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SUSTAINABLE FISHERIES MANAGEMENT PROJECT (SFMP)

Proceedings of the National Fisheries Stock Assessment Peer Review Workshop:The Status of Small Pelagic Fisheries in Ghana

APRIL 13-15, 2016

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Citation: Lazar, N. (2016) Proceedings of the National Fisheries Stock Assessment Peer Review Workshop. The status of small pelagic fisheries of Ghana.The USAID/Ghana Sustainable Fisheries Management Project (SFMP). Narragansett, RI: Coastal Resources Center, Graduate School of Oceanography, University of Rhode Island. GH2014_SCI024_CRC. 18 pp.

Authority/Disclaimer:

Prepared for USAID/Ghana under Cooperative Agreement (AID-641-A-15-00001), awarded on October 22, 2014 to the University of Rhode Island, and entitled the USAID/Ghana Sustainable Fisheries Management Project (SFMP).

This document is made possible by the support of the American People through the United States Agency for International Development (USAID). The views expressed and opinions contained in this report are those of the SFMP team and are not intended as statements of policy of either USAID or the cooperating organizations. As such, the contents of this report are the sole responsibility of the SFMP team and do not necessarily reflect the views of USAID or the United States Government.

Cover photo: Sardinella in fish bowls (photo courtesy Najih Lazar)

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ACRONYMS

ABNJ	Areas Beyond National Jurisdiction
AIMS	African Institute of Mathematics
CECAF	Fishery Committee for the Eastern Central Atlantic
GEF	Global Environmental Facility
ICCAT	International Commission for Atlantic Tuna
MESA	Monitoring for Environment and Security
MoFAD	Ministry of Fisheries and Aquaculture Development of Ghana
NOAA	National Oceanic & Atmospheric Administration
NPFMC	North Pacific Fishery Management Council
NSF	US National Science Foundation
SFMP	Sustainable Fisheries Management Project
STWG	Scientific and Technical Working group
UN FAO	United Nations Food Agronomic Organization
URI- GSO	University of Rhode Island Graduate School of Oceanography
URI-CRC	Coastal Resources Center of the University of Rhode Island
USAID	United States Agency for International Development

INTRODUCTION

The fishery for small pelagic fishes is an extremely important economic activity for local coastal communities and a key source of protein for many Ghanaians. However, this fishery is currently facing a near collapse status due primarily to overfishing by lack of managed access and excess fishing capacity. Available data show a continuous fall in total landings and loss of income for thousands of fishermen and women processors. The total landings were about 450,000 mt in the mid-1990s but declined steadily to less than 250,000 mt in 2012 and continue to decline to date. The small pelagics, especially *Sardinella aurita* and *Sardinella maderensis* which form the backbone of the country's artisanal fishery, declined from 120,000 mt in 2000 to 23,000 mt in 2014. The fish stock assessment of fisheries in Ghana is conducted through a collaborative effort with member countries of the Central Eastern Central Atlantic Fisheries (CECAF) from Morocco to Namibia, often sponsored by the Food and Agriculture Organization (FAO). The frequency of these fish stock assessments depends on funding availability, usually every 4-5 years. When it is concluded, the assessment report does not include up-to-date information which reflects the status of the stocks 5+ years behind. Since the CECAF report on the status of the stock is a non-binding document, the member-countries' management agencies do not respond to the management recommendations.

In Ghana, the new national fisheries management plan imposed annual reviews of the status of the fish stocks within its EEZ. This has increased both the detail and the number of assessments that are to be conducted. This requirement has called for additional capacity and technical expertise in fish stock assessment and management from various national research institutions, fisheries projects and academia.

The Sustainable Fisheries Management Project (SFMP) is funded by the United States Agency for International Development (USAID) and implemented by the Coastal Resources Center of the University of Rhode Island (URI-CRC). The project was set up in 2014 to support the Ministry of Fisheries and Aquaculture Development of Ghana (MoFAD) to reform its fisheries and implement its' national fisheries management plan (2015-2019). The project's specific goal is to assist the MoFAD and other fisheries stakeholders to end overfishing and begin the rebuilding process of the depleted small pelagic stocks. The STWG prepared a draft status of the stock for the small pelagic stocks, established rebuilding targets, and provided a scientific review of the National Fisheries Management Plan. In addition, the STWG prepared a management recommendation to the Fisheries Commission on fishing closed season, which is currently under considerations by MoFAD. The STWG is currently preparing a full status of the small pelagic stocks which will be presented to an independent panel of experts (local and international) for review and validation. The review will provide a judgement on the quality of the science used in the stock assessment and the conclusions relative to the status of the small pelagic fish stocks.

TERMS OF REFERENCE

The overall objective of the peer review workshop was to review and validate the stock assessment report presented by the STWG on the status of the stock of small pelagic fish in Ghana. The panel shared experiences on stock assessment and explored appropriate methods based on existing fisheries data available in Ghana. The workshop also developed management recommendations and strategies to improve fisheries data and assessment methods.

The specific objectives were to:

- Review the reports of the STWG on the assessment of small pelagic fish of Ghana.
- Provide advice on the assessments made, considering the data that had been available to the group and consider the inclusion of environmental factors in the assessment methods.
- Review the proposed biological reference points on biomass and fishing mortality.
- Review and list key data weaknesses and gaps.
- Prepare inventory and guidance on appropriate reference material for proposed methodologies. Considering existing material including on methodologies for data poor fisheries.
- Prepare a projection of estimated biomass and fishing mortality under possible suite of fisheries management scenarios, including a no action measure (status quo).
- Prepare and present to the STWG on existing methodologies and management practices for fishing capacity assessment and effort reduction schemes based on the results of the assessment.
- Provide research recommendations for the Fisheries Commission.
- Write and submit to the STWG a final review report.

REVIEW PROCESS

In this context and during the first year of implementation of the SFMP project, a Scientific and Technical Working Group (STWG) was established and approved by the Fisheries Commission of Ghana. The working group was made up of representatives from the Fisheries Commission, Fisheries Scientific and Survey Division, academia, fishermen, women processors and other specialized personnel with scientific and technical expertise and knowledge in fisheries. The representatives from Monitoring, Control and Surveillance sent their excuses.

National Fisheries Stock Assessment Peer Review Workshop

Day 1- April 13th, 2016

Minutes of meeting

The core mandate of the meeting was to come up with a sound, scientific and well-reviewed report which will be handed to the MoFAD to help improve the management of the fisheries resource of Ghana.

Registration of participants for the workshop started at 8:30. The opening session began at 9:15am.

Opening prayer: Mrs. Patricia Markwei

The participants of the peer review process were welcomed by Najih Lazar, who spoke of the need to piece together input by stakeholders during previous sessions, update information and help come out with valuable input for the FSSD in the form of sound scientific advice. The chair of the workshop, Professor Yankson expressed his satisfaction with the fact that this was the first time the scientific community had been involved in such discussions. This will help give sound scientific advice to policy makers for better management.

Welcome remarks: Thomas Insaidoo of the Fisheries Commission (Greater Accra Region).

He stressed the fact that the mandate of the WARFP is to help manage fisheries through shared management with stakeholders and also make use of reliable data for policy and decision making. To ensure sustainable fish stocks for posterity, it is a shared duty to know the status of fish stocks as a tool for fisheries management. This involves the input of all stakeholders in the fisheries management: fishers, academics and processors to help policy makers to help come out with solid working plans for fisheries management.

Peer review process and panel discussion on the NFMP: Najih Lazar, SFMP

Key points:

- Peer review provides an independent and unbiased review of the fisheries stock assessment.
- The STWG will support the SFMP and the FC with sound scientific and technical advice, with the possibility of the STWG becoming an arm of the FC management board even after the end of tenure of the SFMP.
- Fisher folk need to be educated and trained on the science behind management decisions to help with effective implementation of the NFMP.
- Immediate action needs to be taken to revive fish stocks as it takes about 10 years for the results of donor funded fisheries management projects to be implemented and any effects seen.
- Some measures outlined in the NFMP are very ambiguous and will be difficult to implement; i.e. the document does not specify which days should be made extra fishing holidays when in effect culturally established fishing holidays differ from town to town.
- The proposed closed season for trawlers is out of place as small pelagics are mostly targeted by the artisanal fleet.
- The proposed 50% reduction in effort for industrial vessels in not clear on the unit of effort to be used and the baseline number of vessels to start from.
- Catch reconstruction needs to be done to give an accurate estimate of landings as about 50% of landings are not recorded due to illegal fishing, poor recording and a lack of logistics.

- A month long closed season for small pelagics in August is biologically and economically beneficial since the small pelagic species; especially sardinellas are in peak spawning condition, but difficult to process at that time. However, alternative livelihood methods must be proposed and properly implemented for the closed season and backed by strong political will.
- Political entities which are mandated to be the final implementers of sound fisheries laws end up going against sound scientific interventions and this is having disastrous effects on the fishery. This needs to be factored in future deliberations on fisheries management.
- Vessel reduction as a means of effort reduction may only lead to a migration of vessels elsewhere and increased effort in terms of gears and power. Output controls in the form of catch quotas and TAC will yield better results.

Presentation of Closed Season Recommendation by STWG: Najih Lazar

Key points:

- Seasonal closures have been successfully implemented in the U.S.A, Philippines, Senegal, Guinea, Morocco and Mauritania with an increase in landings.
- A proposed seasonal closure in Ghana should target all vessels and gears due to multiplicity and take place in August which is the current peak spawning season for sardinellas and other small pelagic species. It is also the month with the strongest upwelling index where an abundance of plankton also means faster growth for planktivorous species.
- Spawning and nursery grounds should be designated as closed areas as well during this period.
- Gear restrictions need to also be clearly enforced as nets less than 10mm are illegally in use in the artisanal fishery due to poor enforcement of laws and political interference.
- The effects of climate change on stock biomass and spawning season should be well research into and factored into fisheries management measures.

Presentation on Stakeholder Engagement in Fisheries Management: Kyei Yamoah, FoN

Key findings:

- Fishers and associated stakeholders strongly agree that there is a need for closed areas, an increased minimum mesh size, closed fishing season between July-August, increased minimum fish size and territorial use rights as the best tools for fisheries management.
- Two new measures were proposed by stakeholders: strict enforcement of existing fisheries laws with no new management plans for the next five years, and a "do nothing approach" where the fishery should be allowed to be collapse before any management measure is implemented.
- Critical habitats such as estuaries, lagoons, mangrove swamps, and rocky areas in the sea should be established as closed areas and fishing boundaries established in these areas.

Discussion

Key points:

- Fishing boundaries around nursery areas are needed as large quantities of juvenile fish are currently being exploited by beach seines at/near estuaries and lagoons.
- The proposed addition of an extra fishing holiday needs to be probed further as there are different holidays at different beaches which were established as cultural norms.

- Members of the FC need to be included in stakeholder consultations and the format for such standardised for consistency in results.
- More than one management measure is needed to effectively manage the fishery, and this must be carried out with scientific backing and strong political will.

Presentation on available data summary: Input data by Najih Lazar, SFMP

Key points:

- Pursing nets (APW, purse seines) and beach seines are the main gears that target small pelagics. Industrial trawlers however, are now reporting small pelagics as 40% of total catch which has also been due to gear modification and the quest for profit made by the sale of bycatch ("Seiko")
- There has been a decrease in landings of Sardinella species as well as a decrease in effort (number of trips).
- The graph of CPUE oscillates due to changes in gear type, efficiency and number of trips. Gear modifications, use of light fishing and other fishing methods have also led to an increased effort efficiency and this must be factored into measures of effort. The CPUE must be calibrated to be have consistent data over time.
- Peak landings of sardinellas is currently in the month of August, but the data sets for anchovies and chub mackerel show no observable trends due to the fluctuations in numbers recorded.
- Landings of Sardinella aurita and Sardinella maderensis have undergone a sharp decline in the last 30years.
- Data from fisheries independent surveys which give more information on stock biomass, spatial distribution and environmental factors among others should be made readily available for research purposes for comparison with modern day trends.

Prof. Kobina Yankson gave his closing remarks and the meeting ended at 4:56 pm.

In attendance:

- Bradford Brown- (NOAA-Rtd.)
- Hassan Moustahfid- NOAA
- Najih Lazar- Senior Fisheries Advisor, SFMP
- John Blay-DFAS, U.C.C.
- Kobina Yankson- DFAS, U.C.C.
- Kofi Amador- Fisheries Commission (Data analysis)
- Kojo Sortoh- Vice President: Inshore Fishermen Association of Ghana
- Kyei Yamoah- FoN
- Raymond Annan- Fisherman, fisheries researcher
- Thomas Insaidoo- Deputy Director in charge of Projects at the Fisheries Commission
- Jemimah Etornam Kassah- Ph.D. student, U.C.C
- Nafisa Ataru- SFMP
- Patricia Markwei (Fisheries Commission- Rtd.)
- Bilinisi Borley Wradi- Fish Processor
- Elizabeth Effah-DFAS, U.C.C.
- Sheila Fynn-Korsah- DFAS, U.C.C.

National Fisheries Stock Assessment Peer Review Workshop

Day 2- April 14th, 2016

Minutes of meeting

Registration of participants for the workshop started at 8:00 am in preparation for the start of the workshop. The session began at 9:15am. The welcome address was given by Najih Lazar and he gave a few announcements and information on the impending visit of the President of the University of Rhode Island to Ghana.

Opening session

Opening prayer: Ms. Bilinisi Borley Wradi

Minutes of the previous day were read by the rapporteur, Mrs. Jemimah Etornam Kassah

Presentation: Status of the Small Pelagic Fisheries Resources of Ghana- Najih Lazar

Lazar gave a presentation on the status of the stock of *Sardinella* species.

Key points

- Model used is a general production model using catch and effort information.
- Data time series from 1980-2014.
- The 2015 data is not available yet. When it becomes available the STWG will update the stock assessment.
- Results of the assessment show that stock of small pelagics has been severely overfished since 1996.
- Recruitment has also been declining as a results of low spawning stock biomass
- The fisheries of small pelagics are severely overfished and overfishing continues to occur.
- Fishing mortality remains unsustainable, estimated at Fcurr=0.74.
- Fishing mortality which will produce a Maximum Sustainable Yield (MSY) is Fmsy=0.4.
- Biomass is below the sustainable level Bmsy.
- An effort reduction of 45% is needed for rebuilding of stocks.
- Effort reduction is not possible under open access in the artisanal fisheries.
- Effort is changing as what used to be small canoes, 10-15 m, is now 20-30 m long.
- Purse seine nets used have also increased over time from 200 m to as high as 800 m today.
- Current management system will lead to the collapse of the fishery and loss of jobs and food for coastal communities.
- Research on the socio-economic aspect of the fishery will be very helpful to give an accurate picture of the consequences the collapse of the fishery will have on livelihoods.
- Bootstrap analysis showed that the estimates have a percent standard error in the order of 20-30% due to inherent error in the input data.
- Landings data are also estimated by surveys instead of census.
- Biomass estimates can be calibrated using acoustic surveys.
- Environmental variability was not accounted for in the assessment.

Discussion

- The stock of small pealgics is an important source of food for millions of Ghanaians.
- The small pelagic stock is overfished confirmed by the STWG and by FAO.

- Reference points for small pelagics must be reduced to take into account environmental variability and predation. Treat it as forage species for large pelagics.
- A reconstruction of data based on inter-annual variability will be very helpful in making the stock assessment model more robust.
- A robust, well defined measure of effort is needed for standardization.
- The multispecies nature of the fishery and fishing gears leads to some degree of error in the estimation of species specific data.
- The different types of gear in use are often not target specific.
- Research is underway to study the effects of removals of subsidies in the Ghanaian fishery on the fishery, livelihoods of fisher folk and their dependants.
- There is the need for a standardised collection and reporting format to help come up with solid results.
- Field enumerators need to be routinely trained in fish identification and collection methods for reliable estimates to be carried out and results communicated to them.
- FC-FSSD should provide access to the data for updating the assessment annually.

Presentation on the Small Pelagic Fisheries Profile of Ghana- Cephas Asare, Hen Mpoano

Asare spoke on the socio-economic profile of the small pelagics fishery in Ghana. A survey was carried out to guide fishery management strategies and come up with updated information on fishermen and fish processors.

Key findings

- The number of canoes, fishermen and catch has increased over the years.
- The level of education among fishermen is low.
- A spatial shift has occurred in the fishing grounds of the dominant small pelagics over the last forty years.
- Breeding grounds over rocky outcrops in deeper waters serve as "protected" areas for small pelagics since fishermen do not deploy their nets over there.
- Livelihood interventions should focus on younger stakeholders in the industry.
- Seasonal migrations are very important in the fishery of small pelagics and transcend local and regional boundaries.
- Space and material should be considered in the improvement of smoking units as space and cost of materials influence the choice of smoking unit.
- Communication should be put across in formats that are easily understood by fisher folk.

Discussion

Key points

- The socio-economics of migration of the fishery sector is multi-faceted and is affected by the migratory patterns of both fish and fisher folk. It can also give an indication of the changing dynamics of the fishery. An in-depth study of this is very critical for effective fisheries management.
- In previous years, there were effective fisheries regulations and fewer vessels in the fishery. Today, increased effort in the fishery and coastal pollution among others has led to an overexploitation of fish stocks for which fishers need to go farther out to sea to get fish.
- Dishonesty in the disclosure of fishing grounds by fishermen also leads to inaccuracies in reporting.

- The panel also reported sightings of "red tides" known as "abro nsuo, atror tsi" during the major upwelling season which leads to some fish kills. However, the fishermen report that the quality of fish flesh obtained around this season tends to be very poor as well. This is valuable information for fisheries management. It is imperative to research more into this phenomenon.
- Fisheries management plans need to be implemented as soon as possible using every possible data available.
- Fish caught by light has been reported by fishermen as not to directly have any impact on the quality on fish flesh. However, the use of dynamite, carbide and others in conjunction with the use of light have health risks and render fish flesh poor and this affects sales and shelf life of fish.
- The FC needs to enforce fisheries regulations and make sure offenders are punished according to law.

Closing prayer: Ms. Sheila Fynn- Korsah

The group ended deliberations for the day at 1:15pm to allow the reviewers to review and analyze the assessment and re-run the model used.

Members in attendance:

- Bradford Brown- (NOAA-Rtd.)
- Hassan Moustahfid- NOAA
- Najih Lazar- Senior Fisheries Advisor, SFMP
- Cephas Asare- Hen Mpoano
- Kofi Amador- Fisheries Commission (Data analysis)
- Kojo Sortoh- Vice President: Inshore Fishermen Association of Ghana
- Raymond Annan- Fisherman, fisheries researcher
- Jemimah Etornam Kassah- Ph.D. student, U.C.C
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- John Blay-DFAS, U.C.C.
- Kobina Yankson- DFAS, U.C.C.

National Fisheries Stock Assessment Peer Review Workshop

Day 2: April 14th, 2016

Minutes of panel Discussion

Panel discussion and input by STWG panel- Najih Lazar

A meeting was held to discuss key inferences and input on information disseminated at the STWG workshop by the panel to help come out with a strong argument for the management of the small pelagics fishery of Ghana. The meeting started with a brief presentation of the results of a Vessel Monitoring System (VMS) which showed the spatial distribution of industrial vessels in Ghanaian waters on a monthly basis for 2015. It could be observed that most vessels clustered around the Cape Three Points area due to a wider continental shelf during upwelling seasons but then were fairly distributed along the Ghanaian coastline. However, there was a questionable foray by some vessels in the month of May into deeper waters offshore for which the panel suspected transhipment of catch to mother ships could be a likely reason.

Input by experts for way forward in the management of small pelagics in Ghana:

- The report by the team of experts should start with the experience of fisheries management from other areas.
- It is proposed that fishing effort be minimised even during periods when fish landings are high.
- A possible ban on fishing at the present moment will prevent a total collapse of the fishery given the current decline in fish stocks.
- Extra fishing pressure intensifies the damage done to fish biomass.
- The emphasis of the STWG should be to avoid the total collapse of the small pelagic fishery and this is an urgent decision that needs to be taken instead of using the precautionary approach.
- The proposed seasonal closure is necessary to save the small pelagics fishery although there may be casualties in the tuna and bait fishery.
- A seasonal closure is easier to enforce and will bring about some fairness in the management process.
- It is possible that demersal species are currently overfished and hence a total seasonal closure will be beneficial to demersal species as well.
- The industrial fishery has some checks such as a Vessel Monitoring System (VMS) and restrictions on mesh sizes and minimum fish size.
- Issues such as transhipment of fish to mother vessels and illegal, unregulated, unreported fishing are problems encountered in the industrial fishery.
- There is a strong case for the closed season to be fixed in the general spawning season and yet be flexible enough for adjustments to be made to maximise the benefits as directed by sound scientific data.
- Some vessels can be used for experimental fishing and research purposes during the closed season.
- Models currently in use need to be calibrated with real time data from fishers and satellites to correctly time closures.
- A closed season spanning longer months could be proposed for further negotiations on how to further reduce the duration while yet maximising the benefits. A three-month window was proposed but the experts stressed the need for a solid argument to be made for this cause, with a specific time frame.

- Strong negotiation skills are needed to present the proposed management measures to governing bodies and the arguments must be very solid.
- A closed area for small pelagics in Ghana is difficult to determine as there will be territorial issues.
- An analysis and survey of deep water nursery and spawning habitats is needed to help outline proposed closed areas for fishery management.
- No-fishing zones must also be demarcated around the proposed spawning areas to prevent the fishing of target species on the periphery.
- The FC's decision to allow have a month long closure in the industrial fishery while allowing the artisanal fleet to keep fishing is not a sound scientific one as the trawlers land only 5% of the total catch of small pelagics. The FC has also not been able to come up with any sound scientific backing for this decision.
- A major problem that could be associated with a closure of the trawl fishery will be the fact that a lot of influential Ghanaians front as owners of trawlers for foreign fishermen mostly of Chinese origin. A seasonal closure of the trawler fleet could be met with stiff opposition from these "vessel owners" and a lack of political will on the part of government agencies.
- A strong case should be made for adherence to existing fisheries laws to help reduce the fishing mortality even further. A voluntary compliance of rules by about 80% of fisher folk and enforcement 20% of the time will be enough to also help reduce pressure on fish stocks.
- Education and sensitization programmes need to be carried out and sustained to help in sustained fisheries management.
- Small pelagics fisheries all over the world, especially in West Africa are on the verge of collapse and may take over a decade to bounce back. This may happen with a bad year class where recruitment into the fishery is very poor.
- There is the need for some information for what may happen to a fishery if it is left to collapse. This is a very strong case that can be presented to governing agencies to buttress the urgent need for remedial management measures. The fact that collapsed stocks are very difficult to rebuild needs to be effectively communicated to all stakeholders. The highly volatile nature of abundance of small pelagic species is also tied to environmental factors.
- A major stumbling block to the implementation of proposed fishery management measures is the perception of fishers that they may be cheated out of their livelihoods. However, this can easily be resolved with effective communication. The biggest problem in this context is the lack of political will on the part of the politician.
- The issue of viable alternative livelihoods for fishermen during the proposed closed season need to be strongly implemented so that political interference will be reduced.
- An insurance package which could serve as a microfinance package could be repaid to fisher folk or to the community in the form of self-help during the closed season. Savings on fuel subsidies could also be used in the same manner. However, disbursement of such funds need to be clearly spelt out and closely monitored to avoid misappropriations at the community level. Equitable sharing of unemployment benefits and other vocations connected to the fishing industry should be promoted for as alternative means of income generation during the closed season.

The meeting ended at 4:55pm and sitting was adjourned for 10:00am on the 15th of April 2016.

In attendance:

Dr. Brad Brown- (NOAA-Rtd.)

Dr. Hassan Moustahfid- NOAA

Dr. Najih Lazar- SFMP

Mr. Kofi Agbogah- Hen Mpoano

Mrs. Jemimah Etornam Kassah- U.C.C (Rapporteur)

National Fisheries Stock Assessment Peer Review Workshop

Day 3: April 15th, 2016

Minutes of meeting

Registration of participants started at 10:00am in preparation for the start of the workshop. The session began at 10:15am.

Opening prayer: Ms. Elizabeth Effah

The group was welcomed by the chair for the day, Mrs. Patricia Markwei and Najih Lazar gave opening remarks. The panel of experts made up of Bradford Brown and Hassan Moustahfid delivered a presentation on their observations of the STWG meeting and proposed what could be done moving forward.

Presentation: STWG panel- Bradford Brown and Hassan Moustahfid

Introductory remarks by Bradford Brown

Brown expressed his pleasure with the proceedings, especially with respect to member participation. According to him, the STWG is a gold standard because it draws on participant expertise and factors in experts from government, universities and fishing practitioners. These will help the management community come up with sound scientific recommendations based on reliable data from both facts and theory. This builds confidence in the recommendations implemented by decision makers and in the management measures adopted by impacted communities. Hassan Moustahfid expressed his satisfaction with the process so far and said he hoped that the process will move from the conference room into practicality. He introduced his presentation by stating the fact that fish stocks are near collapse and need to be remediated. Although environmental factors do play a major part, overfishing needs to be curtailed as a matter of urgency.

Key points:

- Oceanic animals depend on a healthy small pelagics population and a crash in the small pelagics fishery affects all links in the food chain.
- The collapse of small pelagics in the latter half of the 20th century has both ecological and economic consequences.
- Inter-annual variability of catch needs to be closely factored into stock assessment management models.
- The effects of the collapse or a recovery of a single species overfished stock on the ecosystem is a difficult task and as such, the approach must look at the multiplicity of species and factor in appropriate management objectives of the entire ecosystem as a whole.
- In view of the inability of man to control environmental and other variables, the best option for management is to undertake immediate management measures in the form of reducing the pressure on the fisheries by regulating effort.
- This type of management requires good, standardised information collected over time to help inform policy measures.

Discussion

- A crash of the small pelagic fishery will not only affect the artisanal fishery, but other fisheries which depend on it. For example, a collapse of small pelagics stocks will affect the feeding habits of predatory fish and other organisms in lower trophic levels of the

food chain. The key players in the management of fish stocks to be strongly made aware that the collapse of the small pelagics fisheries will lead to the collapse of other high value fish.

- The ecosystem approach to fisheries management is the best option. However, the precautionary approach needs to be presently implemented to target the small pelagics species in a bid to resuscitate the fishery. This is a matter of urgency and should be clearly communicated to implementing agencies.
- The effects of environmental factors on small pelagics stock is very profound but then remedial measures in the form of effort controls need to be carried out with urgency.

Bradford Brown

He delivered a presentation on closed areas versus closed seasons. According to him, waiting for climatic conditions to improve only reduces fish stocks even further. He gave examples from other stocks on fisheries collapses, where good year classes after stock collapse have also been overfished leading to even more disastrous consequences for the fishery

Key points

- There is no question on the need to reduce fishing mortality.
- If the "do nothing approach" is used, it will be very difficult to revive the stocks.
- Management by quotas and effort allocations are very data and management intensive and are difficult to enforce.
- Closed areas and closed seasons are preferred by fishing participants from the survey results.
- It is difficult to define specific areas to close without conflicts arising in the small pelagics fishery (between artisanal and industrial vessels).
- Closed seasons are easier to implement and benefit other fish stocks as well, but the length of the closed season is related to catch intensity.
- The standard exploitation strategy for small pelagics is to fish moderately when the fish stocks are abundant and to close the fishery when the stocks are present in moderate amounts.
- The initial closure must be as long as practicable. This needs to be closely monitored and adjusted to avoid collapse.
- Additional research could lead to the determination of real time dates for closure.
- Adaptive management should be considered for the management of small pelagic species as it will help adjust for changes and account for the feedback from the fishery.

Participants went on coffee break at 11:10am and sitting resumed at 11:32am.

Lessons learned from other fisheries- Hassan Moustahfid and Najih Lazar.

Discussion

Protected areas can displace effort and these have higher impacts on the harvest rates of the fishery. An additional thing to do to help will be to close sensitive estuarine and lagoon areas with the inclusion of a buffer zone to help reduce overfishing. An ideal, though difficult method to implement will be to combine the closed seasons with closed areas. Impediments to such measures may be the unwillingness of some fishermen to comply with management measures. However, effective communication, the formation of "watchdog committees", strict law enforcement and an adoption of the closed fishing season will work well to revive small pelagic stocks.

- A strong point can be made for the spawning grounds of sardinellas off the coast of Cape Three Points to be designated as a closed area to help revive both small pelagic and demersal stocks.
- Monthly VMS data on the location of trawlers along the Ghanaian coastline show an interesting pattern. Detailed VMS data will provide more information about the fishing activity of these vessels and inform further management decisions.
- "Seiko" (trawler bycatch) landings are openly sold at certain landing sites and this goes unrecorded by the FC. It is imperative to record such information separately from regular landings to help give information on the state of bycatch from trawler landings.

Najih Lazar gave his closing remarks.

- There is an urgent need to implement fisheries management measures such as a closed season for all fishing fleets (artisanal and industrial) to prevent the collapse of small pelagic stocks.
- The STWG, though adhoc is a very important group that should be formalised under the FC and provide an unbiased view on the management of small pelagic stocks.
- The need to undertake an ecosystem based approach to management is the best way forward.
- A closed season is the most suitable option for stock rebuilding, and a closure of sensitive estuarine areas will also help.
- Equitability in the distribution of management measures and a removal of political interference will help greatly in law enforcement.
- The length of the proposed closed season of one month in August is the best recommendation as it also happens to be the peak spawning season of sardinellas and coincides with the upwelling season. Economic losses to fishermen and fish processors will also be minimal at this time.
- Lazar expressed the gratitude of the SFMP to the team of experts from the NOAA for their technical guidance and help with the workshop.
- The panel will meet the members of the FC on the 18th and 19th of April, 2016 at the offices of the SFMP in Accra to finalise the report on the proceedings of the peer review workshop.
- The STWG will convene another meeting in June, 2016 to review fisheries data from 2015 and make more specific recommendations.

The ended at 12:45pm.

Closing prayer: Ms. Sheila-Fynn Korsah

Members in attendance:

- Bradford Brown- (NOAA- Rtd.)
- Hassan Moustahfid- NOAA
- Najih Lazar- Senior Fisheries Advisor, SFMP
- Kyei Yamoah-FoN
- Kofi Amador- Fisheries Commission (Data analysis)
- Kojo Sortoh- Vice President: Inshore Fishermen Association of Ghana
- Nathaniel Nartey-SFMP
- Raymond Annan- Fisherman, fisheries researcher
- Jemimah Etornam Kassah- Ph.D. student, U.C.C
- Nafisa Ataru- SFMP
- Patricia Markwei (Fisheries Commission- Rtd.)

- Bilinisi Borley Wradi- Fish Processor
- Elizabeth Effah-R. A, U.C.C.
- Sheila Fynn-Korsah- DFAS, U.C.C.
- John Blay-DFAS, U.C.C.

Outcomes of peer review workshop

The STWG reviewed the reports and presentations given by experts and agreed that the small pelagics stocks of Ghana are severely overfished and on the brink of collapse. Immediate action is needed to revive the stocks and the management measures must include other aspects of the ecosystem such as environmental variables as well the socio-economics of the industry. According to the team, the ecosystem based approach to fisheries management should be carried out alongside adaptive management which factor in inter annual variability in landings, catches and effort modifications to come up with sound scientific advice to management. The lack of political will, poor law enforcement and logistics were some of the difficulties associated with the implementation and enforcement of fisheries laws.

It was proposed that the STWG could become a technical arm of the Fisheries Commission after the tenure of the SFMP to help provide up to date scientific advice on the status of fish stocks and propose efficient management measures for sustainability.

It was proposed that data for the year 2015 should be included in the analysis of the stock of small pelagics to give up-to date information on the status of the fishery. Data from fisheries independent surveys and environmental data from satellites and other agencies should be used in conjunction catch and effort data to provide a robust model for stock assessment. In the implementation of management measures for small pelagics, the socio-economic aspects of the fishing industry should be factored in; with the adoption of alternative livelihood mechanisms for fishermen and other players in the industry in case of closures.

The current exploitation rate for the *Sardinella* fishery is 0.74 instead of the ideal of 0.4, an indicator of the overexploited nature of the stock. The month of August is the month with the highest upwelling index in Ghanaian waters. This is also the peak spawning season for *Sardinellas* and other small pelagics and the period when processors record the most economic losses due to the poor nature of fish flesh around this time. A seasonal closure of all fishing fleets except tuna in August was proposed and accepted by the STWG as the major management measure needed to help revive the declining status of small pelagics. However, other measures such as the designation of nursery areas (estuaries and lagoons) and the inclusion of a buffer zone around these areas will go a long way to revive fish stocks. Enforcement of laws on minimum mesh and fish size, use of light, DDT, carbide and other bad fishing methods need to be strictly enforced by policy makers to prevent a collapse of the small pelagics fishery.

The key weaknesses and gaps in data were reviewed and listed. These are:

- the multiplicity of gears and species in the small pelagic fishery lead to most data on small pelagic species not being gear or species selective.
- Inter-annual variability in catches and gear type have not been factored into stock assessment models.
- Inadequate information on the effects of a fishery collapse, closure or changing environmental conditions will have on the socio-economic aspects fishery.
- Human error in species identification and data estimations on the part of enumerators.

- Effects of a seasonal closures or a closed season on the livelihoods of fishers and their dependents and whether alternative livelihood measures had been outlined.
- Definition of fishing effort is not clear, and the current use of "number of day trips" as a measure of effort is not robust enough as the catch is affected by other factors such as gear type, power of vessel, use of ice, light and others.

A "no action" measure to fisheries management will lead to a total collapse of the small pelagics stocks of Ghana. Immediate action needs to be taken to revive the fish stocks and the major measure will be to establish a closed season in August which will include all fleets except the tuna fleet.

The panel of experts of the STWG will prepare a scientific report based on the proceedings of the workshop and discuss the effects of various management measures on the biomass of fish stocks. They will include lessons learned from other fisheries and give technical advice on the best way forward to revive the stocks of small pelagics in Ghanaian waters. This will include research recommendation to improve existing information and the inclusion of environmental factors in stock assessment.

A final report will be delivered to the STWG which will in turn be presented to the Fisheries Commission of Ghana.

Total number of participants at STWG workshop: 18

- Bradford Brown- (NOAA-Rtd.)
- Hassan Moustahfid- NOAA
- Najih Lazar- Senior Fisheries Advisor, SFMP
- John Blay-DFAS, U.C.C.
- Kobina Yankson- DFAS, U.C.C.
- Cephas Asare- Hen Mpoano
- Kofi Amador- Fisheries Commission (Data analysis)
- Kojo Sortoh- Vice President: Inshore Fishermen Association of Ghana
- Kyei Yamoah- FoN
- Raymond Annan- Fisherman, fisheries researcher
- Thomas Insaidoo- Deputy Director in charge of Projects at the Fisheries Commission
- Jemimah Etornam Kassah- Ph.D. student, U.C.C
- Nafisa Ataru- SFMP
- Patricia Markwei (Fisheries Commission-Rtd.)
- Bilinisi Borley Wradi- Fish Processor
- Elizabeth Effah-DFAS, U.C.C.
- Sheila Fynn-Korsah- DFAS, U.C.C.