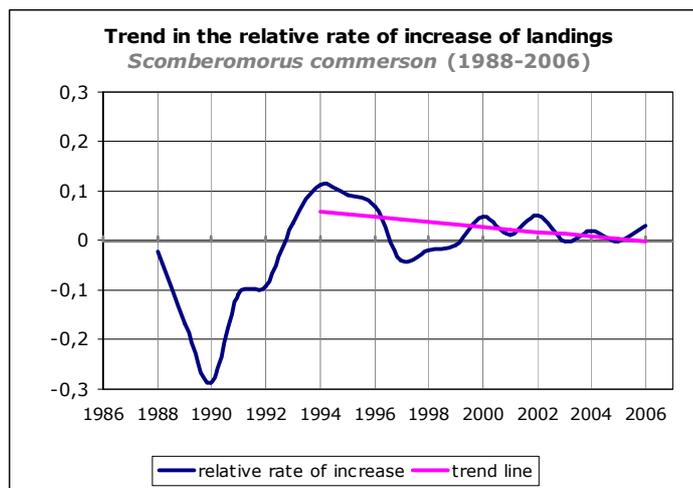


Figure 11. Trend in the relative rate of increase of *S. commerson*. Source: RECOFI Capture Production (1986-2007) (FAO, 2009c).

EMERGING ISSUES RELATED TO FISHERIES IN THE GULF

In the last decade the increases in fishing capacity and fishing effort, particularly in the dominant artisanal fisheries, have resulted in increasing pressure on many regionally important fish stocks and a number of these are now believed to be significantly overexploited (De Young, 2006). Therefore, some alternative resources are currently being exploited such as the blue swimming crab and the jellyfish, or considered for commercial exploitation (lanterfish).

The family Portunidae is widely distributed throughout the Gulf and the blue swimming crab *Portunus pelagicus* was estimated as the more common Brachyuran species in Iranian waters (Naderloo and Alireza, 2007). A growing fisheries exists for the blue swimming crab in Bahrain and Saudi Arabia, landing respectively 3 248 and 4 472 tonnes in 2007.

A recent developing fisheries in Bahrain target jellyfish, exported in Asia, mainly in South Korea and China (FAO, 2009b). The jellyfish harvested for food in Bahrain belong to the family Rhizostomidae and its capture production reached 1,759 tonnes in 2007.

Several researches attempted to evaluate the resource potential of the myctophid fish *Benthosema pterotum* (Myctophidae) in Iranian waters and to estimate the catch rates that could be achieved during commercial fishing. Even if some results showed that this species is thought to be highly resilient and a high biomass seems available, none of these studies demonstrated the commercial viability of this fisheries (Valinassab et al., 2007). In 2003, the Iranian fishing industry established a fishery for lanternfish in Iranian waters in the Gulf of Oman and has successfully processed these into fish meal. As reported by Iran, the current exploitation level and fleet size are quite low comparing to the optimum level. While estimated biomass of Mictophida was more than one million tonnes, only 5 700 tonnes were taken with two vessels in the last years (FAO, 2009b).

Finally, an emerging issue related to the marine ecosystem and its fisheries is represented by the red tide phenomenon, an harmful algal blooms (HABs) caused by marine ichthyotoxic dinoflagellates and responsible for mass mortalities of fishes, limitation of traditional fishery operations, damage of coral reefs etc. The sudden occurrence of HABs in the Gulf in 2008-2009 coincided with the expansion of the specie *Cochlodinium polykrikoides*. The mechanisms underlying this expansion require further investigation, and may include increased nutrient enrichment of coastal waters from domestic and industrial inputs, natural meteorological and oceanographic forcing (Mindy et al., 2009).

SOCIAL AND ECONOMIC ASPECTS OF THE MARINE CAPTURE FISHERIES IN THE RECOFI REGION

The fisheries in the Gulf and the Sea of Oman are multi-gear and multi-species, almost entirely represented by small scale fisheries, as in 2006 the industrial shrimp trawls were less than 0.01% of the fleet (number of fishing units) of the region. Analyzing the results of a regional preliminary qualitative assessment on the importance of fishery from social and economic aspects (FAO, 2009b), the fishery sector is firstly recognized essential for its role in local food supply contributing to national food security. It is also considered important in providing direct employment and for its contribution to export (Table 1 and 2). Shrimp trawl fisheries, spanish mackerel fishnet and barriers are considered the fisheries contributing more to the economic and social development.

Table 1: Number of vessels and fishers in the RECOFI countries. Source De Young (2006); FAO (2008b); FAO (2009b).

	Number of vessels			Estimated participants in the fisheries
	Industrial (Shrimp trawls)	Small scale	Total	
Bahrain	-	1129	1129	3152
Islamic Rep. of Iran*	44	7000	7044	33639
Iraq	-	400	400	2600
Kuwait	35	901	936	3377
Oman	31	13109	13140	27844
Qatar	-	515	515	4721
Saudi Arabia	34	1825	9619	8944
United Arab Emirates	-	5038	5038	16926

Table 2: Fishery product trade and fish consumption in the RECOFI countries. Source FAO (2008b; 2009c; 2009e).

	Capture Fisheries (t; 2007)	Fishery product trade (2007; USD 1000)		Apparent Fish consumption (kg/person; average 2003-05)**
		Export value	Import value	
Bahrain	15.012	15.600	9.052	15.4
Islamic Rep. of Iran	329.571	59.777	33.861	6.4
Iraq	12.319	70	2.117	1.2
Kuwait	4.373	1.564	65.990	9.7
Oman	151.744	92.493	26.849	28.0
Qatar	15.190	1.463	24.507	20.6
Saudi Arabia	56.862	60.569	250.922	8.5
United Arab Emirates	87.000	89.906	261.351	18.5

DISCUSSION AND CONCLUSIONS

The information provided above suggests the complexity of the fishery sector in the Gulf and the Sea of Oman, characterized by multiple components and interactions, involving natural and human environment, and transcending political boundaries. The management of shared fishery resources is one of the great challenges in the pursuit of sustainable fisheries. It should be

highlighted the fact that non-cooperative management easily leads to overexploitation and that management and enforcement of rules are rather obviously more complex for shared fisheries than for non-shared fisheries. Moreover, the nature of a semi-enclosed sea makes the RECOFI region a particularly suitable case to meet the provisions contained in Part IX (Article 23) of United Nations Convention on the Law of the Sea (UNCLOS, 1982) on cooperation of coastal states in enclosed or semi-enclosed seas. In addition, the FAO Code of Conduct for Responsible Fisheries (FAO, 1995) in coherence with UNCLOS and other relevant international declarations and fisheries instruments further emphasizes the necessity, when in presence of shared stocks, for coastal states to cooperate for fisheries research and management. Nevertheless, cooperative fishery research and, above all, management can be really effective when each part foresees benefits equal or superior to those it would expect in a scenario with no cooperation.

THE ECOSYSTEM APPROACH TO FISHERIES IN THE GULF REGION

The RECOFI region is comparatively small and bordered by a relatively high number of countries. The marine ecosystem's goods and services, including the rich fishery resources, are shared by eight coastal countries and territories. Addressing future ecological issues and challenges of the RECOFI region, calls for an ecosystem-oriented approach that includes cooperation among all the countries concerned.

Since the 2007, the RECOFI recognized a need to look more broadly at the fisheries considering not only the individual species but the surrounding ecosystem, and initiated the effort to establish a regional strategy for fisheries management based on an EAF with adaptive management procedures. In line with the RECOFI acceptance of the EAF (FAO, 2003; García et al., 2003), shared stock fisheries management should proceed on an ecosystem basis rather than on a single stock basis. Consequently, the RECOFI and its member countries could be expected to adapt themselves increasingly to deal with the ecosystem issues. In the implementation of the EAF it is important to understand the current state of the fisheries and its social, economic and institutional elements (De Young, et al., 2008). In practice it is necessary to consider explicitly what fishing activities, areas, groups that will, or will not, be included in the EAF process and what key community values will to be achieved. The RECOFI Commission conducted a preliminary survey exercise on the social and economic aspects of fisheries, associated to a Susceptibility Productivity Analysis (PSA), in order to identify possible management objectives to be adopted and implemented regionally. Based on the issues identified during this review process, three major and common concerned areas were identified: 1) ecosystem wide impacts of shrimp trawls ; 2) exploitation of finfish resources; 3) stock status of selected species (Narrow-barred Spanish mackerel) (FAO, 2009f). Currently the RECOFI intends to address the identification of the operational objectives to be adopted for each of the management issues recognized and then to proceed with the identification of the indicators to monitor the performance of the operational objective.

HOLISTIC APPROACH TO REGIONAL FISHERIES MANAGEMENT

A successful implementation of EAF requires the cooperation of the RECOFI Commission with others agencies operating in the same area such as the Regional Organization for the Protection of the Marine Environment (ROPME). The ROPME manages the marine environment of the Gulf following an ecosystem-based management (EBM) (Khan, 2007). The ecosystem-based management involves managing multiple resources and habitats taking into account a wide range of environmental factors. Thus EAF and EBM are complementary and should operate in synchrony even while their scope differs with respect to what is being managed.

Example of common management issues could be: the coastal zone development; the identification of sensitive areas and habitats. The coastal zone development caused significant impact on coastal fishery resources and marine ecosystems. Oil extraction, land reclamation, power plants, land-derived pollutions, decline in freshwater discharge all lead to changes of natural coastal environments, particularly the most sensitive and important inter-tidal zone that often provides nursery and fishing areas for many of important fishery resources. Responsible fisheries management and sustainable development of the fisheries in the region will much benefit

of knowledge sharing practices and of synergies with those organizations such as ROPME focusing on their impacts from pollution and environmental prospect.

Sensitive areas and habitats essential for life cycles of important fishery resources, including spawning areas and nursery areas, often coincide with habitats to be protected, like intertidal mud-flats, seagrass and algal beds, mangrove forests and coral reefs. These sensitive areas could be properly highlighted through joint activity developing GIS maps, an useful tool to handle spatial dimension in both fisheries and environmental management.

Worldwide one of the main trends today is the regionalization and internationalization of scientific research activities (Chang et al., 1997). Moreover, there is a general agreement that the fisheries management paradigm needs to be significantly broadened to match the definitions and principles of sustainable development and the welfare of humans as well as that of the ecosystem (García et al., 2000). In general, the contribution of science to support sustainable development processes will have to be based on the integration of different disciplines. Consequently, in recent years, commitments to a wider approach to fishery management have become numerous (e.g., implementation of the FAO Code of Conduct for Responsible Fisheries, and of the Ecosystem Approach to Fisheries) and increasing attention has been directed to the analysis of both the biological and socio-economic aspects of the fisheries management measures (Hilborn, 2007).

The adherence of RECOFI to the EAF will determine the need for a more integrated approach to the analyses and assessments that incorporate various types of data, disciplines and decision support tools. The need and rationale behind concerted regional activities and initiatives should be common to all the coastal countries concerned. Particular consideration should be given to address those issues that are of national relevance and at the same time are common to the whole region. This should contribute to the optimization of the available financial resources.

The role and function of Regional Fisheries Management Organizations such as the RECOFI are essential to facilitate and reinforce regional collaboration. They are the primary way to achieve cooperation between and among fishing nations that is essential for the conservation and effective management of international fisheries (Lodge et al., 2007). The sound management and development of the regional fisheries wealth necessarily require the establishment and development of regional and sub-regional cooperation for fisheries and environmental research. RECOFI appears as a convenient and valid mechanism to promote and enhance the regional dialogue and cooperation for the sustainable development of regional fisheries.

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