REPORT

The 1st Workshop on the Assessment of Fishery Stock Status in South and Southeast Asia

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1. Background

The state of fishery resources is an essential piece of information for effective fisheries management and policy formulation at the national, regional and global levels. As part of a global effort to improve the information on the state of fishery resources, FAO has planned two workshops in South and Southeast Asia region in 2009 to review the data and information available and, based on these, identify appropriate methods to update the assessment of the state of the fishery resources in this area.

The main objectives of the first workshop were to determine data availability, local management issues, and appropriate assessment methods, as a basis to:

- review the state of fishery resources in each participating country;
- review data availability, particularly auxiliary data, of major fisheries;
- identify management and social-economic issues that demand immediate attention and action;
- discuss and identify most appropriate methods that can incorporate auxiliary data and improve the assessment of fishery resource status.

The expected outputs included:

- Country reports that overview the data availability, the state of major fishery resources and national management issues;
- consensus on what data should be used for the assessment of the state of major fishery resources in the region;
- Appropriate methods identified to improve the assessment of the fishery resource status.

The workshop was attended by 33 participants from 11 countries, the Southeast Asian Fisheries Development Center (SEAFDEC), the Worldfish Centre and FAO.

The workshop prospectus and the list of participants are attached in Appendixes 1 and 2, respectively.

2. Opening

Siri Ekmaharaj, Secretary-General of SEAFDEC, welcomed the participants. While he stressed the importance of this initiative, that would give the South Asian and the Southeast Asian countries the opportunity to discuss experiences and exchange information with regards to the assessment of the region fish stocks, he noted the importance of recognizing ongoing efforts at the national and regional levels. He also reminded participants of the efforts, led by SEAFDEC, in collaboration with FAO, to improve collection of fishery statistics. The full text of his speech is attached in Appendix 3.

Gabriella Bianchi introduced the background and objectives of this workshop. Noting the increasing concerns on the state of the world fishery resources, she underscored the importance of adequate data and information on fishery resources as basis for good management and policy making at the national, regional and international levels. The poor

state of the world fishery resources has a number of causes, including free and open access, inadequacy of enforcement systems, weakness of decision making, poor transparency and communication with stakeholders in decision-making and fisheries as the last resort to alleviate poverty. However, she stressed how poor information on desirable levels of fishing in relation to the productive capacity of the resource, and limited use of scientific information by responsible management agencies, are still the major concerns of current fisheries management.

Finally she summarised the overall objectives of this initiative, consisting of two workshops; expected to result in a revised overview of stock status in the region; identification of information gaps and capacity and resources constraints in relation to resource assessments and their use in policy formulation and fisheries management to strengthen resource assessments in the region.

3. Review of available data and assessments

3.1 FAO's assessment of the state of world fisheries resources

(Yimin Ye, FAO)

FAO has been conducting the assessment of the state of world marine fishery resources since 1972. Its results are published in the FAO flagship publication, the State of World Fisheries and Aquaculture (SOFIA) every second year and presented in connection with the Committee on Fisheries (COFI) meetings. More detailed information on these assessments can be found in the FAO Technical Papers "Review of the State of World Marine Fishery Resources" published every 5-6 years. The summary results from these assessment have been cited widely the media and by scientific journals and reports.

For stocks/species groups that have formal stock assessment, either carried out by a member country or by a regional fishery body, FAO simply adopts the existing assessment. However, for those species/stocks that do not have formal assessment, FAO conducts its own assessment using ad hoc methods that are believed to be most suitable to the data available and the characteristics of the fishery concerned, e.g. incorporating stock abundance information from auxiliary data such as scientific surveys and length frequency data. For some stocks, the assessment involves consultation with local scientists and incorporates expert judgments from local mangers. However, these assessment methodologies have not been documented. In addition to a possible issue of transparency, it is hard to maintain consistency between different regions and years, particularly when the officers responsible for the assessment change. There is therefore a need for improving the reliability of the assessments by establishing "assessment principles" or "protocols" that give detailed procedures for assessors to follow; by exploring methods to handle assessment of data poor fisheries and collaborating more closely with national institutions; and indicating the level of uncertainty involved in the assessment for each stock.

The discussion focussed on some of the main constraints of the present FAO's assessment of the state of the world fishery resources. One key problem was the issues of presenting the state of the stock status by main fishing areas and therefore loosing the resolution of information at the national level. There was widespread perception that assessments based on catch data only were insufficient and even misleading in tracking the state of the stocks. They

may be tracking the state of the fishery, but they should not be used as a substitute for stock assessment. Another issue is the difficulty of determining stock status in the case of multispecies fisheries.

Some discussion dealt with the definition of formal versus informal assessments. Two main opinions emerged, one underlining the importance of the process (e.g. achieving agreement among stakeholders), the other based on the scientific rigour of the assessment.

Some participants noted the additional difficulties posed by the fluctuating nature of some resources that respond to environmental change within a relatively short time span.

3.2 State of the fishery resources and management in Southeast Asia

(Somboon Siriraksophon, SEAFDEC)

The overall trend of catch statistics from marine fisheries in the Southeast Asian Region from 1989 to 2006 shows an annual increase of at least 5%, based on country statistical data, particularly in Indonesia, Myanmar and Vietnam. However, the fishery statistics on which these trends are based, may be biased due to the fact that catch statistics from member countries may contain reporting errors. The fishery sector plays an important role for food security and employment and involves 5.4 million people in the region. The total value of marine production from capture fisheries was about USD 9,091 million in 2006. Fishing gears in the region are generally categorized into 12 groups –surrounding net, seine net, trawl, gill net, scoop net, lift net, falling gear, trap, hooks and lines, drive-in net, dredges, and miscellaneous gear. There are also different types within each category. Fishery management structure in the region is complex and hard to define because each country uses different legal definitions. Therefore, fishery zoning is one of the approaches to show the country management structure, different fishing zones being used by different types of fishing gear/boats.

Various initiatives and efforts have been made by the ASEAN-SEAFDEC member countries to incorporate the CCRF into their policies and legal instruments, specifically in Fisheries Laws (with revision and/or updating of these) as well as in a number of legal documents and fisheries management programmes. A Regional Code of Conduct for Responsible Fisheries (RCCRF) has been developed as the policy and technical framework to update country's Fisheries Acts, addressing the excess fishing capacity through zoning, mesh size regulation and limiting the number of fishing vessels.

SEAFDEC contributes to the assessment of the state of the fishery resources with various studies and activities such as: 1) covering the status of small pelagic fishes *Rastrelliger brachysoma, R. kanaguata, Decapturus macrosoma, D. russelli, and D. maruadsi* in South China Sea in terms of exploitation rate in 2003-5; 2) assessment of the oceanic squid, *Sthenotuethis oualaniensis* or purpleback flying squid in South China sea and Andaman Sea. Based on these studies, the biomass of the oceanic squid S. *oualaniensis* in the waters of western Philippines was estimated to be 283 thousand metric tons and about 1.132 million metric tons in South China Sea. A third activity resulted in the assessment of the status of demersal resources in the Andaman Sea and South China Sea, including the relative abundance estimated from CPUEs of the trawl fisheries.

In the discussion that followed it was further clarified that exploitation rates of small pelagics for specific areas in Southeast Asia, were calculated using the software FISAT II. Furthermore, with reference to the biomass estimate of oceanic squid, it was further noted that all the information was published. Investment for developing this fishery seemed quite high compared to the catches and therefore the fishery has not yet developed much. The species are also found in the Indian Ocean and the Bay of Bengal. It was noted that squid fisheries often use light fishing. Japan tried to develop this fishery with jigging, but was not very successful and SEAFDEC will be trying alternative gears (cast nets, drift nets etc.).

One participant noted that, based on analyses carried out with the TRAWLBASE data, catch rates in the Gulf of Thailand are now just about 10 kg/h, compared to over 400 kg/h in the early 1960s, raising the question of the need to reduce fishing capacity.

3.2 Fisheries and regional management issues in the South and Southeast Asian countries

(David Lymer, FAO/RAP)

A regional review was provided of fisheries assessments and statistics, on behalf of the Asia Pacific Fisheries Commission (APFIC) and the FAO Regional Office for Asia and Pacific. A number of issues were highlighted as important to be explicitly considered for successful stock assessments: 1) misreporting; 2) distortions caused by IUU fishing; 3) stock/fishery vs. national reported catch; 4) poor disaggregation of catch by species; and 5) lack of fleet statistics.

On the issue of misreporting, there are certain errors associated with statistical data collection, specifically under-reporting (e.g. by fishers) and over-reporting, e.g. to reach production (set by policy targets). Also noted were the difficulties to properly estimate the contribution of small scale fisheries, relating to small landing sites (i.e. not official) and an over-reliance on estimation for statistics/landing records. Also, many countries suffer from the lack of budget and of human resources for data collection of small scale fisheries. Misreporting may happen when there is an over-reliance on estimation replacing statistics and landing records. For example, proxy indicators may be used for vessel numbers and effort/CPUE, or extrapolations made from known landings to cover the unknown ones. These estimated are usually not validated or triangulated. Additionally the increasing trash landings that are unaccounted for, or not disaggregated (may be recorded as marine nei or small pelagic species) is a problem for correctly estimating stocks.

On the issue of IUU fishing it was noted that production is not recorded in the correct water area (fishing area). Examples of drivers for IUU fishing in the region are higher prices in neighbouring countries, fishmeal demand, and large reflagged fleets with national crews. Needs for stock/fishery related information is an issue when using national reported catch as both transhipments and cross border fishing take place. Catch caught in foreign EEZs may be reported as caught in own EEZs, thus distorting the resulting assessment of productivity.

The lack of fleet statistics, especially for the huge artisanal and/or small scale fleets is an issue for the region. These fleets use diffuse landing places and it is difficult to extract reliable CPUE figures (small scale gear). Further, small scale gears and vessel sizes are poorly reported at the national level, but good estimates of vessel numbers may exist locally. As an

example a recent fishing vessel census demonstrated a very different fleet structure to what recorded officially, which highlights the need for baseline studies.

There is also a poor disaggregation of marine catch by species in the region generally and specifically for the Southeast Asia region. A recent APFIC recommendation points to the need of "Targeted surveys to assess composition of "nei" to get better estimates" and this should be a priority for those countries reporting large catches of this category. Large catches described as 'marine fishes nei' could also hide a possible situation of "fishing down the food chain".

Three case studies were presented to illustrate the above points. The first study was on The Gulf of Thailand with data from TRAWLBASE and Malaysian catches by districts. These data revealed that there has been a change in catch composition with less valuable species becoming more abundant. The second case study was on the South China Sea and highlighted the need to study composition of trash fish. Between 16% - 70 % of the catches in certain parts of this region can be trash fish and the composition of the catch can be as follows (data from 2 ports): between 25% and 70% of low value fish are small size species of commercially important fish species and between 32% and 50% of trash fish are juveniles of commercially important fish species. The third case study was on the Bay of Bengal and highlighted that although total catch is increasing in the BOB, the catch of large pelagics and high valuable demersal has actually declined since the year 2000.

In summary, misreporting involves under- and over-reporting, poor statistics from small scale fisheries, and distortion caused by IUU fishing that leads to recording production in the wrong area. For stock/fishery assessment, it is important to consider the catch from outside EEZs to avoid distortions in the assessments. The poor disaggregation of catch by species in the region may hide fishing down the food chain effects and declining abundnace of stock. Finally, the lack of fleet statistics (and other socioeconomic data) hinders the development of a reliable statistical and fishery management system.

It was noted that the high reported catch of "nei" comes from countries where freshwater fisheries are more important than marine fisheries (Cambodia and Bangladesh). Thailand, Malaysia, Indonesia and the Philippines provide more reliable statistics for marine catches.

In general, there is a consensus that there is an urgent need to improve the quality of fishery statistic data in the region as reliable and accurate data is the prerequisite for better stock assessment and effective fishery management. However, it was noted that fisheries in the region have poor infrastructure and lack of financial and human resources. Great effort is needed to communicate the current fishery situation to higher government levels for more financial resources and capacity building for fishery data collection, stock assessment and management.

3.4 Review of common practices in fish stock assessment in the Southeast Asian region

(Purwito Martosubroto, FAO Consultant)

Fish stock assessment can be conducted only if, at least, data and information on catch and number of active fishing gear are available. Research vessel surveys have provided

standardized gear and CPUE can be easily derived. When such surveys are conducted regularly, trends in CPUE through time can be generated. This method has been commonly used by many countries in the region since 1970s. However, because research vessel surveys are expensive, regular surveys cannot normally be fulfilled. In the region, SEAFDEC has assisted member countries by conducting regional research vessel surveys, however, not on regular basis. In a global context, the RV "Dr. Fridtjof Nansen" has also conducted snapshot surveys in South and Southeast Asian region in 1980s.

For small pelagic species, acoustic surveys have also been conducted, although in limited numbers, to derive biomass estimates.

Scientists of the region have also been widely involved in analyses of modal progression of fish length distributions through the application of the ELEFAN and FISAT software, through which population parameters of fish can be estimated. Though less frequently, length-based virtual population analyses (VPAs) have also been applied for small pelagic species.

Submission of logbook by commercial fishers is not a requirement for fishing licenses, which is a lost opportunity to obtain catch data from licensed vessels. Furthermore, observer programs which should be established along with the logbook system are not implemented. Current work by a tuna RFMO has encouraged member countries to establish log book and observer programs as one of the requirements for obtaining regular catch data from the active fishing vessels.

As research vessel survey is costly, scientists have been using fishery statistic data to derive trends in CPUE. Such analysis is normally based on landing data by fishing gear, and use the dominant fishing gear for standardization with the assumption that efficiency ratio between different types of gear remains constant. Such analyses also assume that the number of gears recorded in the statistics is the same number of active gears. Both assumptions are under criticism.

Marine Fisheries in the South and Southeast Asian region have also to face other challenges such as the multispecies and multigear character of the fisheries, the still flourishing IUU fishing, and the fact that most fisheries are managed under open access regime. Any stock assessment effort in this type of fisheries is then only considered an academic exercise and not as a good source of basic information for establishing good fisheries management. Current emerging initiatives in certification system promoted by the MSC scheme may eventually contribute to enhance better fisheries management in future.

The FAO seminar on communication between scientists and administrators held in Bangkok in 1984, does not seem to have resulted in major improvements and it may be worth revisiting such an effort.

One of the participants from India confirmed that logbooks and observer programmes were not implemented in India and that fisheries were open access. Certification is expected to put some pressure on incentives for improved fisheries management. A difference between what presented and the situation in India is that managers do consult with scientists.

The Marine Stewardship Council has developed procedures for certificating data poor (small scale) fisheries. The question was asked whether any fishery in the region has obtained certification. In Japan only two fisheries were recently certified. In Indonesia a pre-assessment was asked for the blue swimming crab prior to possible export to the USA.

3.5 Countries' information on available data and assessment

Thailand

Thailand is one of the ten top ranking countries of marine fishery production in the world. Its total production from capture fisheries and coastal aquaculture totalled 2.64 MT in 2004. Fifty-six percent of landings were recorded within the country's EEZ, the remaining catches were from distant fisheries.

Thailand's marine fisheries are classified into 2 main categories, i.e. small-scale fisheries (vessel < 5.0 GT, with or without engines < 30 h/p and operated within 5 km from shore) and commercial fisheries. From the census carried out in the year 2000, it appeared that 57,801 families and 158,166 fishermen are engaged in full-time fishing, some supplementing with aquaculture. Fishing gear can be classified into two major groups: small-scale (gillnet 54.8%), and commercial fishing gears (mostly trawls and purse seines). There were 58,119 fishing vessels, with outboard engines (72.7%), inboard engines (22.8%) and no engines (4.5%). Thailand's fishing grounds are mainly in the Gulf of Thailand and Andaman Sea.

The status of the fisheries in Thailand showed a continuous decrease since the trawl fishing was introduced into Thailand. The catch rate declined enormously from 177.42 kg/hr in 1966 to 17.9 kg/hr in 1998. During the last 3 decades, six important species/groups of pelagic resources, as indicated by the state of the sardines (*Sardinella* spp.), are in an overfishing state. Indo-Pacific mackerel (*Rastrelliger brachysoma/neglectus*) and bigeye scad (*Selar crumenophthalmus*) are also fully exploited. Round scads (*Decapterus* spp.) and anchovies (*Stolephorus* spp.) are heavily exploited. Neritic tunas resources (*Thunnus tonggol*, *Euthynnus affinis* and *Auxis thazard*) were estimated to be at the MSY level. Indian mackerel (*Rastrelliger kanagurta*) did not seem overfished. Demersal fish and shrimp had been estimated to be heavily exploited for a long time and cephalopods were estimated to be fully exploited. Thai fisheries face 3 main issues: economic - too high investment, social - conflict between different groups of fishermen, and political - inadequate fishery regulations.

Recommendations made at national and regional levels required primary attention on the development of fishery strategic plans and the periodical determination of total allowable fishing effort and catch. Amendments to the existing fisheries regulations covered the conservation and management of fishery resources and environment, as well as the improvement of fisheries information of catch statistic, both inside and outside Thai waters, and including improvement of socio-economic information. Fishing technology to reduce by-catch and discards is promoted.

In order to manage the straddling fisheries resources in Thai and neighbouring waters, two levels of management policy, i.e. at national and regional levels, should be established. Collaboration on training on new technologies, establishing data sharing and exchanging mechanism and sharing management experiences among the member countries should be initiated. Management of shared resources will require compatibility of measures across jurisdictions, consensus among the countries and funds should be made available for the necessary mechanisms to be put in place.

Many assessments seem to be available for Thailand. They are largely based on length-frequency analyses and on survey data, including 100 stations over a 30-year period.

A comment was made on the fact that the number of young fishermen seems to be decreasing in some countries (fishing being less attractive than other employment opportunities), but the number of fishermen is maintained by importing labour. There seem existing pressure groups at the political level, and this is a common problem in the region

Malaysia

As in many Asian countries, fisheries in Malaysia are an important industry in terms of employment, trading and food security. In 2007, the marine fishing sector directly employed almost 100,000 people or about 1% of the national labour force to work as fishers onboard of 39,268 licensed fishing vessels in the country. Fishery sector contributed 10.5% of the GDP in the Agriculture sector or 1.2% to the national GDP. Presently, the Self Sufficiency Level (SSL) for fish in the country stood at 91%. However, management structure for specific fishery in Malaysia has not been well established. Therefore, the present management measures are general in nature and include, among others, control over fishing area (Fishing zone & Closed area), fishing effort, and fishing unit, controls in port and at sea, registration of fishers and conservation of fishery habitats. Assessment of the status of the fishery resources was done mainly by using holistic methods. This includes the conduct of scientific resource surveys; swept area method for demersal (fish and shrimp) resources and acoustic survey for pelagic resources. Results of the assessment show that demersal fish resources are fully exploited in coastal and offshore (> 30 nautical miles from coastline) areas except in east coast of Sabah and untrawlable offshore area of Sarawak. The pelagic fish resources are fully exploited only in the west cost and the coastal area of the east coast of Peninsular Malaysia. Both shrimp and anchovy are fully exploited in the area where the resources are harvested. Among the management issues highlighted are limited information on fish resources and the declining trends of resource status. Malaysia is expecting FAO to provide help on capacity-building particularly on stock assessment, competency on implementing EAF and formulating fishery management plans.

In the discussion that followed, it was noted that the number of fishermen was declining in the early 2000, but is now increasing because of economic slow-down. Incentives are given to the fishermen if they get a vessel id. Some questions were raised with regard to the prospect of substantial increase in the production of both aquaculture (from 250 000 to 600000 tonnes) and capture fisheries. A major effort/investment has been put in aquaculture production in Malaysia and Thailand, including capture-based aquaculture (tunas). Issues of interaction between capture fisheries and aquaculture were raised.

Cambodia

In Cambodia, fisheries and aquaculture play an important role in the national economy and contribute to food security. This sector provides employment and economic benefits to Cambodians involved in these activities. The Ministry of Planning (2002) indicates that Cambodia derives 16 % of its GDP from the fisheries sector.

The accuracy of fisheries statistics in Cambodia needs to be improved. The statistics presented in this report are the most accurate available to the Department of Fisheries (DoF). However, a reliable statistical system and data collection protocols have not yet been developed. A number of factors contribute to the inaccuracy such as fish not being landed at central locations, or foreign vessels not landing or recording their catches in Cambodia. Therefore, the statistics presented here should be considered as being only indicative.

Catch and effort statistics are not available and therefore CPUE trends for Cambodia's marine fisheries are not estimated. Surveys from neighbouring countries, such as Thailand, may give some indication. It is possible to make assumptions about CPUE from socioeconomic surveys and comments from fishers.

Research should be conducted at regular intervals to assess CPUEs of commercially important species. A regular monitoring program should be established for water quality parameters, hydrography, phytoplankton production, and zooplankton biomass. There is also an urgent need to change the catch recording system in order to ensure the reliability of fisheries statistics. This will probably require international assistance as well as special training of technical staff, especially in the provincial offices and the Marine Fisheries Inspectorate.

A question was raised regarding some of the information presented that show an increase in catch and the number of vessels involved. Analyses on the state of fishery resources have not been carried out, but fishermen clearly complain the deterioration of resource status. The Cambodian government has a plan to improve data collection with SEAFDEC's support.

Philippines

The Philippines in 2006 ranked 8th among the world's top fish producing nations, and its total annual production of fish and other aquatic resources amounted to 4.41 million metric tons with a value of more than 163 million (~US$ 3.6 billion). The fishing industry's contribution to the country's Gross Domestic Products (GDP) were 2.2% and 4.3% at current and constant prices, respectively. The industry employs more than 1.6 million fishing operators, of which more than 1.3 million are with the municipal sector.

The Philippine fisheries consist of three main sectors, namely commercial, municipal and aquaculture. The capture fisheries sector is divided commercial (large scale, using fishing vessels greater than 3 GT) and municipal sectors (artisanal or small scale, using fishing vessels 3 GT and below). Since 1987, the Philippines official fishery statistics have been compiled by the Bureau of Agricultural Statistics (BAS); Annual Fisheries Statistics for commercial, municipal, inland and aquaculture sectors are published for a three-year time frame, which includes volume and value of production by province and by region, information on fish price and foreign trade statistics.

The Philippine Fisheries Code of 1998 (RA 8550) defines the management jurisdiction of the Bureau of Fisheries and Aquatic Resources (BFAR) in terms of water area. It also spells out the role of the Local Government units (LGUs) under the Local Government Code of 1991 (RA 7160), which exercises jurisdiction on municipal waters. Even though it appears many agencies involved in the management of fishery resources, the immediate burden still lies on local governments, or the municipality in particular, specially the important task of enforcing fishery laws.

Marine fish landings from both commercial and municipal sectors are dominated by pelagic, schooling fish species. Small pelagic fishes account for more than 50% of the total marine fish landings and more than 26% of all fish landings in the Philippines. A staple and cheap source of protein for most Filipinos, especially the lower income groups, a major reduction in production would have serious implications to the Filipinos, whose per capita consumption of fish remains high at 38 kg/year (BFAR, 2007). The Philippine Fisheries are under threat because of over-exploitation, exacerbated by increasing incidence of poverty, accelerating resource use, and population growth. Due to the limited financial resources available to implement measures and strategies to ascertain the current state of fisheries exploitation, only a relatively small portion of the country's vast fishing areas have been studied/monitored. Time series data on production for major species of economic importance are readily available, but corresponding effort statistics are lacking.

Fisheries management in the Philippines is still essentially based on the traditional top-down sectoral approach that uses licenses and permits as the main management tool, which was designed for optimum exploitation as the primary goal. The Fisheries Code of 1998 provides specific management measures to conserve and manage the fishery resources of the country. The issuance of the Fisheries Office Order (No. 217, 2008) by the BFAR for the adoption of the Integrated Fisheries Management Unit scheme is an initial step in the direction of ensuring the long term sustainability of fishery resources.

FAO should continue to help with the popularization of the EAF. The regionalization of the CCRF is a very important undertaking by both FAO and SEAFDEC. However, main follow-up activities need frequently include a wide range of stakeholders, particularly policy-makers from different regions, backgrounds and nationalities. Unfortunately the socio-economic reality hinders these initiatives, which at times are politically unacceptable in other countries.

In the discussion following the presentation, when asked about whether the jurisdictions differed between Integrated Coastal Management (ICM) and Ecosystem-Based Fisheries Management (EBFM), it was clarified that the jurisdiction of national waters (>15 nm) is with national agencies (i.e. Bureau of Fisheries and Aquatic Resources) and local governments have jurisdiction over the waters within 15 nm. It was also reported to the workshop that there is an executive order to encourage ICM. Most of the existing ICM are however driven towards conservation or towards pollution prevention. However, for some people, there is a fishery component included.

On the issue of "length based assessments" it was clarified that reference points used come from Brunei waters (which have longer time series) and that it was found hard to use with non technical people and hence this information/advice does not go back to the local government or back to the responsible national body.

As a response to queries relating to small- pelagics stock status in certain areas of the Philippines, it was highlighted that special attention is given to small pelagics, with a new concept proposal for the Sulu-Sulawesi Sea being developed for funding. There are reports of declining biomass of small pelagics, however some of these species are resilient (e.g. sardines). Also, declining catches of sardines are followed by increased catches of other small pelagic species.

The Pilipino waters are divided into fishing areas (24 areas) and 14 administrative regions. The 24 areas were earlier used for annual fisheries statistic, but now statistics is done by region and the regions also do the stock assessments. Landing data and fisheries area are not

always clearly defined, catches are often landed in [and also transported by land from other provinces to] Manila (fished elsewhere) because of proximity to airport. This is mainly a problem related to small scale fisheries (controlled by local governments), and not so much for commercial fisheries are controlled by national Government.

The ecosystem-based fisheries management (EBFM) boundaries were made using bathymetry and characteristics for the coastal waters (soft bottom areas, hard bottom, and coral reefs). Also the division between national and municipal waters were taken into account. However, the boundaries were developed with the notion that one area should correspond to one ecosystem, hence initially each gulf or bay was considered as one ecosystem. This division was then discussed with local fisheries officer and for some areas further division was made (also due to political reasons). The final divisions are still discussed but should be finalized shortly.

The national department provides guidelines for indicators for commercial fishers: they are educated in submission of "true" catch and effort data (collaboration with statistical department). The log sheets are now giving a more realistic picture of the catches. Previously, catches were underestimated by as much as 20%. The municipal fisheries is a problem, registration aris at municipal level (with no standardised scheme). There is a standardised vessel registration available (developed at the national level) but not all municipalities use this registration scheme.

The management structure of the fishing fleet is such that the fleet is divided at 3 GT. Vessels larger than 3 GT (commercial fishers) are licenced by national authorities and only allowed to fish outside 15 nm whereas vessels below 3 GT are licensed by local governments.

Viet Nam

Viet Nam is located in South East Asia, having a 3,260 km coastal line and an Exclusive Economic Zone (EEZ) of more than 1 million km². Vietnam's marine waters have many islands, bays, lagoons and estuaries. There are over 2030 fish species in Vietnamese waters, among which are around 130 species with economic value; 1,600 crustacean species; 2,500 species of mollusc and many other kinds of seaweed and seabirds. The standing stock of fisheries resources in 1997 is estimated at 3.3 - 3.5 million tones and the potential yield is about 1.5 - 1.6 million tones.

Total fishery production was estimated at 2,410,900 tones in 2002, of which 1,434,800 tones from capture fisheries. Export value reached US$2,014.0 million, increasing 9.8 times in comparison with 1990. Fisheries sector provides about 40% of the animal protein diet for the people and has also directly employed over 4 million people.

Viet Nam's annual landing of marine capture fisheries has increased rapidly over recent years, from around 0.73 million tons in 1990 to 2.07 million tons in 2007. The average annual increase is about 6.5 %. In contrast to the increase in production, catch rate has declined over the last few decades, from about 1.1ton/HP/year in 1985 to o.35 ton/HP/year in 2003.

However, Viet Name's fisheries are facing many difficulties because capture fisheries in Vietnam are almost all in small-scale, with 84% of fishing boats having less than 90 HP engines. The number of fishing boats has increased rapidly in last few decades. In 1981, there were about 29,000 motorized fishing boats. Ten years later, the number of fishing boats increased by about 2 times, reaching 83,000 boats in 2003.

Fishery data availability is poor in Viet Nam. Catch and effort data are collected only after 1996, and catches are often reported by species groups rather than by species. Various scientific surveys have been carried out between 1996 and 2005, however, there is lack of consistency in survey design such as vessels used, survey timing, and survey areas. Although some scientific surveys have continued after 2005, they are at a much smaller scales and irregular in both spatial and temporal coverage.

Vietnam's fishery remains open access, which has lead to an continuous increase in fishery capacity over the last two decades. In contrast, fishery resources are over-exploited in almost all areas. Target species of marine capture fisheries has changed, and there is a shift from high to low value species. There is a need to implement management plans at national level

1. Strengthening fishery research to support management
2. Promoting responsible fishing technology and practices
3. Developing management strategies and plans to control the ever-expanding fishing effort and to protect the long-term sustainability of fishery resources
4. Re-structuring the national fishery statistic system.

The workshop noted that there is an increase in catch, but that the fleet increased even faster, hence the CPUE or catch rate goes down. In light of this it was queried whether stock assessment was available for major species. Viet Nam explained that decreasing catch rate has been seen for all species. There are stock assessments available for some target species. Some of these are assessed as heavily exploited (e.g. lizard Fish) whereas others are assessed as not overexploited. Viet Nam has data available for several species.

Open access is still in effect in Viet Nam. Management is not very effective, and efforts have been made to control new vessel building (i.e. no new fishing boats are allowed in some fisheries).However, this is not effective because of implementation problems. There was a rapid increase in number of vessels in 2009, reflected in a national count of vessels during 2008, where every fishing boat was counted. The result of the national count show that there are much more vessels than previously recorded, meaning many vessels are unregistered and outside government's control.

Time series of fisheries statistics data exists (not at species level),and these are grouped into commercial groups and are hence hard to use for stock assessment. There is currently a restructure of the statistical system in Viet Nam.

Licensing of boatbuilding does not reside within the ministry of fisheries (other department), hence it is beyond the control of the fishery ministry. As there is limited data available from fisheries between 2005 and 2009, a possible future solution could be to have logbooks institutionalized (i.e. no logbook – no licence). Another issue was that licensing of smaller boats is done at the provincial level, and therefore hard to control and difficult to coordinate with the central authority (the ministry of Agriculture) that gives license to larger boats (larger than 90 Hp).

The numbers of surveys are decreasing (because of cost) and observer schemes might be an option. In Vietnam observers are used in several types of fisheries, additionally data is collected for length frequency and other biological variables and catch composition.

The estimate of large pelagics is done only for part of the population within Viet Nam. The limitations of this type of assessment were noted, given the migratory nature of these species,

and the need to collaborate with the states exploiting the same populations in both research and management.

Landing production could be a good way to assess fisheries in the future. Sampling programs exist at provincial and district levels. At the provincial level, monthly reports and annual summaries (including total catches by fishing fleet) are sent to the central government. Using log books to assess fisheries catch is at the moment not feasible because of the large number of unregistered vessels.

The usefulness of the data availability table was highlighted by the workshop. Trawl base (1996) have 4000 stations and hopefully the sampling strategy that Vietnam has applied in recent years is comparable with previous surveys, which would allow a historical analysis of trends in abundance and distribution.

India

At the national level, marine fish production has increased more than 5 times in the last 60 years; however, on a micro-level, there are evidences of full/over exploitation of some fish stocks.

Among the strengths related to stock assessment in India, the following are noted:

- Continuous data on fish production and effort with high taxonomic resolution for the last 60-years.
- Length-based assessment available for nearly 100 stocks for the past 25 years.
- Development of ecosystem modeling: detecting fishing down the food web and poised for correlating time series climate and oceanographic variables with fish catch trends to find out impact, adaptation and vulnerability of Indian marine fisheries to climate change.
- Database on marine mammal interaction with fisheries.
- Structured fisheries management initiatives in place.

Among the weaknesses the following were noted:

- Fisheries remains coastal, several factors limit oceanic fisheries.
- Inadequate oceanic/acoustic surveys
- Insufficient validation of growth studies through tagging
- Implementation of rules/acts is a problem
- MCS/VMS not adequately developed

There are a number of new initiatives aiming at improving fisheries management, e.g. improvement in data collection, storage and analysis for more robust stock assessments, developing fish stock sustainability/vulnerability indices, ecolabelling of selected traditional fisheries, value chain approach to development of oceanic tuna and squid fisheries. India is seeking support and assistance from FAO for moving towards EAF.

The workshop noted that looking at the exploitation status, fish stocks appeared going down. It was clarified that the data refers to catch data and it was going down between 1960s and 2001, however some of the stocks have recovered afterwards. Stocks assessment has been done recently (in the last 3-4 years). This does however differ between regions and stocks and they will be consolidated by a review team. Additional stocks will be added as part of the 8 projects that started in 2007.

It was clarified that 40 % of the catch are juveniles (by weight), and around 50-60 % by number of fishes caught. This catch is mainly from trawls, due to the small mesh size of the trawl nets. Trends in total landings (growth rates) are influenced by several factors: increase in fishing effort and efficiency and expansion of fishing area (possible to explore deeper areas). However, no decline was seen since however, at micro level there are declining stocks (trends). Oil sardine has recently been assessed by catch and length frequency and its abundance fluctuates and hence so does its catch. No explanation on why this happened was found looking at thelength frequency data. It was suggested that the catch data from India (specifically from BOB) could be compared to Gulf of Thailand data.

The licences of coastal fishing vessels are issued by the state government whereas the ocean fishing vessels are licensed by the central government. All vessels are registered, except non-mechanised and non-motorized. India has a closed season in some areas and it was queried whether fishermen are moving between states during the closure (i.e. to open areas); this may create conflicts between fishermen. It was also highlighted that it would be problematic to implement catch quotas in India fisheries.

The staff are specialised and divided into 2 group. The first group has 72 staff and are responsible for data collection (landing data, effort data) and species division. The other group (40 people) is responsible for biological sampling of subsamples of the catch (e.g. stomach content, spawning length frequency). There is a short of staff if the entire coastline is considered (very long coastline), and it is assessed that at least 150 people are needed.

Bangladesh

The fishery sector plays an important role in Bangladesh in terms of nutrition, income, employment and foreign exchange earnings. The southernmost part of this country is bordered by about 710 km long coastal belt of the Bay of Bengal, with a continental shelf, up to 50 m depth, of about 37000 km2. The Exclusive Economic Zone (EEZ) of Bangladesh lies from the base line of the 710 km coastal belt to 200 nautical miles, having an area of about 164000 km2 is now under economic jurisdiction of the country for exploration, exploitation, conservation and management of its marine resources. As a whole, the total fish production, especially from inland and marine sector is increasing each year being 1.4 million tons in 1997-98, 1.9 million tons in 2001-02 and 2.56 million tons in 2007. Fish production of inland open-water capture fisheries has declined sharply due to the environmental degradation and numerous anthropogenic activities. On the other hand, the production of marine fish has been steadily increasing for the past few years, indicating a viable alternative for more and more fish production to meet the demand of the vast population of the country. However, the marine ecosystem, especially the mangrove habitat, is under threat due to the rapid expansion of coastal shrimp farming and pollution. Therefore, there is a need to develop comprehensive marine fisheries management policy considering biological, environmental and socio-economic issues to get maximum sustainable production of marine resources to feed the ever-growing vast population in this area and to protect the marine ecosystem. In this connection, implementation of ecosystem approach to fisheries and aquaculture development in the APFIC region could be the most vital option. Nonetheless, ever neglected marine sector needs more attentions for sustainable utilization of its valuable resources. In this comprehensive report on “Marine Fisheries Resources of Bangladesh”, an attempt has been made to highlight the information about i) Major Resources; ii) Fishing Gears used and iii) Management Practices. The National Fisheries Policy and The National Fisheries Strategy have also been briefly explained including the hilsa Management Plan and the Integrated Coastal Resource

Management of the country. Finally data availability, resource management issues and a number of recommendations have been made.

The workshop noted that there Hilsa sp. catch has increase by 40% and wondered how the stock is doing. It was explained that the stock is shared by several countries and that it migrates to freshwaters for spawning. It used to be caught as juveniles during migration. Hence the government has imposed a ban on fishing during the spawning period and supported alternative livelihoods during fishing ban period. So, part of the 40% increase reflects the positive effects of these measures, including protection of spawning grounds and increase in fishing effort.

There is currently no formal assessment of Hilsa sp. stocks, but there are plans to do assessment in the near future. It was highlighted that Hilsa sp. is a shared stock among neighbouring countries and any attempt of developing a management plan (for the shared stock) should involve all the countries that share the stock. Sub regional cooperation was highlighted as important and needed for management and assessment.

The workshop noted that in the national fisheries policy only one of 6 items relates to stock conservation and that not many indicators were available on stock status. Inland fisheries have better data (species level) because of their relative importance (80% of national production). Hilsa sp. catches are recorded as marine catch although they ares caught in rivers (freshwater).

Myanmar

The Union of Myanmar has a coastline of some 3,000 km, which can be divided into three coastal regions: the Rakhine region to the north, facing Myanmar's most prolific shrimp grounds in the Bay of Bengal and bordering with Bangladesh; the Gulf of Mottma region or "Ayeyarwady" in the centre; and the Tanintharyi region to the south, facing the 800-island Myeik archipelago of the Andaman Sea and bordering with Thailand. The continental shelf spreads over some 228,751 square kilometers, and the exclusive economic zone (EEZ) has a surface area of almost half a million square kilometers (486,000 square kilometers).

Total fishery production in 2007-2008 was 3,169 thousand metric tones of which freshwater fishery accounts for about 47 % and marine fishery 53 %. The fishery sector is of major importance to Myammar since most of the protein in the diet of the population comes from fish. It is also the third largest earner of foreign currency for the country. According to the surveys and research, the annual Maximum Sustainable Yield (MSY) of the marine fisheries is estimated at about 1.05 million metric tones. In 1993, only 0.59 million metric tones were caught, well below the MSY.

Even there is no scientific data for stock assessment of marine fisheries, some indicator shows that marine capture fisheries are becoming over-fished or nearly over-fished. Size of some commercially important species are becoming smaller and smaller and catch per hour are also decreasing year by year. Changes of fish species composition are also observed in last few years. Number of fishing licenses issued for marine capture fisheries is based on Maximum Sustainable Yield of marine fish stocks in Myanmar waters. According to marine fishery stock assessment survey conducted by FAO experts in 1980-1983, Myanmar has accepted 1.05 million metric tons as its maximum sustainable yield for marine fisheries. Even this figure is nearly thirty-year old, it is still used as a reference point for marine fisheries development and management. In light of

signs of over-exploitation by some indicators, stock assessment of Myanmar marine fishery is urgently need to be updated.

It was clarified that the weights were presented in Myanmar's standard measure (biz = 1.6 kg) and that the fishing maps (showing the species specific fishing grounds) were based on a study of trawl catches.

The workshop noted that the total production was 0.5 million tonnes, but that no species breakdown exists as these are not collected by the township fisheries officers (responsible for fisheries data collection). Only weight data is collected by the township officers, 1800 staff in fisheries so not enough to collect detailed data.

Regarding a tagging programme aiming at protecting marine sea turtles, it was noted by the presenter that no tags had been recovered. However these are mainly used for satellite tracking, hence recovery is not needed.

There is no breakdown of production between inshore (nearshore) or offshore fisheries in Myanmar and the main countries importing fish from Myanmar are China, Thailand, and Malaysia.

Indonesia

Indonesia as an archipelagic country has some 5.8 Km^2 of waters, consisting of 2.7 million km^2 of territorial waters and 3.1 million km^2 of EEZ, and a 81.000 km coastal line. Marine ecosystems include estuarine, coastal, shelf, offshore, deep and high seas. Fisheries range from semi large-scale industrial-sized fisheries, such as the prawn and tuna fisheries, to small-scale community based fisheries such as those that operate within one day fishing with no engine.

There are 11 fisheries management areas and the total number of fishers in 2007 was about 2.2 million, with a total production of 4.73 million tons. Most of the fishermen are involved in small scale operations.

The Stock Assessment Working Groups provide information on the past and current status of fish stocks and of their fisheries through the National Committee on fish stock assessment that was initiated through the Fisheries act 31/2004. Several indicators on stock status were developed. Some of the fisheries were categorized "overfished", such as shrimps and demersal fisheries in the Arafura Sea, Java Sea, Makassar and Malacca Strait, as well as the small pelagic fisheries in the Java and Natuna seas. A precautionary approach was introduced to maintain the fisheries at sustainable levels.

Technological creeps and shifting fishing grounds of the purse seine fishery became evident due to interactions/overlaps with the indigenous fisheries. A large number of vessels under 30 GT, which should be managed by local fishery authorities, are difficult to control due to the limited capacity and understanding of sustainability issues and stock status at the local level. Limited capacity of both human resources and infrastructure is the main obstacle to the collection of fisheries data and data analysis. Strengthening communication between research and field staff through log-book system is one of the potential solutions to provide a reliable atch and effort data.

The workshop noted that Indonesia had provided a very extensive presentation full of information and that the historical review of assessment was very useful. It was highlighted that a recent project coordinated by SEAFDEC, reporting on fishery status and trends, has recently been completed. There is a report available from Indonesia on the status and trend in Bahasa Indonesia. The project was successful and lots of indicators were developed. The project was started with a stock assessment meeting in 2005; maybe there will be a new meeting in October (focusing on changes in stocks after 4 year). In connection to the above, SEAFDEC explained that fishery statistical data collected from member countries are based on gear or type of fishing boats (production figures). No data on assessment of stocks are regularly collected by SEAFDEC.

The stock status assessment by species groups was done by selecting certain fisheries and trying to look into the existing data, using good data collection systems as examples (certain ports). The assessment experienced problems with assessing demersal stocks. It was further highlighted that some assessments had been done in collaboration with ASEAN.

Previously production figures were collected by landing areas while now is by fisheries management areas. Data availability varies between areas. The CPUE values were derived from statistics that are reviewed by the "Committee of stock assessment". Although a draft management plan has been developed, it has not been used by the government. Sixty percent of the information [in the management plan] was extracted from scientific studies. Perhaps the lack of participation of fishers and stakeholders explains why the plan is not successfully implemented.

China

China is a large fishing country, with a total production of aquatic products (both freshwater and marine) of 47.5 million tons in 2007. The marine production was 25.5 million tons, of which about 12.4 million tons was from marine capture, including distance-water fishing (DWF, about 1.07 million tons). Mariculture accounts for about 13 million tons. Marine capture fisheries contributed 0.44% of total Chinese GDP in 2007. Multi-species and multi-gear fisheries are typical in Chinese marine fisheries along the long coastal waters. Total CPUE has decreased in recent years. Most of the inshore stocks have been fully or over exploited, average trophic levels have declined. Few single species and some species group fisheries data are available.

The major management measures for marine fisheries include seasonal and temporal closures, especially the 2-3 month summer fishing ban implemented since 1995. The ban extended to 3-3.5 months more recently. Licensing control, minimum mesh size, minimum landing size for major species and limited young fish percentage in catch have been used for a long time. The buyback of fishing boats has started and 30000 boats were planned to be reduced during the period 2002 to 2010. Stock enhancement started 20 years ago and seems producing good results, with abundance remarkably increased in recent years. In the future, the establishment of a self-regulation system by fishermen and community-based management in the coastal areas has been recommended. The Use of Total Allowable Catch (TAC) and Individual Transfer Quota (ITQ) based on survey and assessment should be encouraged in fisheries management. EBFM should be considered.

Following the presentation, there were queries on the summer ban on fishing and its efficiency in recuperation of stocks. The summer ban was assessed as it has been effective

although it was done without scientific evidence from the beginning. In China, there are too many fishing boats which make specific enforcement difficult. A ban on all kinds of fishing is easier to enforce than other measures. Timing of the ban was mainly designed to preserve spawning stocks as many stocks spawn in May and June.

It was noted that there is an increasing trend in total catch for most countries in the region, however China has seen decreasing catches since 2000. It was explained that the decrease was minor (compared to total catch), but it is quite stable. This is probably because production has reached its maximum in China's waters. There has also been a large development of mariculture in recent years.

Three research institutes (Yellow Sea, East China Sea, and South China Sea) are responsible for stock assessment in respective regions/seas. The research institutes have time series data for some stocks either from surveys or fishing boats. For example, in South China Sea stock assessment for the Chinese part has been done by the South China Sea Research Institute, and joint assessments have been done with Vietnam.

There is also a limit over the total number of licences issued and fishing right is only granted to licensed boats. There are however too many fishing boats, hence China decided to reduce fishing boat number by implementing a buyback scheme from 2002 to 2010, with a total buyback of 30 000 boats and also new job opportunities are provided to the fishermen. This reduction of fishing boats does not include boats sold to other countries, which have been reflagged or in the fleet operating in distant waters. However, the distant-water fishing fleet is small (few boats) compared to the total number of vessels in domestic waters. The total catch statistics includes catches from distant water fisheries (2.3%). The distant-water fish catch has been stable over the years, showing significant numbers from 1990 and onwards. The southern Atlantic Ocean is currently the major fishing ground, but other areas are also fished by the Chinese distant-water fleet..

The zero growth policy implemented in 1999 for marine capture fisheires has seen the total marine catch capped; however the catch composition might change between years

Overall conclusions following countries' presentations

The discussions that followed each presentation addressed general issues as well as details and clarifications on each country's presentations. The general considerations that arise from the discussions are:

- *Difference in capacity of data collection and stock assessment among the countries*
- *There has been substantial improvement in the region as regards data availability and assessment in comparison with the '80s or '90s. Survey data does exist and stock assessment has been done for some species, but the robustness of the data and assessment methodologies need to be ascertained.*
- *Catch is increasing in almost all countries except China. However, the increase is not proportional to effort change and CPUE has been decreasing. The general perception in all countries is that there is a decline in abundance of most stocks and resources are largely overfished.*
- *Management systems are in place in many countries but implementation lags behind.*
- *There is a high percentage of juveniles in catch*

- *Influence on fisheries form other sources such as pollution and habitat destruction seems substantial in the region.*
- *There are cases showing a high exploitation rate together with a declining trend in stock, probably caused by increased fishing efficiency.*
- *A step forward from here could be to examine the role of phytoplankton and zooplankton abundance and species composition in association with productivity of fish stock.*

3.6 Experience in South and Southeast Asia: The Australian Fishery Status Report and challenges common to fisheries of the region

Since 1992, the Australian Bureau of Rural Sciences has undertaken an independent, annual review of the status of fish stocks which the Australian Government manages. This is published as the Fishery Status Reports (www.daff.gov.au\brs\fisheries_marine). Two indicators are used to describe the status of fish stocks: 1) whether the stock is overfished or not (ie there are too few fish left) and 2) whether the stock is subject to overfishing or not (ie too many fish are being caught). The status of a stock may be classified as 'uncertain' due to a lack of information on which to base an assessment, or substantial uncertainty in stock assessment results. These two indicators translate the complexities of the stock assessments into easily understood terms for stakeholders, managers and policy makers. The Fishery Status Reports have had a substantial impact on fisheries management and policy in Australia. Since the introduction of the Australian Government's Harvest Strategy Policy (2007) (www.daff.gov.au\fisheries\domestic\harvest_strategy_policy) target and limit reference points, in terms of both biomass and fishing effort, have become more explicit.

The assessment of stock status in some Australian fisheries faces challenges that are common with South and Southeast Asian fisheries, including: multi-species, multi-gear fisheries, lack of formal stock assessment models, data poor fisheries, lack of discrimination between species in catch reporting. In these cases indicators and reference points for stock status can still be developed using proxies and other available information.

It was noted that Australia stock assessment methodology is different from the methodology presented at the workshop by the FAO secretariat. Risk assessment methodologies are used in Australia and a four-tier system was adopted so that the complexity of assessment methods is in line with the data available.

Assessment reports do include only specific assessments or also broader assessments (i.e. fisheries assessments). For each fishery environment and stocks status are described, however no holistic assessment for the whole fisheries is made.It was noted that the economic fisheries status report will be incorporated into the report. Hence biological and economic issues will be in the same report.

It was explained that federal and state governments work in different ways. For export permits, a full assessment has to be passed (guidelines for responsible fisheries). Each fishery under assessment has to submit an assessment and the authority then evaluate it (so far no fishery has failed, but there are cases where fisheries have been revoked export approval - e.g. shark fishery). Reduction of number of fishers is ongoing. Quota will be reduced when stock is overfished or getting closer to being overfished. Also fishing days are used as a

management tool of fishing effort, so in the same way a lower number of days of fishing are allowed when stocks are close to being overfished.

As regards the relationship between commonwealth and state, commonwealth does not comment on the management of the states. There are many species assessments at state level, but many states do not use the category "overfished". Hence for some states there are no overfished stocks but there could be many fully exploited. There is a resource assessment group that is doing assessment yearly. These assessments may however not lead to a categorization into "overfished". The categorization can be influenced by different stakeholders (including industry).

3.7 An Overview of the Fisheries Resources Information System and Tools (FiRST) and Rapid Appraisal Approach (RAFMS): Tools for Assessing Status of Fish Stocks in Asia

Mr. Garces presented the highlights and key results of a collaborative project entitled "Sustainable Management of Coastal Fish Stocks in Asia", also known as the TrawlBase project. The project was implemented from 1996 to 2004 with eight participating Countries (i.e., Bangladesh, India, Indonesia, Malaysia, Philippines, Thailand, Sri Lanka, and Vietnam) and the WorldFish Center (formerly ICLARM). The main objective of this project was to promote sustainable management of coastal fish stocks in Asia. Mr. Garces highlighted the key results of the coastal fisheries project, which include:

- Development of the database system called "Fisheries Resource Information System and Tools" (FiRST), which contains resource and socio-economic data for the marine fisheries sector in South and Southeast Asia, and relevant tools for analysis. The TrawlBase is now an important regional repository of information for sustainable management of coastal fish stocks in developing Asian countries. In 2003, a software upgrade and enhancement of data in TrawlBase was undertaken with the 8 country and additional partners (i.e., Brunei and Australia);
- Analyses of the compiled data have documented the decline in coastal fishery resources in several major fishing areas in the region. Alarmingly, stock abundances are down by 70-95% from original unfished levels in major fishing areas in most countries. The assessments have also shown that the relative abundance of the more valuable fishes (such as groupers, snappers, sharks and rays) has decreased sharply and that there has been a proportionate increase in smaller, less valuable species (such as cardinal and trigger fishes). Fish assemblage structure analyses also indicated that most assemblages occur across fishing zone boundaries and mainly influenced by water depth.

Mr Garces also gave an overview of the Rapid Appraisal of Fisheries Management System (RAFMS) is largely based conceptually on a methodological framework known as institutional analysis and development (IAD), and is a semi-structured research tool designed to quickly document and evaluate the existing fisheries management systems in a given fisheries environment. The RAFMS uniquely focuses on fisheries management systems taking the broader context of socio-economic, bio-physical and institutional dimensions. Its other innovative features include the: (1) active roles of the local researchers and members of the fishing community in the process; (2) ability to generate some quantitative (i.e., interval and ratio scales) data; and (3) use of quick biological assessment techniques. Rapid

assessment of community level fisheries has been carried out in several localities in the Philippines and Indonesia by the WorldFish Center and its national/local partners. Illustrative examples of the fisheries component results from the rapid assessments were also presented.

As regards a question on how to access the data contained in TrawlBase, Mr. Garces noted that all data available in this database are owned by the countries. Requests to get such information could be made through communication with the WorldFish Center.

The usefulness of the information that can be generated by TrawlBase was noted, including an example from Malaysia where a fishing boat buyback program has been triggered by the recognition of poor resource status that was evidenced through Trawlbase analyses .

It was suggested that assessment of some trash fish species should be carried out, for example considering ecosystem important key species.

Involvement of Cambodia in the Trawlbase program in the future can be established. Capacity building program will be provided by the WorldFish Center to the Cambodian fishery officers to be able to input data and information to the existing system of this program.

Rapid assessment is an integrated assessment method that looks at the different aspects of fisheries including economic, social, etc., but the state of fishery resources is evaluated by using only key indicators of the fishery ecological system.

3.8 Monitoring Global Resources and Fisheries (FIRMS)

(Marc Taconet, FAO)

A presentation was delivered on FIRMS, including a live demonstration of the system, explaining how FIRMS is contributing to the global review on status of marine resources, what the perceived benefits are at regional fishery body levels, and how the application of FIRMS concepts (focus on inventories and indicators, information sharing, and communication) can be of benefit at country level.

FIRMS is a formal information partnership arrangement launched in Feb. 2004 which currently brings together 13 international organizations. FIRMS's objective is to provide information users with a better means to monitor the status and trends of world fishery resources and their management, based on authoritative information sources. Being a formal arrangement, partners make commitments for the provision of information and the governance of the system assured by the FIRMS Steering Committee (FSC). FAO provides the FIRMS Secretariat.

The FIRMS website http://firms.fao.org is the visible outcome of the FIRMS information sharing work. Currently, FIRMS disseminates through its marine resource module information for about 1000 stock units. This module hosts scientific knowledge about the biotic component of the fishery system: structure of marine resources populations, habitat and biology of concerned organisms, stock units, stock assessments, resources status and trends. The FIRMS web-based system is powered by the Fisheries Global Information System (FIGIS) and benefits from its content management system and information exchange protocol features. FIRMS is currently launching its new Fisheries module which hosts status and trends

information on the human component of the fishery system, from either production systems, management, resources, or fishing activity view points.

FIRMS information sharing mechanisms are based on two fundamental tools:
- the inventories constitute the backbone of the FIRMS system. Each partner enumerates the list of resources and fisheries under its monitoring and/or management mandate, and the system organizes the reporting on status and trends according to these lists and related data ownership;
- the information standards are developed to ensure consistency and common understandings of the information shared, and include classifications, controlled terms, concepts and their definitions, and the Metadata which drives the template for the presentation of fact sheets.

Fact sheets and other FIRMS products: as a result of these sharing mechanisms, the FIRMS information products are web-based fishery reports formatted following a standard template, tagged with the agreed controlled terms for status and trends description, and presented in the form of homogeneous Resources or Fisheries fact sheets. The knowledge thus collated and organized might be exploited in many ways to present synopses on the state of resources, or to enable clever searches, as anyone would expect from a database.

By providing an information sharing framework, FIRMS can contribute to improve visibility and communication of the available information in South and South East Asia, in support to fishery resources status and trends monitoring. Join in the FIRMS partnership is expected to bring benefits at the national, regional and global levels. FIRMS mechanisms can be implemented and applied in South and South East Asian countries through International Fishery Organizations (eg SEAFDEC, APFIC). On behalf of the FIRMS Steering Committee, International Fishery Organizations that had not yet joined this partnership were invited to do so.

Following the FIRMS presentation, Bangladesh and India (two countries not yet involved in FIRMS owing to the absence of any Regional FIRMS partner which they are member of, unlike other SEAFDEC member countries) remarked that more communication on FIRMS would be desirable, and asked how non-member countries of regional organizations can be involved. Australia, which has advanced reporting mechanisms at Federal level, was also interested in learning more about the inventories and workflow processes, in an endeavour to have an integrated Federal and State reporting system. FAO could examine the possibility of publishing, as part of the Fishery Country Profiles, nationally validated inventories and resources status reports. The modalities of such publishing process should be discussed within FAO.

APFIC stated that its interest in FIRMS would mainly lie in its ability to analyse FIRMS content, and indicated that FIRMS would provide a good mechanism in support of the Regional Advisory Committee (RAC). Regarding APFIC's perception that FIRMS is very much stock- based, and the concern that reference points do not seem to be part of the FIRMS design, the meeting was reassured that fishery indicators and reference points are part of the FIRMS metadata model and are utilized by FIRMS partners, and that the new fisheries module offers a broad scope of new types of fishery reports which should be able to address the various dimensions of the EAF.

4. Overview of potential assessment methodologies

(Yimin Ye, FAO)

Fisheries in the South and Southeast Asian countries are characterized as multispecies, multigear and small scale. Adding to the difficulty of stock assessment of these fisheries are that there are very limited data available and that there is short of stock assessment skills in the region. Despite the difficult situation, some countries have carried out stock assessment for their major fisheries using methods that are tailored to the data available. It is strongly believed that for fisheries that have formal/quantitative stock assessment, the present methods should be used to update the assessment. However, for the fisheries of which no formal assessment has been done, some simple assessment methods presented here can be tried. These methods are simple and could be used for data-poor fisheries, but it must be kept in mind that such simple methods make very simplified assumptions, which often do not hold in specific fisheries, and therefore should only be used as a last resort, and that resulting assessment should be viewed with care.

The following three methods were presented at the workshop:

1. **Depletion-Adjusted Average Catch**

   The Depletion-Adjusted Average Catch is a straightforward method for estimating sustainable catch levels when we have little more than a time series of catches to provide an interim solution until a more complete assessment is available. The Windfall/Sustainable Yield Ratio method was first developed by MacCall unpub. (http://www.safmc.net/Portals/6/Meetings/Council/BriefingBook/March09/SSC/A10_LENFESTACL.pdf) and recommended by an Expert Working Group for setting annual catch limits for US data-poor fisheries.

   The approach relies on a time series of catches, some basic life history parameters and expert opinion on the current level of depletion of the resource relative to the unexploited biomass level or the level of biomass needed to support MSY. Essentially, the average catch is discounted by the amount of that catch that can be considered part of the fishing down process, i.e., the difference between the unexploited biomass level and the MSY biomass level. That discounted average catch level can then be used as a basis for OFL, and uncertainty estimated by Monte Carlo methods by simulating performance for different buffer levels using the same sort of MSE approach described above.

   There is certainly a need for extension to use this method to assess stock status. Once MSY is estimated and the parameters of a surplus production model can be calculated under the assessment that stock dynamics can be described by the production model. With the parameter estimates, the trajectory of stock abundance can be calculated and then stock status be estimated.

   A practical example of the American widow rockfish fishery was presented at the workshop. The Excel sheet can be easily used for similar analysis of different fishries.

2. **Stock Status Assessment using Life Parameters** (Beddington & Kirkwood 2005)

   Using life-history invariants, the method allows the estimation of maximum sustainable yield and the fishing mortality rate that produces the maximum yield form estimates of the growth parameters, the length at first capture and the steepness of the stock recruitment relationship. This allows sustainable yields and fishing capacity to be estimated from sparse data, such as those available for developing country fisheries.

Stock status was evaluated by comparing the current fishing mortality of the fishery with the fishing mortality that could produce the maximum sustainable yield. Therefore, a method for estimating current fishing mortality based on length frequency data was presented. The method can be simply implemented using the FiSAT II software developed jointly by FAO and ICLARM. In addition, a few empirical methods were also presented that estimate natural mortality rates based on life-parameters and ambient water temperature.

3. Ecological Risk Assessment (ERA)

The Productivity and Susceptibility Analysis (PSA), which is the second level of a three level Ecological Risk Assessment for the Effects of Fishing (ERAEF), for this purpose. The Marine Stewardship Council (MSC) also uses the PSA (plus the Level 1 Scale Intensity Consequence Analysis) in a pilot program to assess sustainability of data deficient stocks (Hobday, 2007).

The PSA approach is a method of assessing a fishery species or stock based on a comprehensive screening of risk for a set of predetermined measurable attributes. The PSA approach is based on the assumption that the risk to a species will depend on two characteristics: (1) the productivity of the unit, which will determine the rate at which the unit can sustain fishing pressure or recover from depletion or other impacts due to the fishery; and (2) the susceptibility of the unit to fishing activities. The PSA analysis essentially measures the relative risk or the vulnerability of the resource to the potential for fishery impacts. This approach is especially useful as it allows for a baseline comparison between many species with varying levels of available information. In the stocks discussed below, there are cases where full assessments have been regularly conducted, while for other stocks little is known other than distribution or life history characteristics.

The PSA approach examines attributes of each unit (stock or assemblage) with respect to productivity or susceptibility to provide a relative measure of risk to the unit. Productivity is measured by averaging the seven attributes outlined in Table 1. Susceptibility is estimated as the product of four independent aspects; Availability, Encounterability, Selectivity and Post-capture Mortality (PCM); these aspect values are composed of attributes.

Examples were presented at the workshop and the corresponding Excel sheet can easily used for PSA of similar fisheries. However, it must be beard in mind PSA does not produce stock status assessment, but evaluation o f resource vulnerability, which is often useful to determine which species is at higher risk in a fishery or an ecosystem. PSA is becoming more popular recently for data poor fisheries and seems useful for designing fishery management plans. The method was presented as sort of capacity building effort FAO has committed to the region.

The three methods of stock status assessment for data poor fisheries were detailed in Appendix 4.

Discussion

It was suggested that a table summarizing data/input parameters for each model be developed and disseminated to all participants. It was further noted that combinational use of models (use more than one model for specific target species) should be encouraged for more concrete analyses.

Discussion on the 3 models included:

- *Only fishery catch data is needed for the 1st model resulting a quite acceptable results for the American widow rockfish fishery. This 1st model is highly recommended for trial for Cambodia that has never carried out any stock assessment.*
- *The 2nd model is recommended for analysis of the stock status of a single species, using FiSAT and the estimation of Z using length-frequency data.*
- *The 3rd model (PSA) will be useful for assessing the ecological risk of multi-gear and –species fisheries. By extending some attribute, risk analysis could be done more comprehensively.*
- *IUU fishing could be one of the problems of which the countries in the region should be aware when assessing stock status.*
- *Productivity Susceptibility Analysis (PSA) has developed particularly for multi-species and gears fisheries. PSA can also be used for separated target species. Relative level of risk of a fish species is the major output of PSA.*

Discussion was also made on the limitation on the use of indicators for the stock assessment.

- *The workshop was informed that the sustainability index, biomass trend, and scoring system are now being used in India and results could be brought to the 2nd workshop. Representatives of India will share such information via email communication with other participants.*
- *Bilateral cooperation and analysis should be established in order to estimate the trans-boundary fish stock status. Geographical area can be used to facilitate data collection and input.*
- *Identification and selection of species of which assessment will be completed prior to the 2nd workshop was made by country representatives.*

5. Resource assessment and the ecosystem approach to fisheries (EAF)

(Gabriella Bianchi, FAO)

A brief introduction was provided on the key principles of the EAF, with focus on its relationship to the Code of Conduct for Responsible Fisheries (CCRF), methodologies for its applications and how EAF relates to conventional fishery (single species) management.

The key principles for effective and responsible fisheries management are contained in the FAO CCRF. EAF is a means of implementing many of the provisions of the Code and provides a way of implementing sustainable development in fisheries.

The key features of the framework proposed in the FAO guidelines for planning and implementing under an EAF management can be summarised as follows:

- it is participatory, at all levels of the planning and implementation steps;
- it is comprehensive: it ensures that all key components of the fishery system are taken into consideration, including those related to the ecological, social-economic and governance dimensions, while also taking into account external drivers;
- it encourages use of the 'best available knowledge' in decision-making, including both scientific and traditional knowledge, while promoting risk assessment/management and the notion that decision making should take place also in lack of detailed scientific knowledge;

- it promotes the adoption of an adaptive management system and stresses the importance of establishing mechanisms for feed-back loops at different time scales to adjust the tactical and strategic performance based on past and present observations and experiences;
- it evolves from existing fisheries management institutions and practices;

Realization of the EAF will require a sincere societal commitment to a vision that promotes conservation, sustainable use and equitable sharing of ecosystem services. Its actual application does not need to follow a single blueprint but be consistent with local context, means and culture.

The process involved in planning and implementation of EAF, as described in the FAO guidelines (FAO, 2003 and 2005), shows how to comprehensively implement sustainability and equity principles (as compared to a piecemeal, non-systematic and top-down implementation). Operating with the understanding that best available knowledge will be used in the management process, the FAO guidelines introduce a participative and adaptive process, that utilizes a risk management approach to deal with uncertainty and consistent with a precautionary approach. The guidelines propose an initial systematic and comprehensive assessment of a given fishery in relation to its ecological, socio-economic and governance issues. More specifically, the assessment looks at the fisheries impacts on the target species, on non-target species and on the ecosystem where the fishery takes place. Furthermore, the assessment also covers issues related to the social and economic contribution of the fishery, to the governance structure and its suitability/efficiency in relation to achieving sustainability goals.
The impact of fishing on those resources that still form the backbone of the fishery, either in terms of production or of economic returns, will still need to be assessed under an EAF framework, and hence the relevance of specific stock assessments for these resources.

6. Overall discussion on methods

Depletion-Adjusted Average Catch was widely discussed at the workshop. Some of the key highlights during the discussion include:

- *If a consistent and long enough time series of catch data is not available, this method, despite being presented as a "data poor" methodology, will not be helpful;*
- *Spatial changes in fishing ground over time would not be captured by this method. These changes have to be documented and accounted for in the assessment;*
- *The Malaysian representative stated that this method could be used for stock assessment and for fisheries management;*
- *Changes in productivity may result from climate change and these would not be easily handled by this method that focuses on fish stocks like any stock assessment models.;*
- *Changes in type and efficiency of fishing gear have to be considered in connection with the selection of time series.*

Stock status assessment based on life parameters:

- *The representative of the WorldFish Centre informed the workshop that estimation of some parameters based on the Trawlbase were already available. These were included in the workshop documentation.*
- *The representatives of India introduced a simple method to estimate potential yield and sustainable maximum fleet size by using data collected over a 10-year period,*

particularly for the trawl fishery. The Idian representative committed himself to make available relevant documentation to the workshop participants.

A brief presentation was made by G. Bianchi on possible analyses, leading to simple reference points for fisheries management, based on time series of survey data (see Appendix 4 b).

Several participants noted that the proposed analysis could be easily carried out based on the data available in TrawlBase and that, in fact, they had already been done, although without reference points. Countries were encouraged to revisit the analyses of Trawlbase data (e.g Thailand, Malaysia, and the Philippines) or do new analyses if additional data are available. Output from these analyses can be presented at the 2nd workshop, including data set from the survey carried out and analyzed for the West coast of Peninsular Malaysia, Java Sea of Indonesia. Vietnam stated that this analysis could be applied to their data and would be very useful.

7. Workplan

The Workshop compiled a summary table that presents, by country, the stocks to be assessed and the respective appropriate methodologies to be applied. It was agreed that PSA analysis could be tested in some cases i.e. in the pelagic fishery in South China Sea (Indonesia), or in Malaysia. However considering that this method is quite new to most countries, additional assistance would be required in preparation of the 2nd workshop in October 2009. The list of agreed assessment activities, to be carried prior to the October meeting, is presented in the table below:

Country	**Species/groups**	**Methods**
Bangladesh	*Hilsa*	• Method 1 Check data and existing assessments (jointly with India and Myanmar?)
Cambodia	Limited information available. *Rastrelliger* data may be available (SEAFDEC help facilitate this)	• Will send available information to FAO before deciding possible methods • PSA could be undertaken for a number of key fisheries/areas
China	Northern area (Yellow Sea). About 10-15 species Southern area (South China Sea) (Contact responsible research institute)	• Utilise available assessments • PSA for (one or two fisheries/areas?) • (to be agreed for Southern area)
India	Total of about 80 species for which assessments are available 5 maritime areas Growth parameters calculated for these stocks (published, not from FISHBASE)	• Stock assessments are available based on commercial fish landings for a number of coastal species (Central Marine Fisheries Research Institute, Cochin, India). These stock estimates by species and zones/maritime states will be consolidated with comments on exploitation status. The

		methodologies of data collection and analysis will be presented in the Report. • Method 1 will be validated for three selected species. • Fish Stock Sustainability Index, which is under development, will be presented partially with the methodology for evolving the Index. Template to be shared with secretariat.
Indonesia	Options: 1. Java Sea (20 years data, but less relevant management wise); small pelagics 2. South China Sea (5 years data available); small pelagics Final decision to be taken	• Method 1 • PSA
Malaysia	Management Area: the West Coast of Peninsular Malaysia (The Straits of Malacca). 15 – 21 species, listed as below **Pelagic fish:** 1. *Rastrelliger brachysoma* 2. *Rastrelliger kanagurta* 3. *Decapterus maruadsi* 4. *Decapterus macrosoma* 5. *Pampus argenteus* 6. *Euthynnus affinis* **Demersal fish:** 7. *Nemipterus japonicus* 8. *Nemipterus hexodon* 9. *Nemipterus mesoprion* 10. *Pennahia anea* 11. *Otolithes ruber* 12. *Nibea soldado* 13. *Leiognathus brevirostris* 14. *Secutor rucornis* **Shrimp species:** 15. *Penaeus merguiensis* 16. *Metapenaeus affinis* 17. *Metapeneus ensis* 18. *Metapenaeus brevicornis* 19. *Metapaeus lysianassa* **Squid & Cuttlefish:**	• Potential Sustainable Yield from Logistic Model – single species analysis (Method 1) • PSA – Productivity Susceptibility Analysis – multispecies analysis, by fishery/area (by state) • Optional: 2. Stock Status Assessment using Life Parameters (Method 2)

	20. *Loligo duvaucelli* 21. *Sepia aculeata*	
Myanmar	Very limited information available More information to be provided. 2 years (2004-2005), 200 fishing trips survey 2007 *Hilsa* data available? (check data availability) Check data from Fridtjon Nansen surveys 1970s	• PSA ?
Philippines	Focus on small pelagic species subdivided into 6 species groups: roundscad, sardines, frigate tunas, mackerels, bigeye, scad and anchovies.	• Methods 1 and 2 applied to 7 fishing grounds located across the country • PSA applied to 2 or 3 fishing grounds
Sri Lanka	(did not participate in the workshop, FAO to make contact for possible preparatory work and participation in the October workshop)	
Thailand	Totally 13 selected key species within 3 major groups (considering 70% of the total catch), including from selected pelagic, demersal and invertebrate (including swimming crab and squid) and trashfish	• Check available assessments • Method 1 (applied to 13 selected species) • PSA for the whole Gulf
Vietnam	Data to be made available to FAO for identification of species/methods. Catch/effort data only available for 5 years, check bottom trawl surveys	PSA for trawl and purse seine fisheries in 4 management areas

It was agreed that FAO would:

- check availability of CSIRO database on PSA values;
- check SPC work on PSA;
- circulate key references on PSA;
- provide information on a Canadian database for steepness of Method 2

It was clarified that the output from these workshops will be incorporated into the next FAO assessment of the state of world marine capture fishery resources.

There seems to be a need for capacity building in stock assessment in the region and steps should be undertaken by relevant organizations (i.e. Bay of Bengal LME, SEAFEC survey, APFIC, FAO).

Appendix 1

THE 1st WORKSHOP ON ASSESSMENT OF FISHERY STOCK STATUS IN THE SOUTH AND SOUTHEAST ASIA

16th -19th June 2009

Jasmine City Hotel, Bangkok, Thailand

Prospectus

1) Background

The state of fishery resources is an essential piece of information for effective fisheries management and policy formulation at the national and global levels. As part of a global effort to improve the information on the state of fishery resources, FAO is planning two workshops in the South and Southeast Asia region in 2009 to review the data and information available and, based on these, identify appropriate methods to carry out assessment of the state of the fishery resources in South and Southeast Asian countries. Methodologies will be explored ranging from conventional stock assessments (in the cases where data availability will allow this) to a combination of alternative assessment methods where detailed information is not available. Assessments will be carried out to test the various methodologies. This activity is expected to result in the identification of methodologies that are better suited and applicable to conditions of high uncertainty and poor data availability, thereby contributing to an improved knowledge base for fisheries management at national level. Furthermore, the results will also have a wider applicability to fisheries outside the region and contribute to FAO's effort to produce global reviews on the state of fishery resources.

This first workshop will be held from June 16th to 19th, 2009 in Bangkok, Thailand, focusing on the data availability in each country of the region and the management issues that national fishery management authorities like to have addressed, bottom-up expectation from the FAO assessment of the stock status and identification of potential methods that can incorporate auxiliary data/information . The second workshop will take place from October 5th to 9th, 2009 in Bangkok, Thailand and is mainly for testing and application of those methods identified in the first workshop to fisheries of the member countries.

2) Objectives

The workshop is oriented towards identification of data availability, local management issues, and appropriate assessment methods with the following specific objectives:

- Review of the state of fishery resources in each participating country
- Review of data availability, particularly auxiliary data, of major fisheries in the South and Southeast Asia region
- Identification of management and social-economic issues that demand immediate attention and action
- Discussion and determination of the most appropriate methods that can incorporate auxiliary data and improve the assessment of fishery resource status

3) Expected Outputs

• Country reports of participating states that overview the data availability, the state of major fishery resources and national management issues;
• Consensus on what data should be used for the assessment of the state of major fishery resources in the region;
• Appropriate methods that can be used to improve the assessment of the fishery resource status.

4) Participants

Participation is by invitation only. FAO, its Regional Office for Asia and the Pacific, and the Southeast Asian Fisheries Development Center (SEAFDEC) together with selected candidates from the countries of the South and Southeast Asia.

5) Language

The workshop will be conducted in English and all the documents distributed during the workshop will also be in English.

6) Venue and Date

The Workshop will be take place from June 16th to 19th, 2009 at the Jasmine City Hotel, Sukhumvit 32 Rd., Klongtoey-Nua, Wattana, Bangkok 10110, Thailand

7) Tentative Agenda of the Workshop

Time	Program	Chair person
June 16 (Tuesday)		
09:00 – 09:30	Registration	
09:30 – 09:45	Welcome remark by Dr. Siri Ekmaharaj	
09: 45 – 10:00	Scope of the workshop -Dr. Gabriella Bianchi	
10:00 – 10:30	Coffee break & group photo	
10:30 – 11:30	FAO's assessment of the state of world fisheries resources -Dr.Ye Yimin	Mr. Duto Nugroho
11:30 – 12:00	State of Fish Resources and Management in Southeast Asia -Dr. Somboon Siriraksophon	
12:00 – 12:30	Fisheries and regional management issues in the South and Southeast Asian countries –Mr.David Lymer	
12:30 – 13:30	Lunch	
13:30 – 14:00	Country report & discussion- Thailand	Dr. E. Vivekanandan
14:00 – 14:30	Country report & discussion- Malaysia	
14:30 – 15:00	Country report & discussion- Cambodia	
15:00 – 15:30	Coffee break	
15:30 – 16:00	Country report & discussion- Philippines	

16:00 – 16:30	Country report & discussion- Vietnam	
16:30 – 17:00	Country report & discussion-Myanmar	
June 17 (Wednesday)		
09:00 – 09:30	Country report & discussion- Bangladesh	Mr. Abu Talib Bin Ahmad
09:30 – 10:00	Country report & discussion- China	
10:00– 10:30	Country report & discussion-Indonesia	
10:30 – 11:00	Coffee break	
11:00 – 11:30	Country report & discussion- India	
11:30 – 12:00	Experience on assessing the status of fishery stock in SEA and SA- Dr. Ilona Stobutzki	
12:00– 13:00	Lunch	
13:00 – 13:30	Trawlbase and fisheries initiatives – Mr. Len Garces	Dr.Worawit Wanchana
13:30 – 15:00	Discussion about fishery data	
15:00 – 15:30	Coffee break	
15:30 – 16:00	Discussion about fishery data	
16:00 – 17:00	Fishery Resource Monitoring System (FIRMS) –Mr. Marc Taconet	
June 18 (Thursday)		
09:00 – 10:30	Overview of potential assessment methodologies and discussion – Dr. Ye Yemin	Dr. Simon FungeSmith
10:30 – 11:00	Coffee break	
11:00 – 12:30	Ecosystem-based assessment of stock status and discussion – Dr. Gabriella Bianchi	
12:30 - 13:30	Lunch	
13:30 – 15:30	General discussion	Dr. Gabriella Bianchi
15:30 - 16:00	Coffee break	
16:00 – 17:00	General discussion	
June 19 (Friday)		
10:30 – 11:00	Coffee break	
11:00 – 12:30	Selection of methodologies and auxiliary data	Dr.Somboon Siriraksophon
12:30 – 13:30	Lunch	
13:30 – 15:30	Adoption of conclusion and recommendation	Dr.Somboon Siriraksophon

Appendix 2

List of Participants

No.	Name	Countries	Position	Address	Contact Phone/Fax	E-mail Address
1	**Mr. Ing Try**	Cambodia	Deputy Director General of Fisheries Administration	No.186, Preah Norodom Blvd., Sangkat tonle Bassac, Khan Chamcar mon, Phnom Penh, Cambodia	Tel: (855-23) 219446 Fax: (855-23)215470	tmmp.cam@online.com.kh
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5	**Mr. Francisco Torres, Jr**	Philippines	Biollogist	Bureau of Fisheries and Aquatic Resources/National Fisheries Research and Development Institute : 940 Quezon Avenue, Quezon City 1103	Tel.No. 632-3725063; 632-4109192 Fax. No. 632-3725063 Cellular Phone: 63-09209080833	francisco_torresjr@yahoo.com
6	**Ms.Ratanawalee Phoonsawat**	Thailand	Fisheries Biologist	Upper Gulf Marine Fisheries Research and Development Center, 49 Soi Prarachveriyaporn 16, Bang Pheung, Phra Pradeang Samut Prakan 10130, Thailand	Phone: +66 2 8167635 to 38 ext. 18 Fax: +66 2 4636775	ratvaree@yahoo.com
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9	**Dr Xianshi JIN**	CHINA		Yellow Sea Fisheries Research Institute, No.150 Qingta,Yongding Rd, Beijing, P,R,China Zip:100141	Tel: +86-10 68673938 Fax: +86-10 68676685	jin@ysfri.ac.cn
10	**Dr. E. VIVEKANANDAN**	INDIA	Principal Scientist and Head of Demersal Fisheries Division	Central Marine Fisheries Research Institute Post Box No. 1603, Ernakulam North (PO) Cochin 682 018	Tel.: (+91) 484 2394061, 484-2400621 Mobile: (+91) 9446084867 Fax: (+91) 484 2390225	evivekanandan@hotmail.com evivekanandan@yahoo.com
11	**Dr Sunil Kumar Mohamed**	INDIA	Principal Scientist	Central Marine Fisheries Research Institute Post Box No. 1603, Ernakulam North (PO) Cochin 682 018	Tel.: (+91) 484 2394061, 484-2400621 Mobile: (+91) 9446084867 Fax: (+91) 484 2390225	ksmohamed@vsnl.com
12	**Dr Ilona Stobutzki**	AUS	Fisheries and Marine Sciences Programme	Bureau of Rural Sciences Department of Agriculture, Fisheries and Forestry GPO Box 858 Canberra ACT AUSTRALIA 2601	Phone: +61 2 6272 3726 Fax: +61 2 6272 3882	ilona.stobutzki@brs.gov.au
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14	**Mr. Len Garces**	ORG	Portfolio Coordinator, East and Southeast	The WorldFish Center, Jalan Batu Maung, Batu Maung 11960 Bayan Lepas, Penang Malaysia	Tel: +604 626 1606 Fax: +604 626 5530	l.garces@cgiar.org
15	**Dr. Ye Yimin**	FAO1	Senior Fishery Resources Officer / RIMF	Fishery Management & Conservation Service (FIMF), FAO of the United Nations, Viale delle Terme di Caracalla, 00153 Rome, Italy	Fax: + 39 06 5705 3020	Yimin.Ye@fao.org
16	**Dr. GABRIELLA BIANCHI**	FAO2	Senior Fishery Resources Officer / RIMF	Fishery Management & Conservation Service (FIMF), FAO of the United Nations, Viale delle Terme di Caracalla, 00153 Rome, Italy		Gabriella.Bianchi@fao.org
17	**Mr. Marc taconet**	FAO3	FIGIS Officer	FAO of the United Nations, Viale delle Terme di Caracalla, 00153 Rome, Italy	Tel +390657053799 Fax +390657052476	marc.taconet@fao.org
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19	**Mr. David Lymer**	FAO/ RAP	Data and Information Officer	Maliwan Mansion Phra Atit Road Bangkok 10200, Thailand	Telephone: (+66 2) 697 4000 Fax: (+66 2) 697 4445	David.Lymer@fao.org
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Appendix 3

Welcome Message
Dr. Siri Ekmaharaj
Secretary-General of SEAFDEC
The 1st Workshop on the Assessment of Fishery Stock Status
in South and Southeast Asia
Bangkok, 16-19 June 2009

Representatives from our collaborating partners, the FAO, Dr Ye Yimin,
Resources Persons from FIRMS, WorldFish Center;
Representatives from the South Asian countries;
Representatives from the SEAFDEC Member Countries;
Ladies and Gentlemen, Good Morning:

On behalf of SEAFDEC as the co-organizer of this Workshop, I wish to welcome you all to Bangkok and to this Workshop. I would also wish to thank FAO for pursuing this initiative as it would give the South Asian and the Southeast Asian countries the opportunity to discuss experiences and exchange information with regards to the assessment of our fishery stocks. I am sure most countries in these regions have conducted various means of assessing their respective fishery stocks. This Workshop would therefore be a chance for us to talk about all our relevant efforts.

As many of you may be already aware of, SEAFDEC has been conducting activities that aim to promote the use of indicators for fisheries management in the Southeast Asian region. With funding support from the Japanese Trust Fund, SEAFDEC has implemented the project on Promotion of Rights-based Fisheries and Co-management towards Institutional Building and Participatory Mechanism for Coastal Fisheries Management. One of the activities under this project aimed to promote participatory mechanism on the use of indicators for fisheries co-management. Guided by the Code of Conduct for Responsible Fisheries as well as the Resolution and Plan of Action on Sustainable Fisheries and Food Security for the ASEAN Region, SEAFDEC in consultation with its Member Countries published in 2006 the Supplementary Guidelines on Co-management Using Group User Rights, Fishery Statistics, Indicators and Fisheries Refugia. The Guidelines provide among others, the need for practical implementation of indicators to support fisheries management in the ASEAN region taking into consideration the respective countries specific requirements. Although many countries in the region have responded to this need, Thailand has advanced by developing the national guidelines on fisheries indicators. I am sure the representatives from Thailand could share their experiences in the development and promotion of such indicators.

In a related development, SEAFDEC has also been collaborating with FAO for the improvement of fishery statistics collection in the Southeast Asian countries. We recognize that the timely collation of national fisheries statistics is very necessary in fisheries management, more particularly in understanding the status of the fishery resources. In this regard, SEAFDEC has recently developed the Regional Framework for Fishery Statistics of Southeast Asia to serve as basic requirement that can be achieved by the countries in the region in terms of collection of their respective fishery statistics. We are confident that the representatives from the Southeast Asian region at this Workshop would be able to elucidate the status of their respective fishery resources and share such information with the other participants at this Workshop.

In view of the need to come up with the most appropriate methods for the assessment of fishery stocks that can be adopted in the South Asia and Southeast Asian regions, I would like to encourage all the participants at this Workshop to take active part in the discussions bearing in mind that such methods could lead to a standardized assessment of the fishery resources in these regions. With your support, I am sure the Workshop would be able to come up with the necessary tangible results.

With that ladies and gentlemen, it is my wish and that of SEAFDEC that this Workshop would be successful and that the results could be doable and adaptable by the countries in these regions for assessing the status of our fishery stocks. After knowing what we have, we can establish the most sustainable management of our assets. Therefore it is in knowing our fishery resources well can we be successful in managing such resources in a sustainable manner.

Thank you very much

Appendix 4

a) Fishery dependent data (parameters for simple assessment methods)

Depletion-Adjusted Average Catch (Methods 1) Determines target levels of yield (Y, see presentation)		
Parameter	Meaning	Value/caveats
Y	Yield	
M	Natural mortality rate	If not available, use a value from same species in different waters or use empirical equations to calculate (see presentation).
α	Empirical factor (F_{MSY}/M)	Likely to be 0.5, (ranging from 0.4-0.7, see the presentation)
β	Empirical factor	Most likely to be 0.8
δ	Current stock level relative to the original stock abundance (Bt/Bo)	Its value is often difficult to know, but can be estimated using expert judgment or using auxiliary data such as CPUE or survey data to estimate. A range should be used to test for different results rather than a single value.
B_0	Initial stock abundance	No need to know its value if δ is estimated.
C_t	Annual catch at year t	Use catch statistical data
n	Number of years of the catch time series data	As long as possible but: check for technological changes (gear efficiency) and areas
Uncertainty can be examined by looking at possible range of values for key parameters		
Stock Status Assessment using Life Parameters (Method 2) Determines target levels of fishing mortality (F)		
Parameter	Meaning	Value/caveats
k	Growth parameter	From the von Bertallanffy growth equation or from FISHBASE. See parameters provided in workshop CD , TRAWLBASE)
l_c	Length at first capture relative to L∞	$L_{1st\ cap}$/ L∞ (L∞ from growth equation or FISHBASE)
h	Steepness in stock recruitment relationship	You can borrow a value from same or similar species if you do not have data to estimate (check Canadian database on website)
f(h,l_c)	Multiplier of k	Estimate its value from the graph given based on h and l_c. (see presentation)
F_{max}	Fishing mortality at maximum production	Calculate its value based on the equation.
F_c	Fishing mortality at current time	You can estimate its value from survey data or length frequency data as given in the equations using the software FiSAT II.
C_c	Current catch	From catch statistics
B_c	Current stock biomass	You can estimate it from survey data (not needed if using length frequency data)
Z	Total mortality rate	Z equals the sum of M and F
M	Natural mortality rate	As above

b) Method for using a time series of fishery independent data (bottom trawl surveys)

Possible analyses:

- Trends in average catch rates/unit area for selected species/groups: $\sum$(Ci/area swept)/ N_{hauls}, in bottom trawl surveys (need for post-stratification)
- average catch rates/unit area swept assumed directly proportional to biomass;
- assuming the following reference points: Target: B= B_{MSY} = 0.5 Bo; limit: B/Bo > 0.5 B_{MSY} ~ 0.2Bo;
- if surveys are available from early development of the fishery, these can provide an index for Bo (they are directly proportional to B)
- IMPORTANT:
    - Areas, time of the surveys have to be consistent
    - If different vessels/trawls have been used, gear specifications have to be checked
    - If surveys are available only for recent time periods (posterior to the development of the fishery), only trends in the abundance index will be utilised.