

**ANNEX 4. QUEEN CONCH EXPERT WORKSHOP
FINAL REPORT**

Report of the Queen Conch Expert Workshop

22–24 May 2012

Introduction

1. The queen conch (*Strombus gigas*) is one of the most important fishery resources in the Caribbean in terms of its annual landings and its social and economic importance. Queen conch is an edible marine gastropod of the Caribbean Region that has been listed in Appendix II of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) and Annex III of the Protocol Concerning Specially Protected Areas and Wildlife (SPA) of the regional Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region (Cartagena Convention).
2. While many problems of the fisheries in the region have been addressed, there is still significant concern over the status of some stocks and management in the region. As a result, a Queen Conch Expert Workshop was organised by the Caribbean Fisheries Management Council in Miami, USA, 22–24 May 2012 to discuss the various constraints on improving the management of the queen conch fisheries. This report contains the findings, conclusions and recommendations of this workshop.

Workshop Activities

3. The workshop included two introductory presentations. Nelson Ehrhardt presented the conch stock assessment manual, which outlined issues related to the biology and ecology of conch relevant to science and management of conch. Paul Medley gave a brief description of the FAO conch management manual, which describes best practice for queen conch fisheries management based on the FAO Code of Conduct.
4. Thereafter, six presentations were made describing the experiences of conch fisheries research and management in their region. Allan Stoner presented recent research results from The Bahamas. Mauro Gongora described management and recent stock assessment work in Belize. Renaldy Navarro discussed the Nicaragua fishery and recent survey, and Nelson Ehrhardt covered the related fishery of Honduras which has been undergoing an extensive stock assessment program that should lead to the fishery being re-opened this year. Martha Prada and Erick Castro provided information and experience on new management and stock assessment for the San Andres archipelago and banks in the insular shelves of Colombia. Particular reference was made to the Serrana Bank. Stephen Smikle presented the Jamaican fishery, which has been successful in developing a sustainable management regime based on surveys. Where relevant, reference is made to these experiences in the report.
5. The remaining time was used to discuss issues related to the assessment and management of queen conch in the region, with special emphasis on identifying common problems which might be addressed through international co-operation, as well as defining a standard for queen conch fisheries management “best practice”. Finally, Tom De Meulenaer outlined the requirements for non-detrimental findings for CITES and Miguel Rolón provided

background on the purpose of the workshop and next steps. The workshop was chaired by Paul Medley.

6. The results from the workshop have been compiled in this report in the form of conclusions and recommendations. The Workshop believed that the recommendations, if implemented, will apply best practice in these fisheries.

Data Collection

Survey Data

7. Surveys are relatively expensive and require special logistics, particularly when assessing remote and oceanic banks and atolls, but they can provide a range of information on stock size and structure relatively quickly. In addition should provide information on essential habitat. Therefore, they are widely used as basis for scientific advice.
8. Surveys are particularly useful where there is no time series of data for a full stock assessment. A single survey can be used to set a precautionary catch limit, which has been 8% of the fishable biomass in Jamaica and Colombia. However, it should be noted that stocks which have been heavily depleted appear to be recovering very slowly, and therefore closures of these stocks is justified.
9. Surveys are not generally conducted annually even where they provide the main indicator of abundance because they are expensive. Therefore, the harvest strategy will need to cover periods between surveys. This has been achieved in most fisheries by setting precautionary limits on fishing that can be applied safely over several years taking account of the abundance of juveniles, as well as using other monitoring information, such as CPUE.
- 10. Recommendation: A default 8% of the estimated mean or median fishable biomass can be used to set a precautionary sustainable yield if only estimates of biomass are available and the stock is not depleted. Adjustments can and should be made to this value justified by the need for greater precaution or based on science showing that the stock is more or less productive than this. The biomass estimate should be based on the surveyed area only, and not expanded or extrapolated to areas not included in the survey.**
- 11. Recommendation: To improve co-ordination and effectiveness of various management controls, such as closed seasons, it is important that information on the distribution of maturity and size composition, as well as estimates of fishable biomass are obtained for the conch population. The survey should attempt to assess the different components of the population as well as overall biomass.**
12. In designing surveys, the sampling area has usually been based on depth, with a depth limit for diving safety, and has been limited to the areas, which are fished. Interviews with fishers have been used in most cases to define the area over which the survey takes place. Both random (Jamaica) and grid (Honduras) sampling designs have been used to cover these areas. Habitat maps are considered useful, where available (Colombia), particularly to cover areas with juveniles that may not be fished, and to determine influences of reef channels.
13. In all cases, the sampled area is limited by depth, and generally conch below 30m depth are not included in the biomass estimate. The depth limit may be further reduced (to 20m) for logistic and safety reasons. Video technology may help conduct surveys at greater depths, but has so far not been used. Where diving has been undertaken below 50m in the Bahamas, conch have rarely been found. It should be assumed that no substantial biomass exists below 50m. In addition, the size of the bank should be an important consideration when planning surveys.
14. It was noted that in most cases only rudimentary habitat information was available, and the area selected for the survey was based on bathymetry and fishing areas. Estimates of

population size may be negatively biased since unexploited parts of the populations may not be covered. However, as long as management advice is limited to the survey area, the advice should still be precautionary. Setting the quota based on the estimate of biomass within the survey area, should result in lower catches than if the survey covered the additional population areas. Biomass estimates should not include areas which have not been surveyed.

15. Recommendation: In the absence of other information, it is appropriate to use the known fishing area with depth stratification. As better information becomes available, the survey area could be expanded to include additional areas based on habitat which might cover unexploited parts of the population such as juveniles or deeper water spawning stock.

16. Recommendation: In designing new surveys, previous experience of the different countries should be used. Good sampling design should cover at least the fished area, taking account of diver safety. Experienced conch fishers and conch biologists should be used to conduct the surveys.

17. Spatial management of the fishery requires surveys, so that fishing effort can be distributed appropriately. Management can choose to encourage fishing effort to disperse or use MPAs and no take zones to prevent any fishing in some areas, depending on specific objectives. In general, an objective should be to prevent serial depletion of stocks, where densities are reduced so as to impact spawning, as well as protect particular components of the population such as juveniles.
18. Fishers will not concentrate in areas of low density, but should reduce densities to similar level across the accessible range. This may be adjusted by fishing costs, so for example, populations further away from landing ports may be less depleted.
19. Research has suggested that there could well be a density-dependence effect on reproduction, with low densities inhibiting spawning, and potentially causing a decline in recruitment. Recruitment failure is a major threat for sustainable fisheries. Conversely, high density may increase stunting and could imply larger numbers of older conch, which may be smaller.
20. A mean density of 56 adult conch / hectare has been use as a reference point for surveys. Densities below this have been considered to put recruitment at risk. Recent research suggests that this may be too low since spawning activity may still be impaired at higher densities, particularly in fished areas.
21. The Colombia fisheries use surveys to estimate densities which are then used in a harvest control rule (HCR). The target catch is based on 8% of the biomass estimated by the survey, which is the same as the value used for the Jamaica Pedro Bank fishery. In addition, the Colombia HCR linearly reduces this exploitation rate when the mean density falls below 100 adult conch / ha to a minimum of 5% fishable biomass. However, if the density is estimated to be below 50 adult conch / ha, the fishery is closed. The HCR has not been tested by computer simulation, but the conch population has quickly responded as expected following a closure cycle.
22. Density may not be appropriate where fishing takes place mainly on juveniles. For Belize, the density indicator is not useful because the fishing and survey occurs in areas where adults are rarer, so reproduction occurs elsewhere.

23. Recommendation: Where a reference point is required for the median or mean density estimated from surveys, 100 adult conch / ha (or higher) should be used. When the median or mean density falls below this level, there is a significant risk that recruitment might be impaired, and therefore special management action might be required to rebuild density above this level.

24. The exploitation depth will vary among fisheries dependent on the diving gear used. Diving with compressed air (SCUBA or hookah) can exploit populations much deeper than free diving fisheries. The presence of an unexploited "deep-water" stock is therefore important

for some fishery's harvest strategy where compressed air is banned, such as Belize and Turks and Caicos Islands (TCI). There is some data supporting this hypothesis of unexploited spawning stock biomass in Belize, but no systematic survey at greater depths to provide an estimate. Both TCI and Belize monitor fishable biomass.

25. Recommendation: If unexploited "deep water" biomass is a critical assumption of the harvest strategy, then its presence should be confirmed.

26. Surveys can not only be used to estimate biomass, but should provide information on age structure, density and distribution of the stock.
27. Estimates of numbers of juvenile conch, even if not fished, can be used to predict short term recruitment to the fishery. This is useful in setting quotas for periods between surveys. Jamaica also uses CPUE to inform on relative abundance when no survey is available. Good estimates of juvenile abundance may require the survey to extend beyond the range of the fishery.

28. Recommendation: Where possible a habitat survey should be undertaken, which can be used to extend the conch survey to get improved estimates of juveniles.

29. Surveys, and other scientific and management initiatives, can be funded from the fishing industry by applying an export or equivalent tax. This has allowed important management and research initiatives in the region such as the Honduras conch survey. However, surveys can also be funded by alliances between government organizations and private enterprises.

30. RECOMMENDATION: FINANCIAL RESOURCES TO CARRY OUT NECESSARY MANAGEMENT TASKS SHOULD BE RAISED FROM THE FISHING INDUSTRY, POSSIBLY WITH GOVERNMENT SUPPORT. AN EXPORT TAX PROVIDES A USEFUL WAY FOR TARGETED FUNDING AND ALSO PROVIDES SOME BIOECONOMIC PROTECTION FOR THE STOCK, SINCE IT EFFECTIVELY LOWERS THE PRICE OBTAINED FOR THE PRODUCT. INTEGRATING FISHERY SURVEYS WITH OTHER TYPES OF SURVEY MAY PROVIDE ANOTHER OPPORTUNITY TO REDUCE COSTS ON REMOTE BANKS.

CPUE Data

31. Catch-per-unit-effort (CPUE) is used as an index of abundance in a number of fisheries in the region. It has generally been found to provide a useful index, although there can be complications in measuring fishing effort appropriately.
32. The industry should be required to report the necessary data to measure catch and effort for CPUE estimation. To identify appropriate data, it is necessary to understand how CPUE might change for reasons apart from changes in abundance.
33. While CPUE data may be inexpensive to collect and can be obtained routinely from most fishing activity, unlike surveys they do not provide direct information on density, spatial distribution or population structure. Nevertheless, CPUE can build into a long time series and may allow stock assessments using dynamic models.

34. Recommendation: Catch and effort data should be collected routinely in all fisheries by requiring that the fishing industry provide the necessary information. These data provide abundance information in the absence of surveys, to confirm survey trends or as guidance between infrequent surveys. Importantly, they may provide a lower cost replacement for surveys as an abundance index.

35. CPUE, depending upon how it is measured, was criticised because it may have a non-linear relationship with abundance, can be affected by factors other than abundance and may be difficult to record. Because fishers do not search randomly, CPUE tends to track changes in the higher densities of the population. Catches can be affected by the level of processing, and effort may be difficult to measure accurately. In particular, it was noted that when divers were collecting a range of species as well as conch, it is not possible to allocate an appropriate effort measure to conch alone. Finally, a high degree of co-operation may be

required from fishers in more dispersed fisheries, and information may be requested which they find difficult to provide without support.

36. While in many fisheries these complications degrade CPUE as an abundance index, their effect can be reduced by CPUE standardisation. Standardisation requires recording any covariate that might affect CPUE, such as engine size, vessel size, gear type, diver fishing experience, weather, other species catch etc. These data can be used to correct CPUE, although they can make recording the data very onerous for the fishers, which can lead to inaccuracies.

37. Recommendation: Where appropriate, the fishery should be required to record and report data which are relevant for improving the measurement of effort and for CPUE standardisation. These include, but would not be limited to, measures of fishing power as well as the circumstances of the fishing activity.

38. Where surveys and CPUE are available, they seem to be consistent measures of abundance, as in the cases of Jamaica and TCI. However, this may depend on the type of fishery. In the case of TCI, the type of fishing is relatively homogeneous. For Jamaica, diver hours are recorded which seems to be a sufficiently accurate measure of effort. Other fisheries data may be more difficult to interpret.

39. A potential source of information on fishing effort can be provided by GPS monitoring systems. Satellite-based systems tend to be expensive, but other types of less expensive data-loggers are becoming available. GPS monitoring would allow improvements in spatial management, such as linking catches to area productivity and habitat.

40. The experience with such vessel monitoring systems (VMS) variable has been variable across the region. Equipment is expensive to install or replace. GPS has been used in TCI for experimental reasons, but not routinely since the vessels are small. Belize similarly would not wish to use GPS routinely on smaller vessels. Larger mother vessels do carry VMS in Jamaica, Colombia and Honduras, but smaller canoes from which divers will work during the day are not monitored in this way.

41. Recommendation: Larger vessels (greater than or equal to 15m length) should be required to report their position routinely. GPS should also be used to map smaller vessel activity and improve measures of effort, even if not used routinely.

Catch Data

42. Estimates of the total annual catch are highly desirable. If the total catch cannot be estimated and is significant, some account needs to be taken of the unrecorded catch in the harvest strategy. Unrecorded catches may include landings which are not exported as well as illegal, unregulated and unrecorded (IUU) catch.

43. Recommendation: It is important that estimates of all fishing mortality are obtained, including local landings and IUU as well as exports. While only one component of these might be measured routinely and accurately, the relative scale of all catches should be known.

44. Size composition in terms of meat weight, or shell length / lip thickness if the shell is landed, will be useful for assessing compliance with minimum size regulations as well as monitoring trends in size. This information is collected in a number of fisheries.

45. Size composition from catches can be used for stock assessment, but as growth is uncertain, age-based indicators are not reliable. Meat weight can be used to monitor trends in size, however, with decreases in size generally still indicating increases in fishing mortality. Whether the meat weight is a valuable source of information will depend on the local biology and the way the fishing is carried out. Meat weight has not been found to be a good indicator in Nicaragua or the TCI, but has been found useful in Belize where fishing mostly takes place on pre-adults.

46. It was noted that if the meat is not cleaned at sea, but landed whole, the landings can be used to monitor maturity. This may be useful for developing management regulations, such as closed seasons or minimum size.

47. Recommendation: If possible, landings should be periodically sampled to provide information on size composition and maturity. While these data may not critical, they provide useful information for management as well as indices that complement other information from surveys, and catch and effort.

48. Whether catch data are used for enforcement or stock assessment, it is important that the level of processing is recorded and the effect of processing on the catch weight is well estimated. Processing affects not only the measurement of catch weight, but also the meat weight size composition. Most fisheries have a standard commercial level of processing which is used as the reference for other calculations (e.g. live weight or 100% processed).

49. Recommendation: Conversion factors must be estimated so that catches can be compared through different levels of processing and among exports from different countries.

Stock Assessment Models

50. There is no single recommended stock assessment model for conch. The model applied would reflect the data available and it is acceptable to apply precautionary harvest rules even if no valid population dynamics model has been used to estimate population size.

51. Conch cannot be aged reliably without a very significant cost. No simple way has been found to age conch, although research is on-going. Growth is known to be variable and may not follow a simple pattern beyond maturity. For example, conch size probably decreases at greater ages and “stunted” conch are commonly found. Ages of juveniles can be estimated reasonably well from their size, although since growth rates vary from area to area, the growth model may not be standard. Nevertheless, growth and recruitment might be obtained from length frequencies representing size composition of the juvenile population.

52. RESEARCH IN PUERTO RICO (APPELDOORN) AND THE BAHAMAS (STONER) HAS SHOWN THAT RELATIVE AGES OF CONCH WITH FLARED SHELL LIPS CAN BE ESTIMATED FROM SHELL LIP THICKNESS. GEOGRAPHIC VARIATION IN THE RELATIONSHIPS BETWEEN LIP THICKNESS AND AGE ARE KNOWN. HISTOLOGICAL STUDIES FROM COLOMBIA, BARBADOS, AND THE BAHAMAS ALSO SHOW THAT LIP THICKNESS PROVIDES GOOD TO EXCELLENT INDICATION OF SEXUAL MATURITY. THESE RELATIONSHIPS CAN PROVIDE IMPORTANT GUIDANCE ON MANAGEMENT CONTROLS WHERE HARVEST OF IMMATURE CONCH IS CONSIDERED UNDESIRABLE, BUT SUFFICIENT DATA HAVE NOT BEEN COLLECTED ROUTINELY TO ALLOW ANY AGE-STRUCTURED STOCK ASSESSMENT.

53. Conch growth seems very variable and shell length changes very little after maturity. This makes it very difficult to obtain reliable estimates of sustainable yield from size based models, since most fisheries take adult conch. Such models still provide useful information to interpret changes in size and other trends in the fishery.

54. Production models have been used for conch stock assessment. The production model assumptions need to be reviewed in the light of possible effects of conch biology. It was noted that with possible depensation effects, the MSY could be at higher levels than the default 50%B₀ assumed in the logistic (Schaefer) model, for example. The Fox production is even less precautionary in this regard than the logistic. However, the TCI stock assessment has used the logistic model alongside other precautionary controls successfully since 1994.

55. Simple harvest control rules, which do not rely on any particular population model, can be used to set precautionary harvest levels in the absence of a full stock assessment. Both Jamaica and Colombia have set the target harvest level to 8% of biomass. For TCI, the harvest level based on a stock assessment, suggested MSY (maximum) was at an exploitation rate of

around 20% per year (based on the 2006/7 stock assessment), although the TCI quota is set lower than this. Belize set their exploitation rate at 18.75% of the survey biomass, which is similar to TCI. Based on these, and considering that the natural mortality rate for conch has been estimated to be as high as 0.71 year⁻¹, 8% would appear to be precautionary.

56. Stock assessment models can be used for sustainable management, but assumptions need to be reviewed. It is apparent that fisheries can be sustained despite complications revealed by research and the limited data available. However, sustainable fisheries are very dependent on certain assumptions, such as implicit selectivity, fisher and conch behaviour and conch biology, which has not been fully tested. These assumptions should be considered in the harvest strategy (see below).
57. An important way to test stock assessments and the harvest control rules used in the region would be to simulate data using models which incorporate the current best available biological research and hypotheses, as well as major uncertainties. This approach has not yet been used to test the performance of stock assessments in the region, but would represent best practice in dealing with data limitations and uncertainties in these fisheries.
58. It was noted that an operational model already exists in the conch stock assessment manual by Ehrhardt and Valle-Esquivel. If this model was to be used, it was suggested that the software would need to be made publicly available, probably converted to an alternative platform (such as MS Excel / R) so that stock assessments could be integrated seamlessly with the operational model, and further developed to deal with spatial aspects of the population which are thought to be important.

59. Recommendation: A conch population and fishery operational model should be developed to simulate data using current scientific research on conch. The model software would need to be publicly available for development by the conch scientific community, so that up-to-date biological research could be incorporated easily and it could be linked to stock assessment methods.

Harvest Strategy

60. The harvest strategy is the management system which ensures that the harvest is sustainable. It includes all management controls, the monitoring system and the decision-making process. Best practice requires that the harvest strategy applies a logic which can be demonstrated to ensure the fishery will be sustainable in the long term, and should include testing and independent review.
61. Well-defined harvest control rules (HCR) are used by Colombia and Jamaica queen conch fisheries. These are important components of the harvest strategy, and are used to set limits on overall exploitation, alongside other precautionary controls which might form part of the harvest strategy. Harvest control rules provide a useful way to negotiate and agree how management will behave in response to indications that the stock is at risk, and make it much more likely that management responses will be appropriate and timely.

62. Recommendation: Well-defined harvest control rules should be developed for each fishery. This may codify current practice or improve current practice, but in all cases they should make management decision-making clearer.

63. Although Jamaica applies a fixed exploitation rate above a minimum stock size, they incorporate a number of additional limits and controls within the strategy. There is a maximum limit on the quota and the quotas can only be lowered between surveys, based on the estimated juveniles abundance and CPUE indicators.
64. The long track record for both Turks and Caicos Islands and Belize fisheries suggest that the management arrangements are sustainable. Jamaica and Colombia use internal review systems to advise on management actions. Honduras fishery is just completing its

management plan and the fishery should begin later in 2012. All fisheries indicate that they have an on-going evaluation of the management strategy.

65. There is no external independent review process for any fishery, and certain aspects of the harvest strategy of all fisheries remain untested. It is therefore overall unclear how reliable the harvest strategies are, how much risk is being taken in each fishery and whether such risks are acceptable or not.

66. Recommendation: An independent peer review process should be developed to ensure that the best scientific advice is being supplied to the fishery, advise on additional precaution if necessary, and provide feedback on the performance of the harvest strategy. Independent review processes should also be used to ensure information quality meets minimum standard.

Precautionary Controls

67. In the absence of specific information for a particular fishery, it was believed that precautionary controls on exploitation would allow a fishery to continue while research and data collection provided the necessary information for management advice. These controls will necessitate lower exploitation levels than when research is complete, since this is the main way to reduce risks of overfishing.

68. Recommendation: The following precautionary controls are recommended to be implemented where appropriate:

- **Prohibit compressed air based diving (SCUBA and Hooka) to protect the stocks in deeper water.**
- **Implement a 2-3 month closed period around main spawning period or harmonised with neighboring fisheries.**
- **Clearly proscribe gears or methods for catching queen conch. New fishing gears or methods should require an evaluation of its impact on the ecosystem.**
- **Establish minimum size limits on shells (length / for flared lip) that can be enforced and is harmonised with neighbouring fisheries.**
- **Establish minimum meat weight that can be enforced within the international trade.**
- **License vessels and apply limited entry and prevent increases in fishing capacity until the potential yield has been estimated.**

Fishing Capacity

69. To help combat IUU fishing and improve compliance generally, it was recognised that fishing capacity should be kept to levels appropriate to the productivity of the resource. Fishing capacity is related to the maximum fishing mortality a fleet can exert and there is always strong economic pressure to use redundant capacity which may encourage illegal fishing. It is therefore necessary to measure capacity and ensure capacity is at an appropriate level for the potential yield.
70. Measuring fishing capacity is not necessarily easy in some fisheries. Levels of fishing activity vary among vessels, and vessels may use excessive numbers of divers and be operational for long periods, to the extent that the safety of the fishers can be put at risk.
71. Fishing capacity will depend upon gear (whether compressed air is used, or not), numbers of fishers for each mother vessel and the multispecies nature of the fishery. Many fisheries will target a variety of species within a trip, not just conch, which makes it more difficult to set limits on capacity.

72. For Belize, both boats and fishers are licensed, but the number of fishers available may fluctuate significantly. Although licenses have been limited to residents who are 18 years or older, the potential source of labor is very high. This is a common problem in Central America and elsewhere. Where there is a lack of opportunity, labor costs are very low and potential fishing capacity very high. It is therefore difficult to measure potential fishing effort since this depends on other economic opportunities and limiting fishing opportunities is both politically and socially difficult.
73. Jamaica uses individual quotas to discourage increases in capacity. In this case, it is in the best interest of the fishing industry to match costs with the quota.

74. Recommendation: If possible, measure fleet fishing capacity and ensure that it matches the productivity of fishing grounds to which it has access. If the capacity exceeds productivity, a capacity reduction program should be implemented.

Ecosystem Management

75. Surveys are very useful for placing MPA (or “no take” zones) to ensure they cover a significant proportion of the stock. MPAs are particularly useful for protecting juveniles, which probably move around less than adults.
76. However, recent research in the Bahamas suggests that MPAs may not always be effective in maintaining densities of adults likely to be required for spawning. It was concluded that use of MPAs should be evaluated to ensure they were providing benefits expected, and that a larger network of MPAs may be required to achieve benefits, at least in the Bahamas.
77. Belize uses MPAs to protect a large number of ecologically significant areas. These target conch nursery areas, among other things. Evaluations of these MPAs indicate that they are effective in increasing stock density, and by extension they are effective in protecting a proportion of the stock.

78. Recommendation: In designing and consulting on MPAs or no take zones, account should be taken of conch population distribution and structure to ensure full advantage is taken of any such management initiative.

79. While, by default, conch populations are usually assumed to occupy those areas which are fished, management might be improved by mapping benthic habitats. This would not only identify where unfished components of the population might be for surveys, but also allow management to consider the whole life history of conch in the coastal zone when making its interventions. Coastal zone management is particularly important for the shallow water fisheries of Bahamas, TCI and Belize.

80. Recommendation: Habitat maps of the coastal zone should be developed which identify, among other things, conch habitat particularly with respect to spawning and juveniles.

81. It is likely that conch populations are linked through recruitment. The overall distribution of populations among countries, their connectivity and the degree to which they support each other is poorly understood. In the longer term, if exploitation increases, it will become increasingly necessary to manage these populations in a more co-ordinated way.

82. Recommendation: Improve stock identity and links between population and population components through larval surveys and/or genetic studies.

83. Conch is thought to be an important prey item for a number of species, notably spiny lobster. No trophic models for conch have been developed, although ECOPATH models have been developed in the region. There is little information on conch parasites and the potential effects of invasive species (lionfish) on conch are not well understood.

84. Recommendation: An ecosystem model with explicit treatment of conch, particularly as prey, would be useful to determine the wider implications of conch fisheries on the ecosystem. The wider implication of conch fisheries on predators would need to consider the different life history stages explicitly.

There are a large number of other possible ecosystem effects of fishing. When the shells are removed, they are dumped in middens, which could cause problems depending on where they are placed. In mangroves, for example, they can prevent regrowth. Conch processing also produces trimmings which may be discarded, which may increase eutrophication or other undesirable effects depending on how it is managed. Climate change effects through raising water temperature and increased acidification on conch are unknown. Similarly, the effect of other activities in the coastal zone of conch is not necessarily well-understood in most countries.

85. Recommendation: Given the limited information of the wider effects of conch fisheries, and the effects on other human activities on conch, an Ecological Risk Assessment would be valuable to identify the most important risks which could be subject to further research, mitigation by management and/or increased monitoring.

Decision-Making Process

86. The decision-making process varies among fisheries, with responsibilities divided between ministers responsible for the environment or for fisheries, and various advisory groups. Final decisions have been divided in a number of fisheries between government ministries responsible for the environment and those responsible for fisheries. This has produced conflicts of interest in the past, although improved understanding has resolved these to a large extent.
87. Various uses are made of co-management systems in decision-making. Most fisheries involve fishers and the fishing industry, and this was considered important both to improve decisions and to increase compliance.

88. Recommendation: Co-management approaches should, as far as possible, be implemented in all conch fisheries.

89. The best practice for decision-making was considered to be convening a management group to advise directly the ministers responsible on setting export quotas and other management controls.
90. It was suggested that in some cases unilateral declarations of export quotas were not being subjected to sufficient scrutiny to ensure that they were justified by science or where science was lacking, sufficiently precautionary. The best way to address this issue is through some sort of independent review process, which can report on the strengths and weaknesses of the implemented management system.
91. There are a number of regional Working Groups, which could be used for scientific review purposes. CRFM has an annual Scientific Meeting which provides scientific advice for CARICOM countries on request. Working groups have been established for a number of species groups, including a conch and lobster working group. OSPESCA does not have a working group system. WECAFC will meet in October 2012, but this will not be a scientific meeting. *Ad hoc* WECAFC scientific meetings have been held infrequently, including on conch fisheries, the last being in 2006.

92. Recommendation: Establish or use current Working Groups to review scientific advice and evaluate management performance.

93. Legislation was not identified as a limiting factor in managing most fisheries, with the exception of Honduras where legislation is not up-to-date. It was noted that ratifying the UN

Fish Stocks Agreement (1982) could help with dealing with shared queen conch stocks and harmonising management of queen conch across the region.

94. As well as legislation, the management and regulatory framework should be well defined and clear for all stakeholders involved in the fishery. This is best achieved using fishery management plans, which should ideally be as short and as simple as possible. These plans should focus on describing or defining key aspects of the harvest strategy and management processes, so the management is transparent and so that co-management is more effective.

95. Recommendation: Fishery management plans should be published for each fishery, documenting *inter alia* the harvest strategy, decision-making process and roles and responsibilities.

Enforcement and compliance

96. IUU is still reported as a significant problem in the region and continues to be of great concern. However, by its very nature, the extent of IUU fishing and who is responsible is uncertain. Information tends to be anecdotal.
97. Foreign vessels are routinely reported as operating illegally in national waters. Transshipment (e.g. purchase from artisanal vessels at sea) appears widespread and can allow vessels that are legitimately allowed to fish to catch beyond their designated quota.
98. Conch pearls are also traded illegally. Some fishers believe pearls come from juveniles, which may lead to fishing (and discarding) conch in juvenile areas.
99. In many cases, sanctions do not appear to have been an adequate deterrence for IUU activity. Legal and repatriation costs, applied indirectly by the court, can be punitive on the prosecuting country. Where this sort of problem was reported, it was stated that action was being taken to address it.

100. Recommendation: The following recommendations represent a set of possible approaches to improving enforcement in the region. Given the on-going problems with enforcement, there are unlikely to be any simple solutions. However, there are a number of initiatives and procedures which could be enhanced and encouraged:

- **Require that vessels which could be involved in IUU activity (i.e. larger vessels) carry a satellite Vessel Monitoring System (VMS). VMS should be harmonised across the region to allow states to monitor activity of any vessel that may stray into national waters.**
- **Implement an auditable “chain of custody” procedure, so that catches can be traced back to their catch location, and not just their point of landing or point of export. Catch documentation procedures are already required by HACCP, the EU and CITES.**
- **Implement closed seasons such that they are similar among countries, so landing any conch within a larger region can be prohibited.**
- **Develop a regional vessel registration system or a positive vessel list.**
- **Develop a negative IUU vessel list for the region, so that vessels identified as involved in IUU activity can be publicly listed (see www.tuna.org.org/vesselneg.htm). This information can be used to discriminate against vessels which have an illegal record even if they are not captured and prosecuted at the time.**
- **Improve co-operation among countries and share enforcement information through bilateral agreements and improved data exchange protocols**

101. A minimum meat weight of 3oz. is enforced by Belize and thought to be effective. Minimum meat weight would not be effective if the size limit just led to increased discarding of dead

conch. However, in Belize it was found that fishers could learn to discriminate meat weight based on the live animal.

102. Shell length, flared lip and lip thickness limits are useful only where enforceable, which is where the shells are landed. Requiring that shells are landed in commercial fisheries was considered too costly and potentially dangerous for fishers, although such a rule could be applied to recreational and subsistence fishing. If shells are not landed, these measures might still be used to guide fishers, but regulation and enforcement would have to come from other means. Age composition of the population can be more generally managed by controlling fishing locations.
103. Deep concern was expressed over fisher safety, with various reports of over-loaded vessels, poor safety procedures, criminal negligence (particularly in the IUU fishery) as well as child-labor on vessels. While this was outside the scope of this workshop, it was noted that proper enforcement of appropriate harvest strategy should also address this issue, which was believed to be urgent.

CITES

104. CITES requires that the harvest of conch is non-detrimental to the survival of species in the wild, allows the species to perform its role in ecosystem and is legal. This can only be achieved by applying a management system and harvest strategy which is tested, evaluated and mitigates ecological risks when they are detected.
105. In March 2013, CITES will hold its 16th meeting. Important decisions can be made at this meeting and it is likely that the meeting will review the status of queen conch. The meeting accepts information, proposals for specific and accountable decisions and resolutions on species. Resolutions capture more general provisions to support species sustainability.
106. It was believed that this meeting provides an important opportunity to support sustainable fisheries of queen conch. CITES can be used to promote best practice for fisheries management in the region, which should increase and sustain benefits to the region's coastal states and fishing industry.

107. Recommendation: Draft and submit a resolution for 16th CITES meeting summarising in general terms the findings, conclusions and recommendations of this Expert Workshop.

Appendix I: LIST OF PARTICIPANTS

<u>NAME/TITLE/ADDRESS</u>	<u>EMAIL</u>
Nelson Ehrhardt Professor Division of Marine Biology and Fisheries Rosenstiel School of Marine and Atmospheric Science University of Miami 4600 Rickenbacker Causeway Miami, Fl. 33149	nehrhardt@rsmas.miami.edu
Allan W. Stoner NOAA Fisheries Alaska Fisheries Science Center Newport, Oregon 97365	Al.stoner@noaa.gov
Erick Castro Agriculture and Fishery Secretariat San Andres Island, Colombia Avenida Francisco Newball Edificio Coral Palace	ecastro@sanandres.gov.co pescastro@gmail.com
Mauro Gongora Fisheries Officer Belize Fisheries Department P.O. Box 148 Princess Margaret Drive Belize City, Belize	megongora@gmail.com
Paul Medley Sunny View, Main St. Alne, York, YO61 IRT, UK	paulahmedley@yahoo.co.uk
Stephen Smikle Fisheries Division Ministry of Agriculture and Fisheries P.O. Box 470 Marcus Garvey Drive Kingston 13, Jamaica	sgsmikle@moa.gov.jm ssmikle@gmail.com

tom.de-meulenaer@cites.org

Tom De Meulenaer
CITES Secretariat
Maison Internationale de l'Environnement
Chemin des Anémones 11-13
1219 -Châtelaine-Geneva
Switzerland

rbarnutti@inpesca.gob.ni

Renaldy Barnuty Navarro
Managua-Nicaragua
Instituto Nicaraguense de Pesca y Acuicultura
INPESCA
Km. 3 ½ Carretera Norte
Cel. 505-86450012

mperez@oirsa.org

Manuel Perez
Central America Fisheries & Acuaculture Organization
Central America Integration System
San Salvador, El Salvador
Edificio Oirsa
Calle Ramon Belloso
Colonia Escalon

pradamc@gmail.com

Martha C. Prada
Coralina
Via San Luis
San Andres
Colombia

Avenica 20 Julio #5-92
San Andres, Colombia

Richard.appeldoorn@upr.edu

Richard Appeldoorn
Professor
Department of Marine Sciences
University of Puerto Rico
Mayaguez, Puerto Rico 00681-9000

Appendix II: Queen Conch Experts Workshop Tentative Agenda

May 22-24, 2012

Hilton Miami Downtown Hotel, Miami, Florida

May 22, 2012

9:00am - 5:00 pm

9:00 a.m. - Welcome - Miguel Rolón

9:15 am - Introduction - Objectives - Expected Results from the Workshop - Paul Medley

10:00 am - Conch Stock Assessment Manual - Nelson Ehrhardt

10:45 am - Manual for the Monitoring and Management of Queen Conch

11:30 am - Presentations by Participants of each Country

12:00 noon - Lunch

1:00 pm - Presentations by Participants of each Country (cont.)

5:00 pm - Adjourn for the day

May 23, 2012

9:00 am – 5:00 pm

9:00 am - Discussion of Data and Models

12:00 noon - Lunch

1:30 pm - Discussion of Data and Models (cont.)

5:00 pm - Adjourn for the day

May 24, 2012

9:00 am – 5:00 pm

9:00 am - Continue Discussion

12:00 noon - Lunch

1:30 pm - Adoption of Draft Report