



**STRATEGIES FOR TRAWL FISHERIES
BYCATCH MANAGEMENT
(REBYC-II CTI; GCP /RAS/269/GFF)**

REPORT ON

**INVESTIGATION OF PRIORITIES FOR FISHING
CLOSED AREAS/SEASONS IN KIEN GIANG**

DIRECTORATE OF FISHERIES

**DEPARTMENT OF CAPTURE FISHERIES AND
RESOURCE PROTECTION**

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I. Introduction

Increasing human populations and exploitation pressures, growing threats from pollution and major ecosystem change are particular concerns in Vietnam in general and in KienGiang in particular. Also – as more widely in the global context – the non-targeted capture of fish and non-fish species, (fish, turtles, corals and other seabed fauna and flora), commonly called bycatch and discards, is of increasing concern. This part of the catch tends to be poorly monitored and not managed but could have an important impact on fishery resources, habitats and ecosystems. In some fisheries and regions, there is an increasing trend towards the retention of the bycatch consisting of juveniles and small-sized fish for use as food for human consumption or for utilization as aquaculture feed. This is therefore a complex issue, requiring resource and biodiversity aspects to be tackled alongside human needs and involving a mix of policy, technical and community support measures.

The project “Strategies for trawl fisheries bycatch management” (REBYC-II CTI) was conceived based on the successes of the 2002-2008 FAO/UNEP/GEF global project “Reduction of Environmental Impact from Tropical Shrimp Trawling through the Introduction of Bycatch Reduction Technologies and Change of Management”. The REBYC-II CTI project focuses on multispecies bottom trawling, where bycatch issues are amongst the most serious, with potentially significant effects on ecosystems and livelihoods. The Project is addressing these challenges by promoting sustainable fishing practices and improved trawl management. The REBYC-II CTI project was developed under the leadership of FAO (the Project implementing agency) in close collaboration with its partners: Southeast Asian Fisheries Development Center (SEAFDEC) and the governments of the participating countries; Indonesia, Papua New Guinea, Philippines, Thailand and Viet Nam. KienGiang province was selected as a pilot site to implement the project in Vietnam.

Marine capture fisheries of Vietnam have developed strongly and have significantly contributed to the socio-economic development, food security and maritime sovereignty of Vietnam. Over the past few years, in KienGiang Province, marine capture fisheries have considerably increased and are contributing significantly to the economic development of the Province. However, these increases have revealed many problems such as unsustainable development, insufficient and uncontrollable fisheries management, uncontrolled number of fishing boats and many fragmented and small-scale fishing operations. Illegal fishing has been occurring and has seriously been threatening marine resources sustainability, especially in the coastal areas. To overcome the above-mentioned shortcomings and to manage the capture fisheries in order to maximize the efficiency of using these resources while also conserving the marine ecosystem, the

development and implementation of fishing capacity management mechanisms will be very important. It is also recognized that the fishing capacity management such as fishing restriction, fishing closed season/areas, etc. will be the most relevant so that marine fisheries can continue to make significant contributions to socio-economic development, food safety and security, coastal community livelihoods, and the generation of foreign exchange through the export of fish and other fisheries products.

Temporary closed areas/seasons may be required to protect target stocks from mortality at a specific stage of their life history, such as when a species aggregates to spawn. The value of temporary closed areas/seasons as a management tool has to be assessed on a case-by-case basis, and will depend on the biology of the target species and the dynamics of the fishery. It is well recognized that temporary area closures lead to effort displacement if they are not accompanied by catch or effort controls. Management measures based on closed fishing area and season have been implemented in some areas of KienGiang such as PhuQuoc, to reduce fishing capacity and to protect some endangered and threatened species. However, the indicators/criteria used to select such areas need to be reviewed and adjusted, if needed in the changing of fishing activities and related ecosystems.

In addition, there have been no investigations to review if the existing closed areas/seasons are being respected and performing well in terms of reducing the effects of trawling activities on fish stocks and demersal ecosystems in Vietnam's waters. This report will (1) review the existing legislation in relation to fishing closed season/areas including MPA establishment regulations in KienGiang; (2) review the natural characteristics of fishing grounds in KienGiang in order to recommend suitable methods for managing fishing capacity (fishing closed seasons/areas) and (3) recommend suitable criteria to establish fishing closed seasons/areas in KienGiang province. Detailed TOR for this study can be found in the Appendix).

II. Overview of KienGiang's natural and resource conditions

2.1 Natural conditions

2.1.1. Geographical characteristics

KienGiang is located in the Southwestern part of Vietnam close to An Giang, Can Tho, HauGiang to the West and Bac Lieu, Ca Mau to the South. It is located in the Cuu Long delta and has a border with Cambodia of about 56 km in length. The overall area of KienGiang province is 6,269 km². PhuQuoc Island is one of the largest islands in the Province with a total area of 573 km². KienGiang's coastal waters are located in the Gulf of Thailand with the coastline length of more than 200 km. The area of sea around the coast is about

63,290 km², including more than 140 small and large islands. Maritime borders exist with Cambodia, Thailand and Malaysia.

2.1.2. KienGiang's climate and natural condition

KienGiang province has monsoon tropical climate with hot and wet weather year round. The annual average temperature of KienGiang is 27 – 27.5°C with an average rainfall of 1,600 – 2,000 mm in the mainland and approximately 2,400 – 2,800 mm in the Island regions. The rainy season starts from April to November and dry season from December to March. The humidity in KienGiang province normally varies from 77 – 87%, with an annual mean value of 82%.

1.1.2.1. Water temperature in KienGiang's waters

In May to June (the Southwest monsoon season), the water temperature is relatively high from 28.8 - 30.8°C, with an average of 30.2°C. The daily variation of water temperature is low (0.8 ÷ 1.0°C) and reaches a maximum level at 13.00-14.00 pm. The variation between surface and deep-water temperature is also not very high in Kien Giang waters with only a 0.7°C (Figure a & b). In December due to effects of Northeast monsoon season, the water temperature decreased about 4.0 - 5.0°C compared to the Southwest monsoon season. In this season, water temperature varied from 24.8 - 27.9°C with an average of 27,1°C. The variation between surface and depth layer temperature was not significant; 1°C higher in the surface than the deeper water layer (Figure 2 a & b).

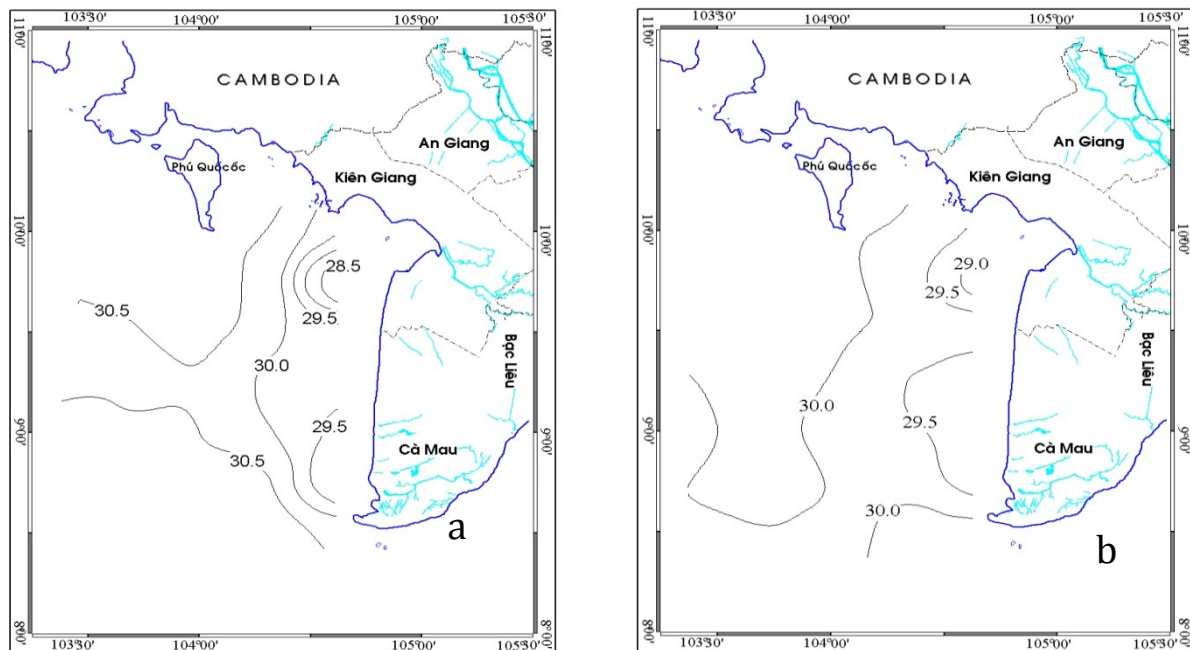


Figure1. Water temperature of surface (a) and depth (b) layers in KienGiang waters. According to a survey conducted at May and June 2005 (the southwest monsoon season). Source: Research Institute for Marine Fisheries (RIMF), 2005

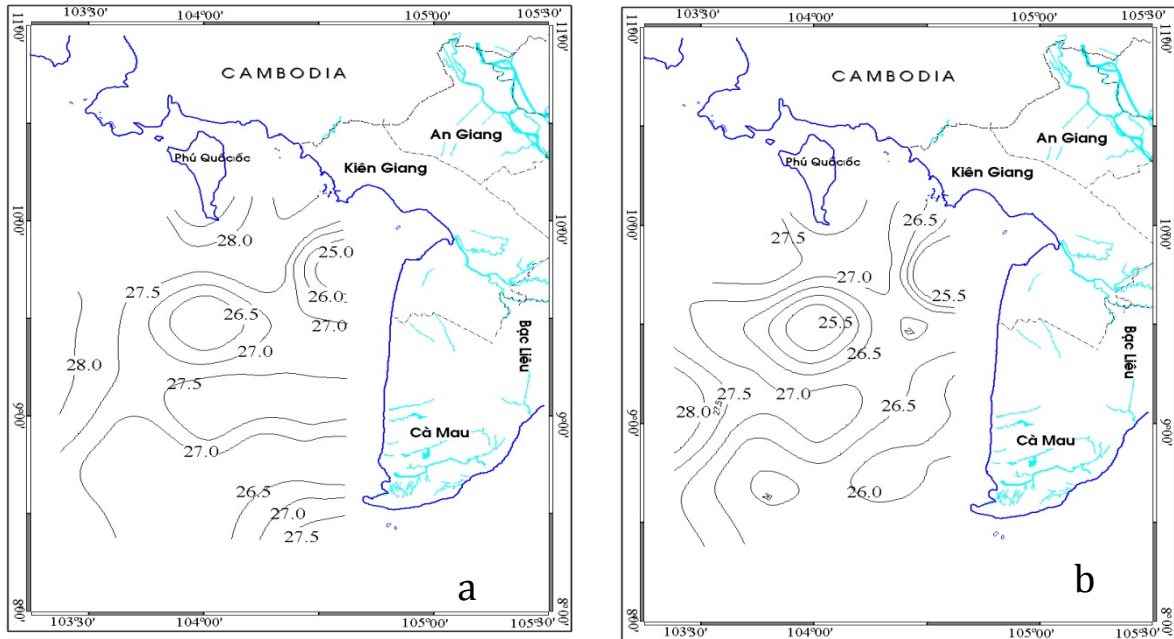


Figure 2. Water temperature of surface (a) and depth (b) layers in KienGiang waters. According to a survey conducted at December 2005 (the northeast monsoon season). Source: RIMF, 2006

1.1.2.2. Salinity in KienGiang waters

The salinity of KienGiang waters varies from 27.0 - 34.1‰ (surface) and 28.0 - 34.1‰ (at depth) with a maximum salinity in March and a minimum in August. The salinity is gradually reduced from shore to offshore with a variation of about 3‰. In the rainy season (September) the salinity is lower than in the dry season (May to June) (Figure 3).

1.1.2.3. Water current

The water current of the southwestern part that KienGiang belongs to, is similar to the water current of the northeast area of the Gulf of Thailand. In the Southwest monsoon season, the current flows in a southeasterly direction from KienGiang to Ca Mau province. The velocity of the current is from 25 - 30 cm/s in the Southwest monsoon season and of 20 - 30 cm/s in the Northeast monsoon season (Figure 4).

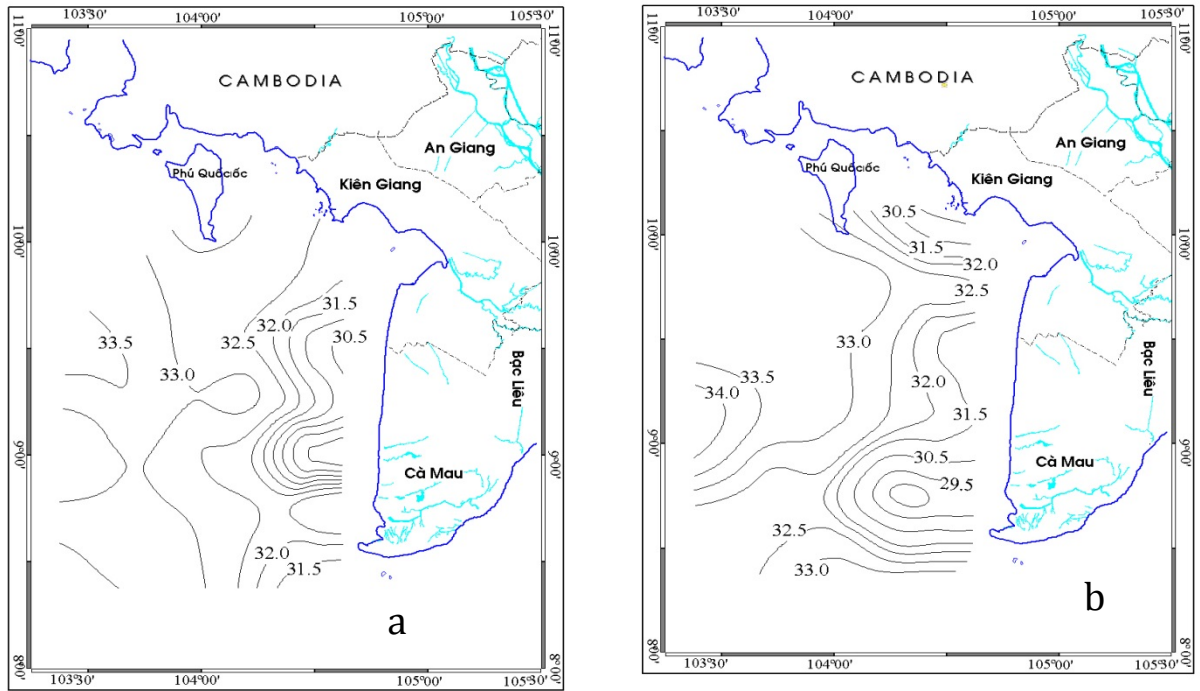


Figure 3. The salinity of Kien Giang waters by (a) dry and (b) rainy seasons. According to a survey conducted in 2005. (Source: RIMF, 2005).

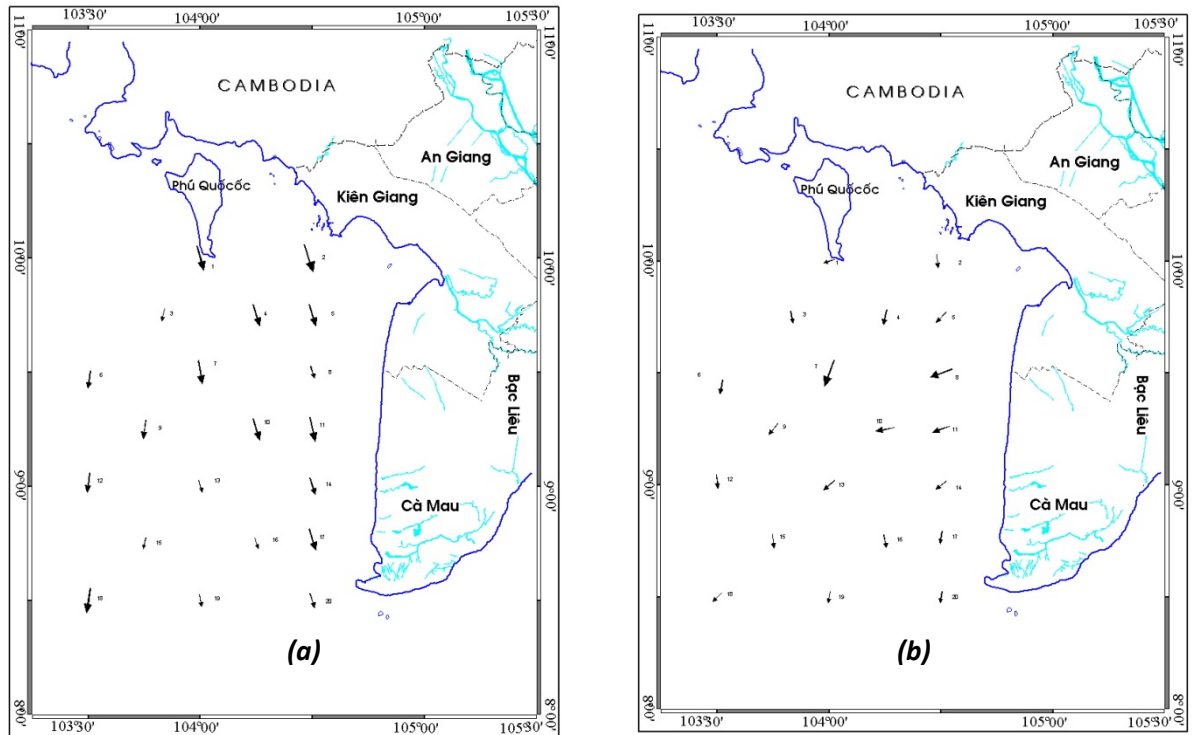


Figure 4. The water current of Kien Giang waters by (a) southwest and (b) northeast monsoon seasons. According to a survey conducted in 2005. (Source: RIMF, 2005).

1.1.3. Natural resources in KienGiang's waters

1.1.3.1. Phytoplankton

An investigation conducted by Research Institute for Marine Fisheries (RIFM) of Vietnam from 2005 to 2006 using 4 marine resource surveys, has indicated that there were a total

of 250 phytoplankton species distributed in the southwestern region (KienGiang's sea). Of those, the most abundant species were the bacillariophyta family accounting for 66% in total and the cyanophyta, accounting for 32.4%. Quantitatively, the density of phytoplankton in KienGiang's waters was about 1,000 individuals/m³ and were most concentrated in the northern part of KienGiang waters (Figure 5).

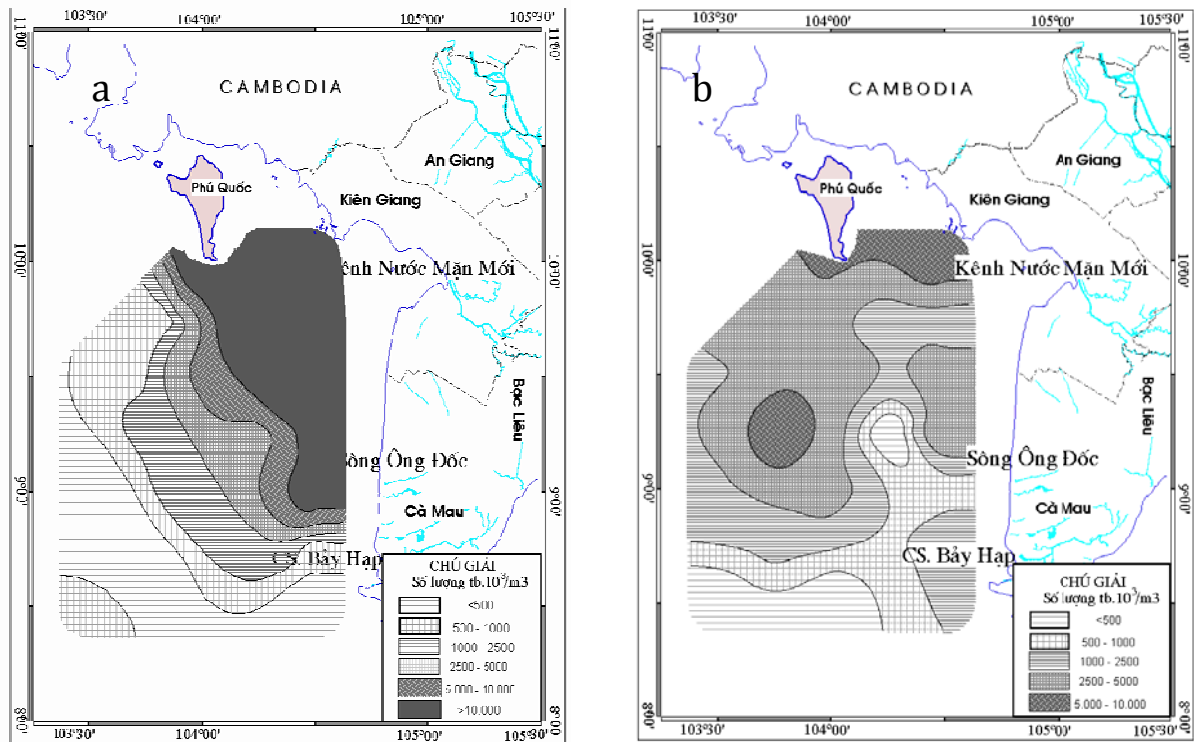


Figure 5. Distribution of phytoplankton (1,000 ind./m³) in the Southwestern region (Kien Giang) in the surveys of summer (a) and winter (b) seasons of 2005. Note: Legends are indicating number of individuals of phytoplankton per cubic meter. (Source: RIMF, 2006).

1.1.3.2. Biodiversity index

The biodiversity index (H') of phytoplankton in KienGiang's waters varied from 4.26 - 4.72, with an average of 4.54. Compared to the Northern (4.51) and Southern (4.59) parts this index was at an intermediate level. In addition, the value of diversity index (Dv) of phytoplankton was also calculated for KienGiang's waters. This value was from 2.99 - 3.64, with an average of 3.42. The diversity value estimated in KienGiang province was also at an intermediate level (type II) comparing to the Northern and the Southern regions of Vietnam. In general, both of the biodiversity indices demonstrate that KienGiang's waters have relative high biodiversity and good environment conditions for fish production.

1.1.3.3. Zooplankton

There were 159 species of zooplankton identified in KienGiang's waters. The distribution of zooplankton varied by season and area. Quantitatively, the biomass of zooplankton

varied from 217.0 - 282.5 mg/m³ corresponding to 2,193 - 2,603 ind./m³. Similarly with phytoplankton, the density of zooplankton of the KienGiang's waters was slightly higher than in the Northern and Southern regions of Vietnam. Differences in the distribution of zooplankton are shown in Error! Reference source not found. and Figure 7.

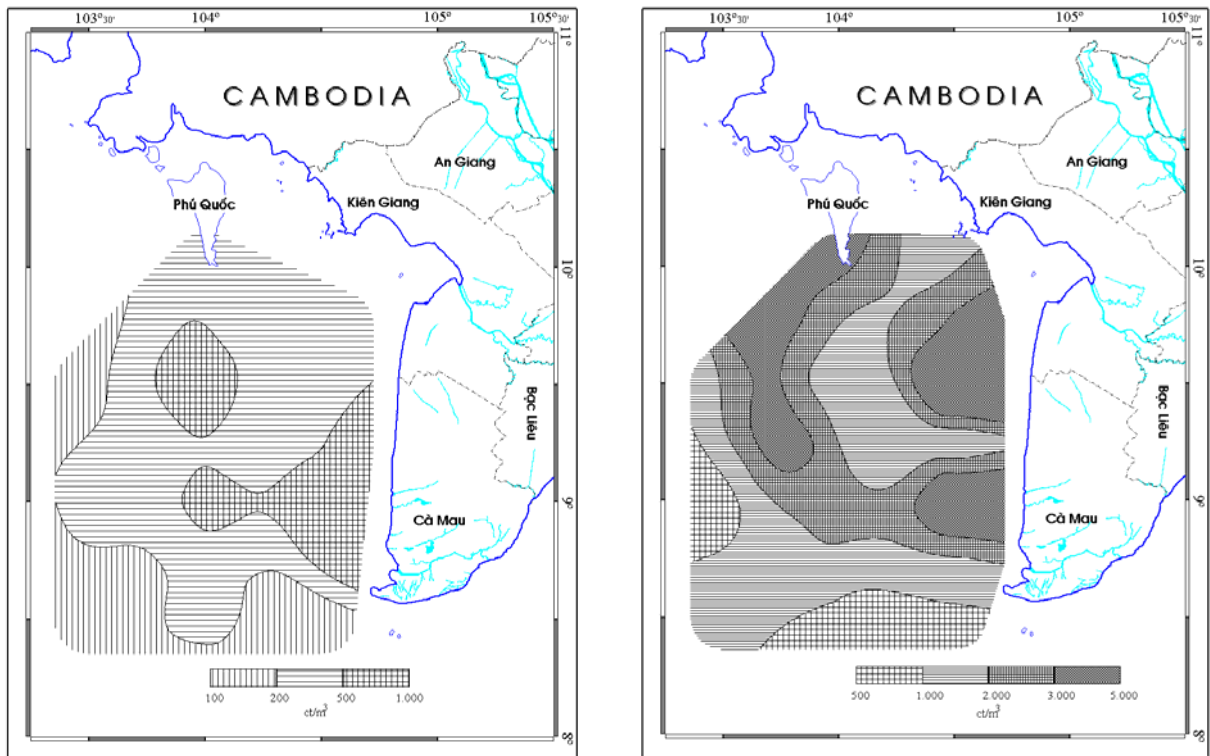


Figure 6. Distribution of zooplankton (ind./m³) in Kien Giang's waters in summer (l) and winter (r) seasons of 2005. Note: Legends are indicating number of individuals of zooplankton per cubic meter. (Source: RIMF, 2005).

1.1.3.4. Fish egg and larvae

There were a total of 40 families and 50 species of fishes identified in the ichthyology surveys conducted in 2005-2006. Of those, *Clupeidae* was the most abundant with 44.9% of the total biomass followed by *Engraulidae* with a density accounting for 18.93%. In the *Engraulidae* family, there were three dominated species; *Encrasicholina punctifer* (15.6%), *Encrasicholina heterolobus* (2.39%) and *Stolephorus commersonii* (0.23%) (RIFM, 2006).

The species composition of fish eggs identified in Kien Giang's waters varied by season. In the Southwest monsoon season, the *Clupeidae* and *Engraulidae* families were the most dominated with 44.91 and 18.93%, of total egg biomass, respectively while in the Northeast season, the *Engraulidae* and *Synodontidae* were more abundant with 37.4 and 2.68% of total egg biomass respectively (RIMF, 2006). More details indicated in the Figure 8 and Figure 9.

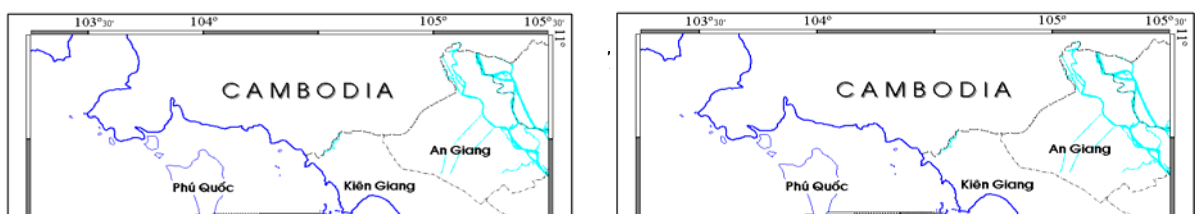


Figure 7. Distribution of zooplankton (ind./m³) in Kien Giang's waters in April (left) and September (right) of 2005. Legends are indicating number of individuals of zooplankton per cubic meter. (Source: RIMF, 2005).

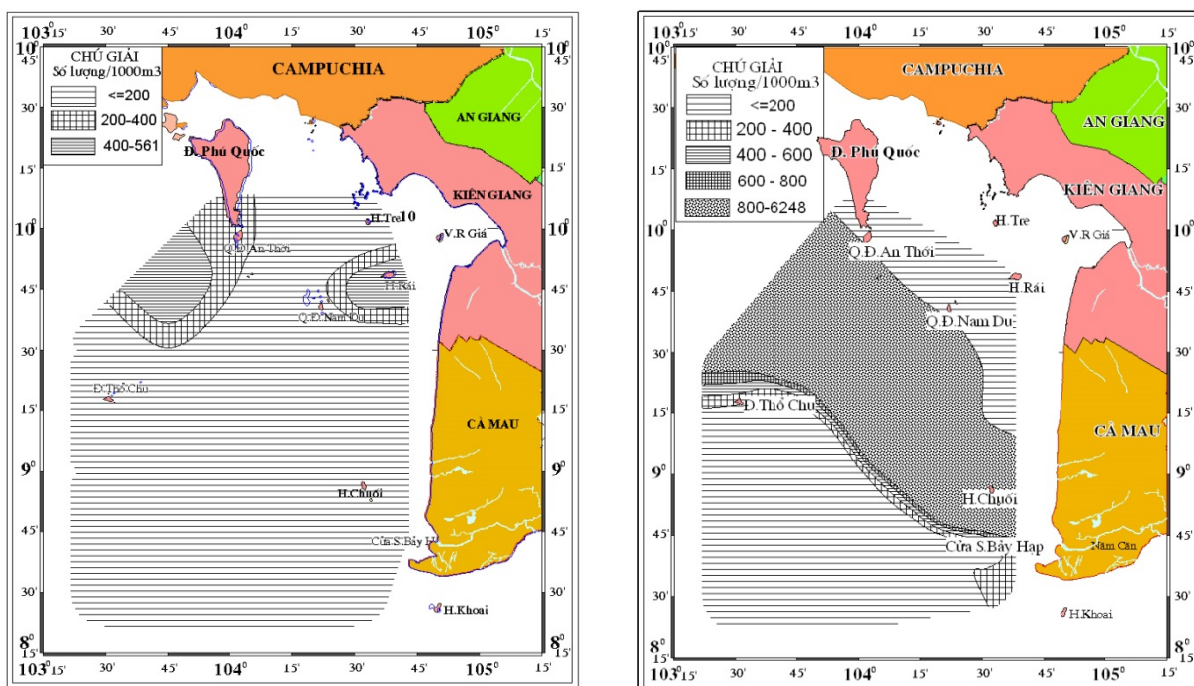


Figure 8. Distribution of fish egg (individual/1000m³) in May/June 2005 (left) and April 2006 (right) in KienGiang's waters. Legends are indicating number of individuals of zooplankton per cubic meter. (Source: RIMF, 2005 and 2006).

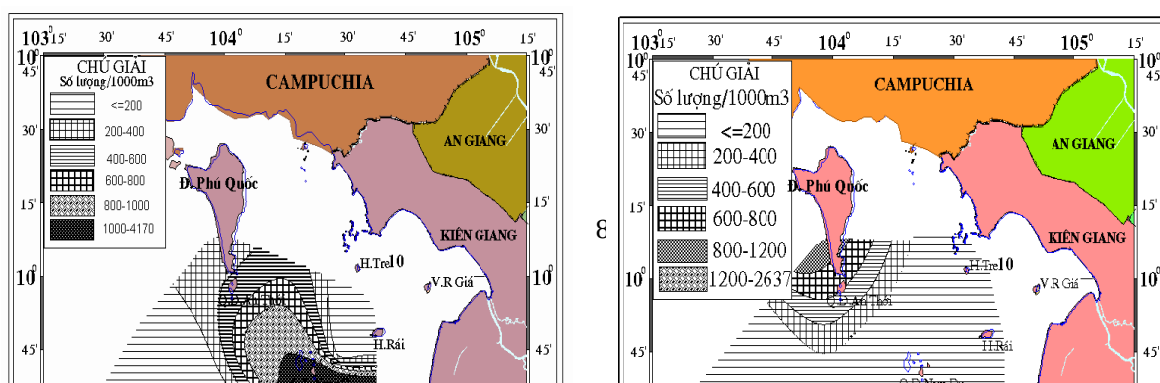


Figure 9. Distribution of fish egg (individual/1000m³) in September 2006 (a) and December 2005 (b) in Kien Giang's waters. Legends are indicating number of individuals of zooplankton per cubic metter. (Source: RIMF, 2006).

2.2 Capture fisheries and marine resource conservation of the province

2.2.1. Total fishing boat

In Vietnam, KienGiang is one of the provinces where the fisheries sector is relatively well developed. The total number of fishing boats in the province in 2011 was more than 12,000 and the total capacity was nearly 1,587 thousand horsepower (HP), with the average capacity of 129.2 HP/vessel (Table 1). However, according to provincial Department of Agriculture and Rural Development (DARD), in 2013 the total of vessels were reduced to 10,720 units of which more than 4,000 units were offshore vessels with an engine capacity of above 90 HP and 263 units were carriers or logistic vessels. Number of trawlers are accounting for nearly 30% of total fishing vessels in the province and second highest just followed gillnet (Table 2).

Table 1. Number of fishing boats and capacity (house power = HP) of KienGiang from 2002 - 2011

Items	Unit	2002	2006	2007	2008	2009	2010	2011	Change 2002-11
No. of boat	vessel	7,030	7,330	7,268	11,142	11,434	11,904	12,286	+6.4%
Capacity	1000 HP	815	1,177	1,195	1,257	1,310	1,323	1,587	+7.7%
Mean capacity	HP/vessel	115,9	160,5	164,5	112,8	114,6	111,1	129,2	+1.2%
By capacity range:									
< = 20 HP	Vessel	2,566	2,249	2,161	6,056	4,440	4,337	4,342	+6.0%
21 - 44 HP	Vessel	1,055	893	882	962	2,586	2,905	2,931	+12.0%
45 - 89 HP	Vessel	1,250	1,188	1,179	936	1,061	1,060	1,077	-1.6%
90 - 250 HP	Vessel	435	512	513	724	806	838	886	+8.2%
251 - 450 HP	Vessel	1,607	2,169	2,209	1,241	1,235	1,290	1,334	-2.0%
> 450 HP	Vessel	117	320	324	1,223	1,306	1,474	1,716	+34.8%

(Source: Sub-Department of Capture fisheries and Resources Protection KienGiang, HP = horse power)

Table 2. Number of fishing vessels by gear types in Kien Giang in 2013.

No	Gears	Engine capacity group (HP)							Sub-total
		< 20	20 - < 50	50 - < 90	90 - < 150	150 - < 250	250 - < 400	>= 400	
1	Trawlers	4	82	126	72	310	625	1,936	3.155
2	Gillnetters	2,501	793	443	32	85	198	14	4.066
3	Purse seiners	8	9	6	10	50	236	27	346
4	Hooks and lines	897	660	128	44	68	61	2	1.860
5	Squid falling nets								
6	Others	312	472	110	57	64	16	0	1,031
7	Transshipment boats	1	11	6	9	34	160	41	262
	Total	3,723	2,027	819	224	611	1,296	2,020	10,720

(Source: Sub-Department of Capture fisheries and Resources Protection KienGiang)

KienGiang's marine fisheries fleets are concentrated in six coastal districts and islands including PhúQuốc, KiênLuong, Tp. RạchGiá, KiênHải, HònĐátvàTx. HàTiên. These areas account for more than 90% of the total number of fishing boats in the Province.

The main fishing gears of KienGiang province are purse seines, gillnet, trawls, longlines and other fixed gears. Of these, there are two dominant fishing gears; gillnet (40.4% of vessels) and trawls (27.3%; 11% single trawls and 16.2% pair trawls). The longliners account for 21.5% of the fishing fleet and the rest are made up of purse seine and other gears.

However, fishing boats with capacity of less than 90HP are dominated in the province. In 2012, these boats, (approximately 8,350) accounted for more than 68% of the total number of fishing boats. Smaller boats operating in the coastal areas and with an engine capacity of less than 20 HP accounted for 35,3% of vessels but their catches did not significantly contribute to the total catch of the province. However, these small boats were highly impacting on marine resources and ecosystems because the small mesh sizes typically used by these boats captured many under-sized individuals and juveniles. Over the years, local fisheries management authorities have tried to prohibit the new building of these types of boats. However, the compliance of local communities has not been high and enforcement not appropriately implemented.

Some districts in the Province having a considerable number of trawlers are; Ha Tien, Kien Luong, Hon Dat, KienHai and Rach Gia City while small trawlers mostly occur in Ha Tien, KienHai and KienLuong districts. Trawl fleets of above 150 CV mainly target fish, squid and cuttlefish and normally operate during the daytime. Conversely, the small trawlers (below 90 CV) fish for shrimp and prawn and operate during the night time. Pair trawlers focus on small pelagic fish species (anchovies, sardines, scads...) and squid, cuttlefish and crabs and are normally equipped with an average engine capacity of above 250 CV per vessel. Fleets of pair of trawler of above 400 CV are dominant in the province.

Recently the number of trawlers has gradually been reduced in terms of both quantities and proportion of the total number of fishing boats in the province. A main reason for this is that coastal resources have been highly reduced and due to the low efficiency, boats have changed from the single trawlers to other gear types.

2.2.2. Total catches

During the last decade, the number of fishing vessels and total engine capacity in KienGiang increased significantly, especially in the period from 2007 to the 2010s. Nevertheless, the total landings grew more slowly when compared to the growth rate of total fishing effort (**Figure 10**). Inversely, the mean of catch per unit effort (CPUE) showed a dramatic decline from 0.3 MT per CV per year (2003) to about 0.2 MT per CV per year in the year of 2013 (DARD, 2013). Accurate data on landings by trawlers were not collected due to insufficient resources. Therefore, there is a lack of information of landing and catches by trawl fleets in the province.

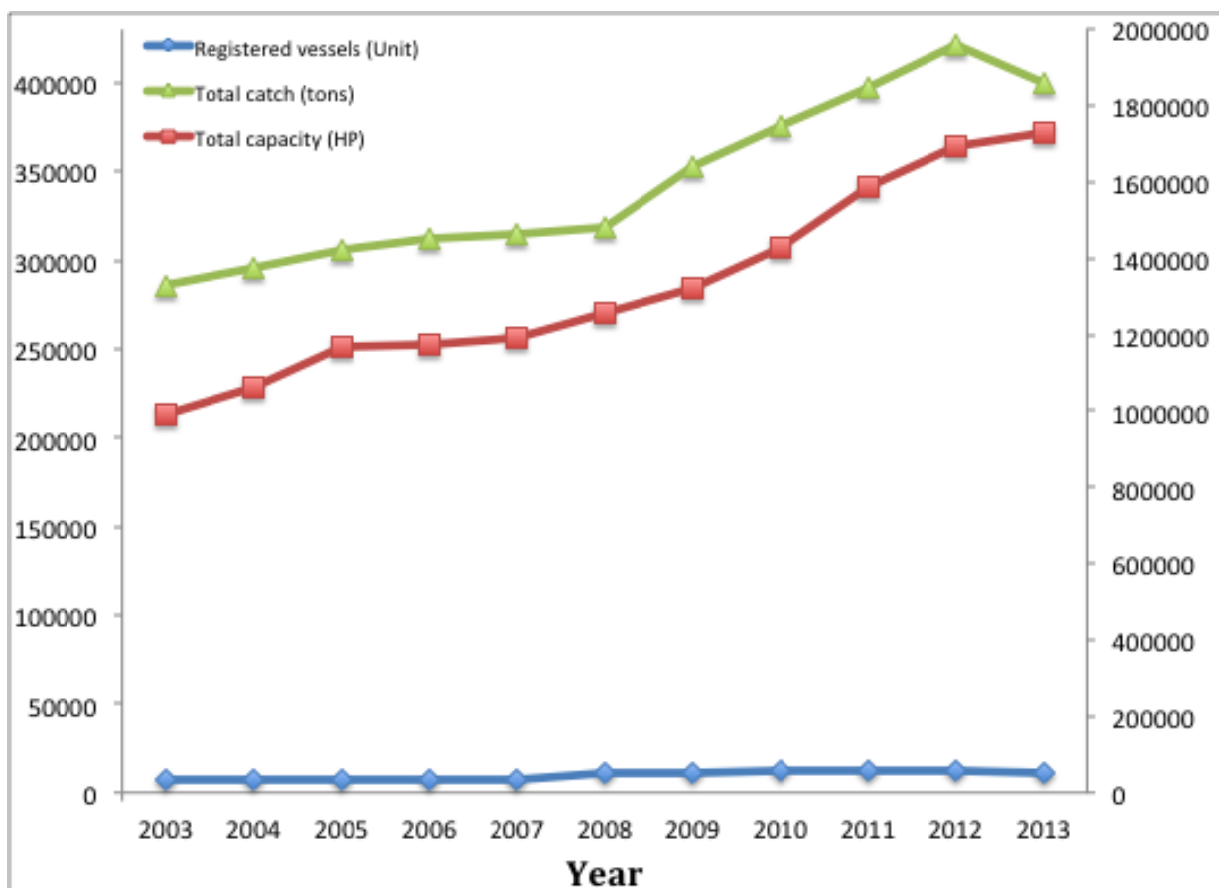


Figure 10. Number of fishing vessels, total capacity and landing in Kien Giang from 2003-2013.

2.3. Legal frameworks on fisheries management in KienGiang

Since the Fisheries Laws were enacted and put in place in 2003, KienGiang has established many local legal and policy documents under the national laws on fisheries management.

2.3.1. Legal documents relating to capture fisheries management

- Directive No. 24/2004/CT-UBND dated on 12/11/2004 by KienGiang Provincial People’s Committee to protect coral reefs in the provincial waters. In this directive, a large water area belonging KienGiang province is permanently closed for fishing to protect coral reef and some other threaten, endangered and extinction species such as Dugong dugong, sea turtle...
- Decision No 30/2008/QD-UBND dated on 16/9/2008 to regulate managing marine capture fisheries activities and marine resource conservation in KienGiang’s waters. This decision regulated some coastal areas prohibited by trawling activities.

- Decision No 18/2011/QĐ-UBND dated on 7/4/2011 replacing the Decision No 30/2008/QĐ-UBND dated on 16/9/2008 to regulate managing marine capture fisheries activities and marine resource conservation in KienGiang's waters.
- Decision No 2601/QĐ-UBND dated on 10/2/2011 by the President of Provincial People's Committee about establishing natural nursery and spawning areas in KienGiang's waters.
- Decision No 1297/QĐ-UBND dated on 12/7/2007 by the President of Provincial People's Committee about establishing procedures and rules to manage marine protected area in PhuQuoc Island.
- Decision No 2510/QĐ-UBND dated on 23/10/2008 by the President of Provincial People's Committee about regulating on the fishing port management in the KienGiang's waters.

2.3.2. Legal documents relating to aquaculture

- Directive No 08/2004/CT-UB dated on 12/04/2004 by the President of Provincial People's Committee about enhancing Government management on reorganization of forestry and aquaculture by provincial master plan.
- Decision No 08/2005/QĐ-UB dated on 02/03/2005 by the President of Provincial People's Committee about establish procedures on managing tiger shrimp species in KienGiang province.
- Directive No 03/2005/CT-UB dated on 25/03/2005 by the President of Provincial People's Committee about enhancement of environment protection and preventing shrimp's disease outbreak.
- Decision No 35/2008/QĐ-UBND dated on 05/11/2008 by the President of Provincial People's Committee about authorization of marine water areas for individuals and organizations to carry out aquaculture activities in KienGiang province.
- Decision No 474/QĐ-UBND dated on 25/02/2009 by the President of Provincial People's Committee about decentralization for district and village's authorities to rent marine waters and certifying rights to use marine waters for individuals and organizations on aquaculture activities.

2.3.4. Policy frameworks on fisheries management in KienGiang

There have been many policies on fisheries management established by the Provincial

People's Committee as following:

- Decision No 2767/QĐ-UB dated on 28/10/2004 by President of Provincial People's Committee about establishing Local Steering Committee of a pilot Project to recover coral reef and sea grasses in PhuQuoc Island.
- Directive No 06/CT-TU dated on 22/06/2004 on enhancing administrative management on marine resource protection.
- Directive No 05/CT-UBND dated on 31/3/2006 to limit and deter the pair of trawl fishery operating in the coastal and inshore areas and other illegal fishing gears in KienGiang province.
- Decision No 1622/QĐ-UBND dated on 09/10/2006 to establish a Provincial Program on marine resource protection and conservation vision to 2010.

In general, the development and establishment of legal and policy systems on fisheries management in KienGiang province have been very good but the implementation of the established legislation and policies has not been effective and efficient.

2.3.5. Institutional arrangements on KienGiang's fisheries management

The Department of Agriculture and Rural Development (DARD) is an agency managed by the Provincial People's Committee, in terms of administrative procedures and by the Ministry of Agriculture and Rural Development, in terms of technical issues. Under the DARD, the Sub-Department of Capture Fisheries and Resources Protection (Sub-DECAFIREP) is the responsible agency for fisheries management in KienGiang province. See flow chart below.

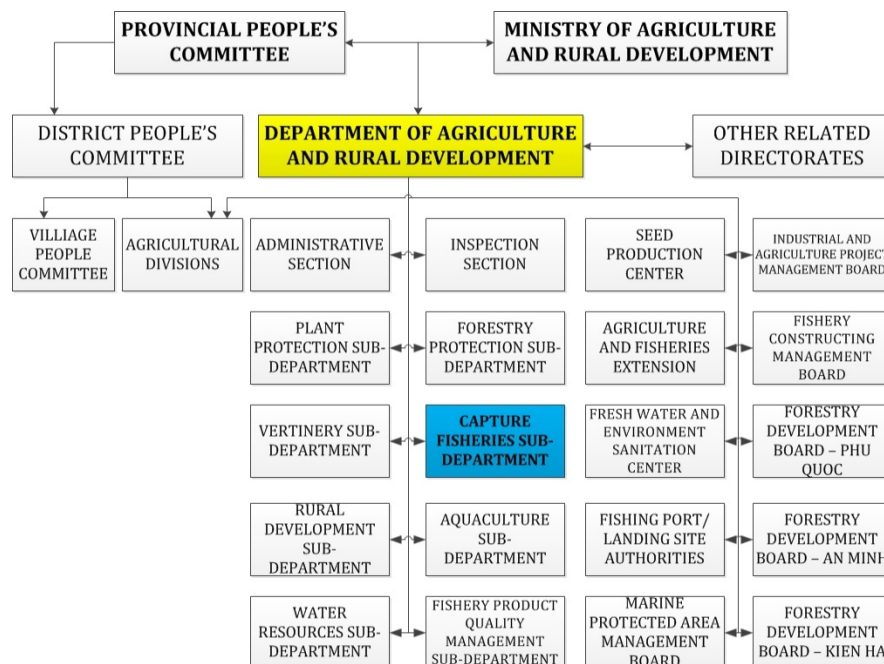


Figure 11. Structure of fisheries management agencies in Kien Giang.

3. Review of area and seasonal fishing closures

Area closures (whether temporary, seasonal or permanent) are referred to by a variety of names, each of which may have a particular formal definition, depending on the legislative or cultural context. Of these various terms, however, 'Marine Protected Area' or MPA is perhaps, the most widely used. The International Union for Conservation of Nature (IUCN) defines an MPA as: "Any area of intertidal or sub-tidal terrain, together with its overlying water and associated flora, fauna, historical and cultural features, which has been reserved by law or other effective means to protect part or the entire enclosed environment".

The seasonal/area fishery closures commonly used in fisheries management for various purposes include limitation of effort, protection of spawners, and maximization of the yield or value that can be obtained from a cohort. Closed areas/seasons have been proposed as one of a range of potential management approaches that could be applied to control the exploitation rate of many fish stocks in the world especially in the European waters. However, although theoretical studies of the potential effects of closed area/season in tropical waters are numerous, they are of limited use for providing practical management advice, because they are not case-specific.

The history of seasonal and areal closures as conservation measures dates back to the 1800s. Perhaps the earliest attempt to evaluate the effects of an area closure was an experiment conducted under the auspices of the Scottish Fishery Board from 1886 to 1896 (Garstang, 1900). In North America, the US Congress passed the Alaskan Salmon Law in 1896, which introduced closed areas in spawning streams and prohibited fishing in the evenings and on weekends. Among marine species, the management of the fishery for Pacific halibut (*Hippoglossus stenolepis*) has probably had the most extensive and continued use of closures, which, along with its other regulations, have attracted the attention of biologists and economists alike. One of the reasons for this attention is enshrined in the most creditable feature of the International Pacific Halibut Commission - that of collecting and maintaining detailed statistics on the fishery since the 1920s.

However, application of seasonal/area fishing close has sometime merged unexpected issues. Removal of the effort from a fishery, previously directed into a closed area, results in the most significant impact from a closure. If effort is allowed to relocate into areas remaining open, the impact of the closed area is reduced substantially and, in some of the cases examined, mortality on the stock could increase. Similarly any derogation to fish in a closed area will reduce the closed area impact. Consequently, closed area management cannot be used in isolation from quota and effort regulation and may require lower levels

of both. In addition, closed areas are designed to make fishers less efficient at catching protected species. Fishers prevented from accessing local stocks can move into areas that they may not have fished before, resulting in conflict, inefficiency and reduced income. The incentive to provide biased landings and effort data will be greater. The quality of catch and effort data is likely to become even more uncertain, until the stock recovers and pressures are relieved.

The approach used by fishers to relocate effort displaced from a closed area is a critical determinant to the effectiveness of a closure. Therefore, case-specific dialogue with fishers during the design process, with regard to potential changes in effort distribution resulting from a closure, is considered to be an important factor in reducing the uncertainty associated with expected returns. Seasonal migration and movement can have a significant impact on the effectiveness of a closed area. Closed areas must be designed to be robust to temporal variability in stock distribution; boundaries may have to be moved during the year or, alternatively, permanent closures may need to be expanded in order to maintain their effectiveness.

4. Review of area and seasonal fishing closures in Vietnam

Investigations on fishing close areas/seasons in order to establish Marine Protected Areas, started in Vietnam from 1993 – 1995 under technical support from the World Wildlife Fund (WWF) in a cooperation program with the Institute for NhaTrang Oceanography. This study focused on the evaluation of biodiversity and conservation potential of 7 coral reefs in Vietnam. In addition, some national programs (namely KT-03, KHCN - 06), an investigation of marine protection areas have also been conducted in Vietnam from 1991 - 2005.

From 1996 – 1998, the Ministry of Technological Science and Environment cooperating with the Sub-Institute for Hai Phong Oceanography, have investigated coral reef ecosystems to provide basic information for MPA establishment. Through this program, 15 areas have been defined and proposed to the Government for establishing MPAs. This was one of the key documents to establish a Master plan on establishing MPAs up to 2010.

From 2001, MPA establishment has been appropriately and increasingly considered. Under financial support from IUCN, Denmark Government, World Bank, a large-scale MPA, namely Hon Mun has been established and operated effectively. After that, in 2004, Cham island MPA has also been established through funding by DANIDA. These MPA (in the Central part of Vietnam) are considered to be the first MPAs of Vietnam.

From 2003-2004, the Institute for Marine Fisheries together with Institute for NhaTrang Oceanography carried out studies and surveys to have information on establishing Cat Ba

and Co To island MPA, in the Northern part of Vietnam. However, the information generated was insufficient to convince management agencies to establish these MPA.

From 2005-2007, the Institute for Marine Fisheries conducted two research studies; “Investigation on coral reef fish resources in the planned MPAs” and “Investigation of natural and environment conditions at important MPAs of Vietnam.

From 2005-2007, the Institute for Natural Resources and Environment implemented a project on planning of MPA at Hai Phong. This project considered not only establishing the MPA but a proposal to establish reserve areas and ecological sensitive areas.

In 2006-2008, the Institute for Natural Resources and Environment conducted a small study on: “Investigation of establishing the MPA in the Truong Sa Island”. This study was under an offshore program. However, the results from this study have not been published but the outcomes could still be an important document to guide future studies and projects.

However, activities relating to the establishment of MPA only really started in 2000 with the assignment of the Government to the Ministry of Fisheries (the former Ministry and now was merged into Ministry of Agriculture and Rural Development) in terms of setting up the master plan for MPAs Network in Vietnam with a list of proposed 15 sites in the whole of the country and up to now four MPAs have been established in Vietnam which include NhaTrang Bay, PhuQuoc, Con Co, Cu Lao Cham, etc. (Figure 12).

In general, over recent years, the Vietnamese government and the international community have invested considerable resources in establishing and managing protected areas in general and marine protected areas in particular. There has been a protected areas system in Vietnam established (Figure 12) to build the institutional infrastructure required for its management and supporting some basic management activities. There have been important regulatory, institutional and political reforms. Despite these achievements, most protected areas remain ‘paper parks’, with little conservation management taking place on the ground.

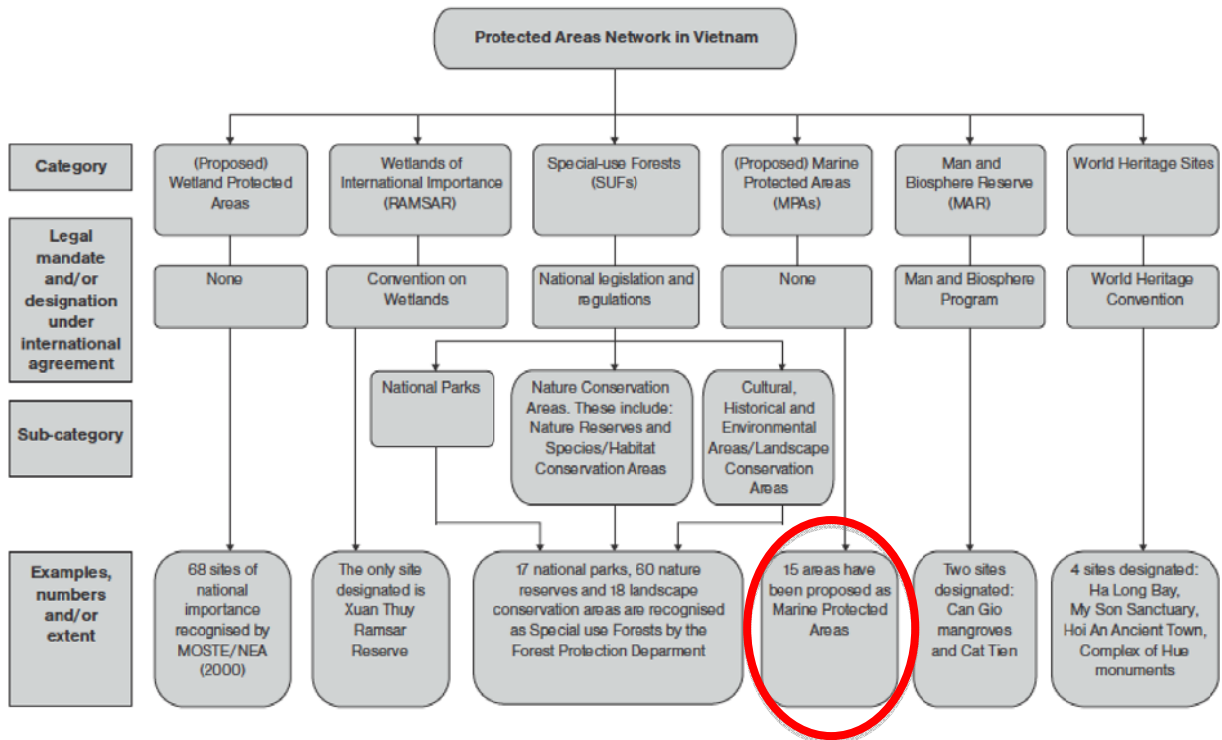


Figure 12. The protected areas network system in Vietnam

The challenges facing protected areas managers go deeper than inadequate funds – often there has been no improvement in habitats and species conservation even where resources have been allocated to specific nature reserves and national parks. Protected areas, even those supported by costly donor-funded projects, continue to suffer from high levels of consumptive uses of biodiversity, particularly through hunting of wildlife for local consumption and trade. The implications of these trends for biodiversity, and for people and cultures who have long depended on these resources are of growing concern.

Levels of conflicts between people and protected areas are poorly documented and understood in Vietnam. Low levels of enforcement have left few incentives for users to comply with official regulations. As enforcement capacity increases and populations increase around protected areas, it is likely that the number of conflicts will rise in the absence of alternatives to forest resource use.

In conclusion, several investigations on MPA establishment have been considered in recent years. However there were few practical and large scale studies providing a scientific basis for establishing MPA and/or fishing closed seasons/areas. Especially there has been lack of information on social-economic issues, ecosystem biology and human dimensions. In addition, no clear criteria on how to select and establish MPA/fishing closed areas and/or seasons are available at present. Therefore, establishing a standard criteria system of marine protected areas is very necessary. In the below sections of the report, detail criteria to establish the protected areas will be discussed and select suitable

criteria in the case of Vietnam in general and in KienGiang in particular for managing trawl fishing activities.

5. Selection of criteria to establish fishing closed seasons/areas

Several schemes have been developed to help select the locations of marine reserves or fishing closures as recommended by Kelleher and Kenchington (1992), Cochrane (2002) and Cochrane and Garcia (2009). All of them combine social, economic, and biological criteria, and few offer any guidance as to how to prioritize among the criteria identified. Where two sites are of equal value ecologically, then socioeconomic criteria should dominate the choice of which should be protected. However, in many cases, socioeconomic criteria are given equal or greater weight than ecological considerations in the choice of sites. This can lead to selection of reserves with little biological value that fail to meet many of the desired objectives. To avoid such a possibility, development of a series of criteria that allow preliminary evaluation of candidate sites according to their relative biological values in advance of the application of socioeconomic criteria is very important. The selected criteria should have a strong influence on the species present or ecological processes. The selected sites should also be assessed according to their biodiversity. There are some criteria proposed by IUCN (Table 3, Kelleher 1999) as follows:

Table 3. General criteria to establish fishing closure areas/seasons

Value	Criteria
Economic	<ul style="list-style-type: none"> • Number of fishers dependent on the area • Value for tourism • Potential contribution of protection to enhancing or maintaining economic value
Social	<ul style="list-style-type: none"> • Ease of access • Maintenance of traditional fishing methods • Presence of cultural artifacts/wrecks • Heritage value • Recreational value • Educational value • Aesthetic appeal
Scientific	<ul style="list-style-type: none"> • Amount of previous scientific work undertaken • Regularity of survey or monitoring work done • Presence of current research projects • Educational value
Feasibility/practicality	<ul style="list-style-type: none"> • Accessibility for education/tourism • Compatibility with existing uses • Ease of management • Enforceability

However, to specifically apply above proposed criteria in Vietnam and KienGiang, two issues must be addressed in order to establish fishing closures that will fulfill fisheries management objectives:

1. The overfishing is likely occurring in the case of KienGiang waters and thus the reserve should be large enough to protect the resource in the event of overfishing.
2. The reserve should serve as a source capable of replenishing the exploited stock. In particular, reserves should protect spawning grounds (e.g. anchovy's spawning and nursery areas).

Table 4. Possible criteria to establish fishing closure areas/seasons in KienGiang

Criteria	Description
Ecological importance	<ul style="list-style-type: none"> • a variety of habitats (e.g. coral reef, sea grass...); • a habitat for rare or endangered species (e.g. sea turtle, Dugong dugong...); • nursery or juvenile areas (id from ichthyology surveys); • feeding, breeding (e.g. mackerel, anchovies and other small pelagic fishes); • rare or unique habitat (e.g. Dugong dugong, coral reefs...); • high genetic diversity (i.e. diverse/abundant in species terms).
Economic importance	<p>Existing or potential contribution to economic value by virtue of its protection.</p> <p>Economic contribution could be delivered through:</p> <ul style="list-style-type: none"> • subsistence; • use by traditional users; • appreciation of tourists; • important habitat for economically importance species.
Social importance	<ul style="list-style-type: none"> • There are about 20,000 fishers involving directly in the fishing activities in KienGiang and thus resource conservation is very important to maintain their livelihoods. • Fish is important for food security of people in KienGiang
Practicality/feasibility	<ul style="list-style-type: none"> • The degree of isolation from external destructive influences? • The social and political acceptability? • The degree of community support? • The accessibility for education, tourism? • The compatibility with existing uses, particularly locals in KienGiang. • The Ease of management, compatibility with existing management regimes in KienGiang.

6. Conclusions and recommendations

The criteria described above can be applied in many different ways to the problem of selecting reserves. Some managers have developed a method of applying the full set of criteria in a process aimed at evaluating candidate reserves in the context of their contribution to larger scale networks. They argue that networking will enhance the performance of individual reserves, and that networks are essential to maintain the large-scale ecological processes that underpin ecosystem functioning in the sea. However, it should also be dependent on specific cases to apply specific rules to select fishing restriction areas/seasons as in KienGiang province. Of course, in this case it is necessary that the selected criteria can be integrated with social criteria to choose locations for fully protected zones within a large multiple use protected areas/seasons. There is still possibility to take an alternate tack on developing the criteria into a series of rules of thumb to simplify reserve selection. Focusing on which criteria must considerably be paid attention in the first stage and balancing between ecosystem and human well-being and, other socioeconomic concerns should be considered in the development of fishing restriction areas/seasons. Then the above mentioned criteria can be used to help facilitate decisions by revealing whether candidate sites possess biological attributes that will enable them to meet management objectives in KienGiang's waters.

An optimal fisheries management perspective is to meet three economic, social, and ecological constraints. However, the scenario that combines economic, social, and ecological constraints in an ecosystem-based fisheries management approach is a challenge. There are usually trade-offs between conservation (ecological) and socio-economic objectives in fisheries management of tropical marine ecosystems with multi-species and multi-gear perspectives (Cheung and Sumaila 2008). From a conservationist's perspective, pursuing ecological objectives, such as maintaining biodiversity and natural resources, is necessary (Agardy 2000). However, from a typical artisanal or small-scale fisher's perspective as in Vietnam, sustaining ecosystem dynamics may be less important than ensuring basic daily food requirements (Bacalso et al. 2013). Therefore, it is necessary to identify priority fisheries management objectives that are practicable and suitable in the relevant context. In this report, we recommended some important criteria to set up fishing close areas/seasons in Vietnam. However, it is noted that there may be variations on application to each specific case based on natural resource conditions, institutional arrangements, and fishing communities around such areas.

It is noted that existing legal legislations on fishing close seasons/areas are quite sufficient, however the implementation of these legal legislations is weak and not fully complied by fishing communities. One of the main reasons to blame for this shortcoming is that existing legal frameworks are based mostly on top-down control management regimes. There were few if not no roles of stakeholders in developing and implementing

the existing legal legislations. One of the good lessons learnt from successful sites on their fisheries management is to apply holistic fisheries management approaches such as ecosystem-based approach, co-management, and integrated fisheries management approach... These holistic approaches can balance human well-being and ecological well-being and can fairly combine different aspects on fisheries management such as ecological, social and economic constraints. Therefore it is recommended that legal framework development and implementation processes of Vietnam in general and KienGiang in particular need to be considered following matters:

- In the development and implementation of legal frameworks, effective participation of main stakeholders is required at certain level of empowerment.
- Effective management regimes require a departure from thinking about the role of local, regional and national levels and considers the political changes that are necessary for power devolution.
- Local engagement, ownership and control, when embedded into a system of institutions that delegate power and are truly interactive, is a key principle in facilitating successful management.
- Management arrangements must go beyond consultation by redirecting social and economic benefits from the fishery back into communities. Unless geographically defined communities are allowed to share power and responsibility with government managers, both fish stocks and fishing as a way of life could be at risk

In addition, fishing operations of coastal and near-shore fisheries is commonly considered to be over-capacity (Anh et al. 2014) and impacts of fishing causing degradation on functioning and structure of coastal ecosystem are obviously. There are also increasing levels of conflict between small and large fishing vessels and this is due to lack of enforcement of regulations to remove larger vessels fishing in inshore waters, although there has been legislations to prohibit the large vessel fishing in the coastal areas (Vietnamese Government 2010). The near-shore waters are considered over-fished, causing challenges for local fishing communities.

Various approaches for managing over-capacity have been tried without success in the past in Vietnam. For example, buyback schemes for small-scale fishers have been tried in several locations in Vietnam. Legal legislations to temporally or permanently prohibit fishing activities in some areas have been adopted (MOFI 2006; MARD 2011). However, the implementation of these legally binding documents is either weak or lack of fully compliance of fishing communities. These are because the existing legal frameworks were only based on top-down control management regimes with forcing from management

agencies without involving relevant stakeholders on developing and implementing the legislations (Pomeroy et al. 2009). Given these realities, the only feasible solution may be one based on a coordinated and integrated approach involving a mixed strategy of resource management (access control and property rights); resource restoration; economic and community development (linkages of coastal communities to regional and national economic development), including poverty reduction and livelihoods; and new governance arrangements (co-management or ecosystem-based management). Thus, in practical terms, reduction of over-capacity of Vietnamese fisheries in general and trawl fisheries in particular must consider an increased focus on people-related solutions and on communities. This approach finds solutions to the problem of over-capacity in both the fishery sector and non-fishery economic sectors. This approach recognizes that any policies that reduce the number of fishers in small-scale fisheries without creating non-fishery livelihood opportunities will inevitably fail. This is because fishers will merely fish illegally, obtain a new boat and gear, or do whatever else is necessary to continue to make a living in order to feed their family. It is necessary to give trawl fishery fishers and their families a broader range of livelihood options to support exiting from the fishery and to reduce the household's economic dependence on the fishery. However, this approach requires strong inter-ministerial and national and provincial and district government linkages to ensure coordination and cooperation for planning and implementation.

7. Reference

- Agardy, T. 2000. Effects of fisheries on marine ecosystems: a conservationist's perspective. *ICES Journal of Marine Science* 57: 761-765.
- Anh, P.V., et al. 2014. An integrated food web model to test the impact of fisheries management scenarios on the coastal ecosystem of Vietnam. *Ocean & Coastal Management*. 92: 74-86
- Bacalso, R. T. M., J. V. Juario and N. B. Armada 2013. Fishers' choice of alternative management scenarios: A case study in the Danajon Bank, Central Philippines. *Ocean & Coastal Management* 84: 40-53.
- Cheung, W. W. L. and U. R. Sumaila 2008. Trade-offs between conservation and socio-economic objectives in managing a tropical marine ecosystem. *Ecological Economics* 66: 193-210.
- Chung BD. et al. 1981. Investigation of pelagic and middle stocks in Vietnam's waters. Research Institute for Marine Fisheries. Technical report.

Cochrane K. L. 2002. A Fishery Manager's Guidebook: Management Measures and their application. The first edition. Fisheries Technical Papers. The Food and Agriculture Organization of the United Nations and Wiley-Blackwell, 426 pp.

Cochrane K. L. and S. M. Garcia 2009. A Fishery Manager's Guidebook. The second edition. The Food and Agriculture Organization of the United Nations and Wiley-Blackwell, 544 pp.

Day J., et al. 2012. Guidelines for applying the IUCN Protected Area Management Categories to Marine Protected Areas. Gland, Switzerland: IUCN. 36 pp.

Decision No 1297/QĐ-UBND dated 12/7/2007 of PPC on promulgation of Management regulations of fishing ports, landing sites and shelters in KienGiang.

Decision No 1622/QĐ-UBND dated 09/10/2006 of PPC on approval of program on Development and Protection of Aquatic resources to 2010.

Decision No 2397/QĐ-UBND dated 29/9/2009 of PCC on Promulgation of Organization and operation regulations on leadership committee of implementation of instruction No 01/1998/CT-TTg.

Decision No 2832/QĐ-UBND dated 04/12/2008 of PPC on Improvement of Leading committee of implementation of Instruction No 01/1998/CT-TTg dated 02/01/1998 of Prime Minister and Decision No 30/2008/QĐ-UBND dated 16/09/2008 of KienGiang PPC UBND.

Decision No 30/2008/QĐ-UBND dated 16/9/2008 of PPC on promulgation of Management regulations on fishing operation and fisheries resources protection in KienGiang seawater.

Decision No 379/QĐ-UBND dated 10/2/2011 of Chairman of PPC dated 14/10/2009 (amendment, supplementation Article 1 of Decision No 2601/QĐ-UBND of chairman of PPC) on announcement of fisheries nursery area in KienGiang seawater.

Directive No 05/2005/CT-UBND dated 31/3/2006 of PPC on banning pair trawl fishery operating in near shore and coastal areas and violation fishing operations in KienGiang water.

Directive No 24/2004/CT-UBND dated 12/11/2004 of PPC on strengthening the coral reef resources management in KienGiang seawater.

Dugan, J. E., and G. E. Davis. 1993. Applications of marine refugia to coastal fisheries management. Canadian Journal of Fisheries and Aquatic Science 50: 2029–2042.

Garstang, W., 1900. The impoverishment of the sea. A critical summary of the experimental and statistical evidences bearing upon the alleged depletion of trawling grounds. 6: 1-69.

Kelleher, G. 1999. Guidelines for Marine Protected Areas. IUCN, Gland, Switzerland and Cambridge, UK. xxiv + 107 pp.

Kelleher, G. and R. Kenchington 1992. Guidelines for Establishing Marine Protected Areas. A Marine Conservation and Development Report. IUCN, Gland, Switzerland. vii + 79 pp.

MARD 2011. Circular on establishing temporary fishing prohibited areas/seasons. No. 89/2011/TT-BNNPTNT dated on 29 December 2011. Ministry of Agriculture and Rural Development (MARD).

MOFI 2006. Circular to regulate some legislations of Decree No. 59/2005/ND-CP dated on 04 May 2005 about fishing and processing conditions on capture fisheries sector. No. 02/2006/TT-BTS dated on 20 March 2006. Ministry of Fisheries (MOFI).

Nguyen D.V. et al. 2000. Fish egg and larvae distribution and density in Bien Dong. Research Institute for Marine Fisheries. Technical report.

Pomeroy, R., N.T. Kim Anh, and H.X. Thong 2009. Small-scale marine fisheries policy in Vietnam. Marine Policy. 33: 419-428.

RIMF 2006. Marine resource investigation in the Southwest region of Vietnam. Research Institute for Marine Fisheries. Final report. In Vietnamese. 143 pp.

Roberts, C., et al. 2003. Ecological criteria for evaluating candidate sites for Marine reserves. Ecological Applications, 13: 199-214.

Sub-DECAFIREP KienGiang, 2013. Review report: 10 years implementation of Fisheries law 2003-2013.

Thao, ND. 2005. Water environmental quality condition in the Southwestern region of Vietnam. Research Institute for Marine Fisheries. Technical report, 15/01/2005.

Vietnamese Government, 2010. Decree No. 33/2010/ND-CP approved by the Prime Minister dated on 31 March 2010. Hanoi, Vietnam.

APPENDIX 1. TERM OF REFERENCE OF THE CONSULTANCY TASK

Job title	Investigation of priorities for fishing closed area/seasons	
Project Number	REBYC-II CTI- Activity 2.1.1.	
Location	Hanoi, Vietnam (with possible internal travel)	
Expected Start Date	1 st April 2014	Duration: 15 days
Reports to	NPC and NTO DECAFIREP	

General description of task(s) and objectives to be achieved

The Southeast Asia is one of the world's most biologically diverse, economically productive and potentially vulnerable marine zones. As a result of increasing populations and exploitation pressures, growing threats from pollution and major ecosystem change are a particular concern in the region. Also – as more widely in the global context – the non-targeted capture of fish and non-fish species, commonly called as bycatch and discards, is an increasing concern. Bycatch includes fish, turtles, corals and other seabed fauna and flora. This part of the catch tends to be poorly monitored and not managed but could have an important impact on fishery resources, habitats and ecosystems. In some fisheries and regions, there is an increasing trend towards retention of the bycatch consisting of juveniles and small-sized fish for use as food for human consumption or for utilization as aquafeed. This is therefore a complex issue, requiring resource and biodiversity aspects to be tackled alongside human needs and involving a mix of policy, technical and community support measures. The project “Strategies for trawl fisheries bycatch management” (REBYC-II CTI) was conceived based on the successes of the 2002-2008 FAO/UNEP/GEF global project “Reduction of Environmental Impact from Tropical Shrimp Trawling through the Introduction of Bycatch Reduction Technologies and Change of Management”. The REBYC-II CTI project intends to focus on multispecies bottom trawling, where bycatch issues are amongst the most serious, with potentially significant effects on ecosystems and livelihoods. The Project aims to address these challenges by promoting sustainable fishing practices and improved trawl management. The REBYC-II CTI project was developed under the leadership of FAO (project implementing agency) in close collaboration with its partners: Southeast Asian Fisheries Development Center (SEAFDEC) and the governments of the participating countries Indonesia, Papua New Guinea, Philippines, Thailand and Viet Nam.

Temporarily closed areas may be used to protect target stocks from mortality at a specific stage of the life history, such as when a species aggregates to spawn. The value of temporarily closed areas as a management tool has to be assessed on a case-by-case basis, and depends on the biology of the target species and the dynamics of the fishery. It is well recognized that temporary area closures lead to effort displacement if they are not accompanied by catch or effort controls. Management measures based on closed fishing area and season have been implemented in some areas of Vietnam, to reduce fishing capacity and to protect some endangered and threatened species. However, there have been no investigations to review if existing closed areas/seasons are being respected and

performing well in reducing the effects of trawling activities on fish stocks and demersal ecosystems in Vietnam's waters.

Under REBYC-II CTI project, a task was devoted to: (1) review existing legislations of KienGiang in relation fishing closed season/areas including MPA establishment regulations; (2) review of natural characteristics of fishing ground in KienGiang in order to recommend suitable methods for managing fishing capacity of KienGiang province (fishing closed seasons/areas) and (3) recommend suitable amendments on the existing legislations of fishing closed seasons/areas

General tasks of the assignment

- Carry out a review of existing legislations of Kien Giang in relation fishing closed season/areas including MPA establishment regulations.
- Carry out a review of natural characteristics of fishing ground in Kien Giang in order to recommend suitable methods for managing fishing capacity of Kien Giang province (fishing closed seasons/areas).
- Carry out a review data/information available in the different trawl fisheries management/research agencies to recommend sensitive ecosystem area, spawning areas, nursery areas.
- Recommend suitable amendments on the existing legislations of fishing closed seasons/areas.

Key performance indicators

Activity	Timing
Review existing legislations of KienGiang in relation fishing closed season/areas including MPA establishment regulations	5 th April 2014
Review of natural characteristics of fishing ground in Kien Giang in order to recommend suitable methods for managing fishing capacity of Kien Giang province (fishing closed seasons/areas)	10 th April 2014
Review data/information available in the different trawl fisheries management /research agencies to recommend sensitive ecosystem areas, etc.	15 th April 2014
Recommend amendments to legislations on fishing closed seasons/areas.	20 th April 2014
Consultancy report conducted both in English and Vietnamese must be sent to NTO and NPC before submission to FAO	30 th April 2014
Participate in any other project related activities as required	As required

Required skills and experiences

- At least a MSc. degree in Fishing technology, fishery science and management;
- At least 10 years working in fisheries sector;
- Good knowledge in fisheries management system in Vietnam, experiences in small-scale capture fishery management;
- Comprehensive understanding of trawl fisheries and management;
- Good communication skills with fishing communities and project stakeholders;
- High independent work capacity as well as capacity to work in a group/team;
- Proficient in the use English, including oral, writing and reading skills;
- Good computer skills, especially in word, excel, PowerPoint and internet applications;
- Understanding of the project is considered as a plus.