V. PANEL'S CONSULTATION WITH SCIENTIFIC EXPERTS

A. INTRODUCTION

5.1. The Panel noted that none of the parties to the dispute had requested the Panel to consult experts. However, the Panel noted that parties had submitted a number of studies by experts and often quoted the same scientific documents to support opposite views. Under those circumstances, the Panel informed the parties that it had decided, acting on its own initiative, to seek scientific and technical advice pursuant to paragraph 1 and paragraph 2, first sentence, of Article 13 of the DSU. The Panel focussed its questions on two main areas: (i) approaches to sea turtle conservation in light of local conditions, and (ii) habitat and migratory patterns of sea turtles.

5.2. Regarding the criteria for selecting the experts, **India, Malaysia, Pakistan and Thailand** noted that the experts should be neutral, diverse in areas of expertise and geographically distributed as much as possible. The emphasis should be placed on experts who had knowledge and first-hand experience with respect to sea turtle populations in the areas of contention, namely Asia and South-East Asia. They should not come from the same university or the same team of research. Moreover, the experts should be asked to provide citations to all sources that they consulted for the purpose of providing information to the Panel and to attach copies of cited sources to any submissions to the Panel. India, Malaysia, Pakistan and Thailand further noted that the Panel had decided to seek expert opinion under the provisions of paragraph 1 and paragraph 2, first sentence, of Article 13 of the DSU, and had decided, therefore, not to establish an expert review group as foreseen in paragraph 2, second and third sentences, of Article 13 and Appendix 4 of the DSU. India, Malaysia, Pakistan and Thailand requested the Panel to conform as far as possible with the provisions of Appendix 4 of the DSU, and in particular with paragraph 3 of Appendix 4 which stated that, unless there was joint agreement of the parties to the dispute, citizens of parties to the dispute should not be called upon to render expert advice.

5.3. The **United States** fully supported the Panel having access to expert advice that it considered useful for the resolution of this dispute. The advice of qualified and impartial experts would support the scientific and technical information that the United States had presented to the Panel and would thus assist the Panel in resolving this dispute on the basis of the best available scientific data. According to the United States, the Panel's enquiry should be limited to resolving those factual issues necessary to determining whether the US measures met the criteria of Article XX(g) and (b); the Panel was not asked to address and decide general policy issues relating to shrimp trawling and sea turtles conservation. In order to determine whether the US measures related to the conservation of an exhaustible natural resource, or were necessary for the protection of animal life or health, the core scientific and technical issues were the following: (i) are sea turtles threatened or endangered worldwide?, (ii) does shrimp trawling without TEDs result in the death of large numbers of sea turtles?, (iii) do TEDs, when properly installed and used, significantly reduce the mortality of sea turtles caused by shrimp trawl nets?

5.4. According to the United States, the Panel should use two basic criteria in selecting the experts: (i) the persons selected should be "experts" with respect to those aspects of the dispute for which their opinions were sought; (ii) as stipulated in the Rules of Conduct for the Understanding on Rules and Procedures Governing the Settlement of Disputes they must be

"independent and impartial, and shall avoid direct or indirect conflict of interest".[1] In particular, no expert consulted by the Panel should be associated with the government of a party to the dispute. The disclosure requirements regarding the existence of any interest, and in particular employment interests, that could affect or raise doubts concerning a person's independence or impartiality also applied to the experts.[2] Given the broad field covered by the questions, it was unlikely that many persons would have expertise with respect to each and every one of these questions. Each expert should therefore be instructed to answer only those questions in which they had expertise.

Panel Procedures with Regard to Scientific Expertise

5.5. The Panel asked the parties to the dispute to provide it with names of possible experts. The Secretariat, then sollicited brief *curricula vitae* from all proposed experts who were ready to assist the Panel. The parties were provided the opportunity to comment on these potential experts on the basis of the *curricula vitae*, and in particular to state any compelling objections they might have with regard to any individual.

5.6. After careful consideration of the *curricula vitae* and of the comments made by the parties, the Panel selected the following five experts:

Dr. Scott A. Eckert, Ph. D., Hubbs Sea World Research Institute, San Diego, United States;

Dr. John G. Frazier, Ph. D., Centro de Investigación y de Estudios Avanzados, Mérida, Mexico;

Mr. Michael Guinea, Northern Territory University, Darwin, Australia;

Mr. Hock-Chark Liew, University Putra Malaysia Terengganu, Malaysia;

Dr. Ian Poiner, Commonwealth Scientific and Industrial Research Organization, Queensland, Australia.

5.7. These experts were requested to serve, in their own personal capacities, as individual advisers under the authority of the Panel. The Panel noted that, in their disclosure forms, three of the proposed experts disclosed what might be considered to be potential conflicts of interest. However, the Panel decided to confirm their appointments being of the view that the disclosed information was not of such a nature as to prevent the individuals concerned from being impartial in providing the scientific information expected of them. The Panel has also taken into account the disclosed information when evaluating the answers provided. The Panel underlined that, in making its choice, it had been guided primarily by the need to gather expertise of the best quality and covering as wide a field as possible. In the small community of sea turtle specialists, it was difficult - if not impossible - to reconcile this need with an agreement by all the parties to the dispute on each and every individual concerned.

5.8. The Panel, in consultation with the parties, prepared specific questions which it submitted to each expert individually. The experts were requested to answer only those questions which fell within their field(s) of expertise. The parties agreed that their written submissions to the Panel, including the written versions of their oral statements, be provided to the selected experts. The written responses of the experts, as well as copies of the sources

[1]See WT/DSB/RC/1, Article II.1 (hereinafter the "Rules of Conduct").

[2]Article III.1 and VI.2 of the Rules of Conduct.

cited in support of their responses, were provided to the parties, which were afforded the opportunity to comment on them. The questions asked by the Panel and the answers provided by the experts are presented in Section V.B. The comments by the parties are reflected in Section V.C. The United States raised the fact that, in their comments, some parties had submitted new material, i.e. material which had not been submitted by the time of the second meeting of the Panel. The Panel specified that it did not intend to take this new material into account in evaluating the comments made by the parties; the Panel would take into account only those comments which were strictly related to the scientific issues under discussion with the experts.

5.9. On 21-22 January 1998, the experts were invited with the Panel and the parties to discuss their written responses to the questions and to provide further information. A transcript of this meeting is contained in Annex IV.

B.QUESTIONS BY THE PANEL AND VIEWS OF THE SCIENTIFIC EXPERTS

5.10. The Panel requested the experts to focus their answers on the situation prevailing in India, Malaysia, Pakistan, Thailand and the United States, and on the following species of sea turtles: loggerhead (*Caretta caretta*), Kemp's ridley (*Lepidochelys kempi*), olive ridley (*Lepidochelys olivacea*), green turtle (*Chelonia mydas*), leatherback (*Dermochelys coriacea*), and hawksbill (*Eretmochelys imbricata*). The experts were also asked to cite references where appropriate.

General Comments by the Experts

Dr. J. Frazier:

5.11. The questions cover a wide range of topics, and many of them are broadly phrased, so to provide complete anwers requires considering a large number of variables. In general, differences between species, time and place all bear on different biological interpretations. Several of the questions are phrased in such a way that it would appear that what was expected was not only a concise, simple answer, but also the reduction of a series of options to one single alternative. If biology and biological conservation were as simple as rocket science, it might have been possible to provide brief, clear-cut answers. But biology is the study of life, of variation and change. It would be both arrogant and deceitful to pretend that biology, and even worse, that I myself, could consistently produce simple answers to simple questions. Furthermore, biological conservation is an interactive, iterative process, during which there are endless events of learning and experimenting. Since biological conservation is an attempt to use the information that we have in order to steward the resources on which we depend, the challenge becomes all the greater, for the needs and desires of many people and societies become paramount.

5.12. Hence, in many cases it seemed that as much as an answer, what was warranted was an explanation, at least from my point of view; and my intention has been to not only respond to the questions presenting my point of view, but also to provide citations to information which bears on my opinion. There are several general principles which I espouse: (i) do not assume that a lack of information is negative information, nor a justification for denying or asserting a case; (ii) to paraphrase from the United Convention on the Law of the Sea: be more cautious when information is uncertain, unreliable or inadequate, the absence of adequate scientific information shall not be used as a reason for postponing or failing to take conservation and management measures; (iii) develop and implement integrated approaches -

not "either-or" alternatives - for conservation biology and resource management; (iv) thus, in concerns of resource management and conservation, especially when they confront various threats, the Precautionary Approach, as explained in the FAO Code of Conduct for Responsible Fisheries is essential.

5.13. While it is fully understood that the case at hand deals with a dispute before the WTO in which five countries are directly involved, there are several aspects of this initial orienting statement that warrant comment, concerning the issue of endangered species of sea turtles and their conservation.

(a) All of the six listed species of marine turtles disperse and migrate over vast distances, with no respect to national boundaries. This has been amply proven in the scientific literature, with contributions by nationals of many of the five countries that are involved; the research includes tag and recapture, satellite telemetry, genetic analyses (notably of the D-loop of mitochondrial DNA), and geographic distribution/life history information. A few of the better known examples, and review papers that synthesize many citations are discussed below. Because of the biological realities, it would be artificial, incomplete, inadequate and deceptive to limit the responses to what is known for just the five nations involved in a dispute. The issue at hand involves many other nations neighbouring those five: the conservation and management of migratory marine animals - marine turtles in this case - can only be accomplished through full international cooperation. Furthermore, many basic aspects in the biology of marine turtles are poorly known, and information available for some of the countries involved is very limited. Hence, it is frequently necessary to draw from studies done elsewhere in order to provide a response.

(b) The issue at hand is far greater than sea turtle conservation. Human activities - in this case fishing, and in particular, bottom trawling - have major effects on marine organisms and environments, some of which are critical to sea turtle survival, and many of which are utilized for human consumption. The subject in dispute is a small, though highly visible part of a gargantuan dilemma before modern society: the destruction of bycatch as a major contributor to the declining status of the world's fisheries. The focus on marine turtle conservation is justified in and of itself. At the same time marine turtles are "flagship species", charismatic, highly visible, and easily identified; and they are employed as ambassadors of the seas in a strategy to facilitate the resolution of other resource conservation dilemmas, less visible and attractive to the general public. A brief description of this conservation strategy, in relation to a new regional convention, is presented in Frazier (1997a).

(c) Finally, no resource conservation or management can be effective without including humans and their societies in the equation. Limiting the discussion of sea turtle conservation to biological and technical questions, risks ignoring the basic social problems, on which the conservation problems rest. Problems of biological conservation and the human situation are tightly inter-linked, and can only be solved in concert. A discussion of this argument, as part of a critique of the magic of "sustainable development", is developed in Frazier (1997b).

Mr. M. Guinea:

5.14. The base unit for sea turtle conservation and management is the demographic unit (Chaloupka and Musick, 1997)[3] or breeding unit (gene pool). A country may have a single, or several, breeding units within its territorial waters. Sea turtles feeding in the waters of that country may not belong to the breeding unit. This has been demonstrated by mixed

[3]The complete references of the literature and other sources cited by the experts can be found in Annex III.

populations of hawksbill turtles on a feeding ground in Northern Australia (Broderick et. al., 1994). The paradigm of breeding units is essential to assess the threats and status of the sea turtle resources of a geographic area (Limpus, 1997). The concept of sea turtles being a global resource is philosophically laudable, but cumbersome in terms of conservation strategies.

5.15. Generalizations regarding sea turtles "... [being] found in the same general habitats and [feeding] on the same types of food throughout the world. Their feeding habits and habitat put them in the direct path of shrimp trawls where they were captured"[4] are incorrect and hamper management options of individual countries in managing their breeding units of sea turtles. Some species e.g., loggerhead, olive ridley, Kemp's ridley and flatback are generally at risk from shrimp trawling. But because of their preferred habitats most greens, and usually hawksbills and leatherbacks, are relatively unaffected by trawling. Sea turtles are very long lived with several decades required before hatchlings grow to sexual maturity. Any management strategy employed to increase the number of hatchlings will not be obvious on the nesting beaches, the accepted reference for the condition of the breeding unit, for some decades.

[4]See above paragraph 3.61.

5.16. The embargo imposed by the United States on the affected countries has been ineffective in reducing any sea turtle mortality because the trawling effort remained unchanged in the affected countries, and alternative markets were found for shrimp banned from the US market. In Australian waters, the incidental catch of sea turtles is directly related to the fishing effort (Poiner et al., 1990). A similar relationship exists in the United States (US National Research Council, 1990). There is no indication that fishing effort decreased in any of the affected countries. The figures given relating to trade pre and post 1 May 1996 relate to exports of shrimp to the United States. India has indicated that other markets for their non-TED shrimp were found.[5] This indicates that shrimp previously destined for the US market before 1 May 1996 could flood existing markets that do not require the use of TEDs for their imported shrimp. This was anticipated by Australia which exports considerable amounts of shrimp of which only a small proportion has been exported to the US market (Stanley, 1996). The embargo imposed by the United States has readjusted trade in shrimp without reducing the alleged mortality of sea turtles in the affected countries.

5.17. Affected countries may still export shrimp to a third country(s) for either processing or transshipment to the US market.[6] A number of countries in their third party submissions indicated that they did not have trawl fleets and did not allow trawling in their waters, but were involved with trade in shrimp.[7]

5.18. The report "Decline of Sea Turtles" (US National Research Council, 1990) was a fine body of work by a highly respected group of scientists, but it focused on mainland Unites States of America with some references to its Caribbean Territories but scarcely mentioned the Pacific Ocean States and the Pacific Ocean Territories. Its outlook is therefore ethnocentric and relates to the decline of sea turtles in the Gulf of Mexico, Western Atlantic Ocean and Caribbean Sea by essentially the US shrimp trawling fleet. I have difficulty extrapolating its conclusions to the global scale. The Australian Endangered Species Scientific Subcommittee has been evaluating a nomination for otter trawls as a key threatening process. After nearly two years of deliberation, it is unprepared to so make such a recommendation because of the equivocal reports of the relative effects of trawling on Australian sea turtles and other causes of decline e.g., egg predation. It will seek further advice before making another statement in approximately one year's time.[8]

Question 1: Status of sea turtle populations - Past and current threats

1(a) Biologists consider that sea turtle populations around the world are affected by various factors, mainly anthropogenic. Are sea turtles threatened or endangered worldwide? Have the causes of any decline of sea turtle populations been the same for all species of sea turtles? Have these causes been similar in different parts of the world? Have these causes been similar over time?

[5]See above paragraph 3.125.

[6]Verbal presentation by India at FAO Responsible Fishing Workshop Darwin, NT, Australia, 24-26 July 1997.

[7]See above paragraphs 4.49 and 4.61-62.

[8]Interim Advice to the Minister of the Environment from the Endangered Species Scientific Subcommittee of a Public Nomination to Schedule 3 of the Endangered Species Protection Act 1992.

Dr. S. Eckert:

5.19. There can be no question that global sea turtle populations have declined significantly to the point where all species are in danger of extinction. Leatherbacks, green turtles, hawksbills, olive ridleys, and the Kemp's ridley are classified as Endangered in International Union for Conservation of Nature and Natural Resources (IUCN) Red Data Book and the loggerhead is classified as Vulnerable. Such listing reflects on the global status for each species. Further, all of these species are included on Appendix I of the Convention on International Trade In Endangered Species of Wild Flora and Fauna (CITES). While such listing is designed to regulate cross border trade in listed species and not control within country utilization, listing by CITES does reflect on the global status of the species.

5.20. Relative to commenting on the status of the species within the regions of the disputing parties, some discussion of how population status is determined is necessary. It is possible to evaluate the status of stocks within different regions, but these values cannot be applied as though regional populations were independent management units. The reason for such limitation is that we do not know the full geographic distribution of each stock, and that stock status is assessed by nesting beach census. Our current rudimentary understanding of sea turtle life history and cohort movements or migrations does not yet allow us to define individual stock boundaries or home ranges (Musick and Limpus, 1996). For example, all sea turtle species except one (Australian Flatback) have a pelagic phase in their development, whose duration is not yet well defined but is apparently in excess of 5 years (Musick and Limpus, 1996). Loggerhead sea turtle hatchlings dispersing from Japanese nesting beaches move across the North Pacific Ocean and reside off the US west coast and the Baja Peninsula of Mexico, before returning to Japan to continue development to maturity (Bowen et. al., 1995). A similar developmental migration occurs in the Atlantic with loggerheads hatched on the US east coast, migrating to Eastern Atlantic developmental habitats. Unfortunately, these are the only sea turtle stocks that we understand where the pelagic developmental phase of theirs lives is spent. All other species are unknown, but similar cycles are likely. Without a clear understanding of the distribution of individual stocks, it is not feasible to determine their population status. Thus, consideration of population status must still be based on the global species status.

5.21. Research into individual stock boundaries is still in its infancy. Improvements in stock identification techniques using mitochondrial and nuclear DNA, as well as improved satellite telemetry are rapidly changing what we know about stock ranges of turtle populations. Unfortunately, both are relatively new methods and sample sizes are still very small. Often information gathered using these new methods cause us to extend what we previously considered the home range of an individual stock. In 1996 I discovered that leatherback turtles distribute across ocean basins covering far greater ranges than had been expected from tag return data (S. Eckert, 1997). By satellite tracking 3 leatherbacks from the nesting beaches on the Caribbean island of Trinidad it is apparent that leatherback females circumnavigate the north Atlantic ocean annually. In the Pacific my ongoing satellite tracking studies of leatherbacks indicate that these turtles migrate from Mexican and Central American nesting beaches to Chile and Peru and probably also circumnavigate the entire Pacific Ocean. DNA analysis of leatherback caught in the north Pacific and stranded on the west coast of the US indicate that leatherback nesting stocks from Malaysia (and probably Thailand as well), Indonesia, the Solomon Islands, Mexico, and Costa Rica distribute throughout the ocean basin (Peter Dutton, NMFS pers. com.).

5.22. Disagreements on population status often revolve around confusion on what constitutes a population. To compound this confusion, what is usually referred to as a

population by the scientific community actually refers to a nesting population or nesting stock. A nesting population describes only the mature females utilizing a particular beach or area for nesting. Traditional monitoring methods for a sea turtle "nesting population" is to count the number of females annually nesting at particular beach, and utilize these counts to calculate nesting population status. The primary reason for this approach is that nesting activities are obvious and can last for many days or weeks after nesting. However, it should be realized that such methods have limitations that must be accounted for when conducting trend analysis.

5.23. There are often stochastic fluctuations in the annual numbers of females nesting in any given year that may be brought about by environmental conditions such as the southern oscillation or El Niño events (Limpus and Nicholls, 1988). Such fluctuations can be quite large. There are also regional differences in what is known as the remigration interval, or the time between nesting seasons for an individual turtle. Generally for most species and most regions this interval is 2-3 years, but in some areas may extend to 5-7 years (Van Buskirk and Crowder, 1994, Limpus et. al., 1992, Dodd, 1988, Witzell, 1983, Hughes, 1974). The reasons for this difference is yet unclear, but may be reflective of local foraging habitat quality. Thus it is recommended that when defining a population trend, census coverage be maintained for 3 times the average remigration cycle, which for most species and most populations requires a nesting beach be monitored for a 6-9 years. One exception to this monitoring duration is for the ridley species which tend to nest annually. Confusion as to population status is often due to trend analysis being carried out on census durations that are too short and thus overly influenced by stochastic fluctuations.

5.24. Determining population or stock status based on the numbers of nesting females can also sometimes mask population status because female sea turtles generally require between 20 and 35 years to reach maturity. Thus, conservation actions or perturbations to the nesting beach population can take many years to be reflected on the number of females nesting annually. This is likely why the leatherback nesting population at Terengannu, Malaysia took so long to collapse. It took at least 40 years of almost 100 per cent egg harvest for this population to be reduced to an effectively extinct nesting population (Chua, 1988a, 1988b, Chan and Liew, 1996). When examining population status, it is critical to remember that these long lag times can confound trend analysis.

5.25. Some analysis of each species current status can be summarized as follows:

5.26. Global population outlook for the leatherback sea turtle is extremely poor. Since 1980 most data indicates that the global population has declined substantially. Of the 28 nesting areas reviewed by Spotila et. al., 1996, 10 may be in decline, 5 may be increasing and 13 may be stable. Even more importantly the largest nesting populations (Mexico, French Guiana/Suriname, Irian Jaya, Gabon, Malaysia), only one may be stable (French Guiana/Suriname). Most of the decline has been in the Pacific Ocean with the nesting populations of Malaysia virtually gone, the nesting populations of Irian Jaya in doubt (Bhaskar 1985, Stark, 1993), but likely reduced, and the once largest nesting population in the world in Mexico almost gone (Spotila et. al., 1996, Sarti et. al., 1996).

5.27. Of all the species, leatherbacks have the most regular long distance migration through the waters of a large number of countries. In the Atlantic, leatherbacks tracked by satellite travelled to the North Atlantic and then south to Africa in a single year (Eckert, 1997). During this single year migration, the turtles passed through the jurisdiction of as many as 7 countries. In the Pacific it appears that females nesting in Mexico and Central America reside for some time in the coastal waters of Chile, but based on DNA data, will also migrate to the northeast Pacific and then down the coast of the Western United States to Mexico. Thus, it can be

predicted that the home range for all nesting populations of the leatherback in the Pacific extends to virtually every government region of the Pacific.

5.28. Green turtle populations for the region(s) are also in decline. According to Groombridge and Luxmoore (1989) "around half of the extant nesting populations are either known or suspected to be depleted or in decline, ...". The draft Recovery Plan for US Pacific Populations of the green turtle (NMFS and USFWS, 1996b), which describes all US Pacific ocean populations as well as those of the Republic of Palau, the Federated States of Micronesia and the Republic of the Marshall Islands, states that "green turtle throughout the insular Pacific region has likely continued to decline due to directed harvest (both illegal and legal) and negative impacts to essential habitats".

5.29. Green turtles nesting populations throughout Malaysia are also in decline (de Silva, 1982, 1987, Eckert, 1993, Chan and Liew, 1996). On peninsular Malaysia, green turtle nesting populations declined 43 per cent between 1956 and 1982 (Eckert, 1993). Given the large and continuing (illegal) egg take in Sabah and Sarawak these nesting populations will continue to decline. Between 1965 and 1973 more than 6 million eggs were harvested from the Turtle Islands (de Silva, 1982 in Eckert, 1993) and turtle egg poaching continues (Francis Liew, in Eckert, 1993) despite the areas classification as a marine turtle refuge. In neighbouring Sarawak 1-3 million eggs were collected per year between 1927 - 1960, 500,000 per year in the 1960's and <300,000 eggs collected until 1986 (Banks, 1986 in Eckert, 1993). In 1989 and 1990, 185,461 and 117,701 eggs respectively were collected (Eckert, 1993). Further, recent information suggest that development pressures from Malaysian business interests at the Turtle Islands may also threaten nesting populations there (Romeo Trono, pers. com.).

5.30. As tropical coral reef residents, hawksbill sea turtles are faced with very much the same suite of threats faced by green turtles. However, the global populations are generally considered to be in far worse condition than green turtles. The Recovery Plan for the US Pacific Populations of the hawksbill turtle (NMFS and USFWS, 1996e) describes that status of the species very well:

"Anecdotal observations throughout Micronesia, from across the Pacific, and from other tropical oceans of the world are in near total agreement that current stock sizes are significantly below historical numbers. Although quantitative historical records are few, dramatic reductions in numbers of nesting and foraging hawksbills have apparently occurred in Micronesia (Johannes 1986; Pritchard 1981a) and Pacific Mexico just South of California (Cliffton et. al., 1982) since World War II, largely because of increased access to remote nesting beaches by indigenous fisherman equipped with spear guns, outboard motors, SCUBA, and other high-tech fishing gear (Johannes 1986; Pritchard 1981a and 1981b). Market pressures from Asia, sustained by a vast fleet of Taiwanese and other fishing vessels of various national origins, are overwhelming the existing stocks. Most important of all, hawksbills are threatened by a pervasive tortoise shell trade, which continues particularly in southeast Asia and Indonesia even though the once lucrative Japanese markets were closed in 1994."

This latter issue is the primary reason that hawksbill population are in so much worse shape than the green turtle.

5.31. While the olive ridley is considered the most numerous species of sea turtle, its populations have also been reduced. In Pacific Mexico, overexploitation of the nesting females and their eggs caused the collapse of 3 of the 4 arribada beaches (Eckert, 1993). Harvest of nesting females was so extensive (for the leather trade) that between 75,000 and 100,000

females were killed each year (despite a legal limit of 20,000). In May of 1990, the harvest of turtles was banned in Mexico. Population status for stocks nesting in India are far less clear. Based on my review of data presented by Dash and Kar (1990) there is no clear trend in nesting population status at Gahirmatha.

5.32. Globally loggerhead populations are considered in less danger of immediate extinction than most other sea turtle species. However regionally there have been serious population declines, particularly in the south-east United States (NRC, 1990). The primary cause for these local population collapses have been shrimp fishing (NRC, 1990). However, some re-consideration of the global status of loggerhead may be warranted in light of the rapid growth of longline fishing methods. Beside shrimp trawling loggerheads are the most frequently caught sea turtle species in longline type fisheries. (Aguilar et. al., 1992, 1993, Balazs and Pooley, 1994).

5.33. It is extremely difficult to credit any one particular cause with decline for all sea turtle species. In the Draft Recovery Plans for US Pacific populations of sea turtles (NMFS and USFWS, 1996 drafts a-f) we identified 29 different general categories of threats to marine turtles, 26 of those were anthropogenic. Those anthropogenic sources fall under 3 headings: (a) direct intentional take of turtles for food or commercial product; (b) incidental take by fisheries; and (c) destruction of habitat. Historically the most significant threats fall within headings (a) and (b).

5.34. The tremendous decline in leatherback sea turtle populations can probably be attributed to over-harvest of eggs, and incidental take in fisheries. The best example of the destruction of any nesting population of sea turtles by over-harvest of eggs was the leatherback nesting population at Terengannu, Malaysia. Mortality of adult turtles was limited at this nesting colony due to religious constraints but commercial egg take was in excess of 90 per cent for over 50 years and caused a slow decline to less that 100 females (Chua, 1988a, 1988b). Some mortality to this population can likely be attributed to the high-seas driftnet fishery which operated through the 1980's and early 1990's, and to trawl fisheries operating off the coast in the early 1980's (Wetherall et. al., 1993, Chan and Liew, 1996). The once large Mexican/Costa Rican populations of nesting leatherback is likely a good example of the impact gillnet and longline fisheries can have to a sea turtle population. Throughout the 1980's the high seas driftnet fleet caught approximately 1000 leatherbacks per year (Wetherall et. al., 1993, Eckert and Sarti, 1997). While this take was likely from all of the nesting stocks in the Pacific, the exceptionally large numbers of leatherbacks nesting in Mexico and Central America, has probably meant that the majority of those killed in the north Pacific were from those stocks. In the mid-1980's, Chile and Peru initiated large scale gillnet and longline fisheries for swordfish and it is estimated that they kill in excess of 2000 leatherbacks per year in this fishery (Eckert and Sarti, 1997). In only 10 years, the population of leatherbacks nesting in Mexico alone has declined over 95 per cent (Sarti et. al., 1996). This decline occurred despite extensive efforts by Mexico to protect their nesting stocks of sea turtles on the beaches.

5.35. Green turtle population declines can generally be attributed to intense harvest for meat, eggs and turtle products, and secondarily to incidental take in fisheries. This species has been highly sought as a source of food, both commercially and by indigenous peoples (Groombridge and Luxmoore, 1989). While most countries have laws to limit such take, those laws have generally been ineffective, such that large scale harvest still continues (Eckert, 1993). However in some areas such as the Pacific coast of Mexico and NE South America and Thailand shrimp trawling has also been a significant source of mortality for these species Hill, 1991, Eckert, 1993, Chantrapornsyl, 1997).

5.36. There are 2 primary causes of population decline for the loggerhead sea turtle. In the southeastern United States, it was estimated that shrimp trawling accounted for the mortality of 50,000 loggerheads per year (NRC, 1990). However, this threat in the United States has been largely eliminated with the application of TEDs in shrimping trawls (Henwood and Stuntz, 1987). In the Pacific Ocean, the high seas driftnet fleets also caught large numbers of loggerheads during the 1980's and early 1990's, but this threat has been largely removed by the outlawing of that fishery (Wetherall et. al., 1993). A particularly serious and growing source of mortality for this species is pelagic longline fisheries in the Pacific and the Mediterranean. Loggerhead turtles will feed on bait used in longline fisheries and become hooked. Large numbers of mostly juvenile loggerheads are killed or injured by these fisheries (Aguilar, 1992, Aguilar, 1993, Argano, 1983, Balazs and Pooley, 1994).

5.37. Olive ridleys have long been harvested in Central America for eggs, meat and skin. This harvest was so intense in Mexico that 3 of the 4 arribada beaches were extirpated by the 1980's (Eckert, 1993). Such harvest was banned in Mexico by 1990 and there is some evidence that the remaining arribada population may be recovering (Marquez, 1996b). Olive ridleys are also heavily impacted by shrimp fishing in Central America, India, Suriname (Hoekert and Schouten, 1996) and to a lesser extent in Mexico. The incidental take of olive ridleys in India is exceptionally severe which supports the largest nesting aggregation of this species in the world. Annually 5,000 - 8,000 dead turtles wash up on the beaches of Orissa which are attributed to incidental take in shrimp trawls. Despite laws banning such fishing, large scale shrimp fishing is occurring within the Bhitara Kinika Sanctuary (the primary nesting area for olive ridleys in India) and more than 4,000 olive ridleys stranded dead on the nesting beach during 1996/97 (Das, 1998). Finally there is evidence that the incidental mortality of olive ridleys due to shrimp fisheries is not limited to reproductive adults, but also to what are likely resident juveniles (Pandav and Choudhury, 1995). Two things are clear relative to the incidental take of olive ridleys in India. The first is that there are severe problems with enforcement of regulations protecting these important olive ridley nesting beaches and, secondly, there seems to be conflicts between the State and Federal government as well as the fisheries resource management agencies in India over the need to protect sea turtles. This latter problem is well defined by incidents in which the State of Orissa attempted to build fishing harbours within and alongside the sanctuary to support increased shrimp fishing, despite the protected status of the area (Andrews, 1993, Mohanty-Hejmadi, 1994, Das, 1998 in press).

Dr. J. Frazier:

5.38. It is certainly true that "biologists consider that sea turtle populations around the world are affected by various factors". The life cycles of all species of sea turtles are very complex: the animals depend on terrestrial areas of sandy beaches to make their nests and deposit their eggs (Miller, 1997; Ackerman, 1997); hatchlings (newly-hatched turtles) of all species, except the Australian flatback, disperse into open ocean, and live as part of the epipelagic (open ocean) assemblage on the high seas (Musick and Limpus, 1997); immatures of many species take up residence in coastal areas, and may pass through a series of "developmental habitats" before reaching maturity; adults migrate between feeding areas and nesting areas (Musick and Limpus, 1997). Depending on the species and "population", these migrations may occur every one, two, three or more years, and can involve displacements of thousands of kilometers, in some cases crossing ocean basins (Meylan, 1982a; Bowen and Karl, 1997). In the wild, sea turtles require more than a decade (several decades in some species) to reach maturity (see references in Bjorndal and Zug, 1995; Chaloupka and Musick, 1997), and they have the capability to live for many decades, during which time they continue to reproduce.

5.39. Hence, during its long life, an individual sea turtle will pass through many different environments, traversing a substantial - often vast - surface of the planet; in any one of these environments, and at any time during its long life, it may meet a large variety of predators and other threats. For turtle eggs laid on beaches, these threats include ants, flies, beetles, crabs, snakes, and lizards, as well as birds and mammals of many varieties; the hatchling turtles are liable to many of the same terrestrial predators, as well as a diversity of marine fishes. Even immature and adult sea turtles are not free from predation, and can be attacked by large fishes and carnivorous mammals, both in the sea and on land (Stancyk, 1982). The list of human-caused (anthropogenic) threats to sea turtles is also long and includes fishing activities, coastal development, marine and coastal pollution, and even upland pollution and deforestation (Eckert, 1995; Lutcavage et. al., 1997).

5.40. For this reason, depending on the time, place and circumstances, the factors affecting a particular sea turtle, or stock of sea turtles, will vary. Anthropogenic factors add to an already enormous list of threats that sea turtles face during the course of their normal life cycle. People can prey on and impact those stages of the life cycle when turtles would otherwise be least vulnerable to predation. Anthropogenic risks can also include large scale perturbations of habitat, thereby increasing mortality, both in time and in space, e.g., the chronic effects of marine pollution or the total devastation of a nesting beach.

5.41. Because sea turtles live for long periods of time and they require decades to reach maturity, it may take years to perceive the effects of loss from the "population". Hence "current" threats may in effect be the results of past actions and damage, which only now are being detected. It is also worth clarifying that the concept of "population" is not easily defined for sea turtles, due to their complex migratory patterns and life cycles; recent information on genetic composition is resolving this problem (Bowen, 1995; Bowen and Karl, 1997; Chaloupka and Musick, 1997: 235). However, in the absence of such information, many specialists prefer to employ the terms "reproductive unit", "breeding stock" (Chaloupka and Musick, 1997) or "management unit" (Bowen and Karl, 1997). In the present review, the term "population" is used simply because it is in common use.

5.42. The terms "threatened" and "endangered" have specific significance to organizations such as the IUCN (World Conservation Union) and CITES. A recent evaluation of these categories, by specialists of the IUCN (Bailley and Groombridge, 1996), concluded that the appropriate categories for sea turtles are as follows:

Caretta caretta	endangered
Chelonia mydas	endangered
Dermochelys coriacea	endangered
Eretmochelys imbricata	critically endangered
Lepidochelys kempii	critically endangered
Lepidochelys olivacea	endangered
Natator depressus	threatened

5.43. At a general level, the decline of any animal population can be attributed to the same causes: that recruitment of new animals into the population cannot keep up with loss of animals from the population. On a more detailed level, the causes of decreased recruitment and/or increased mortality (or emigration) vary according to time, place and a variety of conditions. Unfortunately, there are several basic factors in sea turtle biology which are not well known, these include: age at maturity, reproductive lifetime, reproductive output, rate of mortality in different life stages, and sex ratio in the wild. Hence, in many cases our lack of fundamental information makes it difficult to dogmatically assign simple "causes" to any decline (or recovery) of a population.

5.44. What is known and widely accepted, is that - with few exceptions - the numbers of marine turtles that are found nesting around the world are far less today than they were historically or within living memory (e.g., Frazier, 1980; King, 1982; Ross, 1982; National Research Council, 1990; Chan, 1991; Limpus, 1994; 1995; Limpus and Reimer, 1994; Witzell, 1994; Chan and Liew, 1996b; Liew, in press). In many instances, although systematic or quantitative data are not available, general historic accounts or comments of long-time residents of coastal areas reveal clear declines in numbers of turtles (e.g., Clifton et. al., 1982; Cornelius, 1982; Frazier, 1982; Kar and Bhaskar, 1982; King, 1982; Polunin and Nuitja, 1982; Ross, 1982; Spring, 1982; Jackson, 1997). Indeed, systematic, quantitative information on status is available for very few sea turtle populations.

5.45. With few exceptions, the status of sea turtle populations is evaluated on the basis of the numbers of females, or more commonly, the numbers of nests (or even numbers of eggs) recorded on a nesting beach during a nesting season. The reason for this is simply because it is far easier, and much less expensive, to observe and count what happens on a beach than what happens in the sea.

5.46. Attempts to estimate the number of turtles in a population (immatures, adult males and adult females) are foiled by a lack of basic information on demography of sea turtles (Crouse et. al., 1987; Van Buskirk and Crowder, 1994; Crouse and Frazer, 1995). In fact, even estimating the numbers of reproductive females in a population presents a major challenge. With the exception of ridley turtles, female sea turtles typically nest several times during a season, and then not again for two or three years, or more. Individual females may nest at two-year intervals and then change to three-year intervals, or vice versa (Carr et. al., 1978) so even though they return periodically to lay their eggs on the same beach, there is not even a simple - reliable - way to estimate the number of adult females in a sea turtle population (Crouse and Frazer, 1995).

5.47. In the case of ridley sea turtles, which in addition to nesting annually, nest in great concentrations, arribadas, the challenge of estimating the numbers of nesting females is complicated for additional reasons. During arribadas, the density and commotion of females on the beach makes it physically impossible to accurately count every female that nests. At different arribada beaches different methods have been used to estimate the numbers of females, but these methods tend to be rather rough, without clear consistency between years, and rarely statistically sound (viz. they rarely are based on defensible statistical procedures, and do not include confidence limits, making statistical comparisons between numbers impossible). Two different methods, designed to derive confidence limits, are used at Nancite, Costa Rica, and they produce results which can be very different (Clausella, pers. com.). The most thorough attempt to develop a statistically defensible counting procedure for concentrated nesters has recently been presented by Gates et. al. (1996), but it is not yet in common use.

5.48. Whatever the species, numbers from nesting beaches must be interpreted with great care. In the first place, the methods and effort involved in counting must be comparable. It is not uncommon for effort and efficiency in patrolling a beach, or collecting eggs, to increase as personnel in a programme acquire more experience, and perhaps more support. For example, over the past five years increasing numbers of hawksbill nests have been recorded on the Yucatan Peninsula, in southern Mexico. In part, this is because more turtle camps have been established, some of the camps are better equipped, and there is more attention and concern on part of the local populace to protect sea turtles. However, there are also indications that at some individual beaches, the numbers of nests per season has increased.

5.49. Even when methodology and effort are comparable from year to year, data from nesting beaches must be interpreted with caution. Nesting populations, thought to be free from large scale predation, can show tremendous changes in numbers from one year to the next. For example, on Heron Island, Great Barrier Reef, about 1,100 green turtles nested in 1974-75, and the following year only about 50 nested. During peak nesting season on remote Raine Island, also in Australia, it was estimated that 11,000 females came ashore in one night during the 1974-75 season, but there were only about 100 on the beach in any one night the following year (Limpus, 1982). Similar large variations have been recorded on other green turtle nesting beaches (Meylan, 1982b; Hirth, 1997: 73). In the case of Australian beaches, these fluctuations in numbers of nesting green turtles can be predicted by an index of the Southern Oscillation ("El Niño"), but in other cases it is unknown what causes the fluctuations (Limpus and Nicholls, 1988).

5.50. Yearly variations in nesting are reported to be greatest with green turtles, but annual fluctuations in nesting activity (numbers of nesting females, numbers of nests and/or numbers of eggs) occur in all species of sea turtles; some loggerhead beaches have had tremendous variation from year to year, for which there are no simple nor clear explanations (Meylan, 1982b; National Research Council, 1990; Chaloupka and Musick, 1997). Thus, to fully understand the dynamics of a population requires long-term data, for apparent trends over a few years may not reflect true changes in the total numbers of animals in the population but rather the physiological condition of those animals that migrate to breed, the condition of their feeding areas, etc. (Limpus and Nicholls, 1988; National Research Council, 1990; Crouse and Frazer, 1995; Chaloupka and Musick, 1997).

5.51. A further complication is that individual females generally nest more than once in a single nesting season. But, the number of nests per female varies, even for the turtles sharing the same beach, during the same nesting season. Hence, there is no precise conversion from number of nests to number of nesting females. Using numbers of eggs to derive numbers of females in a season is even more tenuous, because of the added variation in clutch size, both between females and between subsequent clutches of the same female.

5.52. This having been said, there are some cases in which it is possible to relate certain documented changes in a population indicator to a major perturbation in the environment which clearly has had a significant impact on a sea turtle population. For example, direct, unrelenting exploitation of reproductive green turtles in the Seychelles, directed for an export market, was quickly followed by dramatic declines in "annual production" (i.e., numbers of animals captured per year), and in the general abundance of the animals (Frazier, 1980). Similar examples of direct exploitation of both breeding and non-breeding green turtles accompanied by decimation of their numbers are known for the Caribbean (Jackson, 1997), the southern United States (Witzell, 1994), Pacific Mexico (Clifton et. al., 1982), and many other parts of the world (King, 1982; Ross, 1982). Breeding olive ridleys in Pacific Mexico were also heavily exploited, with consequent decimation in their numbers (Clifton et. al., 1982). Throughout the Caribbean, hawksbills have declined drastically, in conjunction with heavy exploitation in both nesting and non-nesting animals (Meylan et. al., in prep.).

5.53. Where no direct exploitation on breeding turtles is recorded, declines in populations have been attributed to intense direct exploitation of eggs, for example in Sarawak, East Malaysia (Limpus, 1994; 1995; Chan and Liew, 1996a). But at least in the case of the Terengganu leatherbacks in Western Malaysia, the decline is thought to have also been influenced by incidental capture and mortality, first in a local fishery, and then in a high seas fishery (Chan and Liew, 1996a).

5.54. In addition to direct exploitation, indirect factors are also known to cause major impacts on sea turtles. For example, declines in loggerheads in Georgia and South Carolina are clearly linked to incidental mortality in shrimp trawls (National Research Council, 1990). Dramatic declines in Pacific leatherbacks have been related to an increase in fisheries activities in South America, and incidental mortality in fisheries using drift- and gillnets (Eckert and Sarti, 1997).

5.55. It is important to realize that multiple, sequential causes can be attributed to the decline of a population, as was explained by Chan and Liew (1996a) in the case of the Terengganu leatherbacks. This case illustrates the danger of attributing simple causes to what appear to be simple phenomena relating to sea turtles. Because of their complex life history, the researcher must be ever vigilant of effects which may take place in some area or time, out of view, and distant to one's area or period of operation; important sources of mortality may take place on the other side of an ocean basin, or a decade before a study is carried out. This is even further complicated because the same beach may be used by turtles that feed in very different places, or turtles that feed in the same areas may nest in very different places (Carr et. al., 1978). Hence, a significant source of mortality may occur at some point during the long generation time of a cohort of sea turtles, but if that factor is not observed during a study, it will be easy to ignore it and attribute the decline to other causes. The challenge in explaining the demography of sea turtles is one of identifying major factors over large periods of time, and over large expanses of the sea.

5.56. In regards to the five countries specifically involved in this report, reasons attributed to declines can be summarized as follows:

India: Green turtles in the Gulf of Mannar appear to have declined, following heavy exploitation of animals at sea for local consumption and occasionally for export (Frazier, 1980). In general, however, systematic data are wanting for the majority of sea turtle populations in India, and it is only possible to compare what little is known of the present-day situation with general accounts of naturalists or long-term coastal residents. For example, intensive development and human immigration on the coast of Tamil Nadu has resulted in extensive habitat perturbation as well as intense exploitation of olive ridley turtle nests. Thus, it is thought that the numbers of olive ridleys here are much lower than years ago. There is a similar supposition that green turtles in Gujarat have declined, but clear trends are not possible to determine in the absence of systematic information. There are conflicting opinions about the current trends of the massed nesting beach for olive ridleys at Gahirmatha (Mohanty-Hemadi and Sahoo, 1994; Pandav et. al., 1997).

Malaysia: Declines in egg production has been attributed to heavy harvest of eggs of green turtles at Sarawak (de Silva, 1982; Limpus, 1994; 1995), and in Sabah heavy pressure from hunting at sea and on nesting beaches as well as intensive egg harvests occurred prior to declines in egg production (de Silva, 1982; Eckert, 1993; Limpus, 1994; 1995; Chan and Liew, 1996b). In both Sabah and Sarawak, habitat degradation (marine and terrestrial), and fishing activities - notably trawls - have been identified (Leh, 1989; Suliansa et al., 1996). Egg production of green turtles in Terengganu (as well as Kelantan and Pahang) declined following heavy egg harvest, coastal development and intensification of coastal fisheries activities (Siow and Moll, 1982). Numbers of eggs of leatherback turtles at Terengganu show a well documented precipitous decline (Siow and Moll, 1982; Chan, 1991; Limpus, 1994, 1995) which has been related to nearly complete egg harvest for decades, as well as incidental mortality first in coastal fisheries, and then in high-seas fisheries (Chan and Liew, 1996a). Nesting by green and hawksbill turtles on the west coast of Malaysia has declined following intensive coastal development and fisheries activities, especially prawn trawling (Siow and

Moll, 1982). Limpus (1995) states that from possible thousands of olive ridleys nesting annually in Terengganu, there may now be 20 per year nesting. Chan (1991) explained that in Malaysia, all five species of sea turtles are considered to be critically endangered.

Pakistan: Data on the numbers of nests at Hawksbay, Sind, indicate declines in both green turtles and olive ridleys from 1979 to 1995 (Firdous, in press). However, there has been no detailed analysis of these data. Very little is known from Baluchistan, but sizable populations of green turtles are thought to occur (or to once have occurred) there. Groombridge et al., (1988) reported commercial exploitation (thought to be green turtles) from remote beaches in Baluchistan. The levels of harvesting were claimed to have been many thousands of turtles in a year; a short-term exportation to Japan was involved, but there was also evidence that much of the exploitation was for local consumption. Later, Groombridge (1989), in reporting on Baluchistan, stated "Incidental catch appears to be a problem in surrounding waters...". He suggested that the nesting colony in the Sonmiani region of Las Bela may have been extirpated by heavy direct exploitation. As the area is remote, and much of the exploitation is for locally consumed products not recorded in normal statistics, it is next to impossible to know what happened historically or even what has happened in recent years.

Thailand: Polunin and Nuitja (1982) explained that little systematic information has been available, but data on egg yields from Phangnga and Ko Khram (probably mainly green turtles) indicated clear declines. Intensive coastal development and reef blasting were reported to have eliminated much nesting habitat. All evidence pointed to serious depletion in the Gulf of Thailand (Polunin and Nuitja, 1982). Phasuk (1982) identified uncontrolled harvest of eggs and turtles, as well as incidental drowning in trawls; to these causes were added habitat modification (Lekagul and Damman, 1977; Ginsberg, 1981). Direct and heavy ("near total, long term") harvest of eggs has been described as the principal cause of declines of green turtles and leatherbacks (Limpus, 1995). Limpus (1995) stated that overharvest of eggs has been responsible for the dramatic declines of olive ridleys that once nested on the Andaman Sea coast of Thailand, which have been decimated to only tens of females per year. This focus on egg harvest is because there is some systematic information available on this activity, unlike incidental kill and harvest of turtles (Eckert, 1993). The most recent review of the situation at Khram Island and other main nesting areas, including the Andaman sea coast, has concluded that there have been significant declines in green and hawksbill turtles. In Khram this was reported to have been caused by heavy fishing activities, while at other areas coastal development, egg poaching and incidental capture in gill nets, long lines, and trawls have been implicated (Supot, in press).

United States: Historic declines of green turtles, due to intensive exploitation at sea for commercial purposes, has been documented for coastal waters from Texas to Florida (Witzell, 1994). Loggerhead nesting has declined in Georgia and South Carolina, due especially to incidental capture in shrimp trawls (National Research Council, 1990). Population declines of loggerheads in these two states are thought to continue, but to a lesser extent, because of reduced mortality from the use of TEDs (Crowder et al., 1995). There have been dramatic declines of sea turtles - notably green turtles - in Hawaii (Balazs, 1980). Declines of both green and hawksbill turtles have been documented for most other US island territories in the Pacific, related to hunting (legal and illegal) eggs and meat, habitat degradation and incidental catch (Eckert, 1993).

5.57. In general terms, the causes have been similar in different parts of the world: an inability of recruitment to match mortality. (Little is known of the processes of immigration and emigration in sea turtle populations, so for simplicity, these terms will not be used here.) However, specific conditions vary, depending on different circumstances (see comments above), so recruitment and mortality may vary from beach to beach and from year to year.

5.58. Nonetheless, there are some aspects that are known to be relatively constant on a global level. When reproductive animals are removed from a population, the decline tends to be relatively rapid (e.g., the case of green turtles in Texas, Florida (Witzell, 1994) and Seychelles (Frazier, 1980); when eggs are removed, it takes longer for the decline to manifest itself (e.g., the case of Sarawak (Limpus, 1994)). In some cases, a complex of factors is thought to be related to the decline, but lack of fundamental information, including good baseline data, makes it a challenge to explain many declines in simple, precise terms. This is not to mention that marine and coastal environments are extremely dynamic, and many non-human effects may interact with anthropogenic threats.

5.59. A constant cause for decline, independent of time, is when mortality is greater than recruitment. Mortality and recruitment vary, depending on predation, food availability and quality, habitat quality, and many other factors. Because the life cycle of a sea turtle is complex, and includes large periods of time and large expanses of the planet, mortality can occur at many places and many times during an individual turtle's life. If mortality occurs anytime before reproductive maturity, the individual will not have the opportunity to contribute to the maintenance of the population. In the case of sea turtles, this means that mortality anytime during the first decade or more of pre-reproductive life will eliminate that individual's potential for reproducing, and contributing to recruitment and maintenance of the population. During the period of maturation a sea turtle will have lived in diverse environments, including spending the first two months of its life in a nest on a beach, years in the open ocean, and more years in coastal waters; in each of these environments it will have to evade diverse sources of mortality.

Mr. M. Guinea:

5.60. The conservation status of the world's sea turtles are presented in the IUCN Red data book of threatened animals (IUCN 1996). The hawksbill is critically endangered. Green, loggerhead and olive ridley, Kemp's ridley and leatherback are listed as endangered. The endemic Australian flatback is listed as vulnerable. The status of each species is achieved by nomination of the decline of the nesting population and the nomination of regional threatening processes. Pritchard (1997) states "[t]he IUCN in close cooperation with the Secretariat and Parties to CITES, has now adopted a set of complex numerical and ostensibly objective criteria by which the status category of a species should be deduced… The criteria incorporate considerations of actual global population numbers, fragmentation of habitat and populations and demonstrable population trends. For the great majority of species, the necessary data are unlikely to be currently available." All marine turtles are included in Appendix I of CITES..." (IUCN, 1995).

5.61. The causes of decline have been the same for all species. Limpus (1997) reviewed the causes of decline in sea turtle numbers in Southeast Asia. Human activities have been nominated as the causative agents in every decline. However, the breeding unit has to be examined to identify what activity or process is responsible for the decline. Trawling may affect some species while egg harvesting and habitat destruction may be more significant for other breeding units. Sea turtles are threatened at all periods of their life. Their critical habitats are also threatened. The nature and level of threat varies for each breeding unit. Threats may be natural and impact on the breeding unit during the nesting season, e.g. Hurricane Pauline destroyed 40 million olive ridley eggs in Mexico (Marine Turtle Newsletter), or affect the morphology of the nesting beach, e.g., storm surges drastically altered the nesting beach at Gahirmatha, India (Satapathy Rajaram, 1997). At least one breeding unit was affected by Cyclone Kathy, which stranded sea turtles on their feeding ground at 1057 km from their

rookery (Limpus and Reed, 1985). These unpredictable natural events are less damaging than continuous human utilization.

5.62. Great attention has been given to the decline of modern day sea turtles (Poiner et. al., 1990). Anthropogenic causes are attributable to negative impacts of human activities at any and all stages of the life history of sea turtles and their critical habitats. Direct alteration to the nesting environment by beach modification, through armouring, replenishment, nourishment and their environs by light and waste pollution as well as from recreational pursuits of beach driving and intensive human beach visitation, all have the potential to harm sea turtles, their eggs and/or hatchlings. Introduced and native predators of sea turtles eggs and hatchlings can have significant negative impacts on sea turtle rookeries. Almost every omnivorous vertebrate and many invertebrates within the vicinity of a sea turtle rookery has the potential to be a predator of sea turtle eggs and hatchlings (Carr, 1973). Yet, predation pressures are greatest as the hatchlings cross the shallow coastal waters on their dispersal into the open ocean (Limpus, 1997a).

5.63. Little is known about survivorship of sea turtles in the open sea and through their intermediate years (US National Academy of Sciences, 1990). Most of the interactions between sea turtles and humans are usually to the detriment of the former. Threats include subsistence, artisanal and direct commercial hunting in the vicinity of the nesting beaches and feeding grounds (Frazier, 1980), succumbing to pollution (e.g., petroleum products (Lutcavage et. al., 1997), discarded plastics and fishing gear (Chatto et. al., 1995)), and accidental capture in fishing activities, including bottom set gill nets (Guinea and Chatto, 1992), protective shark meshing (Paterson, 1979), long lines, drift gill nets (Eckert and Sarti, 1997) and shrimp trawls (US National Academy of Sciences, 1990).

5.64. When the above natural and anthropogenic causes of the decline in sea turtle populations are examined few target a single species, although each has the potential to negatively impact on any group of sea turtle species within an area. Natural threats are indiscriminate and may affect any species. Natural predation on eggs and hatchlings is thought to be kept in check by natural balances of predator prey relationships. Predation is so high that it is obvious that a number of terrestrial, marine and avian species depend on sea turtles as a source of protein. Anthropogenic threats to nesting habitats are again indiscriminate and driven more by coastal development, industrialization and the recreational opportunities provided by coastal environments. Direct human exploitation of sea turtle eggs and adults, if unchecked by legislation, will markedly reduce sea turtle numbers even in the absence of trawling activities e.g., Fiji (Guinea, 1993). The eggs of all species are targeted but major industries have been established in the past for green (meat, cartilage and oil), hawksbill (tortoise shell), olive ridley (leather, oil) and leatherback (oil) sea turtles. Incidental capture in fishing gear has the potential to reduce the population levels of some species. Shallow water fisheries in turtle habitats, using large meshed bottom set nets to capture sharks and rays will inevitably capture sea turtles. These nets are traditionally used to capture green (Travis, 1967) and olive ridley (Marquez, 1990) sea turtles.

5.65. Modern shrimp trawling is a relatively new technology. It should be used in conjunction with a number of management tools e.g., exclusion zones, time of trawl activity, vessel size, number of nets, net mesh size and the duration of individual trawls. The trawl fishery is sustained by this reduction of effort while improving the catch of the target species. Bycatch reduction or sorting devices remove unwanted species and objects or alternatively sort fish from prawn species giving a cleaner catch. Trawls of long duration over areas inhabited by benthic feeding sea turtles i.e., loggerhead, olive ridley, Kemp's ridley, flatback and some adult greens or in waters adjacent to their rookeries will capture a proportion of the sea turtles present. TEDs will allow the majority of adult turtles to escape.

5.66. Natural destruction and replacement of nesting beaches occur throughout the tropical region. Native and introduced predators of eggs and hatchlings occur on most rookeries. Coastal development, recreational pursuits and industrialization of the shore are common throughout the nesting range of sea turtles. Shallow water net and trawl fisheries are present throughout the tropical seas. Essentially all of the threats are present in the majority of tropical countries that have sea turtle populations. It is the intensity of those threatening activities, their duration and the subsequent abatement measures, that determine the viability of the sea turtle populations. Abatement measures vary with the socio-economic structure within various countries. The high technology approach to conservation of so-called developed countries appears at odds when dealing with artisanal fishers and trawl fleets of countries that are still developing. The decline of sea turtles has been driven by development of markets for turtles, their eggs, their habitats and other marketable marine species e.g., shrimp.

5.67. Natural threats to the habitat and native predation pressures have been present throughout time. Subsistence utilization of sea turtles has been in operation for some thousands of years by indigenous peoples. Non-indigenous exploitation of sea turtles and their products i.e., eggs, meat, oil, leather and tortoise shell have been operating for some centuries in areas which were close to centres of trade. With a global increase in commercialism, transport and trade, sea turtle breeding units have come under increasing pressures as a commodity. Their habitats are sought for coastal development. Modern fishing techniques place some species that coexist with shrimp at risk. The increase in human demand for tropical marine products and coastal facilities places increasing pressure on the more vulnerable species, such as sea turtles.

Mr. H.-C. Liew:

5.68. On a global scale, IUCN (International Union for the Conservation of Nature) recognises that all sea turtle species are threatened and endangered as all species of sea turtles are listed in CITES Appendix I.[9] However, different populations are in different states of health. Some populations have disappeared, some near extinction, some threatened but a few have shown some apparent recovery.

5.69. The factors that are known to cause decline in sea turtle populations are generally similar but differences do exist in terms of importance for different populations i.e. in different parts of the world, and with changing laws and technologies through time. For example, before the widespread use of trawlers and high seas gill-nets, turtle mortality caused by fishing was minimal but laws were not in force then to protect turtles and their products. Hence, there was widespread hunting of turtles for meat, shell and leather. Eggs were also collected extensively for food. Seas were not as polluted then, hence mortality caused by plastics, tar balls, pollutant induced diseases were not as extensive. Similarly, the degree of importance of factors threatening turtles in different parts of the world does differ. Presently in the United States, shrimp trawlers may be the most important threat as the United States has managed with various laws, education and conservation programmes through the years to reduce mortalities caused by killing of turtles and egg harvesting. In Hawaii, the main threats to their green turtle population is not shrimp trawling but the widespread occurrence of the fibriopapilloma disease. In Indonesia, turtle mortalities caused by commercial exploitation of

[9]Under the new IUCN criteria, sea turtles are designated as follows: Lepidochelys kempii critically endangered; *Eretmochelys imbricata* critically endangered; *Caretta caretta* endangered; *Chelonia mydas* endangered; *Lepidochelys olivacea* endangered; *Dermochelys coriacea* endangered; *Natator depresus* vulnerable. From CTURTLE List (Internet Source). Marydele Donnelly, 10:47 am 02-10-96, IUCN status of sea turtles.

eggs and large scale hunting for the turtle meat markets are significant to be primary causes of population decline.

Dr. I. Poiner:

5.70. Sea turtles are very long lived animals that mature at a relatively late age (ca. 30 to 50 years). The interval between breeding events is also extended (ca. 5 to 15 years, depending on the species). While many eggs are produced, and egg predation is high, natural mortality of sub-adults and adults is probably relatively low. Because recruitment to the adult population is low, population modelling studies suggest even small increased mortality rates in adults and sub-adults could impact substantially on population numbers and viability (Crouse et. al., 1987; Crowder, et. al., 1994 Heppell et. al., 1995; Chaloupka and Musick 1997).

5.71. Most sea turtle populations in the world are severely depleted. All seven species are included in CITES Appendixes and the World Conservation Union's (IUCN) Red Data Book lists. Most species have been listed as endangered or threatened under various national legislation. For example, all five species found in the United States waters are listed under the Endangered Species Act of 1973 and the five species found in Australian waters are listed under the Commonwealth Endangered Species Protection Act 1992. Recovery from low population number (if non-natural sources of mortality have been removed) will be slow, and there are no clear documented cases of recovery in the world.

Table 1: Sea turtle species that have declined and current anthropogenic threat to sea turtle populations in Thailand (Monanunsap 1997; Limpus 1997; Settle 1995), Malaysia (Chark 1997; Limpus 1997; Liew 1995; Chan et. al., 1998) and United States (Lutcavage et. al., 1997).

Turtle Species and Threat	Thailand	Malaysia	United States
Turtle species	*Documented*	*Population*	*Declines*
Loggerhead (Caretta caretta)			*
Kemp's ridley (Lepidochelys kempi)			*
Olive ridley (Lepidochelys olivacea)	*	*	
Green turtle (Chelonia mydas)	*	*	*
Leatherback (Dermochelys coriacea)	*	*	*
Hawksbill (Eretmochelys imbricata)	*	*	*
Threat			
Habitat alteration and loss	Yes	Yes	
Beach armouring (e.g., concrete sea walls)			Yes
Beach nourishment/sand mining			Yes
Beach cleaning and beach driving			Yes
Human presence on beach			Yes
Artificial light			Yes
Boat strikes			Yes
Dredging and explosive platform removal			Yes
Feral and domestic animal predation at rookeries		Yes	Yes

Turtle Species and Threat	Thailand	Malaysia	United States
Turtle species	*Documented*	*Population*	*Declines*
Oil pollution	?	?	Yes
Other pollution sources and entanglement			
Debris ingestion	Yes	?	Yes
Entanglement	Yes	Yes	Yes
Fishing and incidental capture			
Shrimp trawling	Yes	Yes	Yes
Pelagic fishing gear	Yes	Yes	Yes
Gill nets	Yes	Yes	Yes
Traditional and commercial fishing			
Egg harvests (legal and illegal)	Yes	Yes	Yes
Adult harvests (legal and illegal)	Yes	No	No

5.72. There is data documenting declines in sea turtle populations and the causes of declines have included: habitat alteration and loss of nesting and foraging habitats, pollution and entanglement, and fishing and incidental capture (Table 1). However, apart from estimates of the incidental capture and mortality of sea-turtles in some shrimp trawl fisheries (United States and Australia) (Henwood and Stuntz, 1987; Poiner and Harris 1996; Robins 1992), estimates of mortalities from boat strike, oil pollution and explosive platform removal mortalities in the United States (Lutcavage et. al., 1997), most mortality factors are not well quantified and it is difficult to rank mortality sources either currently or over time. Furthermore, there is a paucity of information about total population size, age structure, age-specific growth and mortality rates of the turtle populations and turtle distributions (patch dynamics) (Chaloupka and Musick, 1996). Without this, and information on the size and age structure of the segment of the population impacted by the anthropogenic activity, it is difficult to rank the relative impact of the different sources of mortality on sea turtle species and populations.

1(b) Is it possible to rank the various sources of mortality according to their impact on sea turtle populations? In particular, is it possible to determine the relative role played by past practice of egg harvesting and direct catch as compared to more recent threats at sea (such as those related to modern fishing practices) on the depletion of sea turtle populations? If these determinations are possible, please explain the basis for them, in particular if the studies cited cover sea turtle populations in the countries parties to the dispute.

Dr. Scott Eckert:

5.73. Our perspective on the impacts of various types of mortality to sea turtle populations has evolved as sea turtle population models have become better refined. This process will likely continue; however, based on work by Frazer, Crouse, Crowder, and Heppell, the current perspective is quite different than that of 20 years ago (see review by Chaloupka and Musick, 1996). What has been determined is that it simply is not adequate to concentrate all

efforts on protecting reproducing females and eggs as has been the traditional approach to restoring sea turtle populations. While it is obviously necessary to preserve the reproductive capacity of any sea turtle population, no population can be preserved by such methods alone. What both Frazer (1983) and Crouse et. al., (1987) pointed out in their population models is that it is vital to protect large juvenile and sub-adult turtles (so called "stage 3" turtles). Based on the reproductive value curves of Frazer (1983) for loggerheads, these larger turtles represent the highest reproductive value to the population, because significant reproductive investment has gone into their survival. There has not been any data presented to date to suggest that these value curves are not applicable to all species of sea turtle.

5.74. What is particularly critical to understand is that for many species (in particular those that have a neritic existence), stage 3 turtles are often the most subject to trawl fisheries (Crouse et. al., 1987). This is likely because this size class seems to pick foraging habitats that are most strongly correlated with shrimp fisheries. A number of possibilities have been proposed for this overlap. One is that this size class is more subject to chumming, i.e. the large quantity of bycatch discarded by the fishing boats attracts the turtle to scavenge. The other possibility is that this habitat is simply the developmental habitat for this size class of turtles. It is likely that these smaller size classes cannot dive as deeply nor as long as larger mature animals, and their ability to handle large prey is reduced. Thus, they forage in shallower waters with soft bottoms that characterize shrimp habitat.

5.75. It is my belief that nothing is as destructive to any turtle population as incidental mortality caused by fishing operations. Beside the issue of how some fisheries focus mortality on critically important size classes, fishery impacts can cause population declines far more rapidly than mortality associated with beaches. Good examples of this are the loggerhead populations in North Carolina, South Carolina and Georgia. All have declined approximately 80 per cent in 26 years, due primarily to shrimp fishing (NRC, 1990). The crises of the Pacific leatherback, has undoubtably been due to high mortality in the high seas driftnet fishery and the South American swordfish driftnet and longline fisheries. In this latter case we have seen the world's largest leatherback nesting population (estimated by Pritchard, 1982, to support 75,000 females in 1980) decline more than 95 per cent to less than 1,000 females by 1997 (Sarti et. al., 1996). The rate of decline caused by these impacts are often too fast for us to respond until it is too late. This latter situation is near to my own experience, as I have been working with colleagues from Mexico on one of the primary nesting beaches for the leatherback in Mexico since 1986. We should have seen this terrible decline, but I have described how long a nesting beach must be monitored before a trend will become apparent. We were not concerned that this decline was real until about 5 years ago, and it took 3 more years to confirm our suspicions. Finally it took until this year to determine that the problem lay with gillnetting in South America, and it may be too late to reverse this trend. The rate of decline caused by incidental fisheries mortalities is simply too rapid to respond with mitigation actions.

5.76. With declines associated with egg mortality such problems take substantially longer and they tend to be far more gradual, as was the case in Terengannu, Malaysia. Thus, our ability to detect these declines is enhanced, and while such perturbations to the population may require many years to turn around, there are many techniques available to mitigate (beach protection programmes, *in situ* beach hatcheries, enforcement of egg harvest regulation etc.). In the case of Terengannu, the problem was that when the population decline was identified, too little was understood about population dynamics of turtles to realize that preserving approximately 10 per cent of the harvested eggs was not enough.

Dr. J. Frazier:

5.77. Turtles that reproduce contribute to the maintenance of the population; hence, those animals are critical to sustaining the population: without reproduction, there will be extinction, sooner or later. Individuals that are not yet reproducing are not yet contributing to the maintenance of the population. Therefore, turtles that have survived the many and diverse risks over a period of decades, growing to reproductive maturity, are essential to the maintenance of the population, because they are capable of reproducing for many more years (decades, apparently). These adult animals are the immediate key to the future of the population. Animals that are not yet mature, still have to survive more years before they can contribute to the maintenance of the population. The younger a sea turtle is, the more time will have to pass before it will begin breeding; during this time, it will be liable to different sources of mortality, and in the end it may not survive to reproduce.

5.78. Therefore, removing a reproductive female from a population will have an immediate impact on the population, by reducing the amount of reproduction in the population. As there is a high probability that a breeding female will nest for many seasons, removing her will eliminate her reproductive contribution, not only in the short term but also in the long term. In comparison, removing a recently hatched turtle ("hatchling") from a population will have no immediate impact on reproduction. This animal would need to evade different sources of mortality for decades, before it began to reproduce. If we assume - for the sake of argument - that the chances of a hatchling surviving to maturity are 1 in 1,000, then on average the removal of 1,000 hatchlings would have an impact comparable to removing one animal that has just reached maturity, but the reproductive contribution of the hatchling that survived to maturity would not be manifested for more than a decade after it had hatched. Clearly, a healthy population needs individuals in all stages of development and maturity; there must be constant recruitment of young animals into the population to gradually replace the older animals as they die or cease reproducing. Thus, even although removing a hatchling may have no immediate effect on the reproduction of a population, continual removal of hatchlings will produce a situation in which the population would "die of old age", that is, there would be no new animals to replace the old ones.

5.79. The purpose of the above simplified example is to clarify the immediate impacts of different sources of mortality. A very clear explanation of the issues of mortality, survivorship and life stages is given in National Research Council (1990: Chapter 5). In more precise, scientific terms population models provide quantitative ways to evaluate how different sources of recruitment or mortality are likely to impact a population. The studies of Crouse et. al. (1987), Crowder et. al. (1994; 1995), and Heppell (1996a; 1996b) have used population models to predict the relative effects of increasing recruitment or increasing mortality on different phases of the life cycle, and how these relate to conservation priorities. Because basic information is lacking, and only two populations of loggerheads have sufficient data to even begin constructing population models, the work has been limited to loggerheads. While some details of life history parameters will be different with other species and other populations, these models are the best predictive tools that we have at the moment. Furthermore, it is not likely that general conclusions will change, given the general similarity in life history parameters between the different species of marine turtles.

5.80. A concept that is used to integrate the above ideas is that of "reproductive value". According to the work of Crouse et. al. (1987), if the reproductive value of an egg is 1, then the reproductive value of a subadult would be 116 and that of a breeding animal would be 584. These numbers are indices of the relative "value" of an individual, at different stages during its life cycle, for reproduction and maintenance of the population.

5.81. Given the above paradigm, a population would be resistant to mortality concentrated on early life stages (e.g., egg harvesting), but mortality of animals that are reproducing, or just about to reproduce, would have an immediate effect on the level of reproduction in the population, and these deficits would continue for many years. The closer to maturity the turtles get, the more they are worth to the population, and the less it can afford to lose them. On the other hand, continual egg harvesting will in the end result in the collapse of a population, but a few years of total loss of eggs, or moderate levels of egg loss over a period of years would have less impact on the status of a population than would several years of removing breeders - this would be true both in the short term and in the long term.

5.82. Hence, sources of mortality that affect animals that are mature, or nearly mature, have far greater instantaneous impact on the status of the population than taking the same number of eggs or young animals, for they reduce levels of reproduction very quickly. Harvesting of breeding animals, or incidental capture in fishing gear, are examples of these very "costly" sources of mortality. Modern fishing practices have been repeatedly documented to cause mortality; and more specifically, large-sized, especially adult, turtles are known to be caught and drown in shrimp trawls in Australia (Poiner and Harris, 1994; Robins, 1995); Pacific Costa Rica (Arauz, 1990; 1996b); and the United States (National Research Council, 1990).

5.83. Systematic data on present population size, trends in population size, rates and sources of mortality, population structure, and indeed geographic distribution are incomplete for many areas. Hence, many decisions related to conservation and management of sea turtles are made with imperfect knowledge, "splicing" together the best information available, from wherever it can be obtained. While this clearly has drawbacks and limitations, the logic is to adopt a conservative approach so that mistakes in decision making will be "conservative", i.e., least likely to be detrimental to the population. In terms of the present discussion, this means paying special attention to those animals that are of greatest value to the maintenance of the population: in other words, making sure that the animals that are breeding, or close to breeding, are protected. Clearly, all stages of a population are important for its long-term continuity, but where risks are focused on individuals with the greatest reproductive value, an immediate priority is to reduce these risks. This is particularly true of populations that are under risk, because they have been decimated.

5.84. A study was carried out using a population model to evaluate the effect of mortality on different stages of the life cycle of loggerheads from eastern Australia. They found that even if hatchling emergence success could be elevated to 90 per cent (well above the natural average), with the present rate of mortality of adult and subadult females, the population may be headed for extinction in what are the equivalent of 3 turtle generations (Heppell et. al., 1996b). Since a major source of mortality for these turtles is incidental capture in prawn trawls (Poiner and Harris, 1994; Robins, 1995), a priority for the survival of these populations is significantly reducing this risk; Heppell et. al. concluded that the use of TEDs, together with other conservation measures, would be instrumental in the survival of these populations. Similar analyses, giving comparable results, have been carried out for the east coast of the United States, where once again it was concluded that eliminating, or significantly reducing, mortality of breeders and large juveniles in shrimp trawls was critical to the long term survival of these populations (Crouse et. al., 1987; Crowder et. al., 1994; 1995).

5.85. Along the Pacific coast of Central America it is estimated that some 60,000 turtles are caught annually in shrimp trawls; and in Costa Rica, which contributes a third of the total,

there may be 24 to 60 per cent mortality (Arauz, 1996a). Systematic data are not available for other populations (neither for the countries involved in this dispute, nor for any others). Thus, these sorts of determinations can only be carried out for other populations by analogies based on existing knowledge of the basic similarities in life history parameters. Until systematic information is available to refute these assumptions, it is generally considered that the most conservative approach is to use the results of the population models as indicators for conservation priorities.

Mr. M. Guinea:

5.86. It is difficult to rank the various threats to sea turtles on a global scale. Hence the paradigm of breeding units becomes an essential tool to assess, for that unit, the relative impacts of human pressures. The major threats to each breeding unit must be independently assessed and managed. Sea turtle populations have declined in some countries which have had a long period of intensive egg harvest. As have the populations in countries that have focused on the exploitation of tortoise shell or meat. This has happened regardless of modern fishing practices such as trawling. Other countries with intensive trawling activities have also experienced a decline in their sea turtle numbers. It is the breeding unit of each species that has to be examined. If nesting beaches have been destroyed by commercial or industrial development, then abatement measures should be directed to halt, modify or remove that development. If introduced predators have reduced the productivity of rookeries, then their reduction becomes the target of abatement measures. If adults are being killed while nesting and by set nets off shore, then legislation to protect rookeries and their off shore refuges needs to be enacted or enforced. Should trawling be responsible for the deaths of sea turtles of any age, then management regulations involving reduction of fishing effort, by exclusion areas, closed seasons, vessel and gear size restrictions, limits to tow duration, adoption and enforcement of bycatch reduction devices such as TEDs, should be adopted.

5.87. As indicated, the sources of mortality should be examined in relation to the breeding units. Malaysia and Thailand because of their proximity may share breeding units of some species. Malaysia may share breeding units with the Philippines and Indonesia. India and Pakistan could share breeding units of some species. The United States and Mexico may share breeding units as well. It is speculative to suggest that southeastern United States shares a breeding unit with any of the other countries in the dispute.

Mr. H.-C. Liew:

5.88. The truth and accuracy of whatever ranks produced are only as good as the information that is available. There will always be shortcomings of such reports and their reliability will vary from country to country depending on how accurate and extensive the information is made available. Scientific studies are still being conducted to improve on the information but gaps still exist especially on mortalities at sea of hatchlings, juveniles and adults. For example, we still do not know what degree of mortalities is affecting our hatchlings at sea. How many are killed by natural predation or by consuming floating debris like tar balls and styrofoam beads, etc. Attempts have been made to estimate these unknowns by modelling, but these estimates are hinged on assumptions made of what is unknown. Turtle landings, egg production, or turtle catch statistics produced by governments or NGOs are sometimes extrapolated figures, misreported, biased or even falsified. With the absence of any other data, they are often assumed to represent the true situation. The degree of error does vary from country to country depending on expertise

available to collect the data and various other limitations. Bearing these limitations in mind, attempts can still be made to rank them when such requests are made.

5.89. In developed countries like the United States where the human population is generally rich, educated, with cheap protein available, they could afford to have strict conservation management policies and effective enforcement. Hence turtle mortalities caused by egg harvesting or killing for meat is negligible (ranked low). With mortalities by these causes removed, mortalities caused by their high technologies like shrimp trawling becomes more prominent and overshadows the other causes (ranked high). In developing countries like India, Pakistan, Malaysia, Thailand, Indonesia, etc., conservation management policies and their enforcement are at a different level. Egg harvesting for consumption is still legal or poorly enforced in many of these countries. Turtles are still being slaughtered for meat in some of them. Fishing technologies like shrimp trawling may not be as developed or still artisanal to be of prime impact on turtle populations. They may even be using other fishing methods which may have a greater impact on sea turtles than shrimp trawling, like the sunken set-net or "pukat pari" in Malaysia.

Dr. I. Poiner:

5.90. It is not possible to rank the various sources of mortality according to their impact on sea turtle populations especially with respect to relative role of past practices.

1(c) A survey of current anthropogenic threats to sea turtle populations in the five countries involved in this dispute would be appreciated. In particular, are anthropogenic threats currently more important at sea or on the nesting grounds? What is the relative impact on sea turtle populations of egg harvests and direct harvesting of sea turtles vs. incidental capture of sea turtles in fishing operations, in particular shrimp trawling? Is this situation similar in different parts of the world? Are different species of sea turtles affected differently?

Dr. Scott Eckert:

5.91. Identifying primary sources of mortality within these countries is quite challenging, primarily because most of these countries (with the exception of the United States) are simply not putting much effort into studying the problem. This seems particularly true for measures of fishery bycatch. The purpose of most government fisheries agencies is to support fisheries with research and technology advances. Generally, measuring bycatch is not a high priority. Hence, bycatch data is rarely gathered. Furthermore with fisheries such as shrimp fishing, the boats are relatively small and numerous, making the application of an observer programme difficult and very expensive. However, without an independent observer programme any data (such as logbook data or even port sampled data) must be suspect. In my experience captains uniformly under-report bycatch data, sometimes unintentionally but often out of concern for what reporting turtle mortalities will mean to their livelihood. It is not surprising to me, therefore, to find a great paucity of rigorous study on incidental take in shrimp fishing in Malaysia, Thailand, Pakistan or India. In the United States there is a large body of information (see NRC, 1990, Crouse et. al., 1992, Murphy and Murphy, 1989), driven primarily by the requirements of the Endangered Species Act. All that is generally reported in these other 4 countries are anecdotal or very limited reports, most gathered during interviews with fishermen.

5.92. In the United States threats to sea turtles are somewhat species and regionally dependent; however, a few generalizations can be made. For green, loggerhead and

Kemp's ridley turtles in the Atlantic, the most serious threat was shrimp trawling (NMFS and USFWS 1992, 1991a, 1991b, NRC, 1990). This threat has been well documented and is probably indisputable (Maley et. al., 1994, NRC, 1990). The requirement that TEDs be utilized in all waters at all times has reduced this threat. At this time the most significant threat has to be enforcement of existing regulations, and the scope of this problem is minor when compared to the previous unlimited incidental take. Also, of significant importance to green turtles and hawksbills occurring within the US insular Pacific Ocean (except in Hawaii) and Caribbean is the direct killing of turtles. (NMFS and USFWS 1996a, 1996e). However, the scale of this problem is substantially less than in other countries of the region. The primary threats to olive ridleys in the United States is the due to incidental take of turtles in the Hawaiian-based longline fishery (NMFS and USFWS, 1996f). Threats to the leatherback in US waters include the shrimp fishery on the Atlantic seaboard, the Hawaii longline fishery and gillnet fishing in Northern California.

5.93. In Malaysia, it is apparent that egg harvest is still a serious problem for green, hawksbill and possibly leatherback turtles, despite regulations designed to limit such harvest (Eckert, 1993, and paragraphs 5.0 and 5.0). During research I conducted in 1989 in Terengannu, Malaysia, leatherback and green turtle eggs were openly sold in the local markets despite their protected status. Trawling has also been described as a threat to turtles residing off Terengannu, though this report may be out-of-date to the current situation (Chan, et. al., 1988). However, in 1991, Chan reported that incidental capture in fishing gear "is now recognized at one of the most serious threats to the survival of the remaining sea turtles in Malaysia." (Chan, 1991). I have no other information on the situation in Malaysia, but based on my general experience with trawl fisheries and sea turtles, I would not be surprised that any area in southeast Asia which support trawl fishing also has incidental catch of sea turtles.

5.94. In Thailand there appear to be a number of threats to sea turtle populations, the most serious appear to be shrimp trawling, killing of turtles and taking of eggs on nesting beaches (Eckert, 1993, Hill, 1991, Hill, 1992, Chantrapornsyl 1997). There also seems be problems with enforcement of trawling regulations (Hill, 1991, Hill, 1992). Both green and hawksbill populations in Thailand are severely depleted (Eckert, 1993, Chantrapornsyl, 1997).

5.95. As described earlier, there are a host of anthropogenic threats to sea turtles in India, including the killing of nesting females, harvest of eggs and incidental mortality associated with shrimp fishing. However, the large numbers of olive ridley killed by legal and illegal trawling operations is extraordinary and must represent the single largest threat to sea turtle populations in India.

Dr. J. Frazier:

5.96. Recent reviews of the topic of anthropogenic threats are provided by Eckert (1995) and Lutcavage et. al., (1997). For several of the countries involved, there simply are no (or very little) systematic data.

India: Kar and Bhaskar (1982) reported the consumption of turtles and eggs in most coastal states and Union Territories. In the south of Tamil Nadu and West Bengal there is a long history of direct exploitation of turtles (Frazier, 1980; Kar and Bhaskar, 1982; Silas et al., 1983b; 1983c; 1985; Pandav et. al., 1997); although illegal, these activities persist in the Bay of Bengal (Pandav et. al., 1997). For over a decade incidental capture and drowning in fishing gear has been known to be an important source of mortality of adult turtles, particularly in the Bay of Bengal; and trawlers, specifically shrimp trawlers, in Tamil Nadu,

Andhra Praesh, Orissa and West Bengal have consistently been singled out for impacts that they cause (e.g., Kar and Bhaskar, 1982: 367, 368; Silas et. al., 1983a; 1983b; 1983c; 1985; James et. al., 1989; 1991; Dash and Kar, 1990; Mohanty-Hejmadi and Sahoo, 1994; Department of Fisheries et. al., 1996). Sand mining from beaches and coastal development have also been identified as threats for over a decade (Kar and Bhaskar, 1982).

Recent reviews identify development along the beach front (roads, buildings, tourist resorts), development of capital-intensive fishing operations (jetties and fish processing centers) and military installations, casuarina (Australian pine) plantations (which often make nesting impossible because of the dense cover of trunks and needles), incidental capture in fishing gear (notably trawl nets) and artificial lighting (Behera, 1997a; Pandav et. al., 1997; Choudhury, in press). With a long tradition of an active civilian population and free speech, there have been countless articles in the popular press, as well as initiatives from NGOs, focused on these various anthropogenic threats to sea turtles - particularly the problems of incidental capture in mechanized fishing boats, viz. trawlers and gill netters (e.g., Anon, 1982; Wright, 1984; Anon; 1985; Anon, 1986; Anon, 1992; West, 1995; Anon, 1996; Anon, 1997a; 1997b; 1997c; 1997d; 1997e; 1997f; 1997g; 1997h; 1997i; 1997j; Behera, 1997b; 1997c; Mishra, 1997; Panda, 1997, Rai, 1997; Sridhar, 1997a; 1997b).

Malaysia: Intensive, long-term egg harvest has occurred up until recently at most nesting beaches on both East and West Malaysia, and has been clearly identified as having been a major threat (de Silva, 1982; Siow and Moll, 1982; Mortimer, 1990; Chan, 1991; Eckert, 1993; Limpus, 1994; 1995; Chan and Liew, 1996a; 1996b). Hunting of turtles, namely in Sabah, has also been identified (de Silva, 1982; Eckert, 1993). Coastal development and habitat loss have been pointed out for some time (Siow and Moll, 1982; Leh, 1989; Mortimer, 1990; Chan, 1991; Chan and Liew, 1996a); this involves both terrestrial and marine environments, for example light and oil contamination at sea (Eckert, 1993; Chan and Liew, 1996a). Incidental capture in fishing gear, including drift/gill nets, long lines, traps, trawls (especially prawn trawls) and other gear (as well as dynamiting in Sabah) has also been identified for years (de Silva, 1982; Siow and Moll, 1982; Chan et al., 1988; Leh, 1989; Mortimer, 1990; Chan, 1991; Eckert, 1993; Chan and Liew, 1996a; 1996b; Suliansa et. al., 1996). Improper hatchery practices have also been singled out (Chan, 1991; Chan and Liew, 1996a).

The most recent review of Malaysian sea turtles (Liew, in press) lists several threats including: direct harvesting for tortoise-shell and leather, over-harvesting eggs, poaching, inadequate hatchery techniques, incidental captures in fishing gear and coastal and offshore development for tourism and industrialization.

Pakistan: At Hawksbay, Karachi, there have long been problems with development of weekend houses, which usurp nesting habitat along the beach. In addition, adult turtles have been washing up dead for decades. Kabraji and Firdous (1984) reported stranded turtles, especially during the monsoon. They had no direct evidence of cause of death, but proposed shark attack, as well as "Drowning in fishermen's nets as part of incidental catch, Poisoning by pollutants such as oil, Disease". Firdous (1989) reported that 69 dead turtles were counted on the beach between June 1983 and June 1989. Most of the strandings were documented in the month of June, when tides and waves were the highest; 65 of the specimens were green turtles. There have been no systematic studies of this problem, but the evidence matches trawl-related strandings in other parts of the world. More recently, commercial trade, poaching of eggs, accidental capture in fishing nets, extensive shore-line development, disturbance and pollution have all been identified as threats (Asrar, 1995?).

The little information available from Baluchistan indicates that direct exploitation has been a serious source of mortality, but there seems to be no recent information. Groombridge et. al., (1988) reported commercial exploitation (thought to be green turtles) from remote beaches in Baluchistan. The levels of harvesting were claimed to be many thousands of turtles (mainly breeders) in a year; a short-term exportation to Japan was evidently involved, but there was also evidence that much of the exploitation was for local consumption. This all occurred in contravention of provincial legislation. As the area is remote, and much of the exploitation yield products is not recorded in normal statistics, it is next to impossible to know what happened historically or even what has happened in recent years. Groombridge (1989), later reported that "incidental catch appears to be a problem in surrounding waters." He suggested that the nesting colony in the Sonmiani region of Las Bela may have been extirpated by heavy exploitation.

Thailand: Harvest of eggs of most (all) species is known to be have been intensive for many years (Lekagul and Damman, 1977; Gilbert, 1981; Phasuk, 1982; Polunin and Nuitja, 1982; Hill, 1992; Eckert, 1993; Stuart and Cartin, 1994; Limpus, 1995; Settle, 1995). The same is true with the harvest of turtles of most (all) species (Lekagul and Damman, 1977; Gilbert, 1981; Phasuk, 1982; Eckert, 1993; Limpus, 1995; Settle, 1995). Coastal development and loss of nesting and feeding habitat is another widespread threat (Lekagul and Damman, 1977; Gilbert, 1981; Polunin and Nuitja, 1982; Settle, 1995). Incidental capture in fishing gear, including drift nets, purse seines, push seines, and notably trawlers, as well as cyanide and bombing, has been identified as a major threat (Lekagul and Damman, 1977; Gilbert, 1981; Phasuk, 1982; Polunin and Nuitja, 1982; Hill, 1992; Eckert, 1993; Stuart and Cartin, 1994; Settle, 1995). Inadequate management, notably headstarting and hatcheries, is also a problem (Stuart and Cartin, 1994; Settle, 1995 (see Donnelly, 1994; Mortimer, 1995; Crouse, 1996; Heppell et al., 1996a)). There have been notices in the popular press about turtles being caught and killed by trawlers (Matchima, 1996; Walakkamon, 1996). The most recent review of the status of marine turtles in Thailand identifies commercial exploitation of sea turtles and their eggs, coastal development, heavy fishing activities (trawling, gill nets, and long lines) (Supot, in press).

United States: Intense, direct exploitation of turtles, especially greens, in the continental United States ended in the mid 1970's, after decimation of these populations (Witzell, 1994), but evidently continues in many of the island territories of the Pacific (Eckert, 1993). A recent detailed analysis of anthropogenic threats for the Gulf of Mexico and Atlantic concluded that by far the most important source of mortality was incidental capture in shrimp trawls (National Research Council, 1990). Other threats include beach erosion, beach armouring, beach nourishment, beach cleaning and utilization, artificial lighting, gill nets, pound nets, fish trawls, traps, long lines, and a variety of other fishing gear, dredging actives, boat collisions, use of explosives underwater, ingestion of plastics and other contaminants (Lutcavage et. al., 1997). Oceanic drift nets and debris are of major concern, notably in the Pacific (Balazs, 1982; 1985; Balazs and Wetherall, 1991; Laist, 1995). The high incidence of fibropapilloma tumors - notably in Florida and Hawaii, and the devastating impacts on sea turtles has become a major concern, and there are suspicions that marine contamination is involved (George, 1997).

5.97. Without a doubt, reproductive and near-reproductive animals are most critical to the maintenance of a population. As sea turtles spend the vast majority of their lives in the sea, they are more subject to threats at sea in terms of the time spent at sea; these threats can be direct harvest (e.g., in nets), incidental capture (e.g., in fishing gear) or effects of contamination and marine pollution. However, while sea turtles are at their nesting grounds, they are concentrated in time and space, and generally this attracts concentrations

of predators and exploiters. Hence, in general, they are more liable to predation while at their nesting grounds. However, the importance of a threat depends not on where mortality occurs, but how that mortality affects the population. As explained above, a few hundred eggs and hatchlings are less important to a population than is one breeding adult.

5.98. Different sources of mortality produce the same effects on the same stages of the life cycle: killing a reproductively mature turtle at sea for its meat, killing it as it comes to a nesting beach to lay eggs, or drowning it in a shrimp trawl means the same thing to the population - the removal of a breeding animal. In terms of the dynamics of the population, it really does not matter what killed the turtle, but rather how many were killed.

5.99. What is important is the life stage where the mortality occurs. One female may lay several clutches, each more than 100 eggs, and this she may do several times during one nesting season; and she can potentially nest for a period of decades. Thus, taking every single egg that she lays over a period of two nesting seasons, say, 1,000 eggs, means stopping her reproduction for two nesting seasons, but not completely. She has the potential (if she is not killed by any one of a variety of threats, both human and non-human) to return to the nesting beach on subsequent seasons and lay more eggs. If she can avoid mortality, she might successfully nest during 10 to 20 nesting seasons, each time laying perhaps 500 eggs. In this case, a female that lost 1,000 eggs in her first two nesting seasons, could successfully lay 5,000 to 10,000 eggs. What is critical, is that the turtle be able to survive to continue reproducing.

5.100. Fishing operations cause mortality - albeit incidental - which impacts large turtles, including those that are breeders and close to breeding. Shrimp trawling is one such fishing operation, which causes incidental mortality on large sized turtles (those that live in coastal waters). The special concern with shrimp trawling stems from several points. Because shrimp are generally most concentrated in coastal waters, trawling tends to concentrate in coastal waters (this occurs routinely, despite regulations and bans on trawling in these waters). Around the world, shrimp trawl fleets have grown faster than the shrimp stocks can sustain levels of exploitation, so the activity is regularly overcapitalized, and investments find decreasing returns. Shrimp trawling is targeted as a valuable export product, for which there is generally intense competition. Hence, shrimp trawling generally is carried out with considerable intensity, resulting in large areas of the benthos having the trawl pulled across them repeatedly. (One clear exception to the above paradigm is Australia, where shrimp fishery is closed entry (Tucker et. al., 1997), so the intensity of fishing effort has not spiraled out of control, as is the case for nearly every other fishing ground in the world.)

5.101. Where shrimp trawling is intense, and concentrated in coastal waters, there is a high probability that sea turtles will be caught and accidentally drowned. If these fishing activities occur near to breeding grounds (nesting beaches or mating areas) or in the migratory routes used by turtles to get to and from the breeding areas, or in feeding grounds, there is an extremely high probability that large numbers of turtles will be caught and drown. Where this happens, the numbers of turtles that are breeders and near-breeders killed incidentally can be relatively large. If this sort of operation continues, it can decimate a healthy population, make it impossible for a recovering population to recover, or even finally exterminate a population.

5.102. In terms of the general demographic phenomena, described above, the situation is similar in different parts of the world. However, each sea turtle population may have specific sources and intensities of mortality, at different times in the life cycle, which may occur at different places in the geographic distribution of the individuals, as they pass

through different stages of the life cycle. Put another way, a dead turtle in Louisiana is just as dead as a dead turtle in Sabah.

5.103. Different stocks are under different situations, and different species have variations in the details of their life history. As such, each one may be affected somewhat differently by different types of mortality. For example, species that mature faster than others (ridleys for example) should be able to sustain relatively more mortality in the breeding adults, than species that require more time to mature. Nonetheless, there will be certain constants: increased mortality of reproductive, or near reproductive animals, will have more affect on the population than the same level of mortality on eggs or newly hatched turtles.

Mr. M. Guinea:

5.104. Threats to sea turtles have been compiled for the various countries. Few have ranked the order of the perceived threats. The ranking is as indicated in the references listed. It is unclear if the authors would give their consent to such ranking given the nature of the question.

5.105. The United States lists (Lutcavage et al., 1997): (i) beach modification by armouring etc.; (ii) Boat strikes; (iii) dredging and explosive platform removal; (iv) depredation of nests by animals; (v) pollution: oil, plastics and debris; (vi) incidental capture in fishing gear particularly shrimp trawls.

5.106. Thailand lists (Monanunsap, 1997): (i) the overuse of marine turtles and their eggs as sea food in the past; (ii) the sale of marine turtle products to tourists and for international trade; (iii) the deterioration of nesting habitats and marine pollution (light and plastics); (iv) the incidental capture of marine turtles in commercial fishing operations offshore.

5.107. Pakistan Lists (WWF, Marine Turtles of Pakistan): (i) Commercial trade for turtle skin, shell medicines and cosmetics; (ii) destruction of eggs by predators and poachers; (iii) accidental capture of turtles in fishing nets; (iv) extensive shore-line development, human disturbance and pollution.

5.108. Malaysia lists (*Threats to Sea Turtles*, http://www.opmt.edu.my/seatru/cons2.htm): (i) beach front development; (ii) heavy egg exploitation; (iii) incidental capture in set nets, drift nets, trawls and longlines; (iv) pollution (both light and industrial).

5.109. India lists (IUCN, 1995): (i) direct mortality: intentional catch by local and artisanal fisheries and on commercial long-lines; (ii) indirect mortality: unintentional catch causing drowning in trawls and gill nets; (iii) habitat degradation: beach destruction due to human activities, sand mining. Walking and driving litter and surface obstructions, disturbance by residential and commercial lights. Coastline modification due to construction etc. Beach destruction due to coastal erosion. Feeding, resting and developmental habitat destruction due to pollution and development; (iv) pollution: plastics and debris in the sea cause entanglement and drowning and death following ingestion; (v) boat collision; (vi) hatcheries: poor management of egg hatcheries; (vii) lack of information on sea turtle population sizes, migrations and natural and anthropogenic mortality levels hampers effective planning.

5.110. Human threats to sea turtles depend on the intensity and duration of the impacting activity. It is difficult to generalize between ocean and shore based threats. However, once the nesting beach has been lost the breeding unit has lost a critical habitat. As long as the

nesting beach is intact there is a chance for seriously depleted populations to recover, should they be given enough protection.

5.111. Once eggs and adults are targeted as a commercial commodity, the breeding unit can suffer serious and rapid decline. Essentially, sea turtles are easy to capture and their eggs are easy to locate. Incidental capture is a relative modern term. Before the 1960's sea turtles were actively harvested in most countries in which they occurred. Modern fishing practices through effective management, should have little impact on sea turtles. This is embedded into the ethos of responsible fishing.

5.112. The species most at risk from shrimp trawling in the United States are the benthic feeding loggerhead, Kemp's ridley and to some extent the green (Robins, 1995). In Australia, flatback, olive ridley and loggerhead are the species most commonly caught in shrimp trawls of the Northern Prawn Fishery (Poiner et. al., 1995). However in the Queensland Trawl fishery, the order changes to loggerheads, greens, and flatbacks, olive ridley and hawksbills (Robins, 1995). The differences may be attributable to the species present in the different trawl fields and composition of habitats and depths on each of the trawl fields. Green turtles will be caught if the trawl field contains seagrass or abundant growths of algae. Hawksbills will be more commonly encountered amongst soft corals and algae. Leatherbacks are seldom caught in shrimp trawls.

Mr. H.-C. Liew:

5.113. The major anthropogenic threats to sea turtles are:

(a) Sea turtles are hunted for their meat and other products. Even though sea turtles are endangered and various countries have regulations to protect them, the hunting of adults and juveniles is still rampant. Some countries still permit such activities by imposing quotas but the quota numbers are in the thousands per year, often far exceeding what is sustainable considering the other threats facing sea turtles today. Very often, the numbers hunted illegally are estimated to be 2 to 5 times higher than the legal quota. Enforcement is generally very poor and difficult. All countries party to the dispute have banned such activities but their neighbouring countries like Costa Rica and Indonesia still condone hunting which invariably affect their population of sea turtles also.

(b) Incidental catch in fishing gears, e.g. shrimp trawlers, high seas gill-nets and other fishing gears. The impact of shrimp trawling on sea turtles appears to be the most important factor today threatening sea turtles in the United States. Thousands of olive-ridleys are also killed in Orissa, India, each year which conservationists attributed largely to shrimp trawlers. Incidental captures of sea turtles in shrimp and fish trawlers are also known to occur in Malaysia and Thailand; however, there is insufficient studies conducted to survey the extent of such impacts. Numerous other fishing gears are also known to kill turtles in Malaysia (Suliansa et al., in press), which, in some locations, appear more important than shrimp trawlers.

(c) A fair amount of turtles are killed or drowned in man-made structures (e.g., oil-rigs) or by speedboats and other powered watercrafts. Many of these go unreported except for stranding of dead turtles with lacerations on them. However, the number of turtles that do get stranded and reported is only a small portion of the true situation. Such problems occur in all countries with turtles.

(d) No estimates are available on the mortality caused by marine pollution to hatchlings, juveniles and adults. There are numerous reports of plastic debris in the stomach of

autopsied stranded sea turtles, especially leatherbacks. Large numbers of hatchlings are probably killed or weakened due to the accidental feeding on marine debris like tar balls, styrofoam beads, plastics, etc. This is because hatchlings aggregate at oceanic drift lines where floating seaweed and other food items are found. Unfortunately, these are the same locations marine debris accumulate. Due to the scarcity of food items in the ocean surface, hatchlings would often attempt to feed on any small items that drift by.

(e) Mortality caused by diseases that may be anthropogenically induced, e.g., fibriopapillomas, is recent but spreading fast. It has affected several populations in the world from the Caribbean to the Indo-Pacific. Among the severe cases are the turtle populations in Hawaii.

(f) Trawlers, fish bombing, pollution, land reclamation and development are continuously destroying the feeding grounds of sea turtles. Large areas of sea-grass beds and coral reefs have been damaged or lost by these activities. All the countries concerned face these problems.

(g) Similarly, nesting beaches of sea turtles also face severe threats from beach front development, coastal protection structures like seawalls, land reclamation, sand mining, etc.

(h) Losses due to unsuitable or poorly managed hatchery practices also occur. Some of these losses can be very significant especially if hatcheries are the primary conservation effort practiced in those countries. Some Asian countries still practice the wrong conservation strategy of withholding newly emerged hatchlings for many days, or months to "harden" them before release, often termed as "headstarting".

(i) Commercial exploitation of eggs both legal and illegal is also still rampant especially in the poorer and developing nations like in some parts of Malaysia, Indonesia, Thailand, India, Maldives, Australia, Latin American nations and many others (Limpus, 1997).

5.114. The relative impact on sea turtle populations through egg harvests and direct harvesting of sea turtles vs. incidental capture of sea turtles in fishing operations, in particular shrimp trawling varies in different parts of the world. As mentioned earlier, egg harvesting and turtle hunting are well controlled in the United States, hence do not pose a major problem. Incidental capture in fishing operations, therefore, stands out as a major threat due to the large number of modern and efficient shrimping fleets, supported by the high demand for shrimps in the United States. The same cannot be said for developing countries in Asia. Even though these countries do have turtle conservation programmes, are signatories to CITES, and have laws to protect turtles, the level of enforcement can be quite different. Some of these countries even allow varied levels of commercial egg harvest or even killing of turtles for meat. Moreover, these countries do not have good statistics on turtle mortalities caused by fishing or shrimp trawling but records are available for commercial egg and turtle harvests where legal. Yet, many may go unreported. Thus, their reports would show egg harvest or turtle harvest as major causes.

5.115. The relative importance of threats does vary from species to species. For example, hawksbill turtles are hunted for their shell, hence largely decimated because of this activity. Leatherback turtles are largely pelagic, not known to rest on the seabed and feed primarily on jellyfish. Hence, threats caused by high seas drift nets and discarded plastic bags may be more important compared to shrimp trawling. Loggerhead turtles, Kemps ridleys and olive ridleys feed on crustaceans and shellfish found on the seabed, often in the same areas where shrimps are found, hence are most susceptible to being caught in shrimp trawlers. Green

turtles forage primarily over seagrass and algal beds. Fishing and boating activities, and pollution in these shallow areas become more of a threat. However, for all these species of turtles, they are also vulnerable in the waters off their nesting grounds during the nesting season where they aggregate in numbers depending on the size of the nesting population. If some form of protection is accorded to these coastal areas during the nesting season, they may help reduce the threat caused by fishing.

Dr. I. Poiner:

5.116. I am only qualified to comment on current threat to sea turtle populations in the United States, Malaysia and Thailand. It appears that all sea turtle populations of all species in the three countries are severely depleted, and/or subject to over-harvesting and/or excessive incidental mortality. Anthropogenic threats in the three countries are similar (see Table 1, paragraph 5.71) but their relative importance is different. Most notably the indigenous harvests of eggs and adults in South East Asia is an important source of mortality not present in the United States, especially since the same stock will be fished in several countries in South East Asia. For example, the Malaysian green turtle population in Sarawak which has declined >90 per cent in egg production since the 1930s and is still under threat despite Malaysian conservation measures. One reason for the lack of recovery is egg harvests and adult fishing in neighbouring Indonesia since they are likely to be the same stock (Limpus, 1997).

5.117. As stated above, apart from estimates of the incidental capture and mortality of sea turtles in shrimp trawl fisheries (United States and Australia), and estimates of mortalities from boat strike, oil pollution and explosive platform removal mortalities in the United States, many mortality factors are not well quantified. It is not possible to estimate the full range of impacts on a stock and this is needed to assess population stability and the relative importance of different anthropogenic threats at sea or on the nesting grounds. None of the mortality factors are well quantified for south east Asia sea turtle populations.

5.118. In the United States the incidental capture of sea turtles in shrimp nets was identified as the major source of anthropogenic mortality for loggerhead, Kemp's ridley and green turtles when compared to other known sources of mortality (Henwood and Stuntz, 1987). However, there is no quantitative data on the various mortality factors in Malaysia and Thailand to make this assessment. In Australia, shrimp trawling has been identified as an important but not a key source of mortality for the six species of turtles that occur in Australian waters (loggerhead, olive ridley, green turtle, leatherback and hawksbill). The assessment is based on robust estimates of the incidental capture of sea turtles in shrimp nets (Poiner and Harris, 1996; Robins, 1995; Anon, 1997) and a variety of numerical population models (dynamic stage-structured and stochastic simulation models) for green and loggerhead turtles developed to help design and evaluate conservation policy and management (Chaloupka and Musick, 1997). Furthermore, there is significant variation in the relative catch and mortality rates for the different sea turtle species both within and between Australian prawn trawl fisheries (Poiner and Harris, 1996; Robins, 1995).

1(d) Is it possible to differentiate between shrimp trawl and other fishing gear in terms of the threat they represent to marine turtles? Are there regional differences in this respect?

Dr. S. Eckert:

5.119. By far the most serious threat to sea turtle stocks living in coastal environments are trawl fisheries. Trawling is particularly serious in that there seems to be a cumulative effect of capture stress. As a trawl net approaches a turtle's response is to flee directly away from the net (Ogren et. al., 1977). Observers suggest that the "doors" which hold the nets open act as "blinders" and they keep the turtle from veering away. Thus, the turtles swim directly in advance of the net until they are exhausted and are overtaken (Ogren et. al., 1977). While most species of turtles are capable of long term submergence in excess of 1 hour (the notable exception to this is the leatherback who routinely only makes 12-15 minutes dives (Eckert et. al., 1996), the exhaustion and depletion of oxygen stores during "the chase" renders them highly susceptible to asphyxiation. Even if the turtle escapes it may be physiologically stressed and subsequent captures may kill the animal (Stabenau, 1991). Another problem for turtles in areas that are bottom trawled is that such fishing methods degrade the habitats many species of turtle rely on as foraging areas (Dayton et. al., 1995). If seagrases are present, such fisheries uproot the sea grass and destroy the area for green turtle foraging or habitat for mollusca and crustaceans relied upon by loggerhead or the ridley species. Further, the constant perturbation may reduce the quantity of prey species that neritic carnivores, such as loggerhead and ridley turtles, rely on for food.

5.120. A close second to trawl fisheries in terms of potential to harm sea turtle populations are gillnet fisheries. Gillnets are very effective at drowning turtles in large numbers. While high-seas driftnets are banned by international agreement (primarily due to the massive bycatch problems caused by this fishery), coastal gillnets are still in use in many places. This type of fishery has probably been the primary cause of the recent decline in the Pacific leatherback population (Eckert and Sarti, 1997). Unlike trawling, there is no known solution to the incidental turtle bycatch problem with gillnets.

5.121. Longline fisheries are not entirely as destructive to turtles as the previous fishery style; however, they do have a large bycatch of turtles, and it is the largest growing fishing method in the world. The reason it may not be quite as destructive is that the drowning rate (=acute mortality) is lower for this type of fishery. However, there is data suggesting that post release mortality is substantial. (Balazs and Pooley, 1994, Aguilar et. al., 1992, 1993, Dayton et. al., 1995). Purse seine fishing does catch turtles, but the mortality rate of such fisheries is negligible for turtles (S. Eckert, unpub data).

Dr. J. Frazier:

5.122. The characteristics of the gear - where, when and how it is used - will determine the organisms that are likely to be impacted by it. For example, gear that is used in coastal waters will affect the turtles when they are in coastal waters; gear that is used on the high seas will affect the turtles when they are in the open sea. Many types of modern fishing activities are known to have deleterious effects on a wide variety of marine organisms, including sea turtles. Modern fishing techniques, such as, drift nets, long lines and trawls are responsible for incidental catch and mortality. Because of its nature, bottom trawling is known to cause major impacts on non-target species because it is an unselective method of fishing (Norse, 1997a). Shrimp trawls are notoriously unselective, and on a world level it has been estimated that they are responsible for more than a third of all bycatch (Alverson et. al., 1994). Hence, shrimp trawls not only catch and drown turtles, but they are responsible for an extraordinary amount of bycatch and discards in world fisheries: it is estimated that approximately 10 million tons of bycatch result from shrimp trawling. This level of environmental perturbation carries with it many other risks, both ecologically and socially. In the end, any of these gear used where there is a likelihood of incidentally capturing turtles poses a threat to the animals, and when a population is at risk all of these sources of mortality must be drastically reduced.

5.123. Since individual marine turtles migrate and disperse over vast distances, they are vulnerable to incidental capture in many different regions. The environmental and social impacts of shrimp trawls are most acute in the tropics (Alverson et. al., 1994) where the intensity of trawling is high, bycatch ratios are high, human populations are high, human food needs are high, dependency on fish is high, proportion of trawled catch which is exported is high, and local availability to traditional fisheries resources is declining. For this reason, there have been calls, nationally and internationally, to ban this form of exploitation of common marine resources (O'Riordan, 1994; SAMUDRA, 1994).

Mr. M. Guinea:

5.124. Few quantitative data are available on the numbers of sea turtles caught in fish trawls, set nets (Chan et. al., 1987), long lines and driftnets (Eckert and Sarti, 1997). Sea turtle mortality in shrimp trawls increases with trawl duration (Poiner et. al., 1990). Short tows of less than 60 minutes pose little threat to sea turtles. Trawls lasting longer than 60 minutes have a proportionally greater influence on sea turtle mortality. Set nets may be set for any length of time. This depends on the target species. Nets set for shark products may be checked only once a day. Others may be set for several hours to coincide with a tidal stream. A single bottom-set, large-mesh, gill-net killed in excess of three hundred turtles in four days of netting in Northern Australia (Guinea and Chatto, 1992). This was approximately equal to the expected annual mortality of sea turtles in the entire Australian Northern Prawn (Shrimp) Fleet which trawls along more than 10,000 km of coastline each season (Poiner et. al., 1990).

5.125. There will be regional differences between shrimp trawl and other fishing gear in terms of the threat they represent to sea turtles depending on the species of sea turtle present and the nature of the nets being used (see paragraph 5.124).

Mr. H.-C. Liew:

5.126. Sea turtles are threatened by numerous fishing methods ranging from hook and lines, drift or gill nets, purse seines, trawlers, fish traps, fish bombing, etc. How much of a threat are they depends on whether the fishing activity occurs during the period and in

regions where significant numbers of turtles occur, e.g. feeding and nesting grounds, migration routes. It also depends on whether the gear or methods cause severe injury or entangle the turtle, resulting in drowning. The differing habits of the different species during feeding, resting, swimming, etc, can also influence the threats by different gears. For example, leatherback turtles are known to feed primarily on jellyfish in the pelagic zone of deep oceans. They would be less likely to be caught by shrimp trawling but are more susceptible to high seas gill-nets and longlines.

Dr. I. Poiner:

5.127. Since there is no quantitative data on the mortality from other fishing gear on sea turtles, it is not possible to make this assessment. However, given the variation in the type and size of the different bottom trawl and other fisheries around the globe there is likely to be significant regional differences in this respect.

Question 2: Conservation measures

2(a) Since most countries regulate the direct exploitation of sea turtles and sea turtle products (quotas and/or prohibitions on egg harvests and sea turtle catch, for instance), can one consider that such direct exploitation no longer represents a threat to sea turtle populations? What is the impact of these regulatory measures on sea turtle conservation efforts? Are you aware of any country where such regulatory measures are in place, but where sea turtles and their products are nevertheless still excessively exploited?

Dr. S. Eckert:

5.128. Direct exploitation is still a serious problem for turtles in the countries involved in this dispute. In the United States the problem is highly reduced, but the taking of eggs, killing of nesting females and in a few cases netting of foraging turtles still take place. Most of such illegal take is limited to US territories in the Western Pacific (American Samoa, Guam, the Northern Marianas Islands) and the Caribbean (Puerto Rico, US Virgin Islands) (NMFS and USFWS, 1996a-f, pers. obs.). Sometimes such illegal take is by foreign fishing vessels that stop at uninhabited islands and atolls within US jurisdiction (NMFS and USFWS, 1996a-f). Generally, however, direct harvest is a minor problem in the US when compared to other countries.

5.129. In Malaysia, it is clear that illegal egg harvest continues at a level which threatens sea turtle populations (Eckert, 1993). In Thailand, both the illegal taking of eggs and the killing of nesting females and foraging turtles continues (Hill, 1991, 1992; Chantrapornsyl, 1997). In India, the direct harvest of eggs and meat is apparently still a problem. I have no information on sea turtle threats in Pakistan. Thailand, Malaysia, India, and the United States (and likely Pakistan) have regulations in place to protect sea turtles and their habitats, yet these stock are still stressed by anthropogenic sources; thus it is clear that lack of wildlife law enforcement is a problem. It is generally clear that more resources need to be applied to protecting turtles than is currently being done in all countries.

Dr. J. Frazier:

5.130. To put this question in context, it is useful to reflect on the contemporary situation regarding hallucinogenic drugs, such as cocaine, crack, hashish, marijuana, and opium, to name just a few. In theory, most modern states have strict controls on the import, export,

sale and consumption of some, if not all of these drugs. Nonetheless, illegal commerce in these items is probably higher now than it has ever been in the history of the planet. Man-made laws do not necessarily result in a significant modification of the human activities that they are meant to regulate. If drug trafficking cannot be controlled - despite the fact that it is an international priority, there is little chance that the illegal use of sea turtles and their products will be controlled.

5.131. Depending on the place and situation, direct exploitation of sea turtles (legal or illegal) may or may not represent a major risk to the survival of the populations. Little systematic information seems to be available from Thailand, but what is known indicates that direct exploitation on eggs and turtles has resulted in major declines, and that the practice continues. Since these populations are evidently badly decimated, any source of mortality - especially concentrated on animals that are breeding or near breeding - will reduce the chances of population recovery.

5.132. Up until recently, there has been sustained direct exploitation on most nesting populations in both East and West Malaysia. However, recently enacted, strict regulations for fuller protection are reported to have stopped, or greatly reduced direct exploitation. Depending on how effectively the regulations are observed and enforced, specific populations may or may not be under continued risk from direct exploitation. In Pakistan, there is very little information from the remote Province of Baluchistan, but what is available indicates that direct exploitation - especially on breeders - has been, and continues to be, a major risk to these populations. There is apparently no significant direct exploitation in Sind. Strict laws and regulations may be observed in some parts of India, but there are continuing accounts of heavy predation on turtles at sea, off the coast of Gahirmatha, Orissa (Pandav et. al., 1997). Egg harvesting surely also continues, along vast stretches of remote beach. However, there are no quantitative data. Illegal exploitation of turtle eggs may occur occasionally in the southeast of the continental United States, but it is thought to be minimal (National Research Council, 1990). Persistent exploitation (illegal) on turtles and eggs apparently continues in some Pacific islands, and the populations may be so small in some cases that this mortality may be a major risk (Eckert, 1993).

5.133. Since conservation involves the integration of biological information with social and political actions, impacts important to conservation can (and must) be evaluated in the organisms involved (in the present case, sea turtles) as well as in the societies that interact with these organisms and/or the environments in which they live. Hence, impacts of regulatory measures must be evaluated in different ways. Public awareness of the plight of marine turtles often increases because of regulatory measures; from personal experience, I know that this is the case in India, Malaysia, Pakistan and the United States (I have never been to Thailand). Clearly, actual protection of turtles or their habitats has also been achieved by regulatory measures. Protection of nesting beaches and nesting turtles has been facilitated by these means in each of these countries. In the United States, stiff fines for poaching sea turtles have been published in the newspapers, and are likely to have dissuaded would-be poachers. Reglamentation for the use of TEDs on the Atlantic coast of the United States, where forward looking state governments took the initiative before the federal government, have resulted in reducing mortality of turtles in shrimp trawls (Crowder et. al., 1995).

5.134. There is probably not a country in the world where despite the existence of national (or indeed regional and/or international) regulatory measures, there is not an active trade in some parts or products of sea turtles. What is open to debate is the phrase "still excessively exploited"; by definition illegal activities are difficult to trace and document. Bearing this limitation in mind, according to the best information available, it is thought that excessive

exploitation may be occurring with ridley turtles off Gahirmatha and West Bengal (Silas et. al., 1983b; Pandav et. al., 1997); green turtles in Baluchistan (Groombridge, 1989); green and ridley turtles in Thailand (Supot, in press); and green and hawksbill turtles in South Pacific Islands under US jurisdiction (Eckert, 1993).

Mr. M. Guinea:

5.135. Direct exploitation of sea turtles, their eggs and their products continues to be a threat to sea turtle populations. In spite of excellent legislation some countries have problems with the enforcement of their laws in relation to wildlife. Wildlife law infringements may be perceived as less important when compared with crimes against persons or property. Laws that cannot be enforced are an impediment to genuine progress in wildlife conservation.

5.136. Legislation prohibiting the direct exploitation of sea turtles are essential for establishing a base from which prosecutions can proceed.

5.137. Enforcement of legislation is a problem in all countries. There will be cases of non-compliance with every conservation measure. I am unaware of any first hand knowledge of where sea turtle quotas have been flouted.

Mr. H.-C. Liew:

5.138. In some countries, especially the developing countries, direct exploitation are still very much a threat to sea turtle populations. For example, egg harvest is still significant in Southeast Asia due to insufficient quotas, poaching, poor enforcement and management problems. There may be hatcheries that practice very good conservation but neighbouring islands or countries that share the same population of turtles may not. In a recent paper, Limpus (1997) showed that excessive egg harvests are still serious threats while the total green turtle kills in Bali approached 30,000 annually in recent years. The impact of such large kills would overshadow the impact caused by shrimp trawling.

5.139. Table 1 below summarises Limpus's findings. In this table, there was no indication of fisheries bycatch mortality for green turtles, hawksbill turtles, olive ridleys and leatherbacks. It may be insignificant compared to the other causes or no information is available. However, shrimp or prawn trawling in Australia was indicated as a major threat to the loggerhead and flatback turtle populations. All the countries listed in Table 1 have turtle conservation programmes and regulatory measures but most are still experiencing declining trends in their turtle populations. Similar situations exist in many other countries in Latin America, Africa and Asia.

Table 1:Critical regional problems that must be addressed if conservation of Indo-Pacific marine turtles in Southeast Asia and the Western Pacific is to be achieved. (Taken from Limpus, 1997).

Species	Excessive egg harvests	Excessive turtle harvests (all continuing)	Predation of eggs	Fisheries bycatch mortality
Chelonia mydas	Malaysia Terengganu Sarawak Sabah (past) Philippines Indonesia	Indonesia Bali + other Market Papua New Guinea Daru + other coastal Solomon Islands Coastal villages	Indonesia Irian Jaya (pigs)	

Species	Excessive egg harvests	Excessive turtle harvests (all continuing)	Predation of eggs	Fisheries bycatch mortality
	Continuing at multiple sites	Fiji Coastal villages Australia Indigenous, Torres		
Caretta caretta			Australia SE Queensland (foxes)	Australia (trawling & crabbing)
Eretmochelys imbricata	Malaysia Terengganu Malacca (cont'd) Johor (cont'd) Thailand West coast Indonesia (cont'd) Solomon islands (cont'd) Australia (indigenous, cont'd)	Fiji		
Lepidochelys olivacea	Malaysia Terengganu			
Dermochelys coriacea	Malaysia Terengganu (past) Thailand West coast Indonesia Irian Jaya Papua New Guinea Northern (cont'd)	Indonesia Kei	Indonesia Irian Jaya (pigs)	
Natator depressus	Australia (indigenous, cont'd)	Australia (indigenous)	Australia Cape York Peninsula (pigs)	Australia Northern Eastern Indonesia Irian Jaya

Dr. I. Poiner:

5.140. All sea turtle populations in the Indo Pacific region including southeast Asia, are severely depleted and/or are subjected to over-harvest (legal and illegal) and/or excessive incidental mortality. Some countries (e.g., Malaysia and Thailand) have instigated management measures to prohibit or control egg and sea turtle harvests but there is no evidence of recovery of these populations (Limpus, 1997). The current Indonesian meat and egg harvest (legal and illegal) is likely to be unsustainable despite a variety of conservation management measures introduced by the Indonesian government (Monanunsap, 1997; Limpus, 1997).

5.141. Local/regional approaches to management are unlikely to be successful since sea turtle breeding stocks usually comprise multiple rookeries within a region while foraging areas and developmental habitats comprise a mix of turtles from several genetically distinct stocks (Bowen et. al., 1995; Broderick et. al., 1994). The breeding adults usually migrate relatively long distances from the foraging areas to the traditional breeding rookeries. For

example, the Australian nesting populations of loggerhead sea turtles are genetically distinct from those in other countries and within Australia there are two genetically independent breeding populations. Breeding females migrate up to 2,600 km from feeding areas to aggregate at traditional nesting beaches (breeding males have not been studied). In Eastern Australia, females migrate from northern and eastern Australia, Indonesia, Papua New Guinea, Solomon Islands and New Caledonia. In Western Australia, recorded migrants come from Northern and Western Australia and Indonesia. Mean remigration period is 3.8yr. At the completion of the breeding season the female returns to the same feeding site as she occupied before the breeding migration.

2(b) Could you comment on how the socio-economic factors prevailing in the five countries involved in this dispute (e.g. history of direct exploitation of sea turtles and sea turtles products, practices and techniques of the fishing industry) interact with sea turtle conservation requirements? Do these factors influence the choice and enforcement of conservation programmes?

Dr. S. Eckert:

5.142. Probably the greatest effect of socio-economic that I am aware of is on enforcement of environmental regulations and on amount of information gathered on the fisheries themselves. Countries with less financial resources seem unable or unwilling to expend these limited resources on wildlife law enforcement. A similar situation exists for the monitoring of fishery efficiency. There are seldom the financial resources or personnel to monitor fisheries, or fish resources. Thus, resource managers seldom understand the resource they are assigned to manage or what factors may be impacting this resource.

5.143. Socio-economic can also play a role in how various shrimp fisheries treat bycatch. It has been my experience that in the US bycatch is regularly discarded in favour of keeping only the target species (shrimp) as the market for bycatch product is limited. The only bycatch utilized is taken home by the fisherman for their own use. In other countries, bycatch seems to be utilized more often for both personal and commercial use. I do not have quantified data for this impression as it is just based on personal experience after having worked in a number of third world countries. One note about this bycatch. In studies of bycatch by shrimp trawling it has been found that such bycatch is often made up of undersized commercially viable species. If these species were left to grow to commercial size, the resulting economic gain can be significant (Amelang, 1994, Dayton et. al., 1995). Limiting (or eliminating) bycatch by shrimp fisheries, whether that bycatch has immediate commercial value or not, is probably a better strategy for long term resource management.

5.144. Relative to how socio-economic might affect the application of TEDs as a conservation tool, I see very little reason to suspect that there would be an effect. Except for the possible impact of reducing commercially utilized bycatch, TEDs should not change the economics of a shrimp fishery. TEDs are incredibly simple devices to construct from local materials, require little special skills above what is already in use by shrimp fisherman and plans for their construction are available (e.g. Mitchell et. al., 1995). Considering the costs of fuel, nets and other required equipment for such a fishery, it is doubtful that TEDs would add significantly to the cost of fishing and may actually be advantageous (Easley, 1982). Further, my limited experience working on shrimp boats suggests that deploying and operating these devices take very little special skills or handling. It must be remembered that the first TEDs were developed and used by shrimp fisherman as a way to reduce fouling and bycatch problems, long before sea turtles were of concern.

Dr. J. Frazier:

5.145. Conservation activities, for sea turtles or any other biological resource, must be seen within a matrix of social and political interactions. Biological conservation is not exclusively a sub-discipline of biology, but rather an activity with clear political dimensions (as clearly illustrated by the present dispute). In this respect, it must be understood that issues of biological conservation and human rights are intricately intertwined, and that without resolving one, meaningful advancements with the other are not possible (Frazier, 1997b). Clearly, nutritional rights, or food security, is a fundamental component of human rights, and as long as large sectors of modern nation states persist in a state of malnutrition and hunger, human rights abuses will continue. In this circumstance, true conservation of biological resources will be an illusive dream. Hence, with or without TEDs, with or without integrated sea turtle conservation plans, there will be no lasting conservation of sea turtles on this planet while the majority of humanity slides ever deeper into poverty and finds ever fewer alternatives for survival. While this problem is worldwide, and present in all modern nation states, it is most intense in the "Third World". It is therefore fundamental to understand how modern fisheries practices have developed and how they relate to the question of food security and human rights.

5.146. Mathew (1990) provided a brief evaluation of the fishing industry in five different Asian countries, making comparisons between historic, social and legal aspects. In his description of the situation in Malaysia, he drew from various in-country studies (e.g., Gibbons, 1976). He described how the introduction of trawling resulted very quickly in violent conflicts, including physical attacks, the burning of trawlers, and murder of fishermen. The small-scale fishers charged that trawlers destroyed their gear and would deplete their fishing grounds. This was unlike the situation in most other countries in the region, where it took several years for conflicts to manifest themselves. After a study, the Government of Malaysia established zoning regulations to keep the trawlers out of the coastal areas; ahead of many other countries, the government introduced legislation to eliminate conflict. Yet, it was reported that enforcement was inadequate, and social conflict - fueled by ethnic divisions - became very violent and bloody. In the end, countless full-time, traditional fishermen lost control of, and access to, their traditional fisheries resources. The fishing sector was restructured from autonomous full-time fishers to capital-intensive enterprises. Although these organizations were called "co-operatives", the authors observed that "they are 'cartels' of local political and economic elites". with little if any active participation of fishermen in management. Evidently, the people who depended directly on the resources being exploited were excluded from the major decision-making process.

5.147. The authors explain that although (as is the case everywhere) scientific information necessary to plan or manage properly is inadequate: "Malaysia is the first developing country to attempt seriously to limit fishing effort in response to indications of overfishing". Yet, while in theory the zoning regulations drawn up by Government make good sense, diverse sources cited in Mathew (1990) - including the Head of the Legislation Department - have highlighted the inadequacies of enforcement and the lack of trawler's respect for the zones (e.g., only 9 per cent of respondents answered that the ban of trawlers within 5 miles of shore is effective). The authors indicate that, like in most other countries in the world where fisheries have been "modernized" and markets "liberalized", the activity is controlled by the elite hegemony, resulting in a socio-political situation in which the full-time, traditional fishers would be the last to benefit from "modernization" and the liberalization of market forces.

5.148. For Thailand, Mathew (1990) describes how the well-intentioned, and generally well-conceived fisheries management plans of the government were foiled by political clout from an industry that is export oriented (and provides a major share of the country's foreign exchange earnings). He explains that Government has been unable to implement critical management measures: "the state has a tendency to swap foreign exchange for long-term sustenance of the fishery". In the end, the trawler owners basically do as they like, even scuttling plans to close entry to the fishery, a measure which is widely recognized as being urgently needed. The fleet provides a classic example of an overcapitalized venture, and because of the degree of overfishing, the Gulf of Thailand is often characterized as an "underwater desert", even by local establishments.

5.149. While there were no immediate, violent conflicts with the introduction of trawling in Thailand, as occurred in neighbouring nations where small-scale fishers depend strongly on fisheries resources, violent clashes with trawlers did eventually occur. Mathew (1990) suggests that the relatively few social problems related to impacts of trawling was largely due to two major factors. Firstly, he suggests that Thais may be "more tolerant of injustice", than are some other people. Secondly, there was no well established, or well organized, sector of society that had traditionally depended on marine fisheries. Hence, according to Mathew (1990), the affected groups were not sufficiently organized and animated to resist incursions of the trawlers.

5.150. Yamamoto (1994) provided a later synthesis of the fisheries situation in Thailand, giving a much more critical view of the social and environmental effects of trawling. He reported that nearly 90 per cent of the "fishery establishments", were "households" which worked in the coastal fishery, as compared to the remainder which were enterprises, focused on offshore and distant water fisheries. He observed that "since its inception, the Thai trawl fishery has come into conflict with coastal fishery, as it tends to operate in the coastal waters". With the rapid growth of the trawler fleet, some of which operated without permits, demersal resources were overexploited. The coastal fishers experienced declining resources, conflicts and lowered standard of living. In order to resolve this, he proposed a new law that would, inter alia assign clear access to resources, and "discourage the continued operation of trawl fishery...".

5.151. In the case of India, Debnath (1994) has described the situation regarding the fishworkers, some 7,000,000 people who live by artisanal fisheries. He clearly describes how the "development" and mechanization of fisheries has left the vast majority of these people actually worse off than they were before "development". Social conditions related to equity, gender, job stability and security, are worse than before, while many basic fisheries resources are over-exploited, making traditional food sources inaccessible and insufficient for this enormous number of people. The ever-present problems between industrialized/mechanized fisheries and artisanal fisheries were explained: the artisanal fishers have not just lost access to their resource base, but through a process of "modernization" have been subjected to violence. Of the imported technologies which are responsible for these dire social and environmental problems, bottom trawling was singled out as one of the most prominent causes (see also Norse, 1997a).

5.152. This process of modernization and consequent loss of access to resources by a large segment of the fishing community has been abundantly documented in the studies of social scientists. What is remarkable is that although these scientists are trained to evaluate the functioning of human social systems and human interactions, their opinions and participation are routinely absent from discussions about fisheries development and resource management. The writings of Professor Conner Bailey (e.g., 1985: 1986; 1988a;

1988b; 1988c; 1988d; 1989; Bailey and Zerner, 1988; Bailey and Jentoft, 1990; Bailey et al., 1986) provide in-depth analyses, drawing mainly from South East Asia, with central relevance to the shrimp/prawn and trawling industries. He has shown, in case after case, how fisheries development activities that focus on gross productivity and income generation have resulted in increasing social and economic polarization, which produce grievous social degradation, stress and disorder, exacerbating problems of poverty. This is to say nothing of the gross depletion of marine resources on which millions of people have depended for generations, resources no longer available or adequate for feeding their families or for sustaining their participation in local, national or regional markets. These people are not just passive bystanders to change and development. Since at least the 1940's, coastal fishing communities have participated in material modernization processes in Southeast Asia. The sale of fresh and preserved fish, shellfish and other marine products has provided cash incomes for other consumer goods, including investments in modernization of boats and equipment (Frith, 1946; Fraser, 1960).

5.153. Bailey's analyses have shown that development initiatives, fueled by foreign aid from diverse sources, are commonly linked also to foreign investments and interests. Of those technologies introduced into the Third World in an effort to increase fisheries productivity, the bottom (or otter board) trawl is a prime example, and because of the extraordinarily export value of shrimp\prawn products, shrimp trawling provides some of the clearest examples of these unpredicted (and often unspoken) environmental and social consequences to development. Taken together, the usual result of these events is that the traditional resource base of a powerless majority is expropriated by a powerful minority, routinely with extra-national interests. In Bailey's words: "Emerson (1980:20) noted that, in the context of fisheries development, 'free-market forces may only reinforce absolute poverty and structural inequality in the name of economic efficiency...' ". "But it became obvious that producing evidence of resource depletion was not the same thing as mobilizing political will to restrict the operations of wealthy and politically well connected entrepreneurs." (Bailey, 1988d:41). As Bailey et. al. (1986:1270) explain: "In the context of an open access resource, the result of this process is a de facto reallocation of access favoring the minority which limits the ability of the majority to earn adequate incomes from traditional pursuits". "By promoting the use of highly productive technologies without simultaneously strengthening institutional capacities to manage and allocate finite resources among competing users, international development assistance agencies are contributing to structural problems and policy distortions which pose serious threats to the majority of those employed in the fisheries sector".

5.154. The studies of Professor George Kent (e.g., Kent, 1980; 1983; 1984; 1985; 1986; 1987; 1989; 1994) provide an additional lens for evaluating the socio-economic underpinnings of fisheries development, characterized by export-oriented shrimp fisheries. For years, and in diverse fora, he has shown that pledge of feeding the Third World, equity and social justice has not been met by increased fisheries production. There are several reasons for this. Much of what is caught is wasted: Alverson et. al. (1994) estimated that more than 27 million metric tons of bycatch are dumped back into the sea, most of it dead or mauled. Furthermore, more than a third of what is caught and landed is not for direct human use, but processed for fertilizer, livestock feeds, etc. (i.e., a third of the landed catch, instead of being used for feeding people, is destined for more round-about routes to producing food, directed by processes of income generation). In summary, this is an industry that is characterized for being grossly overcapitalized, with a distribution of resources heavily biased toward the industrialized countries: fish is caught in the Third World, where there are intense problems of malnutrition and protein need, and exported to the richer nations, where there is an excess of food. Kent (1994) shows that there is a clear inverse relationship between dependence on fish as a basic food and income level. At the same time, there are

clear cases of countries, for example Bangladesh, where despite a traditional dependency on fish for food, and burgeoning human populations, annual exports of fish increase, while available fish for national consumption decreases (Kent, 1994). Recent affairs in Thailand serve as another clear example: in 1996 it was the world's largest exporter of both rice and farmed shrimp, yet the cost of food increased more than that of housing or clothing (from a 1990 base of 100, food had risen to 132 by 1995) (Europa, 1997:3191-3195), this is for a 1995 population with a GNP of US$2,800 *per capita* (World Bank, 1997:9).

5.155. As Kent states: "Fish, like other food products entering the market system, tends to flow toward the rich simply because the rich can outbid the poor." (Kent, 1980:7); "Thus, fish continue to migrate after they are caught. They tend to move from the more needy to the less needy." (Kent, 1983:13). "The fish and other food which moves in international trade is only a small share of the total amount of food produced and consumed. But the pattern of the poor feeding the rich is found within as well as among nations. The thesis that the poor feed the rich is not only about international relations; it is about social structures based on the market system wherever they occur. This regular flow of food toward the top, within countries as well as among countries, helps to account for the chronic undernutrition at the bottom." (Kent, 1985:288). "Often there is some compensation for increasing exports by the increasing imports of food. Typically, however, the foreign exchange earned from the export of food is not devoted to purchasing low cost nutritive foods for the needy, but is diverted to the purchase of luxury foods and other products in demand by local elites." (Kent, 1985:289). In addition to negative effects on that part of society that is most at risk, there are also deleterious effects on the fishery: "When people fish for their own food there is such a thing as sufficiency. In the commercial orientation, however, when people fish for profit, there is no such thing as enough. As one observer put it, 'technology makes overfishing possible, but profits provide the incentive'". (Kent, 1986:138).

5.156. Kent (1987) provides an evaluation of fish and nutrition in India, and the statistics that he presents are remarkable. Although India is one of the top fish producing nations in the world, it is has one of the lowest rates of per capita consumption. Religious and food preferences do not provide a simple explanation for this anomaly, because many people in coastal states have the habit of consuming fish. Over the last few decades, there have been outstanding increases in fisheries production as well as exports. At the same time, the cost of fish for Indians has skyrocketed, especially in comparison to other food articles, and other commodities. Hence, major increases in fisheries production are not helping to feed nationals.

5.157. Explaining fisheries production in Thailand, Kent (1984:7) described the same phenomenon. He wrote: "High export levels, low import levels, declining overall production, increasing trashfish production and increasing [human] population have combined to reduce available per caput fish supplies". "The Philippines and Thailand have well developed fisheries. At the same time there is widespread protein-energy malnutrition, vitamin A deficiency, iron deficiency, and iodine deficiency in these countries. Fisheries products can be used to respond to these problems." (Kent, 1984:25). Yet, there is overwhelming evidence that shows that increased fishing effort - notably for shrimp - is to fuel "increasing needs for exports" (Tuoc, 1995), not to feed local populations.

5.158. A number of writers have explained that fishing is a way of life and resource base for millions of small scale fishers; the fate of these people is germane to any discussion of fisheries, and marine conservation for many reasons. To start with, small scale fishers comprise about 90 per cent of all those employed in the fishing sector; furthermore, they produce a third of the world's food fish, and the bulk of all fisheries products consumed in

the Third World derive from small-scale fishers (Ben-Yami in: Bailey et al., 1986). Yet, these millions of people have little if any political clout and few economic resources; they are at the mercy of development activities, run by national and international elites.

5.159. These evaluations of the social impacts of modern fisheries are not new, nor are they ensconced in hard-to-find academic literature. Social scientists have been writing about this serious problem for decades. Recent publications in the non-academic press also have described these issues in great detail. Two excellent sources of recent information on the contemporary state of fisheries, highly readable and thoroughly documented are Professor James R. McGoodwin's book *Crisis in World's Fisheries: People, Problems, and Politics* (1990) and a special issue of the *Ecologist*, edited by Simon Fairly (1995) and containing a dozen major and minor articles describing the intricacies of modern fisheries. In addition, O'Riordan (1994) reviewed the crux of modern fisheries in the widely read weekly, *New Scientist*. Finally, Dr. Daniel Pauly - dean of southeast Asian fisheries biology - has been elucidating these points for more than a decade (e.g., Pauly, 1988; 1995; Pauly and Neal, 1985; Pauly and Chua, 1988).

5.160. What is more, the same general conclusions were arrived at recently at a regional meeting on Coastal and Marine Biological Diversity, held at Subic Bay, Philippines from 24-25 October, 1996; at least three of the countries involved in the present dispute were represented: Malaysia, Thailand and US (DENR and WRI, 1997). The first Key Issue identified as needing to be regulated was: "Excessive levels of fishing effort - both commercial and artisanal - and the use of destructive fishing gears and methods. One of the key points which was detailed in this synthesis was: "Protection of CBCRM (Community-Based Coastal Resources Management) areas from external predators that local communities are unable to fend off on their own - such as *commercial trawlers*, cyanide fishing operators, and coastal developers." (p. 5, emphasis added). It is noteworthy that in this regional report, commercial trawlers were identified alongside cyanide fishers. The report goes on to state that: "Artisan fishermen constitute one of the poorest social sectors in the region and are highly dependent on fish for protein and cash income, but are exploited by middlemen and squeezed by commercial vessels operating in nearshore waters." (pp. 6-7). "Livelihoods of artisan fishermen throughout the region are increasingly threatened by competition with commercial vessels fishing in nearshore waters - despite the many laws reserving these waters for local fishermen." (p. 7). "Subsidies for development of commercial fisheries have in many cases led to over-capacity - and thus to overfishing." (p. 7).

5.161. It is also important to point out that the United Nations Research Institute for Social Development has clearly described the social and political risks involved in globalization, and the form of development characterized by modern fisheries (e.g., Utting, 1995). *See also Annex I: The Issue of Bycatch in Modern Fisheries, with Special Reference to Shrimp Trawls.*

5.162. In summary, the good intentions of development programmes for the modernization (= mechanization and technification) of Third World fisheries, as a rule have not taken into account fundamental social factors, especially the distribution and availability of food for those sectors of the population that are at risk. The people who are in a position to benefit from development initiatives are those who have access to capital and political power. For example, it is normal for those people who already have substantial financial resources to influence the creation of, and then gain access to (if not monopolize), government subsidies, while those who lack such financial resources are unable to obtain the subsidies, which purportedly were created for them. Those who do not enjoy economic and political advantages, are by definition the majority - in developing countries, they are the vast majority of citizens and producers. Yet, under these sorts of development schemes, this

majority is unable to compete for limited fisheries resources, even though they may have a longer term dependence and interrelationship with them than do those who take advantage of the new technology. The end result is typically an increase in productivity with concomitant decreases in equity of income and wealth, as well as increasing social polarization: greater excesses in wealth for the elite and deeper depression of poverty for the masses. Analysis of civil conflicts in South East Asia have repeatedly referred to this process of social polarization as a primary contributing factor to unrest (Phillips, 1965; Nakahara and Witton, 1971; Milne and Mauzy, 1986; Europa, 1997). Thus, an ever-widening gap between an elite minority and an impoverished majority can lead to intense civil disorder and strife - even open warfare. This is hardly an environment in which effective conservation and resource management can be implemented.

5.163. As pointed out earlier in this section, resource conservation (for sea turtles in this case) will not be effective without considering - and resolving - basic social problems. If traditional sources of livelihood are taken away, people are likely to resort to the simplest alternatives available, despite laws and conservation plans. When the less powerful sectors of society perceive growing social inequity, it only exacerbates the lack of compliance with state regulations, and the greater the social polarization, the greater the chances of conflict and anarchy. Civil strife and lawlessness are by no means absent from industrialized societies (Kaplan, 1994). Indeed, there is a long and bellicose history of conflict in the specific case of the US shrimp fishery, notably in the Gulf of Mexico (Weber et. al., 1995; Tucker et. al., 1997). At one level, the reasons for conflict may appear distinct from those of the "Third World", simply because degrees of socio-economic development are so different. However, in the end, the root causes are comparable, for they have to do with struggles for access to and control of both resources and political power.

5.164. Hence, socio-economic factors do influence the choice and enforcement of conservation programmes.

Mr. M. Guinea:

5.165. In countries such a India, Pakistan, Thailand and Malaysia, the so-called bycatch, in US terms, is a commodity with either a subsistence or retail value. The entire catch has a value. Sea turtles do not have a commodity value in the shrimp trawls and are released according to cultural or religious beliefs. India, Pakistan and Malaysia have indicated that because of these religious beliefs, sea turtles are not killed, but only their eggs are eaten. As these countries are multiracial, "outsiders" are implicated in the direct mortality of sea turtles. The sea turtle research unit in Malaysia is educating people about the presence of a living embryo in each sea turtle egg. This may prove effective in reducing the consumption of sea turtle eggs in that country. Other countries may follow this example, as few convincing arguments had been provided to dissuade people from eating turtle eggs.

5.166. Conservation programmes should emanate from within a country so that implications on cultural, economic and social issues can be addressed at the same time. Reasons for such general conservation measures may have their origins elsewhere but the conservation programmes should have a national focus and flavour.

Mr. H.-C- Liew:

5.167. In a developed country like the United States, the level of education is higher, there is extensive mass media communication, cheap protein available, and people are more aware of their environment and the need for conservation. They could also afford to have

strict conservation management policies and effective enforcement. Turtle meat producing farms that used to operate in the Cayman Islands have stopped operations and all turtle eggs are saved and protected for hatching. Hence, turtle mortalities caused by egg harvesting or killing for meat is well under control and no longer an issue in turtle conservation. These causes of mortality being removed, turtle conservationists in the United States could concentrate their efforts on other more apparent causes of mortalities, like incidental capture in shrimp trawls.

5.168. In developing countries like India, Pakistan, Malaysia, and Thailand, conservation management practices and their enforcement may not share the same effectiveness. Turtle eggs are still eaten, either through legalized harvesting or poached due to poor enforcement or poverty. Their turtles are still being slaughtered for meat in some of these countries or by neighbouring countries. Thousands of green turtles are still being slaughtered in Bali each year to sustain a cultural practice there. Fishing technologies like shrimp trawling may not be as developed or still artisanal to be of prime impact on turtle populations. They may even be using other fishing methods which may have a greater impact on sea turtles than shrimp trawling, like the ray-net or "pukat pari" in Malaysia. Some Asian cultures believe that the act of releasing turtles into the sea will bring good luck and longevity. As such, thousands of hatchlings are not released immediately to the sea on hatching but kept in enclosures for days or even months for release by the public. All these factors do influence the way conservation programmes are run and can differ from country to country.

Dr. I. Poiner:

5.169. I am not qualified to comment.

2(c) What are the sea turtle conservation measures that should be implemented on a priority basis? Are those the same for all sea turtle populations and all countries concerned, or do they differ among countries and regions, and species or populations of sea turtles?

Dr. S. Eckert:

5.170. While it is difficult to speak to socio-economic aspects of the fishing industry in the countries involved in the dispute, there are some ideas I can put forward relative to sea turtles and sea turtle conservation and economics. By far the best and most economical approach to conserving sea turtle populations is to eliminate the problems that caused sea turtle populations to decline in the first place (Frazer, 1992). Sea turtle populations have incredible resilience and ability to restore themselves once the anthropogenic perturbations have been removed. With the generally plastic reproductive capacities (faster growth in times of good food abundance = shorter maturity times and possibly higher reproductive output) of reptiles, turtle populations probably have the capacity for rapid growth and for sustaining very large population sizes, once they are left alone.

5.171. The most commonly utilized conservation method to restore sea turtle populations is to enhance reproductive output. Generally this means protecting reproductive females on the beach and during interesting intervals in the water (which Malaysia is doing very effectively for leatherbacks nesting at Rantau Abang by combining on-shore nest protection with an offshore sanctuary) and by protecting nests on the beach. Such an approach can be done quite economically, and often local peoples can be employed to assist in the conservation activities, thus benefiting the local economy as well as investing local people in the process. Every country involved in this dispute has such programmes. However, given

the structure of sea turtle populations, nesting beach protection alone is not enough to restore sea turtle populations (Crouse et. al., 1987).

5.172. With the exception of passing laws to limit (or prohibit) the intentional harvest of turtles, very little is being done by most of the countries in this dispute to protect juvenile or resident adult sea turtles. The United States with the regulatory strength of the Endangered Species Act its TED regulations and for the US mainland, its lack of cultural desire to harvest sea turtles is the one exception. The reasons for this are probably both economical as well as social. Local peoples in many of the countries have harvested turtles for generations and unenforced regulations are not going to limit the opportunistic efforts to harvest turtles (Johannes, 1986). Economically, sea turtles can provide income, either for meat or shell, and despite its illegality, turtle products are often available in many of these countries. Even in the United States, there are problems where historically turtles were harvested (e.g. territories in the Western Pacific). Thus conservation efforts which include regulatory enforcement and environmental education are still needed.

5.173. A frequently touted method proposed to enhance survival of sea turtle offspring is known as headstarting. The basic strategy is to rear sea turtle hatchlings for between a few months and 1 year and release them to the wild when it has been assumed that they should have a higher survival rate. This is a labour and cost intensive procedure, and it is not yet proven to be successful for enhancing sea turtle populations. Two problems with the technique have challenged its application as a conservation measure. The first is that it has not been demonstrated that such turtles will reproduce on their natal beach. To date, and despite the release of over 20,000 yearly turtles, only 2 head started turtles have been known to nest in the Kemp's ridley head start project in the United States (Shaver, 1996). While these nestings provide some hope that head started turtles might reproduce, such nestings may have also been anomalous. There is a very valid concern that interrupting the typical life cycle of hatchling turtles, which requires a crawl to the sea and a pelagic life stage will yield turtles unable to return to nest. The second problem is that such efforts are very expensive and no cost benefit analysis has been undertaken. The United States spent millions of dollars to rear and release approximately 1,000 Kemp's ridley hatchlings per year. Further, there has not been any determination of whether head started turtles have a survival advantage over *in situ* produced hatchlings. The questions that must be answered before undertaking such an exercise are: (i) will head started turtles become reproductive members of the population; (ii) will they reproduce on beaches suitable for their species/population; (iii) are their survival rates significantly higher than *in situ* hatched turtles; and (iv) is this approach more cost effective than simply fixing the problem that reduced the population in the first place (e.g. TED's) and/or is there a more cost efficient means to mitigate for the problem (e.g., enhancing beach production). At this time headstarting is not considered a valid conservation tool.

5.174. Priority actions that must be taken by all countries irrespective of species or region are (i) identify turtle stock boundaries; (ii) assess threats in all stages of the life history for each stock; (iii) eliminate all incidental take in fisheries; (iv) eliminate all on-the-beach sources of mortality; and (v) enhance production of offspring. As noted earlier, we are finding it more difficult to restore sea turtle populations than previously anticipated precisely because we are unable to account for the entire ranges of each stock and what problems they face. Clearly, eliminating all sources of anthropogenic mortality is critical to restoration of declining populations. However, it is very easy to miss major sources of mortality until we understand where to look for those sources. This is particularly true in international waters, where jurisdiction of stocks is unclear.

Dr. J. Frazier:

5.175. Biological priorities for sea turtle conservation programmes, independent of where they are carried out, focus on providing adequate protection of the habitat which is critical for the animals, during the different stages of their life cycle; this means protecting nesting beaches, feeding grounds, areas of refuge and migratory routes. In addition, the populations must be protected from levels of mortality, independent of what those sources of mortality are, which are greater than the population's capacity of regeneration. Since most sea turtle populations have declined - some dramatically - and since mortality on animals that are breeding or near breeding is most costly to the population, a general priority is to reduce mortality on those animals that have a high reproductive value.

5.176. Because of the complex nature of the sea turtle life cycle, and long period to maturity, individuals are vulnerable to multiple sources of mortality. Hence, to increase the chances of recovery of the population, each of these sources of mortality must be reduced, for simply reducing one of many sources of mortality is unlikely to provide adequate protection, if significant numbers are being removed for other causes. This involves an integrated approach to reducing diverse threats, as has been described in various global and regional strategies for sea turtle conservation (e.g., World Conference on Sea Turtle Conservation, 1982; IUCN, 1995; 1996; in press).

5.177. Each conservation programme must take into account the environmental, social and political conditions where it is to be carried out, hence the assigning of priorities involves social, political and economic considerations. One consideration - especially in these times of privatization - is for conservation activities to be carried out in such a way that they do not cost the State, but are self-supporting, or are born by a segment of society. When a segment of society is involved in an activity which has direct repercussions on the environment and resources used by the rest of society, it is normal to require this sector to contribute to conservation actions. Where an industry makes a profit, carrying out actions that present a risks to the rest of society, it is just that this industry bear the costs of eliminating, or in the very least reducing, the risks.

5.178. Take for example an enterprise which carries out activities, exploiting resources that are public property or property of the nation; consider that this extraction for private gain is done without investing in the nurturing or maintenance of these resources. Further, the actions involved in extracting these resources have direct repercussions on the environment; they reduce other immediately harvestable resources, as well as resources potentially useful to society at a later date. In addition, the undertaking is subsidized by public funds, on both a national and international level. Should this enterprise be completely free to profit, causing multiple costs to society?

5.179. The case of modern fishing industry fits the above example (McGoodwin, 1990; Fairley, 1995): it is highly profit oriented; it exploits common property marine resources, regularly with great intensity; it does not routinely invest in the maintenance of these resources; its patterns of exploitation have direct effects on resources that other enterprises and society could benefit from; there are usually substantial subsidies from public funds to develop and run these modern fisheries. Of the different types of modern fishery, shrimp trawling fits the above description easily. What is more, on a global level although shrimp constitutes less than 2.3 per cent of annual landings of marine catches, shrimp trawling is responsible for more than a third of annual bycatch discards - some 9.5 million tons (Teutscher, 1995b:11; Clucas, 1997a:7); this problem is especially critical in tropical waters (Alverson et. al., 1994). Clearly, the relative benefits of shrimp trawling must be evaluated in the context of the environmental and social problems that it causes.

5.180. On an international level, fisheries scientists have identified that a major priority is to reduce bycatch destruction from fishing activities, notably from shrimp trawling. Thus, eliminating, or at least substantially reducing, mortality of large turtles from shrimp trawling activities conforms with both biological and socio-political priorities. One way to accomplish this is to completely ban trawling, as has been done in much of Indonesia, and as has been called for by fishers from many nations of the Third World (O'Riordan, 1994; SAMUDRA, 1994). A less drastic measure is to use bycatch exclusion devices (BEDs) in shrimp trawling; the TED is a BED developed to exclude turtles (see Appendix 1 "The Issue of Bycatch in Modern Fisheries, with Special Reference to Shrimp Trawls", contained in Annex II of this Report).

Mr. M. Guinea:

5.181. The nesting habitats should be preserved as should the offshore refuge habitats for nesting females. Only those fishing activities that do not harm adult sea turtles or hatchlings should be permitted within the offshore sanctuary. Mitochondrial DNA techniques should be used to determine the genetic make up of the breeding unit. This will assist in determining the relative impact of anthropogenic activities on members of that unit. The survivorship of each stage of the life cycle should be maximized (Limpus, 1997). This should involve either leaving the nests *in situ* on the nesting beach or relocating the eggs to a hatchery within 2 hours, or using ice to cool the eggs during long periods of transport. Hatchery techniques should aim for an 80 per cent hatching success with a bias of about 70 per cent females. Hatcheries should not hold hatchlings, but ensure that hatchlings enter the water at night in a manner as close as possible to a normal hatching event. Responsible fishing techniques should be employed. Bottom set gill nets and tangle nets should be set at seasons and at times when sea turtles are neither abundant nor active. Mesh size, hanging ratio, gauge and material should be such that non-target species are not in danger of being caught. Nets should be checked regularly for entangled sea turtles. Trawls over areas where sea turtles occur should be of short duration (60 minutes) and employ TEDs.

5.182. The procedures should be similar in many countries. There will be some behavioural differences displayed by the sea turtles and cultural differences present in the human custodians. The procedure of securing the nesting beach and increasing survivorship at each stage in the life cycle should ensure the breeding unit will increase to a stable level.

Mr. H.-C. Liew:

5.183. All measures that prevent sea turtles from being killed would be of priority. These are:

-Conservation measures or techniques that reduce the incidental catch of adult and juvenile turtles in fishing gears e.g.: (i) use of TEDs in trawlers (shrimp and fishing); (ii) regulate or ban the use of high seas gill-nets; (iii) regulations to protect turtles or restrict the use of fishing methods harmful to turtles off their nesting grounds during the nesting season.
-Conservation measures to curb the hunting and trade of live turtles, adults and juveniles, for meat and other turtle products.
-Conservation measures to curb commercial exploitation of eggs, both legal and illegal.
-Conservation measures to curb the destruction of nesting grounds by beachfront development, seawalls, land reclamation, etc.

-Conservation measures to curb the destruction of feeding grounds by trawlers, pollution, land reclamation, etc.
-Conservation measures to prevent the killing or drowning of turtles in man-made structures (e.g. oil rigs) or by powered watercrafts.
-Conservation measures to curb marine pollution to reduce the mortality of hatchlings, juveniles and adults caused by marine debris like plastic bags, tar balls, styrofoam, etc.
-Conservation measures to prevent the inducement and spread of diseases that may be anthropogenically related, e.g. fibriopapillomas.
-Measures to reduce losses due to unsuitable or poorly managed hatchery practices

5.184. In general, ranked high in the list would be measures that protect the adults and juveniles but in places where exploitation of eggs is still substantial, they would still be ranked high. Differences in priority would exist for different populations, regions and species as explained in earlier answers given.

Dr. I. Poiner:

5.185. Priority conservation measures for sea turtle conservation will not be the same for all sea turtle populations and all countries concerned. It would be inappropriate to implement uniform measures. For example, in the United States the incidental capture of sea turtles in shrimp nets was/is identified as the major source of anthropogenic mortality for loggerhead, Kemp's ridley and green turtles when compared to other known sources of mortality. Management measures e.g., use of TEDs to reduce this mortality was/is a high priority. In the Indo-Pacific the major sources of anthropogenic mortality on loggerhead turtles are egg predation, incidental capture of sub-adult and adult sea turtles in shrimp nets and the incidental capture of the pelagic phase in high-seas long-line fishing. For green turtles it is egg predation and the harvest of sub-adult and adults for meat; for olive ridley turtles it is egg predation and the incidental capture of sub-adult and adults in trawl and gill net fisheries. In developing and evaluating conservation measures it is important to assess the impact of the full range of mortalities on a stock using both robust population models complemented by empirical studies of the sources of mortalities (Chaloupka and Musick, 1996).

2(d) Have some sea turtle populations found in the waters of the countries involved in this dispute stabilized or recovered so that there is not or will soon not be a risk of extinction of the populations concerned? If so, where has the stabilization or recovery occurred, what measures permitted it, and would the same measures also be effective with respect to other sea turtle populations found in the waters of the countries involved in this dispute?

Dr. S. Eckert:

5.186. To the best of my knowledge, no nesting population of sea turtles has shown any recovery in any of the countries of dispute. There are encouraging signs that the Kemp's ridley nesting population may be growing (Marquez et. al., 1996a); however, this opinion has been challenged (Ross, 1996). If there is a recovery it is likely due to the required use of TED's in the United States and Mexico and to the protection afforded nesting females. However, it is far too early to state conclusively that this population is recovering and it will take quite a few years of continued population growth before this population can be considered "recovered". As I noted earlier, it takes many years of monitoring before a population trend can be determined when using nesting females or egg production as an

indicator. In that regard, it is erroneous to assume that a trend in green turtle populations can be determined after only a few years.[10] This is simply not the case, and particularly so for green turtles in the western Pacific which seem to have exceptionally long remigration intervals (Limpus, 1995). The "trend" described by Malaysia will not be valid for at least another 15 or more years, depending on the maturity time of the turtles within this population. To conclude that this stock is recovering is optimistic but not defendable based on the data presented Malaysia.

Dr. J. Frazier:

5.187. Examples of recovery of sea turtle populations are few and far between. Limpus (1995) felt that green turtles in Florida, Hawaii and Sabah, hawksbills in Sabah, and Kemp's ridley in Tamaulipas (and the Gulf of Mexico) showed signs of recovering. The case of Kemp's ridley has been evaluated in detail by the Turtle Expert Working Group (TEWG, 1996:18), and it was concluded that "the Kemp's ridley population appears to be in the early stage of exponential expansion".

5.188. This not withstanding, I am unaware of conclusive evidence for the recovery of any sea turtle population in any of the five countries involved in this dispute so that there is not or will soon not be a risk of extinction. TEWG (1996:18) made it clear that, despite the exponential increase in numbers of nests of Kemp's ridley, an "intermediate recovery goal" could not be expected before the year 2020. Furthermore, it is unclear if the "stabilization" of a population after a decline removes it from risk, or is desirable in terms of biological conservation.

Mr. M. Guinea:

5.189. Few data are available about the size and stability of the breeding units of the species that nest in Pakistan. India has one of the largest populations of olive ridleys. Data are scant about the size and regularity of the arribadas at Gahirmatha. Estimates of the size of the nesting population are 150,000 in 1976 but none in 1977 (Davis and Bendi, 1978), 200,000 in 1978, 130,000 in 1979 (Kar and Bhaskar, 1992), 286,00 in 1985 and 600,000 in 1991.[11] This indicates that the population is increasing or at least stable. Malaysia's leatherback population has been in decline for some years.[12] However, the green turtle population at Terengganu has declined to about 2,945 nests per year which is 38 per cent of 1956 figures. Because of a history of egg harvesting the population is expected to decline further. The green turtle nesting on the Turtle Islands of Sabah have staged a remarkable recovery, as have the hawksbills.

5.190. In the above areas, the stability has been obtained by conservation measures aimed at protecting the nesting beaches and offshore refuges by a system of reserves and sanctuaries. Legislation to protect nesting turtles and their eggs was passed and enforced. In Malaysia, great effort has gone into hatcheries which have had varied, but improving, success in their hatch rates. As eggs were purchased from collectors, the coastal communities were involved to some extent with the conservation of the sea turtles.

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[10]See above paragraph 3.9 (a) and (b).

[11]See above paragraph 3.51.

[12]The Status of Major Sea Turtle Populations in Malaysia, (http://www.upmt.edu.my/seatru/mals3.htm).

Mr. H.-C. Liew:

5.191. As quoted by Limpus (1997), .."[t]he Sabah (Malaysia)/Philippines stock (of green and hawksbill turtles) may be showing recovery after 25 years of intensive conservation management in Sabah and 12 years in the Philippines". The conservation efforts accorded here were to protect the islands where turtles nest and to operate hatcheries in these islands for the eggs. Though shrimp trawlers do operate around these islands and do catch sea turtles, no TED use is enforced. Apart from some turtle stranding records and boat inspections by park rangers of trawlers that infringe the park boundary (Suliansa et. al., in press), there is no comprehensive study on the impact of shrimp trawlers on sea turtles in these waters. The impact, if found to be significant, may negate other conservation efforts and would need urgent attention.

5.192. The same measures can be effective for other sea turtle populations but they must work in tandem with other conservation strategies to be successful. Saving the eggs and protecting nesting turtles on the beach only while allowing them to be killed in the sea will not work. Neither would the use of TEDs on shrimp trawlers, while allowing turtles to be hunted or killed by other gears, or eggs collected for consumption, or destroying feeding and nesting grounds be effective. It is important for each region, country or state to assess their own sea turtle populations, examine the threats affecting them, and prioritize the conservation strategies accordingly.

Dr. I. Poiner:

5.193. Sea turtles are very long lived animals that mature at a relatively late age (ca 30 to 50 years). The interval between breeding events is also very extended (ca 5 to 15 years, depending on the species). While many eggs are produced, and egg predation is high, natural mortality of sub-adults and adults is probably relatively low. Because recruitment to the adult population is low, recovery from low population number (if non-natural sources of mortality have been removed) will be slow, and there is no clear documented cases of recovery in the world. Modelling studies of loggerhead turtles in the United States following the introduction of TEDs which should have reduced mortalities suggest recovery will be slow e.g., 70 years or more was required for the simulated population to increase by an order of magnitude (Crowder et. al., 1994).

2(e) What are the different reproductive values of sea turtles at different life stages? Given those differences, if any, how do programmes to protect eggs and hatchlings compare to programmes that protect large juvenile and adult sea turtles in terms of their likely benefit to the populations and species as a whole?

Dr. S. Eckert:

5.194. The life tables and reproductive value curves of Frazer (1983) and Crouse et. al., (1987) for the loggerhead turtle have clearly demonstrated that large juvenile and adult size classes have the highest reproductive value to the population. These conclusions have recently been supported by Chaloupka and Musick (1996). Crouse utilized these tables and curves to demonstrate in her model that populations of sea turtles will not recover without minimizing the mortality of these size classes, despite rigorous protection of nesting females and their nests. While these models were for loggerheads, there is little reason to suspect that they will be different for other species. In practical conservation terms it must be realized what it means to replace a juvenile turtle. Each juvenile represents 500 or more eggs (based on the survivorship values determined by Frazer (1983) for loggerheads). For

most species this represents between 5 and 6 clutches of eggs. Economically, this means that resources equal to the cost of preserving 500 eggs could be invested in the conservation of 1 juvenile turtle.

Dr. J. Frazier:

5.195. "Reproductive value" is an abstraction, not a component of a sea turtle that can be measured directly. It is calculated by taking into account basic characteristics of the life history of the animal, notably rates of mortality, time to maturity, and reproductive contribution. Reproductive value serves as a simple index, which is easier to visualize than a complex of other interacting measures. To calculate the reproductive value, basic information on the life history is needed, and long-term, systematic studies are fundamental for obtaining this kind of information. Up until now only two populations have been adequately studied: loggerhead turtles in the southeast of the United States and loggerhead turtles in Eastern Australia.

5.196. Crouse et. al. (1987) were the first to calculate reproductive values, using detailed, long-term information from loggerheads in the southeast of the United States. They reported:

Life History Stage	carapace length (cm)	estimated age (years)	reproductive value
eggs or hatchlings	< 10	< 1	1.0
small juveniles	10 to 57	1 to 7	1.4
large juveniles	55 to 79	8 to 15	6.0
subadults	80 to 86	16 to 21	116.0
breeders	> 87	22 to 54	584.0

5.197. Although the details of sea turtle life history differ between species and from population to population, all sea turtles share a relatively common life cycle. Hence, although precise values for the reproductive value will vary, the large difference between reproductive value for eggs and reproductive value for breeders will be a standard feature for all populations. Given this situation, the protection of those life stages which represent the greatest investment for the population takes precedence over those life stages in which rates of mortality are normally rather high, and the reproductive value to the population is low. Nonetheless, every live stage needs to be protected, for the complete removal of any life stage from a population will sooner or later result in its collapse.

Mr. M. Guinea:

5.198. The figures most often quoted indicate that the reproductive value of a nesting female loggerhead is 584 times that of a single loggerhead egg in a Southeastern United States breeding unit (Crouse et. al., 1987). This was the first stage based population dynamics model for any sea turtle species, but other models had been tried for different populations and all have their limitations (Chaloupka and Musick, 1997). Other models are sure to follow. However the general perception is that between 1,000 and 10,000 eggs are required to produce a single nesting female.[13] There are some assumptions inherent in these models: male to female ratios are 1:1, survivorship is assumed between stages, reproductive

[13]See above paragraph 3.19.

longevity is assumed. However, studies of Australian loggerheads place the reproductive values of adult females at between 200 and 400, depending on the population (Heppell et. al., 1996). Reproductive values of each stage of the life cycle appear to differ for each breeding unit.

5.199. All stages of the life cycle require protection. Eggs may have lower reproductive value to larger turtles but all require protection. It depends on the threats to which the breeding unit is exposed. For example, yearly 50 million eggs are deposited on the beaches at Gahirmatha. Using Crouse's figure of 584, this is equal to a recruitment to the nesting population of over 85,000 adult females annually at one generations duration in the future. In view of this figure, an annual mortality of 5,000 from fish trawls and set nets[14] from a nesting population of 600,000 with a recruitment of 85,000, appears relatively minor.

Mr. H.-C. Liew:

5.200. It is generally believed that out of between 1,000 to 10,000 eggs, only one will survive to adulthood. These figures are, however, estimates as they are not based on scientific evidence but on some models with numerous assumptions. Using such figures, one would be inclined to conclude that the reproductive values of adults are much higher than the young. Similarly in humans, each female can produce 5 - 10 or more children. If one were asked to choose, would it be natural for us to sacrifice all the children leaving only one and save the mother? Knowing also that the child has many more years to go, with many threats before he/she reached adulthood? One should also realize that the probability of survival of humans are much higher as mothers take care of their young. For turtles, there is absolutely no parental care. Many will die, and in fact in nature many do die of natural mortality. Turtles, like may other animals, compensate for this by producing many young. It is thus as important to protect the babies, as much as the mother. Protect the children, they are our future, but we also need mothers and fathers to produce them.

Dr. I. Poiner:

5.201. Crouse et. al., (1987) and Crowder et. al., (1994) used a stage-based-model for United States loggerhead sea turtles to conclude from sensitivity analysis that reducing annual mortality of large juveniles, sub-adults and adults was most important to ensure long-term viability of the stock. This was because of the high relative reproductive value individuals at these stages/ages in the model. Somers (1994) developed a similar stage structured model for an Australian loggerhead stock but concluded that protection of eggs/hatchlings would also have a major impact on long-term stock viability. The reason for the difference was a higher egg/hatchling stage mortality rates used by Somers (Chaloupka and Musick (1997). Chaloupka and Limpus (MS) have developed stochastic simulation model for an Australian loggerhead stock which also suggested that predation on eggs makes a significant contribution to increased mortalities. These different results either reflect the different conditions the United States and Australian sea turtle stocks are exposed to or the limited data on size - and age - specific growth and mortality rates and the lack of data on distribution of stage transition rates.

Question 3: Conservation measures at sea

[14]See above paragraphs 3.49, 3.51, 3.59 and 3.77.

3(a) Do TEDs, when properly installed and used, significantly reduce the mortality of sea turtles caused by shrimp trawl nets? Do different socio-economic conditions and level of education among fishermen, in particular in developing countries, influence the proper installation and use of TEDs?

Dr. S. Eckert:

5.202. Based on the extensive testing so-called hard TEDs have received in the United States (in contrast to the soft TEDs which have been recently decertified in the United States due to poor performance), there can be no question that TEDs reduce sea turtle mortality when installed and operated properly. (Crouse et. al., 1992., Renaud et. al., 1991, Renaud et. al., 1990, Henwood and Stuntz, 1987, Henwood et. al., 1992, Crowder et. al., 1995). While it is certainly possible to deploy a TED incorrectly, my experience with shrimp fisherman in Georgia indicates that most experienced fisherman understand net deployment methodology very well irrespective of formal education, and thus I would expect that deploying a TED equipped net would pose no particular challenges. While I do not have any direct experience working with trawler fisherman from other countries involved in this dispute, I would not expect them to necessarily be less skilled at operating their own equipment than US fisherman.

Dr. J. Frazier:

5.203. Studies carried out in Australia (Robins-Troeger et. al., 1995), Costa Rica (Arauz, 1997; Arauz et. al., 1997b) and the United States (e.g., Watson and Seidel, 1980; Easley, 1982; Seidel and McVae, 1982; National Research Council, 1990) show that when properly installed and used, different kinds of TEDs can significantly reduce the incidental capture and mortality of sea turtles in shrimp trawl nets. In a recent study, Crowder et. al. (1995) analyzed long-term data from South Carolina and concluded that TEDs "reduce strandings by about 44 per cent relative to the estimated effects of shrimp trawls without TEDs". Furthermore, depending on the design of the TED and conditions of its use, it may successfully exclude more than half the bycatch (e.g., National Research Council, 1990; Robins-Troeger et. al., 1995; Olguin, 1996; Olguin et. al., 1996).

5.204. Under the aegis of the Southeast Asian Fisheries Development Center, trials with the Thai Turtle Free Device (TTFD) (a Thai version of the TED) have been carried out in Malaysia (Ali et. al., 1997), Philippines (Dickson, 1997) and Thailand (Bundit et. al., 1997). The trials in Malaysia showed that a mature hawksbill was successfully excluded (Ali et. al., 1997; SEAFDEC, 1997b). In all three cases the findings indicated that the gear was suitable for use by local fishermen. These results were also reported on by the Southeast Asian Fisheries Development Center, in their newsletter (SEAFDEC, 1996; 1997a; 1997b; 1997c), and results of further tests are awaited. Dr. E. G. Silas, former Director of the Central Marine Fisheries Institute, Cochin, India, proposed the testing of TEDs in Orissa (Silas et. al., 1983a; 1983b), and apparently trials were carried out (Rajagopalan, pers. com.), but further information is not available. A preliminary trial recently carried out in Orissa showed that TEDs installed in local trawls successfully excluded turtles (Department of Fisheries et. al., 1996).

5.205. Fishermen who can successfully use the equipment required to trawl for shrimp will have all the skills needed to properly install and use a TED. As with any new gear, they will require some training and some experience (e.g., Renaud et. al., 1993). Socio-economic distinctions between fishermen are not likely to be relevant to this question. Although in the United States many shrimpers are also boat owners, in developing countries fishermen are

routinely employees, working on trawlers owned by investors, for whom fishing is just a business, not a way of life (Mathew, 1990). Level of formal education is not likely to be relevant either, for the skills needed are learned by experience; and certainly in the United States the average level of education for shrimpers is primary school, and a large proportion is illiterate.

Mr. M. Guinea:

5.206. When properly installed and used, a TED will significantly reduce, but not eliminate, the mortality of sea turtles in some shrimp trawls. It would be condescending and culturally insensitive to suggest that any fisherman could not operate a net fitted with a TED. For TEDs to be accepted the technology has to become adapted for the local area. This gives a sense of ownership of the technology and removes the imposition exerted by other countries. Thailand developed two TEDs of which one (Thai Turtle Free Device) is now used on each shrimp trawl net. Australia developed a TED, the AusTED, for use with Australian species of sea turtles on Australian trawl fields (Robins and Campbell, 1997).

Dr. H.-C. Liew:

5.207. Studies conducted by the United States have shown that proper use of TEDs can significantly reduce the mortality of sea turtles caused by shrimp trawl nets. However, even though TED use is mandatory in the United States and in their neighbouring countries, large numbers of turtle stranding still occur there. All shrimp trawlers operating in areas where the likelihood of incidental turtle capture is high should be encouraged to use TEDs or other similar devices. However, proper studies need to be conducted to determine where these areas occur and the seasons involved. Fishermen would not respond positively to the use of TEDs if they hardly catch turtles in their operations. Neither would they use TEDs if they have intentions of eating or selling the turtle.

5.208. After many years of experiments, publicity campaign and TED trials, the United States mandated their use in 1989. Yet, as recent as in 1994, NMFS concluded that poor compliance and enforcement of TED requirements contributed to record numbers of dead sea turtles washed ashore (Crouse, 1996). Considering the socio-economic conditions, educational level, language differences and history of turtle exploitation, it would take at least as long to introduce the use of TEDs, train all the shrimp fishermen, convince them to comply and have effective enforcement. It is important to introduce TED use properly to these fishermen, show how they can benefit from them and getting their full cooperation. To suddenly force them to use TEDs would only be met with blind resistance. Even in the United States where there is mandated use of TEDs, studies are still being conducted to determine if they are needed. NMFS is funding a U$500,000 study conducted by Gary Graham, Texas A&M, Galveston, to determine if TEDs are needed in the offshore waters of the Gulf of Mexico where the "year-long" will place observers on six vessels to see if turtles are caught (Steiner, 1997a).

Dr. I. Poiner:

5.209. Studies of TEDs and other bycatch reduction devices (BRDs) in the United States (Henwood et. al., 1992) and Australia (Brewer et. al., 1995, 1997; Robins-Troeger et. al., 1994) demonstrate that properly installed TEDs are very effective at virtually eliminating the trawl catch of sea-turtles. I am not qualified to comment on the effect of different socio-economic conditions on TED installation and use.

3(b) During the course of this proceeding, it has been stated that TEDs can reduce the number of turtles killed in shrimping activities by 97 per cent or more. This statistic is apparently based on data collected during TEDs testing. Is there any data on TEDs efficiency during commercial shrimping? If so, what does it indicate? Are your aware of data on the rate of turtle stranding in areas where TEDs are currently required or on the relationship between turtle stranding and shrimping activities in areas where TEDs are required?

Dr. S. Eckert:

5.210. Probably the most thorough review of the efficacy of TEDs in the United States is Crouse et. al., (1992) in which they summarize a number of studies on TED use and shrimp catch rates and debunk a large number of anecdotal reports on TED performance. Controlled tests described in Renaud et. al., 1990, 1991 seem to confirm data described in the Crouse et. al., report. (1992). Crowder et. al., (1995) published the most recent and thorough model of the effects TEDs will have on turtle stranding rates and benefits to loggerhead sea turtle populations in South Carolina. Conclusions were that stranding rates should decrease significantly (44 per cent) and that the probability of recovery of this stock (which is currently declining at 5.3 per cent annually) is good.

5.211. Generally three conclusions are put forth in studies on TED effects on commercial fisheries: (i) commercial shrimp catch rates were higher in years after TED's were required (though it is probably not valid to suggest that TED use necessarily resulted in increased catch rates); (ii) shrimp loss ranged from 0.7 - 10 per cent per boat and 0 - 2 per cent for the fleet; however, this value was statistically not significantly different from 0.0 per cent given the sample size and variability in the data; and (iii) performance of TED equipped nets improved with operator experience.

5.212. For other countries, there is one study of TEDs (in this case called Thai Turtle Free Devices (TTFDs)) and shrimping (Senalak and Sujittosakul, 1997); however, the study is probably invalid due to poor data gathering methodology and data analysis. In particular, the data collection seems to rely on dock-side interviews with shrimp boat captains as the sole means of obtaining catch statistics. Such technique is not valid without a means of independent validation of the reported data. Logbook and interview data can often provide important qualitative information, but is usually quantitatively inaccurate. Even more significantly is that the experimental and control groups were fishing in two different years (e.g., non TTFD data was from 1991 and TTFD equipped trawl boat data was from 1992). No attempt was made to correct for between year variation in the data sets. For example, 1991 and 1992 should have been compared to average catch rates over the previous 5 or 10 years to determine if the reported values fall within expected annual variation in catch rates. Without such an analysis it is impossible to know whether the reported differences in catch rates are simply due to annual variation in CPUE or to the use of TTFDs.

5.213. In Malaysia a recent experiment on the use of TEDs in shrimp fisheries concluded that "this study showed that TEDs will prevent marine turtle[s] from being trapped in the net without effecting [sic] the catch of shrimp and fish" (Ali, A. et. al., 1997). Although this study cannot be considered conclusive due to the very small sample size, it does seem to be a well executed and analyzed preliminary experiment.

Dr. J. Frazier:

5.214. The figure of 97 per cent is an arbitrary value which was established by gear specialists from the Pascagoula laboratory of the National Marine Fisheries Service (NMFS), United States. In early tests of TEDs they established a standard for evaluating different designs of TEDs. Because the NMFS design successfully excluded 97 per cent of the turtles that entered the trawl net it was decided that a TED, irrespective of its design, should exclude at least 97 per cent of the turtles in order to be approved by NMFS. This standard was set to provide as much protection as possible for sea turtles, but at the same time allow for a small - and realistic - margin of error. Some of the first experiments on keeping turtles out of shrimp trawls, carried out 20 years, were carried out aboard commercial vessels in Florida, Georgia and South Carolina. Two gear modifications were used, the "reverse barrier trawl" and the "turtle excluder device"; and in both cases they caught significantly less turtles than normal nets ($p < 0.001$) (Watson and Seidel, 1980; Seidel and McVea, 1982).

5.215. During the last few years there have been clear indications from the commercial shrimp fishery in the United States, that TEDs have significantly reduced turtle mortality. Stranding data from South Carolina for the period 1980 to 1993 show remarkable declines, particularly when TED regulations were in place. Crowder et. al. (1995) concluded that the decline in strandings was because of reduced mortality from TED use. Preliminary analyses of results of a study of "naked net" trawling (i.e., shrimp trawling without TEDs) along the coast of South Carolina in 1997, indicates that the rate of capture of loggerheads (CPUE) is now considerably more than it was when these waters were studied a decade ago by Henwood and Stuntz (1987) (Bransdetter, pers. com.). This increase in turtles, together with the decrease in strandings documented by Crowder et. al. (1995) clearly points to the effect of TEDs in reducing mortality.

5.216. TEDs designed in the United States, and TEDs modified locally have been tested on commercial shrimp trawlers in Australia, Costa Rica, Mexico and Venezuela. Robins et. al. (1997) reported on results of 151 test trawls ("tows") using eight commercial trawlers in north-eastern Australia. They found that the catch of large animals (including turtles) was significantly less in nets with the AusTED both in the subtropical estuarine fishery ($p = 0.041$) and in the tropical gulf fishery ($p<0.01$). Arauz et. al. (1997b) reported on the results of 165 test trawls ("drags") using 11 commercial trawlers in Pacific Costa Rica. They found that Super Shooter and Seymour TEDs successfully excluded turtles (as long as bar spacing was not greater than 8 inches): 14 caught in control nets and 2 caught in 1 net with a TED that had been jammed with logs.

5.217. The only country where I know that there is systematic information on turtle strandings is the United States. Increased strandings of Kemp's ridleys, notably in Texas and Louisiana, in 1994 and 1995 (Shaver, 1994; 1995; Steiner, 1994), are thought to be related to improper use of TEDs, use of inadequate TEDs and "intense pulse fishing" (TEWG, 1996:18). As a rule, strandings increase when shrimping activity increases, notably immediately before and immediately after the closure of a shrimping area. This "pulse fishing", very intense trawling in certain coastal areas, results in repeated sweeps of an area over a short period of time which increases the chances that an individual turtle will be captured repeated during a day, undergo successive physiological stress (Lutcavage and Lutz, 1991; Stabenau et. al., 1991), and finally succumb from exhaustion. Pandav et. al., (1997) compiled information on strandings from the Gahirmatha area of Orissa, but the area covered and effort from year to year have varied. TEDs are not used in India. Recently, Guinea and Whiting (1997) have provided evidence of trawl related strandings of four species from the remote coast of Northern Australia, indicating that prawn trawling is a significant source of mortality in these waters. It must be emphasized that the turtles that are found stranded represent only a part - and in certain conditions, only a small part - of all the turtles that have died. Current; tide; tow time; turtle species and size; water depth;

water temperature; wind; predator and scavenger densities and behavior; and other factors will affect the way in which turtle carcasses are deposited on the shore. There is no scientifically substantiated conversion factor to convert number of strandings to total number of drown turtles.

5.218. Murphy and Hopkins-Murphy (1989:15) reviewed the results of two experiments that examined the question of what proportion of carcasses are documented as strandings. They reported:

Experiment	Marked	Stranded	Per cent Stranded
A	13	4	31
B	9	2	22
Total	22	6	27

Under the conditions of these two experiments, less than a third of the free-floating carcasses were recovered; hence, mortality will be considerably greater than indicated by just stranding data.

Mr. M. Guinea:

5.219. Data from the Northern Prawn Fishery in Australia indicate: a reduction in small fish bycatch by about 30 per cent, a reduction in large fish, no sea turtles were captured during the trials. Other studies reported a slight increase in prawn catch (4 per cent and 7 per cent) (Mounsey, 1995) which may have been a result of the otter boards spreading wider in response to the reduction in bycatch and therefore in drag at the cod end. The catch was of better quality with fewer broken or damaged shrimp. The better catch of unbroken shrimp could command a higher price.

5.220. Data on turtle stranding are only available from the United States where sea turtles continue to wash ashore even where TEDs are compulsory. Compliance appears to be a problem.[15]

Mr. H.-C. Liew:

5.221. Mandatory use of TEDs by commercial shrimpers has been enforced in the United States for the most number of years. Hence, they would provide the best statistics. However, even as recent as in 1997, large numbers of turtle stranding still occur (Coyne, 1997). It even reports that while the 96.9 per cent of the vessels were using TEDs, biologists still see a big decline in dead turtles washing ashore when the Gulf of Mexico is temporarily closed each year to shrimping. In a message by Todd Steiner (1997), he stated that "18 turtles washed up dead in Texas last week, nine had straight-edge cuts at Padre Island National Seashore. Shrimpers were observed by Seashore rangers fishing so close to the beach that it looked like they would run aground. When the shrimper left the area, the strandings ceased." All these examples indicate that problems still exist in the use of TEDs and mandating fishermen to use them does not guarantee that sea turtles will be safe from shrimp trawlers.

Dr. I. Poiner:

[15]See above paragraphs 3.51, 3.83 and 3.84.

5.222. For certification purposes TEDs in the United States need to be at least 97 per cent effective in reducing turtle catches. I am not familiar how this is measured in the certification process. Monitoring of TEDs and other bycatch reduction devices (BRDs) in the United States (Henwood et. al., 1992) and Australia (Brewer et. al., 1995, 1997; Robins-Troeger et. al., 1994) under commercial conditions demonstrate that properly installed TEDs are very effective at virtually eliminating the trawl catch of sea-turtles. Caillouet et. al., (1995) compared the relationship between sea turtle stranding rates and shrimp fishing intensities in the northwestern Gulf of Mexico in 1986-1989 (pre-compulsory compulsory introduction of TEDs) versus 1990-1993 (post introduction of TEDs). They found no difference in stranding rates whereas the expectation was that the introduction of TEDs would reduce the incidental capture of sea turtles and hence diminish or eliminate the statistical relationship between sea turtle stranding rates and shrimp fishing intensities. A variety of hypotheses were suggested to explain the continuation of the statistical relationship, including violation of TED regulations in the fisheries.

3(c) In your view, is the obligatory use of TEDs for shrimp trawling an essential conservation measure in all areas where sea turtles occur? Or can alternative measures such as seasonal and time closures, areas closures or tow-time limitations achieve equivalent or better results?

Dr. S. Eckert:

5.223. It is my belief that TEDs provide the best opportunity to reduce turtle bycatch with the greatest efficiency and lowest cost to the fishing industry. Further, as I noted above, I believe it is the most easily enforced conservation measure available. The problem with seasonal and time closures are that: (i) enforcement requires extensive and continual law enforcement presence on the water in the closed area. With the costs of operating enforcement vessels and the extensive areas fished, this is generally beyond the capacity of most countries (including the United States) to support; (ii) such closures do not facilitate rapid adjustment for stochastic fluctuations in the migratory patterns of turtles; and (iii) tow time limitations are almost impossible to enforce and actually do not provide much protection to turtles subject to multiple captures (Stabenau, 1991).

Dr. J. Frazier:

5.224. Nationals from three of the countries involved have expressed the need to employ, or at least test and seriously consider TEDs in their fisheries: India (e.g., Silas et. al., 1983a; 1983b; James et. al., 1989; Department of Fisheries et. al., 1996; Mohanty-Hejmadi, 1996; Sarkar et. al., 1996; Behera, 1997c; Pandav et. al., 1997); Malaysia (e.g., Suliansa et. al., 1996); and United States (e.g., National Research Council, 1990; Weber et. al., 1995). In addition, tests carried out in four of these countries have indicated that TEDs are suitable for local use: India (e.g., Department of Fisheries et. al., 1996); Malaysia (Ali et. al., 1997); Thailand (Bundit et. al., 1997); and United States (e.g., National Research Council, 1990; Weber et. al., 1995).

5.225. As a stop-gap measure, the use of TEDs in all shrimp trawlers should slow the rate of destruction of marine resources, including sea turtles. The real problem, however, is much, much deeper and involves the environmental and social effects of bottom trawling and bycatch destruction as carried out by modern fisheries. In my view, there is ample evidence for banning trawling from countries with dense human populations, high dependency on fish for food, and where modern fisheries (e.g., the tropical shrimp fishery) are focused on exporting food to industrialized nations while local citizens of these exporting countries find

it more and more difficult to find adequate food for themselves and their families. Certainly, people from many different fishing communities around the world have called for a ban on trawling (O'Riordan, 1994; SAMUDRA, 1994), and ample evidence in the fisheries literature shows without a doubt that modern fisheries are overcapitalized, grossly destructive of the environment, and supporting greater social polarization and degradation on national, regional and international levels.

5.226. Area closures do not work because of a lack of enforcement. This has been widely documented in many countries, including those involved in this dispute (e.g., Mathew, 1990; Yamamoto, 1994; Pauly, 1995; Behera, 1997a; Pandav et. al., 1997). Area closures, designed to minimize bycatch of protected species, may actually create problems, for the effect may be simply to displace fishing effort to other areas. To accomplish the goals of the closure, it may be necessary to close a much larger area than originally contemplated, or even to stop fishing (Murawski, 1995:8). The logic behind seasonal and time closures is to remove fishing effort from a particular species, during a critical period. However, the shrimp trawl industry is heavily overcapitalized, and shrimp stocks are generally in decline, so there is intense competition to fish and catch shrimps. Hence, even if enforcement were possible, the usual result of temporal closures is to concentrate fishing effort just before and just after the closure ("pulse fishing"). In general, seasonal and time closures simply offset mortality around the time of the closure.

5.227. Tow-time (the period of time that the trawl net is in the water) limitations are least enforceable of all measures. Furthermore, recent information indicates that forced submergences of more than 30 minutes may be fatal to many sea turtles (Lutcavage and Lutz, 1991; Stabenau et. al., 1991), so to be effective, maximum tow-times would have to be 30 minutes, not 60 as has been frequently claimed. Even 60 minute two times are inconvenient and uneconomical for most trawlers, so there is little chance that they would abide by 30 minute tow-times.

5.228. It must be pointed out that in a well managed fishery, with controlled fleet size and closed entry, such as found in Australia, it has been possible to work with the fishermen and enlist their collaboration (Kennelly and Broadhurst, 1995; Tucker et. al., 1997). However, this is very much the exception, and not anything like the case for any of the countries involved in this dispute where the fishery is open entry and basically a free-for-all.

Mr. M. Guinea:

5.229. "TEDs are not an ultimate solution, they should only be seen as part of an integrated approach to sea turtle conservation and restoration." (Steiner, 1993, p. 180). I agree with the above quote by Todd Steiner in that TEDs are just one option in the array of management options open to the managers of shrimp fisheries. Any of the options mentioned previously in my submission could be employed with or without TEDs. The management options should be tailored to the Fishery. Recent population models have shown that when TEDs are used in conjunction with egg protection, the population has a greater chance of survival than if either egg protection or TEDs were used individually (Grand and Beissinger, 1997).

Mr. H.-C. Liew:

5.230. In certain areas, TED use is essential, but scientific studies must be conducted with unbiased data to show its necessity and to convince the fishermen in those areas why they should used them. TED use should not be mandated blindly without proper studies. When the Gulf of Mexico is temporarily closed each year to shrimping, biologists in the United

States found a significant decline in dead turtle strandings compared to shrimpers using TEDs even with a 96.9 per cent compliance by the fishing vessels.

Dr. I. Poiner:

5.231. The obligatory use of TEDs to reduce the incidental mortality of sea turtles in shrimp trawls is one management tool that can be used but there are others, including area, seasonal and time closures and tow-time limitations that either individually or together may achieve the same reductions in catch. Which suite of management tools to be used will depend on management objectives, the nature of the fishery and ease of surveillance and enforcement. Tucker et. al., (1997) compared the Australian and United States approaches to the introduction of TEDs to reduce turtle mortalities. They suggest a participatory (non legislative) solution to trawl bycatch issues via negotiation and mediation between stakeholders has substantial advantages in the Australian situation (nature of the fisheries, nature of the people, political system, etc.) over a litigation and legislation approach as was/is use in the United States.

3(d) Does variety in geographical and environmental conditions (e.g. different sea bottom topography, vegetation, current) affect significantly the efficiency of TEDs, both in term of loss of catch and protection of the various species of sea turtles? More particularly, do the geographical and environmental conditions prevailing in the Indo-Pacific waters require a different approach to that chosen in the Gulf of Mexico and Caribbean Sea?

Dr. S. Eckert:

5.232. Renaud et. al., (1991) noted that there were differences in catch rates between TED equipped nets and non-TED nets when comparing tests in the Atlantic Ocean and the Gulf of Mexico. However, he also noted that there were no statistical differences in catch rates between different areas within the Gulf of Mexico. Because no data was given to characterize the habitats used in this test, it is difficult to draw any conclusions from this data. Poiner et. al., (1990) compared catch rates between the North Australian prawn fishery and the US shrimp fishery and found comparable catch rates (between the US Gulf of Mexico and Northern Australia). To the best of my knowledge, there is no study that attempts to compare geographic differences in TED performance based on habitat or geographical area.

Dr. J. Frazier:

5.233. To work properly, TEDs must be adapted for the local conditions where they are to be used, taking into account: fishing gear, fishing technique, substrate type, bottom cover, and water depth, among other things. These sorts of adaptations are not unlike the modifications that fishermen have made to gear to be able to fish in different conditions. Sr. Randall Arauz, who has been working on TEDs in Costa Rica for the last four years, stated: "with proper modifications of the TED technology and fishing practices, together with scientific documentation, research to make TEDs work efficiently under virtually any fishing conditions, as we have proven in Costa Rica". (Arauz, 1997).

5.234. There is great variation in the fishing grounds of the Gulf of Mexico, Caribbean and East Pacific, where TEDs are being used. Fishing grounds of the Indo-Pacific are likely to be both similar and divergent from fishing grounds in the Americas. However, the principle of TED modification for local requirements is the same. Indeed, Thai gear specialists have

carried out tests and devised two unique designs, the Thai Turtle Free Device (TTFD) and the Thai-Ku (Bundit et. al., 1997). Under the aegis of SEAFDEC, Thai fisheries officers have been disseminating this gear in other countries of the region (SEAFDEC, 1996; 1997a; 1997b; 1997c).

5.235. It must also be pointed out that the gear specialists of the Pascagoula Laboratory of the National Marine Fisheries Service have decades of experience in devising, modifying and testing TEDs. They have been actively training people as well as distributing gear and information in many different countries, in workshops both in the United States and abroad, since 1983 (see Appendix 2 "Transfer of TED Technology" contained in Annex II of the Report).

Mr. M. Guinea:

5.236. For TEDs to be effective in reducing the mortality of sea turtles, they have to be functional in the fishery. Part of their functionality is the willingness with which they are accepted by the fishery. This involves considerable modification and experimentation not only to provide the previously mentioned sense of ownership, but also to convince operators of the usefulness of new technology. Australian trawl fields are considerably different to the trawl fields of the Gulf of Mexico and the Caribbean Sea.[16] Options such as bottom or top opening for the removal of sponge or sea turtles respectively, have to be explored. The set angle of the TED and the position in the net have to be modified for the nature of the benthic habitat and the species of sea turtles and their size as well as the nature of any other bycatch. There needs to be considerable modification and trials before TEDs or any other bycatch reduction device, e.g., fish eye etc., is accepted by the fishery.

5.237. From trials in Australia (Robins, 1995; Mounsey, 1995) and Thailand (Chokesanguan et. al., 1996), it is possible that the environmental conditions vary greatly between the localities. This is reflected in the performance and unacceptability of the unmodified TEDs.

Mr. H.-C. Liew:

5.238. Not able to comment.

Dr. I. Poiner:

5.239. Monitoring of TEDs and other bycatch reduction devices (BRDs) in tropical northern Australia (Brewer et. al., 1995, 1997; Robins-Troeger et. al., 1994) under commercial conditions demonstrate that TEDs performance depends on the nature of the sea bottom. Different areas require different types of TEDs. These results should be transferable to other parts of the Indo-Pacific waters. What these results show is that if TEDs are to be used they need to be selected and adapted to local fishing conditions and approaches to fishing. TEDs that are effective in the Gulf of Mexico and Caribbean Sea may not be appropriate for Indo-Pacific fisheries.

[16] *US Embargo on the Import of Wild-Caught Shrimp*, Submission by Australia to the US Secretary of State in support of its request for certification under Section 609(b), April 1996. See above paragraph 4.2.

Question 4: Conservation measures on nesting grounds

4(a) What is your assessment of conservation programmes focusing on protection of eggs and hatchlings? Are there examples where these programmes have been proved effective in restoring a population of sea turtles, or in maintaining it at a sustainable level? Are their regional differences in this regard?

Dr. S. Eckert:

5.240. In my response to question 2(b), I have provided some assessment of sea turtle conservation methods. Of greatest importance to any sea turtle conservation programme is to address the problem that led to the "endangered" status of the stock or population as a first priority in conservation (Frazer, 1992). To the best of my knowledge, there has never been a case where enhancing reproductive output has been able to mitigate for juvenile and adult turtle mortality. Thus, while nesting beach programmes are important and useful in mitigating for historical over-harvest of eggs, I cannot advocate this technique as a mitigation for incidental mortality associated with fishing. The reason for this stance in sea turtle conservation is obvious when you consider what it means in terms of sea turtle population dynamics. Due to the low survival rate of sea turtle hatchlings and juveniles, one large juvenile or sub-adult turtle represents many hundreds (or thousands of eggs). Thus, for each turtle killed incidentally many eggs must be hatched and released over and above those that would survive naturally. With the highly depleted status of most nesting populations it is simply not feasible to increase hatch production at the levels required to mitigate for even small levels of incidental mortality.

5.241. An example of where protecting only nesting stocks as a conservation strategy has failed is for the loggerhead nesting stocks of North Carolina, South Carolina, and Georgia. This stock constitutes a unique nesting assemblage and is separated genetically from the larger Florida nesting population (Bowen et. al., 1993). The index nesting beach for this stock is on Little Cumberland Island. This is the best studied loggerhead nesting population in the world and thus much of our information on sea turtle population dynamics is based on this data from this beach (Frazer, 1983; Frazer, 1985; Richardson, 1978; Taylor, 1993, Bell and Richardson, 1978, Bowen et. al., 1993, Frazer and Richardson, 1985, Frazer and Richardson, 1986, Hillestad et. al., 1978, Frazer and Richardson, 1985b, Hillestad et. al., 1979, Kraemer and Richardson, 1979, Mrosovsky et. al., 1984. Stoneburner et. al., 1982, Richardson et. al., 1976a, Richardson et. al., 1979b, Richardson et. al., 1976, Richardson, 1978, Stoneburner and Richardson, 1981, Richardson, 1982, Richardson, 1992). Little Cumberland Island has provided an interesting test of nesting beach conservation, because prior to the initiation of nest protection in 1964, virtually 100 per cent of the nests were consumed by raccoons. After the initiation of protection by beach patrol and maintenance of an on-beach hatchery, almost 100 per cent of the eggs have been protected. Yet, between 1964 and 1991 the population declined approximately 65 per cent (NRC, 1990, Richardson, 1992). Accounting for a 20 -25 year delay in nesting population response due to maturity time in loggerhead (Frazer, 1983), nesting population numbers should have begun to rebound if egg protection was an appropriate conservation tool, and they have not. Similar trends in nesting have been seen in North and South Carolina. Such lack of recovery has been due to the mortality associated with shrimp fishing on the Atlantic coast (NRC, 1990).

Dr. J. Frazier:

5.242. As stated in earlier responses, the protection of eggs and hatchlings of sea turtles is essential for the long-term health of the population; without recruitment into the population from eggs and hatchlings, it will gradually "die of old age". However, "focusing" on

protection of just eggs and hatchlings, and not reducing mortality in older animals will be doomed to failure (see my answers to questions 1(b), 1(c), 2(c) and 2(d)). It makes little sense to invest time, money, materials and effort protecting just eggs, only some of which will hatch, and fewer of which will grown into young turtles, if those turtles are under high risk, and their chances of survival are very low. Because egg protection produces rapid, tangible results (i.e., hundreds of scrambling baby turtles, just two months after eggs are laid) it provides quick and attractive rewards for conservation activities; furthermore, it is much simpler and less expensive than protection of animals in the sea or marine environments. Hence, as a rule egg protection attracts more attention than the more difficult, complex and time-consuming tasks of protecting turtles at sea. For decades, egg protection and head-starting (captive rearing) programmes have been carried out with the best of intentions, and the rapid, tangible results have consistently been activities that have been reported as evidences of success - routinely taken advantage of by politicians. However, over the last decade sea turtle conservationists have come to realize that concentrating on nesting beaches has routinely taken attention away from other, more needy activities (e.g., Mortimer, 1990; 1995; Suliansa et. al., 1996). As explained in several sea turtle conservation strategies (World Conference on Sea Turtle Conservation, 1982; IUCN, 1995; 1996; in press), the priority is integrated management and conservation.

Mr. M. Guinea:

5.243. Conservation measures devoted to eggs and hatchlings have been successful for some breeding units of some species e.g., olive ridleys in Orissa. Mortimer (1995) elegantly distils the evidence for protecting eggs and adults. Each strategy has its individual strengths and possible scenarios for delaying such conservation measures. Conservation involving coastal communities will gain popular support and have a greater chance of being maintained, than a piece of legislation which affects only a small proportion of the population i.e., fishers, or companies and which is out of sight of the community. Like fishing, conservation can become an industry, if properly structured.

5.244. The conservation measures employed by Malaysia (Liew, 1997) and Thailand (Monansunsap, 1997) appear to be successful. The measures have community support and sponsorship from a number or organizations.

5.245. There will be regional differences regarding the effectiveness of conservation programmes focussing on protection of eggs and hatchlings. These will be based on the culture of the area and the socio-economic climate that prevails as well as depending on the breeding unit to which the sea turtles belong. The sea turtles may display plasticity in life history strategies which may be confounded by differing pivotal temperatures, sex ratios and stable age structure. Each breeding unit will respond in a similar manner but at a differing rate to identical conservation measures. Conservation measures that protect nests or eggs will make a significant contribution to the continued survival of the breeding unit.

Mr. H.-C. Liew:

5.246. Protection of eggs and hatchlings are important to ensure the continued sustainability of sea turtle populations. However, they must be conducted properly and in tandem with other conservation strategies determined for each locality. Where possible, eggs should be incubated in natural nests *in situ* and hatchlings immediately released on hatching and not retained for long periods as still practised in some countries. There are a few examples where turtle populations have shown apparent recovery or sustained where conservation efforts focus on protection given to turtle nesting beaches, their eggs and

hatchlings. However, such recoveries were only apparent after many years of strict conservation measures due to the long periods turtles need before they mature after emergence as hatchlings. Some of these include the green and hawksbill populations in the Turtle Islands of Sabah, Malaysia; the leatherback populations of South Africa, the leatherback population in St. Croix and Surinam and the green turtles of the French Frigate Shoals, Hawaii.

Dr. I. Poiner:

5.247. All sea turtles populations in the Indo-Pacific region including southeast Asia are severely depleted and/or are subjected to over-harvest (legal and illegal) and/or excessive incidental mortality. Some countries (e.g., Malaysia and Thailand) have instigated management measures to prohibit or control egg harvests as a conservation measure but there is no evidence of recovery of any of these populations (Limpus, 1997).

4(b) Considering the long timeframe some species of sea turtles need to reach reproductive age, is it still difficult for biologists to anticipate the effects of the more recent programmes on the populations concerned or is it now possible to assess whether egg protection methods are capable of ultimately preventing marine turtle extinction and, if properly implemented, will in fact do so?

Dr. S. Eckert:

5.248. In previous answers I have touched on the disadvantages of using nesting counts for determining population trends. The same is pretty much true for understanding the effect of conservation actions or nesting beach perturbations. Due to the long time it takes for turtles to reach reproductive maturity, it will often take a generation time (25-50 years) to see the fruits of such efforts revealed on the beaches. However, as noted in the example provided by the Little Cumberland Island loggerhead study, we are reaching a point in some projects that enough time has elapsed for the effects of nesting beach conservation actions to be determined. This, combined with improvements in our sea turtle population models (for a review see Chaloupka and Musick, 1996) is indicating the need for a balanced conservation approach and illustrating the fallacy of focusing only on nest beach conservation as a means to restore depleted turtle populations. Finally, consider this illustration. If it takes 1000 eggs to produce 2 adult turtles (Frazer, 1983) (this is probably a minimum estimate) and only slightly less for 2 sub-adult (stage 3) turtles, then for every turtle we want to replace we must hatch just under 500 eggs. If there is a relatively minor incidental shrimping mortality of stage 3 turtles, 100 as an example, then just under 50,000 eggs will need to be protected to mitigate for the fishery mortality. Further, this 50,000 has to be in excess of what is already being produced on the beach, since the current beach production is likely not enough to maintain the population (based on the assumption that most population are already in decline). From this example it can be seen why it is so difficult to use nesting beach conservation as a mitigation for fishery mortality, and why such an approach simply will not work, as was demonstrated at Little Cumberland Island.

Dr. J. Frazier:

5.249. As yet, no species of sea turtle is known to reach reproductive age in less than 10 years. Green and loggerhead turtles, for which the best information on growth rates is available, are generally thought to require about 30 years to reach maturity. The long time needed to reach maturity means that only long-term data will permit a true understanding of trends in the population. As was explained earlier, turtle populations are evaluated by

counting nesting females, nests, or eggs. These counts represent only a small segment of the total population and there is tremendous variation in clutch size, number of clutches per female, inter-nesting intervals, and nesting activity from year to year. Hence, estimating population size from what is seen during a nesting season on a beach has clear limitations.

5.250. It does not matter whether the conservation measure is egg protection or use of TEDs; it takes years of systematic information to be able to decipher the trends in size of a sea turtle population. Because the animals have complex life cycles and need a long time to maturity, they are subjected to many different sources of mortality over long periods of time. It is most prudent to carry out integrated conservation, providing a variety of measures for habitat protection and reducing mortality. This strategy of integrated conservation for sea turtles has been adopted in numerous international fora, for well over a decade (e.g., World Conference on Sea Turtle Conservation, 1982; IUCN, 1995; 1996; in press).

Mr. M. Guinea:

5.251. Egg protection strategies have been employed for less than one sea turtle generation. The nesting beaches are the only points of reference to measure the success of such conservation measures. Ideally if the developmental habitats were known, then an increase in relative abundance of sea turtles may be demonstrated, but developmental habitats may, in fact, be defined more by carrying capacity than the absolute abundance of sub-adult sea turtles. Egg protection measures for olive ridleys in India and green turtles in Malaysia appear to be successful. The relative significance of egg protection is difficult to determine without knowing the other threatening processes impacting on the breeding unit.

Mr. H.-C. Liew:

5.252. Egg protection methods alone is not sufficient especially if other threats are still present and have significant impacts on the population. For populations, if any, where egg exploitation is high while the threats from the other factors are negligible, then egg protection methods would suffice.

Dr. I. Poiner:

5.253. Sea turtles are very long lived animals that mature at a relatively late age (ca 30 to 50 years). The interval between breeding events is also very extended (ca 5 to 15 years, depending on the species). While many eggs are produced, and egg predation is high, natural mortality of sub-adults and adults is probably relatively low. Because recruitment to the adult population is low, recovery from low population number (if non-natural sources of mortality have been removed) will be slow, and there is no clear documented cases of recovery in the world. Our only estimates of recovery times come from modelling studies.

5.254. Crouse et. al., (1987) and Crowder et. al., (1994) used a stage-based model for United States loggerhead sea turtles to conclude from sensitivity analysis that reducing annual mortality of large juveniles, sub-adults and adults was most important to ensure long-term viability of the stock and suggested egg protection programmes are ineffective. Modelling studies of loggerhead turtles in the United States following the introduction of TEDs which should have reduced mortalities suggest recovery will be slow e.g., 70 years or more would be required for the simulated population to increase by an order of magnitude (Crowder et. al., 1994). This was because of the high relative reproductive value individuals at these stages/ages in the model. However, other models by Somers (1994), and Chaloupka and

Limpus (MS) concluded that protection of eggs/hatchlings would also have a major impact on long-term stock viability but give no estimation of recovery times.

Question 5: Migratory patterns

5(a) What are the migratory patterns of the various species of sea turtles mentioned above? Are the migratory patterns similar in different regions of the world? In particular, do sea turtles migrate seasonally -and if so, are those seasons clearly defined- or do they migrate all year round?

Dr. S. Eckert:

5.255. Despite many years of sea turtle flipper tagging, and an increasing number of satellite telemetry studies, our understanding of the migratory movements for sea turtle populations are still very limited. In particular, we know almost nothing of the migratory movements of juvenile turtles during early development or even after they have settled in coastal habitats. As noted earlier, we have only one clear pattern of migration resolved for the loggerhead during this part of its life phase, yet even for that species our sample sizes are small and we know nothing of the timing of the migration. Further, virtually all other migration information is associated with mature female turtles.

5.256. However, some hints at what sea turtles are capable of can be gleaned from recent studies. Early in this document, I described something of what my own satellite telemetry studies are telling us of the migratory capabilities of the leatherback. They have demonstrated a capacity to travel in excess of 11,000 km in a single year, and all indications are that they make north/south migrations annually. In the Pacific it is likely that mature female leatherbacks circumnavigate the Pacific Ocean during the 2 or 3 years between nesting seasons. My current hypothesis for the movement of leatherbacks in the Pacific is that females from the 2 major colonies (Mexico/ Central America and Irian Jaya/Solomon Islands) as well as the minor colonies (e.g. Malaysia) distribute into a clockwise migration of the Pacific Ocean with turtles stopping to feed in areas of high productivity. What I have shown for the Atlantic Ocean is that leatherbacks are very adept at knowing where to anticipate areas of high food availability and will readily migrate great distances to access those resources. Supporting data for the theory of the migration cycle of Pacific leatherbacks is currently being gathered by satellite telemetry and DNA stock assessment, and thus far the hypothesis is supported. Significantly, this make the leatherback a species that shares many government jurisdictions. It is highly probable that Malaysia, Thailand and the United States all share responsibility Pacific leatherbacks during a single nesting migration.

5.257. Green turtle females have well-documented long distance post-nesting migrations. Most of the data is from tag returns, which are somewhat problematic when trying to understand migratory cycles. Such data usually only represents a one-way trip or a stop along a possibly longer journey, because invariably the turtle is killed and thus the tag is recovered. Most green turtle post-nesting migrations are between 1,500 and 3,000 km (Kolinski, 1991, 1992, Meylan, 1982, Mortimer and Carr, 1987, Pritchard, 1973, Balazs, 1976). Even more valuable has been a recent plethora of satellite tracking studies of female green turtle post-nesting migrations, though in most cases the duration of tracking has been too short for the determination of annual movement patterns (Balazs, G.H. 1994, Balazs et. al., 1994, Liew et. al., 1995, Luschi et. al., 1996).

5.258. Migrations or movements of juvenile or foraging green turtles are not as well investigated. It is likely that the species exhibits the same planktonic existence of other species for the first years after hatching. Balazs (1976) proposed for the Hawaiian green

turtle nesting population at the French Frigate Shoals that hatchling probably disperse to the west, though how far and how long is unknown. Generally loggerhead females also make long post nesting migrations in excess of 1000 km; they are generally shorter than what is documented from green turtles (Bell and Richardson, 1978, Hughes 1974, Meylan, 1982, Margaritoulis, 1988). Developmental migrations of juvenile loggerheads is probably better understood than any other species. In both the Pacific and Atlantic, hatchling loggerheads circle their respective ocean basins during their first years of life (Carr, 1987, Bowen et. al., 1995) and return to the coast they were hatched on to settle. From those foraging area they will make migrations to their natal beaches to nest. Early literature on the migration behaviour of hawksbill suggested that they were relatively sedentary and did not make long migrations (Bustard, 1979). Meylan et. al., (1997) summarizes hawksbill migrations and concludes that they migrate comparable distances to green or loggerhead turtles. The longest migration was 2,925 km, with a large number in excess of 1,000 km. Meylan et. al., (1997) also summarizes studies on hawksbill juveniles both in the Caribbean and Pacific that suggests that juveniles probably remain in the same habitat or area for many years and may only move to other developmental habitats as they grow.

5.259. Annual migrations for most species are only poorly documented or understood. I have noted where it appears that Atlantic leatherbacks make annual north-south migrations. There is also a seasonal presence of leatherbacks at various areas along the US East and West Coasts (Shoop and Kenney, 1992, Stinson, 1984). Stinson (1984) also documented the seasonal abundance of loggerheads, olive ridley and East-Pacific green turtles on the US West coast, and concluded that these species follow the 18°C isotherm. Morreale (1990) has also indicated that there is a strong correlation between temperature and presence of Kemp's ridleys and loggerhead sea turtles in Long Island sound and the coastal waters of New York. With the exception of reproductive migrations and leatherback, migratory movement of most species seem to be temperature driven. Given the relatively warm waters of Malaysia, Thailand, India and Pakistan it would not be expected that resident turtle population would exhibit annual or seasonal migrations in those countries.

Dr. J. Frazier:

5.260. The individuals of a population of sea turtles, that nests on a nesting beach, are likely to have migrated to a variety of feeding grounds. Leatherbacks make the largest movements, while in general hawksbills migrate the shortest distances. Olive ridleys take up a pelagic existence, at least in the Eastern Tropical Pacific (Plotkin et al., 1995; 1997). In any event, information on "migratory patterns" is very incomplete, and we are only beginning fully to appreciate the degree to which sea turtles move around the oceans. It has been known for decades - even centuries - that sea turtles migrate over vast distances; Brongersma (1972) compiled hundreds of records from the Atlantic coast of Europe (where sea turtles do not breed), the first of which was from the 1300s. Today, with the exception of the Australian Flatback, there are records of every species of sea turtle crossing ocean basins: viz loggerhead (e.g., Brongersma, 1972; Dodd, 1988; Bowen, 1995; Bowen and Karl, 1997); green (e.g., Brongersma, 1972; Bowen, 1995; Hirth, 1997); leatherback (e.g., Brongersma, 1972; Pritchard and Trebbau, 1984; Eckert and Sarti, 1997); hawksbill (e.g., Marcovaldi and Filippini, 1991; Meylan et. al., in press); Kemp's ridley (e.g., Brongersma, 1972; Pritchard and Marquèz, 1973); and olive ridley (e.g., Pitman, 1990; Plotkin et. al., 1995). The absence of information simply is not evidence with which to conclude that turtles do not migrate. New scientific tools such as genetic analyses (Bowen, 1995; Bowen and Karl, 1997) and satellite transmitters, are providing valuable new insights into the question of sea turtle migrations.

5.261. Generally nesting is seasonal, although in some populations nesting may occur through the year, or much of the year, with a peak in activity at a certain time of year. The migrations for which sea turtles are famous occur between nesting grounds and feeding grounds, and between feeding grounds and nesting grounds. When nesting is seasonal, these migrations will also be seasonal However, some turtles may move over large areas between nesting seasons, as seems to be the case with the leatherback. In addition to the migrations of breeding adults to and from nesting grounds, the immature turtles disperse over vast areas of the oceans, apparently taking up temporary, sequential residence in various "developmental habitats" as they mature. These movements are often referred to as migrations also, although they generally are thought not to involve return trips. Little is known about these "immature migrations".

Mr. M. Guinea:

5.262. All sea turtle species except the Australian flatback undergo extensive ocean migrations during their life. Hatchlings, after they leave the nesting beach, spend a long period, possibly a decade, at sea. In response to an unknown trigger they take up residence in an inshore feeding area. Several of these inshore feeding areas may be used as the turtle grows to maturity. Adult sea turtles are thought to migrate to nesting beaches and back to their feeding areas using the magnetic field of the earth (Lohman et. al., 1997). They are capable of crossing deep water (>2,000 m) on these migrations. The migration may be independent of the coastline of alternatively may be along the coast. The return path appears to be essentially the same route. This is done individually without any social facilitation of others or herding within the breeding unit.

5.263. The migrations are similar but at the same time they are uncoordinated. Reproductive migrations are in response to conducive nesting conditions developing in the coming months at a rookery, possibly over 1,000 km from the feeding area. In mixed feeding grounds, turtles from one breeding unit may leave at a different time and in a different direction to those of another breeding units. Some turtles may not breed that year and will remain resident on the feeding area.

5.264. The migration of a breeding unit will be seasonally to the rookery at the beginning of the breeding season and away from the rookery at the end of the nesting season. This largely goes unnoticed, except where the sea turtles pass through straits, cross shallow water or around geographic projections. This seasonality of green sea turtle migration through the waters of the Torres Straits, north of Australia, have been exploited for centuries by the indigenous islanders (Johannes and MacFarlane, 1991).

5.265. The timing and intensity of the migrations through the straits varies with the number of sea turtles nesting that season and the number of males that migrate to the breeding areas. Males leave the breeding area early in the nesting season and return to their feeding ground. Within the nesting area, movements by the female will be relatively short, 2-20 km, and coincide with movements to the nesting beach to lay the clutch and return to the offshore refuge while awaiting the maturation of the next clutch. After her final clutch the female returns to her distant feeding grounds.

Mr. H.-C. Liew:

5.266. Much has yet to be learned about sea turtle migration. From various evidences gathered, sea turtle hatchlings do not seem to migrate but head offshore on entering the sea to drift and be carried by oceanic currents for about 5-7 years. The oceanic currents may carry some of these hatchlings thousands of kilometres along oceanic gyres and may be

transported across the Pacific or Atlantic Ocean. On becoming juveniles, only the leatherback will continue this ocean-pelagic existence while the other species would begin to work their way towards shallower waters. When they find suitable feeding areas, they would establish these areas as their foraging or feeding grounds, where they may remain for many years. The range of these feeding grounds may vary between species and between turtles. As to whether they have multiple distant feeding grounds and migrate amongst them is not known. The most significant migration that sea turtles perform is their migration between feeding grounds and nesting grounds (see answer below).

Dr. I. Poiner:

5.267. Sea turtle breeding stocks usually comprise multiple rookeries within a region while foraging areas and developmental habitats comprise a mix of turtles from several genetically distinct stocks (Bowen et. al., 1995; Broderick et al., 1994). The breeding adults usually migrate relatively long distances from the foraging areas to the traditional breeding rookeries. I will illustrate this life history pattern using Australian loggerhead (Caretta caretta) and green (Chelonia mydas) turtle populations (Limpus 1997).

5.268. The Australian nesting populations of loggerhead sea turtles are genetically distinct from those in other countries and within Australia there are two genetically independent breeding populations. Breeding occurs in the summer months for both populations. Breeding females migrate up to 2,600 km from feeding areas to aggregate at traditional nesting beaches (breeding males have not been studied). In eastern Australia, females migrate from northern and eastern Australia, Indonesia, Papua New Guinea, Solomon Islands and New Caledonia. In Western Australia, recorded migrants come from Northern and Western Australia and Indonesia. Mean remigration period is 3.8yr. At the completion of the breeding season the female returns to the same feeding site as she occupied before the breeding migration.

5.269. The green turtle has a global distribution in all oceans with nesting occurring mostly in tropical areas. The Australian nesting populations are genetically distinct from those in neighbouring countries. Within Australia there are at least 5 genetically independent stocks. In addition, there are green turtles that feed in Australia that are part of stocks that breed in other countries: Indonesia (Java), northeastern PNG, New Caledonia and Pacific Mexico. Breeding occurs in the summer months for the east coast and west coast populations and during the winter for the northern populations. Breeding females and males migrate up to 3000 km from feeding areas to aggregate at traditional nesting beaches. In Eastern Australia, females migrate from Northern and Eastern Australia, Indonesia, Papua New Guinea, Vanuatu, Fiji and New Caledonia. In Western Australia, recorded migrants come from Northern and Western Australia and Indonesia. Mean remigration period = 5.8 years for females and 2.1 years for males. At the completion of the breeding season the adult returns to the same feeding sites it occupied before the breeding migration.

5(b) What is the typical range of migration of the various species of sea turtles, in particular in relation to the territories (including overseas territories) of the countries concerned? What is the maximum range?

Dr. S. Eckert:

5.270. See my response to question 5(a).

Dr. J. Frazier:

5.271. It would be difficult to derive a value for a "typical range of migration" for a population of sea turtles, much less for a species. Firstly, precise information on migrations of sea turtles from the Indo-Pacific region is only recently becoming available. Secondly, much information is from tag returns, and this only reveals where the turtle was caught - not the route it traveled, nor where it was actually headed. Third, there is often tremendous variety in the final destinations and distances where turtles are recaptured, after being tagged and released.

5.272. A very brief review of some of the more remarkable data on migrations from the Indo-Pacific follows, all it is from nesting females. As more studies are carried out, especially using satellite telemetry, a much better information will come to light on the intricate relationships between nesting beaches, feeding ground, and migratory routes.

-Although at least 2,351 green turtles and 42 olive ridleys have been tagged at Hawksbay, Pakistan (Firdous, in press), there seems only one tag recovery from outside Pakistan. One green turtle tagged in Hawksbay was recaptured in the Gulf of Kutch, India (Firdous, 1991). The distance involved is relatively short, considering the distances that green turtles are known to have moved in other populations.

-Tens of thousands of olive turtles have been tagged at Gahirmatha, Orissa, India, but few if any have been reported recaptured away from India. There are observations that flotillas of these turtles may migrate from offshore Sri Lanka to Gahirmatha (Silas, 1984; Silas et. al., 1984).

-Long-range migration data are available for three species of sea turtle in Malaysia. Leatherbacks tagged at Terengganu have been captured at tremendous distances from their home beach, as far away as Taiwan, Japan and Hawai'i (Leong and Siow, 1980). Green turtles tagged in Sarawak have been recovered as far off as Philippines and California (Leh, 1989). During recent years, a wealth of information on migrations has been coming out of Malaysia. Green turtles nesting on Redang Island, off the coast of Terengganu, Peninsular Malaysia, have been tracked with satellite transmitters more than 1,600 km east to Sabah and Philippines, as well as some 1,000 km southeast into Indonesian waters (Liew et. al., 1995a; 1995b; Papi et. al., 1995). Once they have finished nesting in the Sabah turtle islands, green turtles disperse north and east to the Philippines and even to Palau Islands, as well as south into Indonesian waters; some of the distances between sites of marking and recapture are close to 2,000 km (Chan and Liew, 1996b). Hawksbills from the Sabah turtle islands also disperse east to Philippines (Chan and Liew, 1996b).

-There seems to be no information on tagging or tag returns or sea turtle migration from Thailand.

-From the United States there is a considerable amount of information on long-range tag returns, and more recently satellite telemetry. Eckert (1993) has reviewed findings from the North Pacific. Since then several studies of satellite telemetry have documented movements of green turtles from French Frigate Shoals to Hawaii and Johnson Atoll (Balazs, 1994; Balazs and Ellis, in press), as well as from Rose Island to Samoa (Balazs et. al., 1994). Hawksbill turtles have made shorter movements, within the Hawaiian Islands (Balazs et. al., 1997; in press). Pultz et. al. (in press) found that one of six green turtles tagged while nesting on Tinian Island, Commonwealth of Northern Mariana Islands, was recaptured in Philippines a year later. Dutton et. al. (in press) have found that one of two leatherbacks caught in Hawaii had a haplotype that has been found in Indonesia.

5.273. It is important to understand that in those regions with more active research activities, more scientific information is available. The absence of information is no proof of the absence of a phenomenon; until a systematic study has been carried out to objectively show that a specific phenomenon does not occur, one cannot draw defensible conclusions on the basis of the lack of information.

Mr. M. Guinea:

5.274. The years that juvenile sea turtles spend in their pelagic existence after leaving the rookery enable them to drift around an ocean gyre. At any one time they may be thousands of kilometres away from their natal beach. (The Australian flatback is exceptional in not having a pelagic phase to its life cycle.) The coastal developmental habitats through which they pass as they mature, do not necessarily bring the sub-adult closer to its natal beach. The movement from the adult feeding ground to the nesting beach and return is considered a true migration. Tagging studies in Australia have indicated that loggerheads travel hundreds and even several thousand kilometres to nesting beaches and return during a reproductive migration. Green turtles have been recorded travelling up to 2600 km from rookery to feeding area, but most travel less than 1000 km. Hawksbills travel up to 2369 km in one instance but most travel a shorter distance. In Malaysia, green turtles travel over 1700 km after nesting (Liew, 1997). In India, olive ridleys travel within the country from Orissa to the Gulf of Mannar, over 1,000 km. Leatherbacks appear to retain their pelagic existence in adulthood and may, in their non reproductive state, be several thousand kilometres from their natal beach.

5.275. The concept of maximum range is attributable to sea turtles that migrate from a feeding area to a nesting area and return to the feeding area. The maximum ranges as reported above are in the order of 2,000 km. Breeding units from nesting beaches may be detected on feeding grounds. Comparisons between the genetic profiles of a sample of sea turtles at a nesting beach and a sample of adult mature females turtles on the feeding ground may indicate if they are of the same breeding unit. This may be supported further by tagging programmes. If a turtle has been tagged either at the feeding ground or the nesting beach, then its life history may be pieced together from subsequent recaptures on either feeding grounds and the nesting beach. It is the successful completion of the migration that separates a normal sea turtle from a "waif" which has been carried or drifted out of its "normal" range.

Mr. H.-C. Liew:

5.276. Turtles migrate from their feeding or "home" grounds to the nesting grounds when they are physiologically ready and are in the reproductive phase. This does not occur every year for the individual female but happens in cycles of between 2 to 7 or more years. This is because the females need to build up sufficient fat (or food) reserves to sustain them throughout the breeding season which may last up to 3-4 months before they are able to return back to their feeding grounds. What is known of the green turtles throughout this period, i.e. during migration and at the nesting grounds, they hardly feed. Hence migration ranges would be somewhat restricted. The migration ranges of most green turtles would be in the region of 500 to 2,500 km. Anything beyond that would put severe restrictions on their survival. Leatherbacks, however, being and ocean-pelagic species are capable of migrating over much longer distances.

Dr. I. Poiner:

5.277. See my response to 5 (a).

Question 6:Relation between sea turtles and shrimping grounds

6(a) Does sea turtle biology and in particular the spatial and temporal relation between sea turtles and shrimp differ between the Atlantic and the Indo-Pacific waters? To what extent do habitats and/or nesting grounds of the different species of sea turtles coincide with shrimp fishing grounds?

Dr. S. Eckert:

5.278. Due to the limited information available on the distribution of foraging turtles in Thailand, Malaysia, India and Pakistan I am not able to address the question of where shrimping and turtles might interact. Except for the few reports of where turtles have been killed by shrimping (Orissa, India, Terengannu, Malaysia, United States Atlantic coast and Gulf of Mexico), predicting where such interaction could occur is difficult.

Dr. J. Frazier:

5.279. It is important to understand that "sea turtle" refers to any one of five species of sea turtles, and "shrimp" refers to scores of species; in some countries, a dozen species of shrimp and prawn may be harvested. Each species will have its own life history, with different spatial and temporal characteristics. I am not versed in these details. The spatial and temporal relationship between sea turtles and shrimp trawling has been abundantly and systematically documented. The first global review on the subject was presented by Hillestad et. al. (1982), and since then much more information has become available. There have been specific studies in both northern and eastern Australia (Poiner and Harris, 1994; Robins, 1995 Guinea and Whiting, 1997); on the Pacific coasts of Guatemala, El Salvador, Nicaragua and Costa Rica (Arauz, 1990; 1996a; 1996b; Arauz et. al., 1997a; 1997b); Mexico (Olguin, 1996); along the southern Atlantic and Gulf of Mexico coasts of the United States (National Research Council, 1990; Crowder et. al., 1994; 1995; Weber et. al., 1995); and on the Caribbean coast of Venezuela (Marcano and Alio, 1994). There is also information in the scientific literature from many other countries, such as: Eritrea (Hillman and Gebremariam, 1996), India (e.g., Silas et. al., 1983a; 1983b; 1985; Pandav et. al., 1997), Kenya (Wamukoya et. al., 1996), Malaysia (Suliansa et. al., 1996; Ali et. al., 1997), Mauritius (Mangar and Chapman, 1996), Tanzania (Howell and Mbindo, 1996) and Turkey (Oruç et. al., 1997).

Mr. M. Guinea:

5.280. Just as there are a number of species of sea turtle there are even more species of shrimp. Generalizations about sea turtles and shrimp interactions should be avoided as different shrimp species of different market value have different preferred habitats. Particular shrimp species are targeted by the operators. In Australian trawl fields, some species e.g., the banana prawn (*Penaeus merguiensis*) form dense aggregations which discolour the shallow water and the schools of prawns form an image on depth sounders. Beam or otter trawls are used to target such aggregations. Tow durations rarely exceed 30 minutes. In such short tows on a targeted school, sea turtles are rarely captured. Other prawn species inhabit deep water (90m). Trawls may be longer, but turtles are seldom found at those depths and any negative impact is unlikely. Trawling for some tiger prawn species is conducted in shallower water, with 3 hours per tow being relatively common. They have the potential, if unchecked by restrictions, to interact with loggerhead, olive

ridley and flatback sea turtles. Operators may target different shrimp species at times of the year. Or alternatively they may target different species within a single cruise.

5.281. Regions offshore from sea turtle rookeries, by the soft nature of the sea bed, may support a shrimp ground. These areas offshore from rookeries should have seasonal closures to fishing activities that have the potential to harm sea turtles. The extent of the closed area will depend on the species of sea turtles nesting. Some species may be protected by a 3 km wide refuge, but others e.g., leatherback, may require a width of 20 km for a successful refuge. This is a situation best left to the legislators of the respective countries. All the countries in the dispute have indicated that sanctuaries or seasonal refuges have been established offshore from nesting beaches.

Mr. H.-C. Liew:

5.282. In a broad general sense, they are similar but there will also be localised differences. In Asia, we have the wet and dry season brought about by the monsoon, which may be somewhat different in the Atlantic. Even within the same region, some sea turtle populations nest in the dry season, but others may nest in the wet season. There are also some locations, like in the Sabah turtle islands where nestings occur throughout the year. The season for shrimp trawling may also differ. Feeding habitats of different sea turtles would differ depending on their diet but these habitats may overlap. An area of seabed may have green turtles, hawksbills, loggerheads and ridleys occurring together as the area may have pockets of seagrass, sponges, crabs, shrimps, molluscs and fish there. On the other hand, over a seagrass area in an estuary, you may find only green turtles feeding there. Since loggerheads and ridleys feed on crustaceans and molluscs while green turtles and leatherbacks feed on seagrass/algae and jellyfish respectively, shrimping grounds would have a stronger association with loggerheads and ridleys than the other species. Not all sea turtle nesting grounds have good shrimping grounds in the vicinity. Sipadan Island, off Sabah, Malaysia, is a world renown nesting beach for green turtles but no shrimp trawlers can operate there as the waters off the island is 2,000 ft deep. Many such islands and atolls do occur throughout the Indo-Pacific.

Dr. I. Poiner:

5.283. Globally, tropical and sub-tropical shrimp fisheries are generally concentrated in relatively shallow coastal waters (< 80m). Sea-turtle nesting and foraging habitats also tend to occur in the shallow coastal waters. Hence there is and will continue to be significant interaction between shrimp fisheries and sea-turtles.

6(b) Are statistical comparisons of the interaction between shrimp trawling and sea turtle populations in the Atlantic and in the Indo-Pacific waters available? If so, what do they indicate?

Dr. S. Eckert:

5.284. To the best of my knowledge there are no statistical comparisons on shrimp fishery / sea turtle interaction between the waters around Thailand and Malaysia and the United States. However, there are some studies on the Australian prawn fishery (Dredge, and Trainor, 1994, Harris and Poiner, 1990, Poiner et. al., 1990), the latter comparing Northern Australian catch rates directly to Henwood and Stuntz (1987) report of US catch rates. While this study showed comparable catch rates between the US Gulf of Mexico and Northern

Australia, the mortality rate for Australia was much lower. Unfortunately, for comparative purposes the Australian study was hampered in that the primary species caught (43 per cent) was the endemic Australian Flatback. This species has a very unique life history as compared to all other marine turtle species and it is not known if it has a higher resistance to drowning than other species. Thus, it is difficult to know if the different mortality rates are due to geographical or species composition differences between Australia and the United States.

Dr. J. Frazier:

5.285. Systematic studies of the interactions between shrimp trawling and sea turtles have been carried out in both Northern and Eastern Australia (Poiner and Harris, 1994; Robins, 1995); on the Pacific coasts of Guatemala, El Salvador, Nicaragua and Costa Rica (Arauz, 1996a; 1996b; Arauz et. al., 1997a; 1997b); along the southern Atlantic and Gulf of Mexico coasts of the US (National Research Council, 1990; Crowder et. al., 1994; 1995; Weber et. al., 1995); and on the Caribbean coast of Venezuela (Marcano and Alio, 1994).

Mr. M. Guinea:

5.286. Available data indicate that sea turtle mortality rates are higher in the Gulf of Mexico (29 per cent) and Atlantic Ocean Shrimp Fishery (21 per cent) than has been found in the Northern Prawn Fishery (6-10 per cent) and the East Coast Trawl Fishery (1-6 per cent) of Australia (Robins, 1995). The catch rates of sea turtles per unit of effort was greater in the American shrimp fisheries (0.0031-0.0487 per net h) than in the above mentioned Australian fisheries (0.0057-0.01 per net h). The species of turtles impacted also differed, with loggerheads, Kemp's ridleys and greens being present in the US fisheries and loggerheads, flatbacks, olive ridleys, greens and hawksbills present in the Australian fishery.

Mr. H.-C. Liew:

5.287. Unable to source such information.

Dr. I. Poiner:

5.288. Poiner and Harris (1996) compared the incidental catch of sea turtles in Northern Australia with the Gulf of Mexico and southern North Atlantic. The catch rate of turtles in the Australian Northern Prawn Fishery (mean 0= 0.0113, 95 per cent CI 0.0012 turtles) is higher than the rate Henwood and Stuntz (1987) reported for the Gulf of Mexico (mean = 0.0031, 95 per cent CI 0.0008 turtles) but lower than the rate they reported for the southern North Atlantic (mean = 0.0487, 95 per cent CI 0.0041 turtles). Most prawn trawling in the southern North Atlantic fishery occurs in water depths less than 18 m and, as in the Northern Prawn Fishery, catch rates vary with water depth, with the highest catch rates in water around 14 m deep. In the Gulf of Mexico, prawn trawling occurs in water depths up to 80 m, but unlike the other two fisheries, the turtle catch rate appears to be fairly constant over all depths up to 30 m.

5.289. The turtle mortality rates for the Gulf of Mexico and southern North Atlantic prawn fisheries were estimated as 29 per cent and 21 per cent of captures (Henwood and Stuntz 1987), which is higher than the 14.1 per cent estimated for the Northern Prawn Fishery. The difference may be due to different species having different mortality rates. The loggerhead dominates the American catches: 94 per cent of the southern North Atlantic and 86 per cent of the Gulf of Mexico catches. Its mortality rates were estimated as 29 per cent and 30 per cent respectively (Henwood and Stuntz 1987). The same species is a small component of the

Northern Australian catch (10 per cent), but its estimated mortality rate is similar to the American rates (22 per cent). The loggerhead therefore appears to be particularly susceptible to drowning. In contrast, the dominant turtle in the Northern Prawn Fishery catch, the flatback (59 per cent), has a low mortality rate: 11 per cent. This species is endemic to Northern Australia and tends to be found inshore in relatively shallow (<40 m) muddy waters and possibly has a higher resistance to drowning in trawls (11 per cent mortality) compared to the other species. The difference in the overall mortality rates of turtles in the American and Australian fisheries may, therefore, be due to the dominant species being more or less susceptible to drowning.

6(c) Are all species of sea turtles significantly affected by shrimp trawling in different regions of the world? Or are some species likely to be more or less affected due to their nesting/feeding habits and migratory patterns and such divergences as might occur in those habits and patterns in different parts of the world ?

Dr. J. Frazier:

5.290. Any population of sea turtles that suffers mortality of breeders or near breeders in shrimp trawls will be significantly affected, independent of the species or locality. Some sea turtle populations may be more vulnerable to shrimp trawling than others because of spatial and temporal differences in occurrence of turtles and shrimp. By the same token, some human populations may be more vulnerable to cocaine addiction than others, but in all human populations this drug represents a risk to society.

Mr. M. Guinea:

5.291. All species of sea turtles are not adversely affected by shrimp trawls. Some species have preferred habitats which do not always coincide with shrimp trawl fields. These habitats can be identified and, if need be, seasonal closures to turtle threatening activities may be imposed. Even on relatively uniform substrates sea turtle distribution is clumped rather than random. This gives rise to "hot spots" where sea turtles abound while in seemingly similar areas nearby, they are scarce. After almost one year of trials in the Northern Prawn Fishery, the Australian Fisheries Management Authority (Sachse and Wallner, in press) are looking towards a log-book programme of all sea turtle captures, resuscitation procedures for comatose sea turtles, and closure of some areas such as seagrass beds to protect juvenile tiger prawns and green sea turtles as well as the implementation of TEDs on a voluntary basis. This example from Australia demonstrates the complexity of introducing new technology into a fishery as well as adopting an ethos of responsible fishing. Any legislation requiring the use of TEDs on shrimp trawls would require the allocation of additional resources for enforcement of any such legislation. Australia is encouraging voluntary compliance by stressing the advantages of using Trawl Efficiency Devices (TEDs) in the fishery. This will take considerable time.

Mr. H.-C Liew:

5.292. All species of sea turtles have the potential of being caught in a shrimp trawl as much as any other sea creature large enough to be retained by the cod-end of the trawl net. The only difference is the probability of encounters. Some of the factors that dictate this probability are:

-Number of trawlers operating in the area, their size, power, efficiency, size of nets, trawl time, etc.
-How much the trawling grounds overlap with turtle feeding grounds.
-Species of turtles which will dictate their feeding habits, resting habits, migration routes, how long they remain on the seabed as opposed to midwater or surface, do they feed in the same area as the operating trawlers.
-Offshore internesting habitats, depth, frequency of shrimp trawlers operating there.
-Whether shrimp trawling seasons coincide with nesting seasons.
-Laws and regulations protecting the turtles.
-Enforcement of regulations.
-Awareness and education of the fishermen to turtle conservation.

All these factors do vary from region to region, hence the probability of encounters cannot be the same. There is no doubt that in some regions of the world, sea turtles are significantly affected by shrimp trawling where the probability of encounters is high but the same cannot apply for all regions. Moreover, threats due to other causes may impact the turtles more significantly than shrimp trawling for some regions.

Dr. I. Poiner:

5.293. See my answer to 6(b).

C. COMMENTS BY THE PARTIES

1. Comments by India

5.294. A review of experts' opinions shows that causes of decline of sea turtles should not be broadly categorised as being due to anthropogenic and natural causes. In the *Draft Recovery plans for US Pacific populations of Sea Turtles*[17], Eckert et al. have identified 26 different types of anthropogenic threats. The degree and magnitude of these different types of threats are not the same for all species of sea turtles. Even for the same species differences exist in different geographical regions of the world. All experts have indicated that the causes of decline of sea turtle populations have changed over time for each region and for each species. Again all the experts have emphasized the lack of information in this regard, which makes it difficult for categorization of different threats. For sea turtle populations in different parts of the world, the general consensus is that in the past populations have vanished due to exploitation of eggs, habitats and adults for commercial purposes. There was a great demand for eggs and byproducts all over the world which led to the flourishing trade. Now such large scale exploitation for commercial purposes has completely stopped in many countries including in India. Although eggs have a special value for certain other qualities in addition to nutrition in some countries, in India, there is no such tradition. Again, from the experts' opinions, it emerges that the concept of sea turtles being a global resource, while being philosophically laudable, is cumbersome in terms of conservation strategies.

5.295. The 1997 Limpus study[18] has given an overview of the status of marine turtles of South East Asia and the Western Pacific region. His report does not include the status of

[17]NMFS and USFWS, (1996) drafts a-f, p. 5.

[18]Limpus, C. (1997, *Marine Turtle Population of South East Asia and the Western Pacific Region: Distribution and Status*, Proceedings of the Workshop on Marine Turtle Research and Management in Indonesia, Jember, East Java, Indonesia, November 1996.

turtles in Indian waters. Mr. Guinea has given most extensive answer to the question quoting data from several sources. We generally endorse his views.

5.296. Dr. Eckert's statements regarding "regional populations were independent management units"[19] and that "consideration of population status must still be based on the global species status"[20] are contradictory. Even the DNA analysis and satellite telemetry data by Dr. Eckert show that the Atlantic leatherback turtles migrate within the Atlantic Ocean. Similarly, the Pacific population remains restricted to the Pacific Ocean. The sweeping generalisation regarding leatherback nesting stocks from Malaysia/Thailand/Indonesia being distributed throughout the Ocean basin is based on personal communication (Peter Dutton, NMFS)[21] and needs to be reinforced by more objective data. Though the methods of monitoring nesting population status have limitations, methods remaining the same over years can be used for conducting trend analysis. Dr. Eckert further lists a few causes for population decline for different species. The following are our comments on Dr. Eckert's views.

5.297. Dr. Eckert's views do not include the recent data (MTN, 1996) regarding the recovery of Mexican population of olive ridleys. For population status of ridleys in India he has incorporated old data and not the recent publications which shows recovery in populations (Mohanty-Hejmadi, 1994).[22] Further, Dr. Eckert has quoted several sources regarding the death of some five thousand turtles attributed to incidental catch in trawlers. As pointed out in the presentation by Indian experts to the WTO panel, the paper mostly lists the number and type of fishing vessels in Orissa in which the number of the shrimp trawlers is much less than the other fishing vessels. The conclusion that all the dead turtles are due to shrimp trawler activities is not true. Although 5,000 may seem a large number from other population point of view, India would like to draw attention to Mr. Guinea's comment that "the annual mortality of 5000 from fishing trawls and set nets from the nesting population of 600,000 with a recruitment of 85,000 appears relatively minor".[23] Further, Eckert has mentioned the attempts of State of Orissa to build fishing harbours besides the sanctuary.[24] On this point India repeats that the jetty, specially the Tachua jetty which would have affected the Gahirmatha population, was never commissioned by the Government. Further the whole area has now been declared as a marine sanctuary with the zone up to 20 km from the coast line having been declared as a "No fishing zone". At present the coast guards and the Indian Navy are patrolling the area to enforce the Government's conservation programmes. Regarding loggerhead sea turtles, Dr. Eckert has not provided data on Indo-Pacific populations.

5.298. Dr. Eckert has shown that causes of mortality for sea turtles are different in different parts of the world. For example, decline in the loggerhead populations in North Carolina is due to driftnet fishery in the high seas. The South American swordfish driftnet and longline

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[19]Eckert para. 5.20.

[20]Ibid.

[21]Eckert para. 5.21.

[22]Eckert para. 5.31.

[23]Guinea para. 5.199.

[24]Eckert para. 5.37.

fisheries are the causes of mortality of Pacific leatherbacks. Dr. Eckert has also shown that gill nesting in South America is a major problem. The facts presented by Dr. Eckert show that no generalisation can be made about ranking sources of mortality in different geographic areas of the world. Dr. Eckert has given data only about leatherback sea turtles and no data about India to rank sources of mortality. Regarding anthropogenic threats, Dr. Eckert has not included the recent developments in sea turtle protection in India. He has given the status of harvest of eggs and adults prior to 1985. Indian experts have already provided factual data to the Panel to demonstrate the highly successful steps taken by India to conserve and protect its sea turtle populations.

5.299. Dr. Eckert, Mr. Guinea and Mr. Liew have given only qualitative information to differentiate between shrimp trawl and other fishing gear in terms of the mortality they represent to marine turtles. No qualitative information has been provided on the effect on sea turtle mortality due to trawl fisheries, gillnet fisheries, longline fisheries, purse seine fisheries, fish traps, fish bombing. No information has been provided about the degree of coincidence of the above type of fishing activities in different regions of the world where significant number of turtles occur e.g. feeding, breeding, migrating etc.

5.300. Scott Eckert's view that in India, the direct harvest of eggs and meat is apparently still a problem[25] is not factually correct, as Indian experts have provided the Panel already with factual data to demonstrate that direct harvest of endangered sea turtle eggs and meat is not a problem in India. Regarding the influence of socio-economic factors on the choice and enforcement of conservation programmes, Dr. Eckert has mainly covered the conditions in America relating to application of TEDs. He has not given any answer relating to socio--economic factors in the five countries involved in this dispute. We agree with Mr. Guinea's assessment that the so-called by-catch in US terms is a commodity with either a subsistence or retail value. Mr. Guinea has given a more realistic account on the subject. However, his comment that sea turtle eggs are also eaten is not applicable to India. Large scale exploitation of eggs has been effectively banned since mid 1970s. Mr. Liew's views that turtles are slaughtered in Asia is not true for India.[26] The same applies for eggs.

5.301. In general we agree with the views of Mr. Liew that all measures that prevent sea turtles from being killed are important.[27] We further endorse the views of Mr. Guinea that nesting habitats should be preserved as should the offshore refuse habitats for nesting females.[28] Dr. Eckert's views that very little is being done by most of the countries in this dispute to protect juvenile or resident adult sea turtles[29] is not true. For most of the populations of Southeast Asia, the feeding areas remain unknown. Therefore, more emphasis has been placed on protection to adults and eggs. The offshore turtle sensitive areas declared as Marine Wildlife Sanctuaries have given adequate protection to mating/breeding/feeding/developmental habitats of sea turtles in India. India does not have "headstarting" programme for any species of sea turtle populations at present. We

[25]Eckert para. 5.129.

[26]Liew para. 5.89.

[27]Liew para. 5.183.

[28]Guinea para. 5.181.

[29]Eckert para. 5.172.

endorse Mr. Guinea's opinion that the Gahirmatha population of sea turtles is increasing or at least stable through protection of the nesting area.[30]

5.302. Dr. Eckert's view is that TEDs reduce sea turtle mortality only when installed and operated properly.[31] Even in the United States, with years of education and conservation programmes, improper use of TED has resulted in continuing mortality of turtles. Dr. Eckert has admitted that he does not have any direct experience working with trawler fisherman from other countries involved in this dispute. In reality, improper use of TEDS, inefficiency in implementation and an ineffective monitoring mechanism can significantly affect the efficiency of TEDS, both in terms of loss of catch and protection of various species of sea turtles. The socio-economic conditions prevailing in the South Asian region require a different approach to that chosen in the United States in so far as the proper use, successful implementation and foolproof monitoring mechanism is concerned. No answer has been given by Dr. Eckert to the question "can alternative measures such as seasonal and time closures, area closures or low-time limitations achieved equivalent or better results". In areas of low congregation TEDs will reduce, but not eliminate deaths of sea turtles caused by shrimp trawl net. So far, there is no study on the efficiency of TEDs in areas of high turtle congregation zones and whether in such areas TEDs can significantly reduce the mortality of sea turtles has to be studied.

5.303. India agrees with the interpretation of Mr. Liew on the points that after many years of experiments, publicity campaigns, TED trials, the United States mandated use of TEDs in 1980. As recently as 1994, NMFS reported poor compliance with US requirements. resulting in a record number of dead sea turtles. India also agrees with his views that considering the socio-economic conditions, educational level, language and cultural differences, it will take some time to convince and introduce the use of TEDs in different countries. These are all time consuming processes. Mr. Guinea has also mentioned that for TEDs to be accepted, the technology has to be adopted for the local area. There is no data on TED efficiency in Indian coastal waters except for demonstration of a few hours. No data has been collected on the efficiency of TEDs or their effect on bycatch. In so far as the "data on rate of turtle stranding in areas where TEDs are currently required or on the relationship between turtle stranding and shrimping activities in areas where TEDs are required", India endorses the views of Mr. Guinea. Data on TEDs efficiency during commercial shrimping seems to be most extensive for the United States and data from other countries and geographical locations would be necessary for comments. On this last question, India further endorses the views of Mr. Liew.

5.304. On question 3(c), India endorses the views of Mr. Guinea and Mr. Liew. On question 3(d) India endorses the views of Mr. Guinea.

5.305. In his answer to question 4(a), Dr. Eckert's data is based on specific populations. It is not clear why he has not quoted some of the recent data. However, India endorses the views of Mr. Guinea and Mr. Liew on the subject. Even Mr. Guinea has specifically cited the conservation measures devoted to eggs and hatchlings of olive ridleys in Orissa, India. Dr. Eckert has restricted his answer to question 4(b) to loggerheads in Little Cumberland Island and has not paid any attention to the data that is available for other areas. In this regard, India endorses the views of Mr. Guinea. It may be noted that he has made a special note on egg protection measures for olive ridleys in India and green turtles in Malaysia.

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[30]Guinea, para. 5.189.

[31]Eckert para. 5.202.

5.306. When examining the migratory patterns of sea turtles, Dr. Eckert has mainly used data on leatherbacks which, as pointed out by Mr. Liew, are ocean pelagic species, capable of migrating over long distances. In India, the major population is olive ridleys. Mr. Guinea has already indicated that in India olive ridleys travel within the country from Orissa to Gulf of Mannar, i.e. a distance of about 1,000 kms. On question 5(b), India endorses the views of Mr. Guinea.

5.307. On question 6(a), India agrees with Dr. Eckert's view that information is limited on the distribution of foraging turtles in Thailand, Malaysia, India and Pakistan. Dr. Eckert has cited few reports where turtles have been killed by shrimping but he has also said that predicting interactions between sea turtles and shrimp between Atlantic and Indo-Pacific waters is difficult. India would like to mention that the report often cited about turtles being killed by shrimping in Orissa, India is not true. As Indian experts have demonstrated to the Panel, the death of a relatively minimal number of sea turtles in this area is due to all types of fishing activities, and not to shrimp trawl fishing by itself. On question 6(a), India further endorses the views of Mr. Liew and Mr. Guinea.

5.308. On question 6(c), India agrees with the views of Mr. Liew and would further like to say that the turtle sensitive areas in Orissa, India, have been declared as a Marine Wildlife Sanctuary with a no fishing zone extending upto 20 km from high tide line. Indian Navy and Indian Coast Guard have been deployed for protecting the area and enforcing the Government's sea turtle conservation programmes.

5.309. On the issue of bycatch addressed in Dr. Frazier's Appendix 1 (see Annex II), India would like to recall the point made by its experts to the Panel that in India, shrimps are harvested along with other fish. There is no specific shrimp tawling activity in Indian waters. The concept of bycatch therefore has to be applied in the Indian context with due care, since the catch involves all kinds of fish, and not exclusively shrimp. Endangered species of sea turtles are not the target of fish harvesting activities in India. Indeed, India would note that Dr. Frazier has not mentioned that endangered species of sea turtles do in fact form part of the bycatch in Indian fishing operations in his description of bycatch as contained in pages 1-10 of his Appendix 1 (see Annex I). India would endorse the point made by Dr. Frazier regarding the non-exclusionary approach of India towards TEDs as one of the many ways for conserving and protecting sea turtles. The reference to ban on trawling in Indian waters off the coast of Kerala (paragraph 60 of Appendix 1), the reference to the interest in experiments on the use of TEDs in India (paragraph 77 of Appendix 1) illustrate this point.

5.310. India would like to highlight the fact brought out by Dr. Frazier's account that "the issue of endangered sea turtles, the use of TEDs and the questions of the present dispute" has been focused on in 1997 (paragraph 98 of Appendix 1). This helps to emphasize our point made to the Panel that the embargo imposed on our shrimp exports by the United States was not introduced on the basis of any factual or scientific evidence derived from Indian data known to the United States before 1997. Even data relevant to India in 1997 cannot, on a scientific basis, support the embargo imposed by the United States.

5.311. India is unable to see relevance for Indian sea turtle conservation programmes of the linkage between bycatch as a danger to the marine environment and the conservation and protection of endangered species of sea turtles (paragraphs 103-108of Appendix 1) since the argument appears to be developed on the basis of hypothetical situations, without supporting scientific data derived from Indian waters.

5.312. India would note that Dr. Frazier's views on the transfer of TED technology contained in Appendix 2 (see Annex II) of his report do not contradict the Indian expert opinion provided to the Panel, namely, that the workshops conducted under the auspices of the US NMFS in India were of too short a duration, and used only a limited type of TED made in the United States, to come to any definitive conclusion that TEDs are indeed the only way to protect and conserve endangered species of sea turtles in India. The correspondence provided by Dr. Frazier (p. 28 of Annex II) also demonstrates that India has always been interested in TEDs as one of the many ways to conserve and protect endangered species of sea turtles. Finally, India would like the Panel to disregard the objectivity of the views on the *Amicus Brief* submitted by the Centre for Marine Conservation dated 17 September 1997, as well as the WWF Amicus Brief and the Statement of Scientists attached to Dr. Frazier's opinion (see above section III.D).

2. Comments by Malaysia

5.313. In general, the views of Mr. Guinea, Mr. Liew, Dr. Pointer and Dr. Frazier (except Appendixes 1 and 2 contained in Annex II) are in conformity with the views of Malaysia. However, Malaysia does not agree with a number of points raised by Dr. Eckert and Dr. Frazier in his Appendixes 1 and 2.

5.314. Malaysia would like to reiterate that all trawling activities in Malaysia are subjected to zoning under the Fisheries (Maritime) Regulations, 1967. Under these Regulations, four zones have been established, as follows:

Zone AThe zone within 5 nautical miles for traditional fishing fears owned and operated by Malaysian fishermen. Any form of trawling is prohibited within this zone.

Zone BThe zone between 5 to 12 nautical miles is reserved for trawlers and purse seiners less than 40 GRT (Gross Registered Tonnes) owned and operated by Malaysian fishermen.

Zone CThe zone between 12 to 30 nautical miles is reserved for trawlers and purse seiners greater than 40 GRT, and other fishing gears owned by Malaysian fishermen.

Zone C2The zone beyond 30 nautical miles is reserved for foreign or partially - Malaysian owned fishing vessels greater than 70 GRT.

5.315. Zone A which covers shallow waters within 5 nautical miles (or 9.41 km.) from the shoreline would include all shallow water habitats utilized by sea turtles as feeding or internesting habitats. This zone therefore coincides with the areas where turtles concentrate. The exclusion of trawling in this zone would effectively protect the turtles from trawl nets as well as their habitats from destruction. In a sense, these zoning Regulations can be seen to be superior to TEDs requirements since it serves not only to protect the turtles, but also the habitats of the turtles from destruction by trawling activities. Enforcement as a general rule has its problems in any country. This is due mainly to the extensiveness of coastal waters and constraints imposed by limitations in financial and manpower resources. Enforcing zoning Regulations would be less cumbersome than enforcement of TEDs regulations because in Malaysia, the fishing vessels are required to paint their wheel houses with colours ascribed for each zone, besides having to mark prominently whether their

vessels are of the A, B, or C2 classes. Therefore enforcement officers can easily sight cases of encroachment.

5.316. It is recognized that sea turtles do occur in waters beyond Zone A, i.e. when they perform breeding migrations between feeding and nesting grounds. However, during migration, the turtles do not stay at the bottom, but are engaged in constant swimming activities in the pelagic zone. During this time they are more susceptible to being caught in drift nets and longlines, not trawls. Internesting habitats of leatherback turtles may also extend into waters beyond Zone A. However, leatherback turtles do not normally sit on bottom habitats during the internesting period, making them less vulnerable to incidental captures in trawl nets.

5.317. To further protect turtles, Malaysia is amenable to introducing TEDs to trawl fishermen, including both fish (since most trawlers are fish trawlers) and shrimp trawlers. However, its use should be on a voluntary basis, as is in the case of Australia. Further, TEDs should be recommended only in those places where interactions with sea turtles occur and trials must be carried out to test their suitability in fish and shrimp trawls. It is important that fishermen be convinced of the beneficial effects of TEDs for them to voluntarily use them. More educational campaigns and workshops just as the one which had been held in Perak, Malaysia, can be conducted to popularise the use of TEDs. It is clear that in order to execute a sea turtle conservation programme which is comprehensive and addresses all threats faced by sea turtles, financial resources are urgently required. It is hoped that concerned rich nations like the United States can provide funding assistance in this respect.

5.318. There seems to be some disagreement among the experts regarding the status of the green and hawksbill populations of the Sabah Turtles Islands. Limpus[32] gives the recognition of recovering status, with Mr. Guinea, Mr. Liew and Dr. Frazier agreeing, although the latter has expressed some reservations. Dr. Eckert does not acknowledge that the Sabah Turtle Islands population has recovered. His contention is that the population has been monitored only a few years and this is not sufficient to ascertain its status. Malaysia would like to reiterate that the nesting population of the Sabah Turtle Islands has been monitored since the mid-1960s[33]. A declining trend was evident in the first 20 years, from 1966 to 1987. A reversal in trend started from 1988, with the upward trend maintained since then. Chan and Liew[34] provided data up to the year 1994 (i.e. for seven years). We now have additional data for 1995 and 1996, as shown in the table below. Lately, the Sabah Turtle Islands have been subjected to erosion. Notwithstanding, the nestings did not show any appreciable decline:

Turtle nestings and egg incubation in the Sabah Turtle Islands for 1995 to 1997

Year	1995	1996	1997
No. of green turtle nestings (egg clutches) deposited	9,120	8,359	Not available* yet

[32]C.J. Limpus, (1995), *Global Overview of the Status of Marine Turtles*, in D.A. Bjorndal (ed.), Biology and Conservation of Sea Turtles, Smithsonian Institution Press; C.J. Limpus, (1997), *Marine Turtle Populations of Southeast Asia and the Western Pacific Region: Distribution and Status*, Proceedings of the Workshop on Marine Turtle Research and Management in Indonesia, Jember, East Java, November 1996.

[33]C.H. Chan and H.C. Liew, (1996), *A Management Plane for the Green and Howksbill Turtle Populations of the Sabah Turtle Islands: a Report to the Sabah Park*, SEATRU, Universiti Kolej, Universiti Putra Malaysia, Terengganu.

[34]Ibid.

No. of green turtle eggs incubated	910,274	833,078	1,032,580
No. of hawksbill nestings (egg clutches) deposited	420	615	Not available yet
No. of hawksbill eggs incubated	40,835	60,657	55,360

*Although this data is not available yet, the number of green turtle nestings have reached the ten thousand mark, based on the total number of eggs which have been incubated (on average, green turtles lay about 100 eggs per nesting).

Source:Paul Bisintal, Assistant Director, Sabah Parks.

5.319. With the additional data for the three years 95-97, we now have data which shows an increasing trend for the last nine years (1988-1997). This already fulfils the time series requirement of "6-9" years stipulated by Dr. Eckert.[35] Therefore, we do not understand why he requires "another 15 years" of monitoring before he would accord the status of "recovered" to the Sabah Turtle Islands. Dr. Eckert has criticized Malaysia for being wrong assuming that a trend in the green turtle populations can be determined only after a few years.[36] We would like to point out that the recovering trend in the Sabah Turtle Islands has been observed since 1988, more than a matter of a few years. We now have additional data for years 1995, 1996 and 1997, as shown above.

5.320. Mr. Liew, in his response to question 2(d), says that for the Sabah Turtle Islands population, "the impact (shrimp trawling), if found to be significant, may negate other conservation efforts and would need urgent action". The fact that the nesting population of the Sabah Turtle Islands has shown a recovery, with the current levels fluctuating at a level about 2-3 times the levels of post-recovery years indicates that incidental captures, including trawling mortality have not negatively impacted the current population. Current levels have not been short-lived, but instead, have been sustained since recovery in 1988. If fishing mortality is serious, there would have been a persistent continuing declining trend.

5.321. The argument put forth by Dr. Eckert for the case of the loggerheads of Little Cumberland Island, Georgia,[37] supports our contention. In this case, population recovery has not occurred even though the eggs have been accorded 100 per cent protection since 1964. Dr. Eckert attributes this to mortality associated with shrimp fishing on the Atlantic coast, which has negated the effects of 100 per cent egg protection. By the same token, there must have been an absence of significant mortality attributed to shrimp trawling and other fishing activities around the Sabah Turtle Islands to have made possible the population recovery there.

5.322. It is generally agreed that each stock or population or breeding unit of sea turtle should be identified and managed as an independent unit. These units are genetically defined.[38]

[35]Eckert para. 5.23.

[36]Eckert para. 5.186.

[37]Eckert, para. 5.241.

[38]M.Y Chaloupka and J.A. Musick, (1997), *Age, growth and population dynamics*,in: P.L. Lutz and J.A. Musick (eds.), The Biology of Sea Turtles, CRC Press, pp .234-276.

Limpus (1997)[39] recognises this when he says that "population genetics studies are clearly showing that each of the geographically separate clusters of rookeries represents an independent management unit". Mr. Guinea similarly recognizes this in his introductory comments.[40] However, Dr. Eckert does not seem to subscribe to this. He maintains that regional populations cannot be viewed as independent management units. However, he subsequently stresses that top priority should be given to the identification of turtle stock boundaries,[41] which appears contradictory to his non-recognition of independent management units.

5.323. In his response on the analysis of population status of the individual species, Dr. Eckert argues against the determinant for population size which is based on nesting density.[42] It is agreed that there are shortcomings since any population or unit stock of sea turtle comprises hatchlings, post-hatchlings, juveniles, sub-adults and adults of both male and female turtles. However, due to current limitations in assessing the status of all life stages of the turtles, nesting density is still universally used as a measure of population size for breeding units of sea turtles. Dr. Eckert's own analysis of the population status of the various species is also based on assessments of the size of nesting populations. Limpus (1997)[43] identifies a population "by the focus of its nesting population, irrespective of where it migrates to feed".

5.324. It is observed that Dr. Eckert regards sea turtles as a global resource. Malaysia refutes this as sea turtles are a shared regional resource as elaborated in Malaysia's arguments to the Panel. The recognition of different breeding stocks of sea turtles as independent management units (see paragraph 5.0) reinforces the fact that sea turtles are a regional resource, and not a global resource. Mr. Guinea essentially captures the essence of the regional status of unit stocks of sea turtles when he says "Malaysia and Thailand because of their proximity may share breeding units of some species".[44] Malaysia may share breeding units with the Philippines and Indonesia. India and Pakistan could share breeding units of some species. The United States and Mexico may share breeding units as well. It is speculative to suggest that southeastern United States shares a breeding unit with any of the other countries in the dispute. Dr. Eckert attempts to justify the status of sea turtles as a global resource by projecting a picture of extensive migrations. He hypothesises that leatherback turtles "circumnavigate the entire Pacific Ocean" and that "females from the two major colonies (Mexico/Central America and Iran Jaya/Solomon Islands) as well as the minor colonies (e.g. Malaysia) distribute into a clockwise migration of the Pacific Ocean ...".[45] Malaysia argues against this as follows:

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[39]C.J. Limpus, (1997), *Marine Turtle Populations of Southeast Asia and the Western Pacific Region: Distribution and Status*, Proceedings of the Workshop on Marine Turtle Research and Management in Indonesia, Jember, East Java, November 1996.

[40]Guinea para. 5.14.

[41]Eckert para. 5.174.

[42]Eckert para. 5.20.

[43]C.J. Limpus, (1997), *Marine Turtle Populations of Southeast Asia and the Western Pacific Region: Distribution and Status*, Proceedings of the Workshop on Marine Turtle Research and Management in Indonesia, Jember, East Java, November 1996.

[44]Guinea para. 5.87.

[45]Eckert para. 5.21.

-The work that Dr. Eckert has cited to support his view shows impressive migrations across latitudes (i.e. in a north-south direction, extending from Chile to the Northeast Pacific), but is limited in range with respect to longitudes (i.e. east-west direction). More information on the migration ranges of leatherbacks in the Eastern Pacific is provided in Eckert and Sarti (1997).[46] Here again, migration is limited with respect to longitude. The single individual which migrated westwards, beyond the longitudinal range of all other individuals studied was considered by Eckert and Sarti to be an anomaly, rather than the norm. The claim that leatherback turtles "circumnavigate the entire Pacific Ocean" is highly speculative and cannot be validated by available scientific information.

-Peter Dutton's work through a personal communication to Dr. Eckert cannot be accepted as scientific evidence, unless a written statement is issued from Dutton, outlining his method of study and how samples were procured.

Dr. Eckert's hypothesis that leatherback turtles circumnavigate the entire Pacific is an argument put forward to provide justification for the United States that they have jurisdiction over Malaysian and Thai sea turtles. What hypothesis would be offered to justify the claims of the United States for jurisdiction over the sea turtles of the Indian Ocean?

5.325. All the experts subscribe to the status listings of IUCN and CITES. Mr. Liew specifies that different populations are in different states of health, with some populations having disappeared, some near extinction, some threatened, and a few having shown some apparent recovery.[47] Mr. Guinea recognizes that "the green turtle nesting on the Turtle Islands of Sabah have staged a remarkable recovery, as have the hawksbills".[48] Elsewhere, in South Africa, leatherback turtles have also staged a recovery from 5 nesting females per year in 1963 to over 100 per year in 1995.[49] This demonstrates that although general status listings are recognized, certain populations are in fact doing quite well.

5.326. Regarding the leatherback sea turtles, it is true that, as mentioned by Dr. Eckert[50], some previously large populations, including the Malaysian population, are almost extinct. However, Spotila et. al.[51] had identified the population of 18 out of 28 important leatherback nesting areas reviewed as either increasing or stabilized. The case of the decimated leatherback population in Malaysia is recognized both locally and internationally. The local authorities have put in much effort to save the leatherback (even Dr. Eckert recognises this).[52] Malaysia would welcome international effort to bring about a recovery of the decimated population.

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[46]Eckert, S.A. and L.M. Sarti, (1997), *Distant Fisheries Implicated in the Loss of the World's Largest Leatherback Nesting Population*, Marine Turtle Newsletter 78:2-7.

[47]Liew para. 5.68.

[48]Guinea para. 5.189.

[49]G.R. Hughes., (1996), *Nesting of the Leatherback Turtle (Dermochelys coriacea) in Tongaland*, Kwa Zulu-Natal, South Africa, Chelonian Conservation and Biology 282):153-158.

[50]Eckert para. 5.26.

[51]J.R. Spotila, A.E. Dunham, A.J. Leslie, A.C. Steyermark, P.t. Plotkin and F.V. Paladino, (1996), *Worldwide Population Decline of Dermochelys coriacea: Are Leatherback Turtles Going Extinct*? Chelonian Conservation and Biology 2(2):209-222, (cited in Eckert's response).

[52]Eckert para. 5.171.

5.327. Most of the references used by Dr. Eckert to conclude that green turtles in Malaysia are in decline are outdated reports, except for Chan and Liew (1996).[53] Malaysia requests Eckert to review Chan and Liew (1996) again because this report demonstrated population recovery since 1988, and the recovery has now been sustained for almost ten years. The reference used by Dr. Eckert to allege Malaysian business interests at the Turtle Islands is not valid since Romeo Trono is a Filipino and does not have reliable information on Malaysian business interests. The allegation can only be accepted if Dr. Eckert provided a primary source. As a representative of the Malaysian government, we assure this Panel that there is currently no business developments being considered in the Turtle Islands which may destroy the natural habitats or in any way pose any threat whatsoever to the continued recovery and survival of the turtle population there.

5.328. In Malaysia, hawksbill sea turtle are not hunted any more. The outlook for Malaysian hawksbills is not as dismal as Dr. Eckert has made it out to be. The hawksbill population in the Sabah Turtle Island has recovered in the same manner as the green turtles (Chan and Liew, 1996). According to Limpus (1997)[54], "[t]he largest hawksbill nesting population in Southeast Asia appears to be in the Sulu Sea Turtle Islands of Sabah (Malaysia) with a nesting population of several hundred females annually. This .... may currently be increasing significantly". Elsewhere in Malaysia, hawksbill nesting appears stabilized, except in Terengganu where it has declined. Efforts are being made in Terengganu to maximise egg protection.

5.329. It is recognised that the causes of decline of sea turtle populations are generally similar for all species of sea turtles. However, the degree of threat of each of the causes may vary according to time, place, and a variety of conditions. These views are held by Mr. Guinea, Mr. Liew and Dr. Frazier. Dr. Poiner says that it is difficult to rank mortality factors either currently or over time. The views of Mr. Guinea, Mr. Liew, Dr. Frazier and Dr. Poiner are upheld because the same conditions do not prevail uniformly in the United States, India, Malaysia, Pakistan and Thailand. Notwithstanding, Dr. Eckert argues the "...by far the most serious threat to sea turtle stocks living in coastal environments are trawl fisheries".[55]

5.330. Dr. Poiner and Mr. Guinea are of the view that it is not possible to rank the sources of mortality. Mr. Liew believes that in the United States mortality caused by shrimping is high, while in India, Pakistan, Malaysia and Thailand, other fishing methods such as sunken set nets or "pukat pari" may have a greater impact than shrimp trawling. The information provided by Dr. Eckert and Dr. Poiner that shrimp trawling presents the most serious threat to green turtles[56] is inconsistent with the findings of NRC (1990) which has not even listed shrimp trawling to be among any of the factors responsible for green turtle mortality. The major threats identified in the reference were direct exploitation of eggs and meat, and the degradation of nesting and feeding habitats.

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[53]Eckert para. 5.29.

[54]C.J. Limpus, (1997), *Marine Turtle Populations of Southeast Asia and the Western Pacific Region: Distribution and Status*, Proceedings of the Workshop on Marine Turtle Research and Management in Indonesia, Jember, East Java, November 1996.

[55]Eckert para. 5.119.

[56]Eckert para. 5.92 and Poiner para. 5.118.

5.331. There is currently no large and continuing illegal egg take in Sabah and Sarawak. Some poaching may occur, but most of the eggs are being conserved. Eckert (1993)[57] mentioned that data supplied by the Sarawak Museum showed that in 1989 and 1990, 185,461 and 117,701 eggs were collected respectively. The implication is that the eggs were still collected and completely marketed. Dr. Eckert failed to provide the rest of the information where, out of these eggs, 107, 237 (57.8 per cent) and 88,869 (75.5 per cent) were respectively replanted in hatcheries (Leh, 1997).[58] In subsequent years, over 90 per cent of the eggs collected have been conserved (Leh, 1997). Leh has also provided turtle landing statistics in Sarawak from 1970 to 1996, which showed population stabilization, rather than decline. In the Sabah Turtle Islands, close to 100 per cent of the eggs collected are conserved (Suliansa, 1997).[59] It is true that legalized egg harvest is still a problem in Peninsular Malaysia. However, numerous hatcheries have been established where increasing percentages of eggs are being purchased from the egg collectors for conservation. Local governments provide funds for the purchase of eggs for incubation and this is supplemented by conservation projects conducted by universities[60], resort and chalet operators and other conservation groups.

5.332. Malaysia agrees that incidental mortality caused by fishing gear does occur, but in Malaysia, shrimp trawling is not the major gear impacting sea turtles. The more serious gear are the fish trawls and bottom gill nets which are used for catching rays. The latter nets have been banned. Dr. Eckert cites Crouse (1987) whose study was based on loggerhead turtles and tries to extrapolate the conclusions to all species of sea turtles. The conclusion that loggerheads "... pick foraging habitats that are most strongly correlated to shrimp fisheries" is true for loggerheads and this is the very reason why loggerheads suffer the most serious impact of shrimp trawls. However, it has not been shown anywhere that leatherbacks, green or hawksbill turtles "...forage in shallow waters with soft bottoms that characterise shrimp habitat".[61] Dr. Eckert is of the opinion that "stage 3" sea turtles of all species, meaning large juveniles and sub-adults, forage in shallower water with soft bottoms which characterise shrimp habitat. He thinks that these habitats are the developmental habitats since the turtles at this stage cannot dive as deeply nor as long as larger mature animals. Malaysia would like to point out that this is a generalization, and not a proven scientific fact. This generalization has been extrapolated from studies conducted on loggerhead turtles. However, if this is possible, zoning Regulations in Malaysia prohibit any form of trawling activity in these shallower waters.

5.333. There is some confusion with regards to the word "trawl"; as it is used in Malaysia, trawling means fish trawling, not prawn or shrimp trawling. However, in the United States, trawling is synonymous with shrimp trawling. The Malaysian publications which prescribe turtle mortality to trawls actually refer to mortalities in fish trawls and not shrimp trawls.

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[57]K.L. Eckert, (1993), *The Biology and Status of Marine Turtles in the North Pacific Ocean*, NOAA Tech. Memo, NOAA-TM-NMFS-SWFSX-186, 156 pp. (cited in Eckert's response).

[58]C.M.U. Leh, (1997), *Country Status Report: Status of Marine Turtles Conservation in Sarawak*, Proceedings of the First SEAFDEC Workshop on Marine Turtle Research and Conservation, SEAFDEC MFRDMD RM/3:13-20.

[59]M.S. Suliansa, (1997), *Country Status Report 2: Status Report of Sea Turtle Management at the Turtle Islands Park, Sabah Parks*, Proceedings of the First SEAFDEC Workshop on Marine Turtle Research and Conservation SEAFDEC MFRDMD RM/3:21-34.

[60]See the SEATRU website at http://www.upmt.edu.my/seatru.

[61]Eckert para. 5.74.

Grazier, referred to by Dr. Frazier[62], cites Siow and Moll (1982) when he attributes declines in turtle population is Malaysia to prawn trawling. The exact words of Siow and Moll were "... increases in fishing activities, especially trawling and drift-netting were blamed for the ... dead turtles on the beach ...". There was no mention of prawn trawling in the reference. The type of trawling referred to be Siow and Moll (1982) was fish trawling.

5.334. Malaysia recognizes that the trans-Pacific and trans-Atlantic movements (not migrations) of hatchlings and post hatchlings sea turtles described by the experts. Malaysia wishes to point out to the Panel that the extensive ranges of the hatchlings and post hatchlings occur only during the first few years of the life cycle of turtles and that at this phase, turtles are found only in the pelagic zones. In terms of vulnerability to shrimp trawls, this phase of the life cycle is of no relevance. It is true that leatherback turtles show extensive migration. However, the circumnavigation of the Pacific Ocean by all leatherback populations which nest in the Pacific area, as alleged by Dr. Eckert is highly speculative and is as yet unsupported by published scientific data. Data available so far indicate that movements of leatherback turtles which nest along the Eastern Pacific range from the north-eastern Pacific to the south-eastern Pacific, but do not extend to the Western Pacific. The satellite tracking work conducted by Dr. Eckert illustrates this point as explained in paragraph 5.0 above. The recent satellite tracking data on green turtles show regional migrations which do not exceed 3,000 km in range, with most within the 2,500 km range. The studies involved were carried out over a few months, and in most cases, were continued well after the turtles had reached their destinations at the feeding grounds. Studies in Australia have shown that adult green turtles do not change feeding grounds, but remain within particular feeding grounds until the next reproductive migration. They also return to the same feeding site they occupied before the breeding migration.[63] Therefore, green turtles do not perform annual movements, their migrations are strictly between feeding and nesting grounds at 2-7 year intervals.

5.335. Dr. Eckert has attempted to discredit the recent satellite tracking studies of post-nesting green turtles by saying that the studies have been carried over too short a duration to determine annual movement patterns. Malaysia would like to point out that adult green turtles, unlike the loggerheads, do not undertake annual migrations. Dr. Eckert himself admits that "given the relatively warm waters of Malaysia, Thailand, India and Pakistan, it would not be expected that resident turtle populations would exhibit annual or seasonal migrations in those countries".[64]

5.336. Malaysia notes that the experts are quite divided about the status of breeding populations which have recovered based on protection of nesting beaches, nesting females and 100 per cent protection of eggs. There are examples where conservation programmes focused on protection of eggs and hatchlings have proved effective in population restoration or maintaining it at a sustainable level. Malaysia would like to cite the following examples: Tongaland, South Africa where beach patrols and 100 per cent protection of eggs and nesting leatherbacks on the beach, and in the absence of TEDs application, have resulted in a recovery of the population from 5 to over 100 nesting females per season (Hughes, 1996).[65] This recovery was gradual and occurred over a period of more than 30 years, from 1963 to 1995. In

[62]Frazier para. 5.56.

[63]See Poiner para. 5.269.

[64]Eckert paras. 5.257 and 5.259.

[65]G.R. Hughes, (1996), *Nesting of the Leatherback Turtle (Dermochelys coricea) in Tongaland, KwaZulu-Natal, South Africa*, Chelonian Conservation and Biology 2(2):153-158.

this proceedings, Malaysia also gave the example of the Sabah Turtle Islands. Examples are also provided in the responses of Mr. Guinea and Mr. Liew to question 4(a). In that regard, Malaysia wonders where would the sub-adult and adult turtles come from if the eggs were not protected in the first place? Dr. Poiner has cited several studies conducted in Australia which indicate that protection of eggs and hatchlings also have a major impact on long-term stock viability, and that predation on eggs makes a significant contribution to increased mortalities.[66]

5.337. The priority action for sea turtle conservation would vary, as stipulated by Dr. Poiner.[67] Mr. Guinea mentions protection of nesting habitats and offshore refuges for nesting females as priority.[68] However, Dr. Eckert advocates one set of uniform priority actions for all species and all countries.[69] We hope that Dr. Eckert can appreciate the level of capability and financial resources in poor developing countries. The priority actions given by Dr. Eckert are indeed idealistic and the dream of every sea turtle conservationist. However, each country is able to act only within the limitations of its financial and manpower resources. To the question posed by the Panel "Do these [socio-economic] factors influence the choice and enforcement of conservation programmes", Dr. Frazier puts it in a nutshell by responding very succinctly "Yes, they do". The time when reproductive females are most vulnerable to exploitation and capture are the times when they arrive predictably and concentrate on specific nesting beaches to nest. Therefore, in sea turtle conservation, a top priority should be to eliminate direct capture and harvest of sea turtles on nesting beaches. Malaysia has been practising this for many decades now, in addition to protecting nesting beaches as well as eggs.

5.338. Malaysia would like to draw the attention of the Panel and experts to the fact that TEDs were developed for shrimp trawlers where the targeted species are shrimp and all other catch, including fish that are considered to be bycatch. In Malaysia and other developing countries, most of the trawlers in operation are fish trawls which target fish, both small and large-sized fish. TEDs developed in the United States will not be appropriate under such conditions as they will cause the escape of large fish which are targeted in the trawl fisheries of the region. Dr. Eckert believes that TEDs are extremely simple to use and that the socio-economic conditions in complainant countries would not pose a constraint. Theoretically, this may seem to be the case. However, in the practice of TEDs deployment, an array of situations and problems may arise. This is apparent as seen in the strong resistance of US shrimpers the mandatory use of TEDs (Weber et. al., 1995).[70] Further, even after TEDs became mandatory in the United States, large numbers of turtles continued to strand.

5.339. Malaysia notes that Dr. Eckert has not answered question 3(b) in context. The question is "Is there any data on TEDs efficiency during commercial shrimping?" The studies of Renaud et. al., (1990, 1991) cited by Eckert were "controlled" tests. Further, Crowder et. al., (1995) cited by Dr. Eckert used a model to predict the effects of TEDs. Dr. Eckert did not attempt to cite the references from which he drew his three conclusions. The examples cited by Dr. Eckert for other countries were results from trials conducted by gear specialists and not from actual

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[66]Poiner para. 5.201.

[67]Poiner para. 5.185.

[68]Guinea para. 5.181.

[69]Eckert para. 5.174.

[70]M. Weber, D. Crouse, R. Irvin and S. Iudicello, (1995), *Delay and Denial: A Political History of Sea Turtles and Shrimp Fishing*, Center for Marine Conservation, p. 12.

commercial shrimping carried out by the fishermen themselves.[71] Dr. Eckert has avoided answering questions concerning rate of turtle stranding in areas where TEDs are currently required. Malaysia has already provided data to the Panel (see Section III.B); in addition, Mr. Liew in his response to question 3(b) refers to Coyne (1997), who states that "while Kemp's ridley are nesting, others are dying in large numbers along the Texas coast ... so far this year (1997), 275 dead turtles have washed ashore up along the Texas coast ... biologists still see a big decline in dead turtles washing ashore when the Gulf of Mexico is temporarily closed each year to shrimping". The last part of the quote shows that closed seasons appear more effective in reducing turtle mortality.

5.340. Dr. Eckert talks about problems in enforcement relative to seasonal and time closures, area closures and tow-time limitations.[72] Similar problems would apply to TEDs enforcement as well. There is information which reveals that US fishermen disengage their TEDs once they are out at sea (Seber et. al., 1995).[73] There is information which shows that TEDs may be exempted after storms. Apparently, debris in the nets prevent TEDs from closing, allowing shrimp to escape, thus reducing shrimp catch efficiency.[74] Malaysia would like to stress again that prohibition of trawling within 5 nautical miles of the coastline eliminates turtle mortalities attributed to both fish and shrimp trawling in these shallow waters. Enforcement of the regulations is facilitated, as explained in paragraph 5.0. What is needed in Malaysia is not an additional regulation but rather more financial resources and personnel to enhance existing enforcement of regulations which are already in place for the protection of sea turtles against trawling activities.

5.341. Malaysia notes that some experts have cited several studies conducted on loggerheads and attempted to superimpose or extrapolate the findings uniformly on all species of sea turtles in all geographical regions. This is not acceptable for the following reasons:

-The reproductive values of sea turtles: population modelling of loggerheads in the United States (Crouse et al. 1987)[75] give a reproductive value of 584 for breeders, as opposed to the value of 1 for eggs or hatchlings. Studies on Australian loggerheads put a reproductive value of 200-400 on adult females, depending on the population.[76] These two examples show that even for the same species, the values will vary according to geographical location. This is obviously the case since the same conditions do not prevail.
-Similarly, survivorship values must necessarily differ among species and geographical locations. The extent of threats confronting sea turtles would differ from location to location.
-Dr. Eckert cites the case for loggerheads which "pick foraging habitats that are most strongly correlated to shrimp fisheries".[77] This is true for loggerheads, and accounts for the fact

[71]Eckert para. 5.210-213.

[72]Eckert para. 5.223.

[73]M. Weber, D. Crouse, R. Irvin and S. Iudicello, (1995), *Delay and Denial: A Political History of Sea Turtles and Shrimp Fishing*, Center for Marine Conservation, p. 12.

[74]CURTLE List (Internet Source), T. Steiner, 14:30 pm 29-07-97, *Are TEDs Comming Off?*, referred to by Mr. Liew.

[75]Referred to by Frazier, para. 5.196.

[76]Guinea para. 5.198.

[77]Eckert para. 5.74.

that loggerheads suffer the most serious impacts of shrimp trawls. However, it has not been shown anywhere that leatherbacks, green or hawksbill turtles similarly pick such habitat (see paragraph 5.0).

5.342. Evidence is provided in the experts' responses that green turtles are directly harvested in the thousands annually in some countries (approaching 30,000 annually)[78], but yet, these same countries are given exemption to the import prohibition. Does this not amount to arbitrary or unjustifiable discrimination between countries?

5.343. Malaysia recognizes the effort and time Dr. Frazier has dedicated towards preparing his lengthy discourse on the issue of bycatch in modern fisheries (Annex I, Appendix 1). The international community, Malaysia included, is well aware of all the issues associated with bycatch. In recognising this, FAO adopted the Code of Conduct for Responsible Fisheries in 1995. Malaysia fully supports the Code, and is especially appreciative of the way in which it has been mediated - through international consensus. Malaysia would like to state that nations should not impose trade prohibition on every fisheries product found to have a relationship with an endangered species. Such actions cannot bring about conservation, and is certainly not the way to bring about cooperation in saving an endangered species. Malaysia believes on a proper balance between the urgent and recognized need for conservation and impact on people and livelihood. Any form of conservation requires the dedicated cooperation of the various groups of people directly dealing with and affected with conservation matters. FAO and fisheries bodies and organizations are working out ways to mitigate the problems recognized in modern fisheries, and they are the ones most competent to do so.

5.344. With reference to the example mentioned in paragraph 72 of Appendix 1, Malaysia would like to repeat that the TEDs trial referred to in Ali (1997) was conducted in a zone which is off limits to trawling. Therefore, Dr. Frazier should not use the CPUE derived from this study to calculate the potential number of turtles caught per year. For extrapolation, the CPUE should be derived from trawling activities, which are conducted in those zones where trawling is permitted.

5.345. With regard to Appendix 2 provided by Dr. Frazier, Malaysia notes that the Panel did not request the experts to provide information on the issue of transfer of TED technology. However, in Appendix 2, Dr. Frazier has obtained a long list of documents relating to TED technology transfer. Malaysia would only point out that the correspondence appended to Appendix 2 merely lists down individuals who have written to NMFS. There does not demonstrate any actual transfer of TED technology. Malaysia therefore requests the Panel to disregard Appendix 2 as any form of proof that there was technology transfer. Malaysia does not contend that the United States has been incompetent or made inadequate attempts at TED technology transfer. Malaysia, however, wishes to reiterate that the United States has not made any official offer or attempt at a government-to-government level to negotiate an agreement for the protection of sea turtles in Malaysia. Malaysia further reiterates that there has been no workshop conducted by the United States in Malaysia itself, apart from the participation by Malaysia in a regional workshop organized by the Department of Fisheries, Thailand, in cooperation with the Department of Foreign Trade and NMFS, US Department of Commerce. Malaysia similarly reiterates that this workshop was held way after the imposition of the import prohibition which commenced on 1 May 1996.

[78]Liew paras. 5.138-139 and Poiner para. 5.140.

5.346. To conclude, Malaysia notes that the United States is merely addressing shrimp trawling in its effort to conserve turtles. Malaysia contends that merely introducing TEDs for shrimp trawling only may save certain breeding units in certain places, for example the Gulf of Mexico, where shrimp fishing grounds coincide with habitats of turtles there. In other parts of the world where interactions do not occur, fish trawling, gill nets etc. would cause more turtle mortality rather than shrimp trawling alone. Therefore, there is a need to address the conservation of turtles in a broader spectrum rather than confining one's effort to the effect of shrimp trawling on turtles. Dr. Frazier's report contained in Appendix 1 aptly highlights the issues and concerns for selective fishing and the conservation of turtles and the need for international cooperation rather than a unilateral initiative on the part of the United States in this case. It simply demonstrates the magnitude of the problem which we believe the United States alone, as one of the 132 WTO Members, could never hope to address adequately in a unilateral manner. In conclusion, Malaysia would like to request the Panel to consider the introductory comments of Mr. Guinea[79] which have captured the essence of the present dispute.

3. Comments by Pakistan

5.347. Pakistan is located along the rich and bountiful Arabian sea which is very rich in species diversity. A large number of marine animals and plants are found along the coast of Pakistan. Among the reptiles, sea snake and sea turtles are commonly found along the coast of Pakistan sea. Sea turtles, as in other parts of the world, inhabit shallow coastal waters especially along sandy, sandy *cum* rock and rocky shores. Females come to lay their eggs at high water marks on sandy shores. Along the coast of Pakistan turtles are found on a number of sandy beaches; important among them are Sandspits, Hawks Bay, Paradise Point, Cape Monz, Goth Mubarak, Gaddani, Malan, Had Ormara (West Bay), Tay, Sakoni, Astola Island, Shumal Bundar and Jiwani. Five species of marine turtles are known from Pakistan including loggerhead, green turtle, olive ridley, hawksbill, and leatherback, though only the green turtle and the olive ridley seem to be common.[80] Other species are known to have very rare occurrence. Very little work has been done on the population of turtle in coastal waters of Pakistan except Kabrahi and Firdous (1984)[81] who calculated the population of green turtles to

[79]Guinea paras. 5.14-18.

[80]Butler, E.A., (1877), *Astola, a summer cruise in the Gulf of Oman*, Stray Feathers, Calcutta, 5:293-304; Firdous, F., (1986), *Marine turtle*, Proceedings of International Conference on Marine Science of the Arabian sea, Institute of Marine Sciences, University of Karachi; Ghalib, S.A., and S.S.H. Zaidi, (1976), *Observations on the survey and breeding of marine turtles of Karachi coast*, Agric. Pak 27(1):87-96; Groombridge, B., (1982), *The IUCN Amphibia-Reputilia Red Data Book*, Part I, Testudines, Crocodylia, Rhynchocephalia, IUCN, Gland, Switzerland; Groombridge, B., (1983), *A preliminary environmental profile of the India-Pakistan Bodelands in the Sind-Kutch region*, IUCN Conservation Monitoring Centre, Report for the World Bank; Groombridge, B., (1987a), *A preliminary marine turtle survey on the Makran coast, Baluchistan, Pakistan with notes on birds and mammals*, Unpublished report, IUCN Conservation Monitoring Centre, Cambridge; Groombridge, B., (1987b), *Makran coast: a newly explored habitat for marine turtle*, WWF-Pakistan Newsletter 6(2):1-5; Groombridge, B., (1989), *Marine turtles in Baluchistan: report of an aerial survey*, 9-11 September 1988, World Conservation Monitoring Centre, Cambridge, U.K; Groombridge, B., A.M. Kabraji and A.K. Rao, (1988), *Marine turtle in Baluchistan (Pakistan)*, Marine Turtle Newsletter 42:1-3; Kabraji, A.M., and F. Firdous, (1984), *Conservation of turtle, Hawkesbay and Sandspits, Pakistan*, World Wildlife Fund Project 1451, Unpublished report, WWF International ad Sind Wildlife management board, 52 p.; Khan, M.S. and M.R. Mirza, (1976), *An annotated chcklist and key to the reptiles of Pakistan*, Part I, Chelonia and Crocodilia, Biologia, Lahore, 22(2):211-219; Minton, S.A., (1962), *An annotated key to the amphibians and reptiles of Sind and Las Bela, West Pakistan*, Bull. Am. Mus. Nat. hist. 134; Minton, S.A., (1966), *A contribution to the herpetology of West Pakistan*, Bull. Am. Mus. Nat. hist. 142(2); Pernetta, J.C., (ed.), (1993), *Marine Protected Area Needs in the South Asian Seas Region*, Volume 4, Pakistan, A marine conservation and Development Report, IUCN, Grland, Switzerland, 42 p.; Shockley, C.H., (1949), *Herpetological notes from Ras Jiunri*, Baluchistan Herpetologogica 5:121.

[81]Kabraji, A.M., and F. Firdous, (1984), *Conservation of turtle, Hawkesbay and Sandspits, Pakistan*, World Wildlife Fund Project 1451, Unpublished report, WWF International ad Sind Wildlife management board, 52 p.

be about 24,000 to 36,000 and that of olive ridley turtle to be 800 and 1,200. The figures for green turtles are seemingly overestimated because even visual and casual observations of the coastal area do not verify such high concentrations of green turtle in waters of Sindh. Along the coast of Balochistan, major turtle populations are observed in Taq (Ormara), Sakoni, Astola Island and Jiwani.

5.348. Turtles are very slow growing animals and achieve maturity at about 30 to 50 years. Recruitment is considered to be very low because of high mortality at early ages due to natural predation and human interference. Most turtle species world over are considered to be severely depleted due to human and natural factors. All turtle species are considered to be threatened along the coast of Pakistan. Their populations are considered to be thin along the entire coastline. Steps have been taken by the Government to enhance population of sea turtles by banning their commercial exploitation through Wildlife acts and through a programme of enhanced recruitment by protection of eggs and juveniles of hatchling. As with most recovery programmes of sea turtles, recruitment is very slow and considerable changes will be seen only after a very long period. In Pakistan the major threats to sea turtles are anthropogenic (Table I).

Table I

Anthropogenic threat to sea turtle species along the coast of Pakistan

Threat	Status
Habitat alteration and loss	
Beach armouring (e.g. concrete sea wall)	No sea wall is constructed along nesting beaches. Threat to turtle population and nesting areas because these are located only on a few beaches, also not inhabited except on holidays and mostly located above high water mark in sand berm areas.
Artificial lights	Not used along sea coast.
Dredging and explosive platform	No such activities in Pakistan, especially along turtle nesting beaches.
Boat strikes	No report of boat strikes with turtles from Pakistan. Only a few speed boats in Pakistan which are not operated in turtle areas.
Feral and domestic animal predation at rookeries	Feral dogs are reported to dig out recently laid eggs of turtles on some beaches along Karachi coast. Sindh Wildlife Department with help on municipal agencies regularly carry out elimination of pye dogs from important turtle beaches. However, it is not a serious threat to turtle nesting.
Oil pollution	Most of the turtle nesting beaches are located West of karachi, therefore, not affected from oil pollution generated from Karachi and other ports (because circulation in most parts of the years remain clockwise). Tar balls are found on sandy beaches. But since no major oil spill has occurred in the area, therefore, oil pollution seemingly a threat to turtle nesting beaches. Those turtle found in sea are also not affected because oil pollution is not a major problem in the area.
Other pollution sources and entanglement	
Debris ingestion	A few reports of debris ingestion report. This problem seems to not serious at present.
Entanglement	No record on any turtle entanglement in debris and solid waste materials. May however, occur if level of such pollutants increase in sea.

Threat	Status
Fishing and incidental capture	
Shrimp trawling	Not a threat because of small mouth opening of shrimping net, short duration of operation, location of shrimping ground in muddy cum sandy areas (not a turtle habitat) and use of manual retrieval system (vs. mechanical retrieval system in other parts of world such as in United States).
Pelagic fishing gears	No record of mortality from any other pelagic fishing gears. Encircling nets are used for catching sardinellas and anchovies but because of the their mode of operation these do not pose any threat to turtle population.
Gill nets	Major fisheries along the coast of Pakistan. However, seldom any record of turtle in the nets. If a turtle is found in the net, it is released immediately.
Traditional and Commercial fishing	
Egg harvests (legal or illegal	No harvesting of eggs in Pakistan.
Adult harvest (legal or illegal)	No legal or illegal harvesting of adult turtle. Considered to religiously forbidden.

5.349. Decline in sea turtle population is attributed to a number of factors in other parts of the world, including habitat alteration, loss of nesting and foraging areas, pollution and commercial harvesting. In Pakistan, probably pollution may be the only factor which to some extent started affecting turtle populations; however, it is not a serious threat owing to circulation pattern and restriction of pollution to city of Karachi. Fishing operations not targeting sea turtles, shrimp trawling, can lead to incidental catches of sea turtles, especially in the United States. However, this is not a problem in Pakistan because trawl nets have smaller mouth, the operation is done manually, the duration of fishing operation is short and shrimping grounds are located in areas not inhabited by turtles. On very small scale commercial harvest of sea turtles was done along Karachi coast in early 1970's but since then this commercial harvesting was totally stopped. Along Balochistan coast in 1982, turtle commercial harvesting was done for a few months but the Fisheries Department took immediate action and since then no commercial harvesting of turtle is done. Groombridge[82] had reported mortality of turtles in Balochistan owing to commercial harvesting. These statements were based on a rapid assessment trip made to Balochistan coast during late 1980's. The harvesting referred to in these studies occurred in 1982, after which commercial harvesting was altogether stopped. Authentic information cannot be collected during snap visits to one particular area, especially if one is not familiar with the major turtle beaches and because of language barriers. Similar sweeping statements are made in these articles about utilization of sea turtles by local population. These area all based on speculations. Local population do not consume or utilize sea turtle for any specific purposes. Sonmiani has not been visited but nevertheless turtle utilization has been presumed in these areas. It can be categorically stated that turtles are not utilized nor consumed in Pakistan for any specific purpose.

[82]Groombridge, B., (1987a), *A preliminary marine turtle survey on the Makran coast, Baluchistan, Pakistan with notes on birds and mammals*, Unpublished report, IUCN Conservation Monitoring Centre, Cambridge; Groombridge, B., (1987b), *Makran coast: a newly explored habitat for marine turtle*, WWF-Pakistan Newsletter 6(2):1-5; Groombridge, B., A.M. Kabraji and A.K. Rao, (1988), *Marine turtle in Baluchistan (Pakistan)*, Marine Turtle Newsletter 42:1-3.

5.350. The major cause of mortality amongst various factors in Pakistan seems to be natural factors. Along the Sindh coast in 1970's and along Balochistan in 1982, the major cause for the mortality was due to commercial harvesting. At that time, eggs on small scale were also harvested for utilization in some bakeries. But these practices were altogether stopped since then. About 3 to 4 turtles die each year entangled in gillnets. However, no mortality is reported from shrimp trawling operations. Habitat alteration and other human activities do not cause any mortality of turtles.

5.351. Disposal of solid waste seems to be the important anthropogenic factor which may interact with turtle populations; in particular, disposal of polyethylene bags may result in accidental ingestion by turtles. Anthropogenic factors seem to be more important at sea, especially around the city of Karachi. The pollution is restricted to Karachi area. Most of the nesting grounds are located in areas not affected by sea pollution. Egg harvesting is not done in Pakistan and no harvesting of sea turtles is practised. With the exception of gillnetting, which may lead to a few turtle mortality, other fishing operations do not affect turtle population in Pakistan. Shrimp trawling, in particular, does not lead to sea turtle mortality. It is worth mentioning shrimp trawling is not practised along the major part of the coastline. There is a total ban on the shrimp trawling along Balochistan coast which covers about 800 km (out of a total of about 1050 km coastline). It is also interesting that along the Sindh coast (about 250 km) the turtle population is restricted to about 50 km along the Western coastline. Turtles are rarely seen along the remaining 200 km of the coastline facing mouth of River Indus, which is mostly muddy. Mortality of turtles in gillnet fisheries is mostly confined to green turtles and olive ridleys are seldom reported entangled in gillnets. Other species, though reported from Pakistani waters, are of very rare occurrence.

5.352. Shrimp trawling in Pakistan does not lead to any sea turtle mortality. A few turtles, however, do die every year in gillnet fishery. Along Balochistan coast, gillnet mortality is comparatively higher (about 4 to 5 each year) as compared to Sindh where about 2 to 3 turtles die entangled in gillnets.

5.353. Direct exploitation of sea turtles is done in Pakistan. As already pointed out, in the 1970's along Sindh coast and in 1982, commercial harvesting of sea turtle was practised but since then commercial harvesting of sea turtle is effectively banned in Pakistan. Under Sindh and Balochistan Wildlife regulations turtle are declared protected animals and thus no commercial harvesting is allowed. Since turtles are not consumed locally, no illegal fishing is in practice in Pakistan. Conservation measures taken by the Government have led to the protection of the turtle populations in Pakistan.

5.354. Turtle harvesting is not done on a commercial scale in Pakistan; therefore, there is no relation of dispute with socio-economic condition of Pakistan. Turtle harvesting done in 1970's along the Sindh coast was not a regular fishery of the area. It was started by a group of exporters to meet the demand in South East Asian countries. Fishermen and the local population resented this harvesting; in particular, the local population was very much annoyed with commercial harvesting done in Ormara, Balochistan, in 1982. The Fisheries Department had to take action and stopped this operation effectively.

5.355. There is a need to start protection of the nursing ground, especially that of hatchlings and to ensure their safe release in the sea, as has been done by Sindh Wildlife Department in Sanspits area. This programme may be started in Balochistan, as well as in other areas of the Sindh coast. There is also a need to start mass scale tagging programmes to understand

migration and population biology of sea turtles. There is also a need to study other aspects of sea turtle biology, such as stock assessment, natality and mortality parameters.

5.356. Turtle population in area of Taq (Ormara), which was exploited at a commercial level in 1982, has started showing signs of recovery for a period of about 3 years. In 1982 commercial harvesting was done on a small scale but because the local population protested, the Fisheries Department stopped this harvesting. Taq now receives a large number of females which lay their eggs on these beaches. Along the Sandy beaches of Sandspits, where the Government of Sindh has started egg protection in fences, more females are reported visiting these beaches for laying eggs. There seems to a stable population of turtles in the Sandspits area. Protection of sea turtles through Wildlife Acts has helped population stabilization. Though not adequately managed, the wildlife acts were instrumental in controlling commercial harvesting. This was supported by the fact that there is no commercial utilization of sea turtles by local population in Pakistan.

5.357. There is not enough long term data from Pakistan on the various life stages (eggs, hatchlings, large juveniles, sub-adults and adults) which may indicate the importance of any particular stage in population recovery or stabilization. However, results from various parts of the world showed the importance of all these stages in population recovery, depending on the areas.[83] The programme of protection of eggs and hatchlings by the Government of Sind may have a bearing on the population of adults after a decade because this programme was started in 1980 and hatchlings released will mature by 2010 or later (because sea turtle mature in about 30 years or so). Since the species of sea turtles are protected by law and mortality due to gillnet fisheries or pollution is negligible, there seems to be no potential threat to turtle stocks in Pakistan. However, this does not mean that further protective measures are not needed. There seems to be a need to start work on various aspects of population biology of turtles, as well as to take steps for protection of eggs and hatchling, so that natural mortality due to predation and other factors may be reduced.

5.358. TEDs are not installed in shrimp trawlers in Pakistan because of following reasons:

-Pakistan has a substantially large shrimping fleet, consisting of about 2,000 medium sized trawlers. The net used on these trawlers is comparatively much smaller. Its opening during operation is about 2m x 15 m. In addition, the net is towed at a very slow speed, usually less that 2 knots. Because of the small size of the opening and the slow speed of the trawler, turtles can easily avoid these nets. The entrapment of turtles is seldom noticed in shrimp trawlers.
-Major shrimping grounds are located along the Sindh coast, in the areas east of Karachi.[84] Indus estuarine creek and adjoining areas of the mouth of the creeks are the main areas of concentration for shrimp catching activity. The bottom of these areas is muddy *cum* sandy, therefore, not suitable for sea turtles. No turtle nesting is reported from the Indus estuary, associated creeks and adjoining areas.
-Major turtle nesting, feeding and breeding areas are located between Sanspits, Hawks Bay up to Cape Monz. These areas have sandy and sandy *cum* rocky bottom, which is ideal for turtles. Shrimp trawling is not carried out in these areas because of the bottom is not suitable. Shrimp are also not reported in these areas.

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[83]Chaloupka, M.Y. and Musick, J.A., (1997), *Age, growth and population dynamics*, p. 233-276, in: The Biology of Sea Turtle, Eds. P.K. Lutz and J.A. Musick, CRC Press, Boca raton, USA; Crouse, D.T., L.B. Crowder and N. Casewell, (1987), *A stage based population model for loggerhead sea turtles and implications for conservation*, Ecology 68:1412-1423; Crowder, L.B., D.T. Crouse, S.S. Heppell and T.H. Martin, (1994), *Predicting the impact of turtle excluder devices on loggerhead sea turtle populations*, Ecological Implications 4:437-445.

[84]Zupanovic, S., (1973), The Pakistan Shrimp resources, FAO TA-3218, FAO, Rome, 76 p.

-Turtle are regarded as sacred animals and killing them is considered to be a bad omen. Fishermen, therefore, do not kill any turtle if accidentally entrapped in the net but release it immediately. In addition, there is no turtle fisheries in the country. Similarly turtles are not eaten and there is also a ban on the export of any products derived from turtles. Turtle mortality because of shrimp trawling is therefore insignificant.
-By-catch studies carried out by research organizations in Pakistan have not reported a single case of turtle entrapment, even juvenile or hatchling, in shrimp by-catch.
-Studies carried out by the Sindh Wildlife indicate that turtle population is static. There is no increase in turtle nesting due to breeding programmes.

5.359. Shrimp trawl net used in Pakistan was designed in 1958 when shrimping was introduced for the first time in Pakistan.[85] No change in the design of the shrimp trawl net has been made since then. A typical shrimp trawl has a circumference of 860 meshes by 50 mm stretched mesh and a cod end of 25 mm stretched mesh, lined with a second layer of 10 mm stretched mesh.[86] Wooden trawlers of about 15 m are used for shrimp purposes. There is no mechanical device used on the shrimp trawler and every operation of deployment and retrieval is done manually. The crew consists of about 8 to 16 fishermen. Duration of trawl operation is about 30 minutes to one hour, depending upon the catch rate. In addition to target species, i.e. shrimp, a variety of fish and invertebrates are caught as bycatch. The Marine Fisheries Department started a programme of analysis of shrimp bycatch which indicated a preponderance of juveniles of food fishes, small fishes, invertebrates and flotsam. The study revealed that adult and juvenile turtles are not represented in the bycatch. A creel survey was conducted by Marine Fisheries Department in June and July 1997 and about 146 fishermen were interviewed to find out the frequency of turtle entrapment in shrimp trawl nets. The results revealed that turtles are very rarely entrapped in shrimp trawl nets. In almost all cases where a turtle was accidentally entrapped, it was released immediately. Fishermen have not reported any case of mortality due to drowning in net. It is worth mentioning that along the coast of Balochistan (which covers about 800 km out of 1050 km of the entire coastline of Pakistan) shrimp trawling is not allowed.

5.360. TED's are known to reduce bycatch in various parts of the world. Since no turtle dies in shrimp trawl nets in Pakistan, there seems to be no justification to press upon installation of these gears. However, under a phased programme, TED's or other bycatch reduction devices may be installed in shrimp trawl nets in Pakistan so that catch of non target species may be reduced. There is no data on TEDs efficiency in Pakistan because these gears are not installed in shrimp trawl nets. Turtle stranding has been reported by Firdous recently, especially in June; however, the mortality cannot be attributed to shrimping because June and July are closed season for shrimping. The mortality during this period may be attributed to intensive monsoonic wave action, which may result in colliding of sea turtles with man-made structures or vessels operating in the area or to any other cause but not to shrimping.

5.361. There seems to be not adequate justification for installation of TEDs in all shrimp fisheries. Pakistan shrimp fishery is an excellent example where the size of nets, tow duration

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[85]FAO, (1995), *Report to the Government of Pakistan on mechanisation of West Pakistan fishing boats*, UNDP/FAO, TA; Jaleel, S.A., (1978), *Fish resources of Pakistan*, UNESCO/IOC Advanced Regional Traning Course in Biological Oceanography, karachi, Pakistan (4-30 November 1978), 21p.; Qureshi, M.R., (1961), *Pakistan's Fisheries*, Central Fisheries Department, Karachi, Pakistan, Government of Pakistan Press, Karachi.

[86]Khan, M.Y., (1994), *Fishing techniques in coastal waters of Pakistan*, in: Proceedings of national Seminar of Fisheries Policy and Planning, Marine Fisheries Department, Government of Pakistan, Karachi 345-364; Van Zalinge, M. Khaliluddin and W. Khan, *Pakistan's Shrimp Fishery*, in: Proceedings of national Seminar on Fisheries Policy and Planning, Marine Fisheries Department, Government of Pakistan, Karachi 130-177.

and area exclusion result in no mortality of turtles. Similar practices in other parts of the world can lead to protection of sea turtle population. Advocating the installation of TEDs in all shrimping activities is, therefore, not justified. Other management tools, if properly used, can result in similar reduction of incidental mortality of sea turtles. Since TEDs are not used in Pakistan, comments on efficiency of TEDs in Pakistan cannot be made. However, there is a need for TEDs to be selected and adapted to individual local fishing conditions, in particular to the design of shrimp trawl net used in a particular area, including Indo-Pacific waters.

5.362. An effective programme of protection of sea turtle eggs and hatchlings was started under the auspices of the Wildlife Department, Government of Sindh in 1980. This work is confined to Sandspits area. It is believed that this programme has helped to at least maintain the population of sea turtles to a static level, if not to restore the population. Stop and control on commercial onslaught of sea turtles and harvesting of their eggs, general public awareness are other benefits of this programme. Long terms effects of these conservation measures will be known only after a few decades because turtles take a very long time to mature. Similar programmes started in other countries, especially to control or prohibit control of egg harvests as a conservation measure, but no evidence of recovery of any of these populations.[87] Although egg protection and hatchling release started in Pakistan in early 1980's, it seems difficult to assess the effects of such a programme on the recovery of the adult population after a period of about two decades. It will take another ten to fifteen years before any substantive evidence on the population recovery is available. However, studies in other parts of the world based on modelling indicate that protection of eggs/hatchlings may have a major impact on long term stock viability.[88]

5.363. Sea turtle migration is not well understood in all parts of the world. However, it is known that breeding adults usually migrate over very long distances from breeding areas to foraging grounds. Such information is especially lacking about sea turtle populations inhabiting the Arabian Sea. One specimen of sea turtle tagged in Pakistan (Sindh coast) was captured in Kutch, India, which indicates that there is a long distance migration involved in populations inhabiting Arabian Sea; however, to understand the actual migration pattern and their seasonality, etc., it is necessary to have regional cooperation amongst the countries of the area, as well as to increase tagging programme. Information on the typical range of migration of sea turtles is not available for sea turtle populations living along the coast of Pakistan. However, sea turtles are known to have extensive migration.

5.364. Shrimp are known to inhabit shallow coastal waters predominantly in areas with muddy *cum* candy bottom. This is the reason why most shrimping grounds along the coast of Pakistan are located in front of River Indus delta. Other shrimping grounds are Gaddani (in Sonmiani Bay) and Pasni, etc. All these areas have muddy *cum* sandy bottom. Major turtle populations of sea turtles which spend a part of their life cycle in shallow coastal waters inhabit areas with sandy or rocky *cum* sandy bottoms. However, there may be marginal overlapping of shrimping and turtle foraging and breeding areas. However, because of short tow duration and small mouth opening of the trawl net, turtle entrapments in shrimp trawl operations are very rare. Even if some turtles get entrapped, they do not die because of short tow duration. Since turtles are considered sacred animals in Pakistan, they are released immediately. No nesting ground is located in shrimping areas along Pakistan's coast. Statistically there is significant difference in incidental catches of sea turtle in shrimping nets in

[87]Limpus, C., (1997), *Marine turtle population of South east Asia and Western Pacific Region: Distribution and Status*, p. 37-72, Proceedings of Workshop on Marine Turtle Research and Management in Indonesia.

[88]Somers, I., (1994), *Modelling loggerhead turtle populations*, in: Proceedings of the Marine Turtle Conservation Workshop, p. 142-153, (Comp. R. James), Australian National Park and Wildlife Service, Canberra, Australia.

various parts of the world.[89] However, since no incidental mortality of sea turtles is reported from Pakistan, a comparison with other fisheries cannot be made.

5.365. Sea turtle populations of all species are not affected by shrimp trawling in Pakistan. Even if it is presumed that mortality of turtles occurs due to shrimp trawl operations, then there should be stranded carcasses of sea turtles on the beaches, especially during peak shrimping period, i.e., August and October. In such instances, strandings should occur on the beaches east of Karachi, especially Clifton, Bundal Island and islands on Indus creeks, since shrimp trawling operations during this period are carried out in the nearshore areas off Karachi and Indus delta. However, no stranding of dead turtles was observed in the area.

4. Comments by Thailand

5.366. Review of the experts' responses to the Panel's questions reveals that the factual issues before the Panel are highly complex and that much of the available data is subject to varying interpretations. However, in general the responses contradict many of the "facts" that the United States has asserted to support its position that the measures are justified under Article XX of the GATT 1994. Based on the responses, the Panel should determine that the US shrimp embargo is inconsistent with the GATT 1994 and should recommend that the United States dismantle the embargo in conformity with its obligations under the GATT 1994.[90]

5.367. In support of its claim that the conservation measures at issue are "necessary" and therefore justified by Article XX(b), the United States has asserted that: (i) accidental drowning in shrimp trawl nets is the greatest single cause of human-induced sea turtle mortality and (ii) other measures to protect sea turtles are not sufficient to allow sea turtles to recover from the brink of extinction. To support its contention that the measures "relate to" the conservation of an exhaustible natural resources as required by Article XX(g), the United States has asserted that shrimp trawl nets have caused the greatest number of human-induced sea turtle deaths, accounting for more sea turtle deaths than all other human activities combined, and (ii) TEDs are highly effective in preventing such mortality.

5.368. In addition, in response to arguments raised by Thailand, the United States asserted that the measures were "made effective in conjunction with" domestic legislation as required by Article XX(g) because TEDs technology was readily available by the mid-1990's so that, by the time that Section 609 became applicable to the complainants, they were able to reap the benefits of the research and development that the United States had been undertaking on TEDs technology for many years and therefore received even-handed treatment irrespective of the fact that they were not give the same phase-in period provided to US shrimpers. Finally, and again in response to arguments raised by Thailand, the United States argued that the measures complied with the Preamble of Article XX since at the time the TEDs requirement applied to initially affected nations, TEDs technology was neither as well-developed nor as readily available, especially for developing countries; by the time Section 609 became applicable to shrimp harvested in the complainants' countries, extraordinarily effective TEDs were both inexpensive and easily available, making the adoption of TEDs programmes considerably more feasible.

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[89]Pointer, I.R. and A.N.M. Harris, (1996), *Incidental capture, direct mortality and delayed mortality of sea turtles in Australia's Northern Prawn Fishery*, Mar. Biol. 125:813-825.

[90]In presenting these arguments, Thailand does not concede any of its legal arguments concerning whether the Article XX exceptions invoked are applicable to the measures at issue.

5.369. A review of the responses provided by the experts demonstrates that the above assertions are incorrect. In general, the information provided indicates that a majority of the experts disagree with these factual assertions. On the whole, the experts' responses demonstrate that the United States has not, and cannot, meet its burden of establishing that the measures at issue are justified by Article XX.

5.370. The United States has alleged that "the greatest human-related cause of sea turtle mortality is drowning in shrimp trawl nets" and has relied upon this assertion to demonstrate that its conservation measures are "necessary" within the meaning of Article XX(b). However, a majority of the experts consulted by the Panel recognize that different sea turtle species and even different populations or stocks of the same species are subject to different threats in different locations. Additionally, the responses demonstrate that even when the same threat is present in multiple locations, the significance of that threat may vary in each location. Consistent with these general observations, the experts have identified multiple sources of mortality for sea turtles in Thailand; while it is generally stated that the overall impact of each source cannot be quantified, it is clear from the responses that within Thailand, the significance varies by species and location. Thus, while shrimp trawling is the greatest human-induced threat to sea turtles in US waters, the responses demonstrate that this is not categorically true elsewhere, and it is not true in Thailand.

5.371. While several of the experts disagreed as to what constitutes a particular "population" or "stock" of turtles, the experts stated that threats to sea turtles vary in different locations throughout the world.[91] Specifically, it was stated that the causes of decreased recruitment and/or increased mortality vary according to time, place and a variety of conditions.[92] Further, even when the same threat is present in several locations, its significance or intensity will vary from location to location.[93] Indeed, as Thailand has argued throughout this proceeding, the United States has erroneously extrapolated from conditions in the United States in forcing its conservation measures on other nations. In this respect, Mr. Guinea specifically noted that he has difficulty extrapolating conclusions described in the report

[91]Frazier para. 5.40 ("depending on the time, place and circumstances, the factors affecting a particular sea turtle, or stock of sea turtles, will vary."); Eckert paras. 5.25-5.37 (noting various threats that affect different species in different locations); Poiner para. 5.71 (showing that egg harvest and adult harvests are threats in Thailand and Malaysia, but not in the United States); Liew para. 5.69 (indicating that shrimp trawling is the most significant threat for the US mainland; fibropapilloma disease is a significant threat to green turtles in Hawaii, and egg exploitation and large scale hunting turtle meat is significant in Indonesia); Liew para. 5.89 (noting that in developed countries, mortalities caused by high technologies such as shrimp trawling are prominent, while in developing countries egg harvest and turtle harvest still occur and, other fishing techniques may have a greater impact than shrimp trawling); Liew para. 5.115 (noting that the relative importance of threats varies by species); Liew para. 292 (noting that in some regions threats due to other causes may impact sea turtles more significantly than shrimp trawling); Guinea para. 5.61 (noting that the nature and level of threat varies for each breeding unit). Interestingly, with respect to the impact of shrimp trawling on loggerheads in the United States, Dr. Eckert cites a 1987 source (two years before the imposition of the US Federal TEDs requirement) for the assertion that "this threat in the United States has largely been eliminated with the application of TEDs in shrimp trawls." (Eckert para. 5.36). Thailand believes this assertion has been largely discredited by information presented by several of the other experts concerning the high strandings of turtles in the United States since imposition of the TEDs requirement.

[92]Frazier para. 5.43.

[93]See Poiner para. 5.116 ("Anthropogenic threats in the three countries [the United States, Malaysia and Thailand] are similar ... but their relative importance is different."); Poiner para. 5.118, (shrimp trawling is the most significant factor in the United States but is not a key factor in Australia); Liew para. 5.69 ("the factors that are known to cause decline in sea turtle populations are generally similar but differences do exist in terms of importance for different populations... The degree of importance of factors threatening turtles in different parts of the world does differ."); Liew para. 5.292 (noting the multiple factors that may impact the interaction between sea turtles and shrimp trawling and that the factors vary from region to region.); Guinea para. 5.15 (generalizations concerning sea turtle and shrimp trawl interaction "are incorrect and hamper management options of the individual countries in managing their breeding units of sea turtles."); Guinea para. 5.15 ("Because of their preferred habitats most greens and usually hawksbills and leatherbacks are relatively unaffected by trawling."); Frazier para. 5.102 ("each sea turtle population may have specific sources and intensities of mortality").

Decline Of The Sea Turtle to the global scale.[94] In fact, Mr. Guinea cited specific evidence demonstrating that in Northern Australia incidental take from gill nets is far greater than incidental take in shrimp trawls.[95] If, however, resources are diverted from meeting this threat because they are being expended to implement the conservation measures imposed by the United States, there may be a negative net effect on turtle mortality.

5.372. Consistent with the fact that threats and their significance vary between regions and species, the evidence presented by the experts demonstrates that threats and their significance vary throughout Thailand. All of the experts indicate that direct exploitation of both adults and eggs has been a serious threat to sea turtles in Thailand in the past, and continues to be so today. Additionally, threats to sea turtles in Thailand include destruction of habitat through development and incidental mortality in a variety of fishing gear. Quantitative information on the relative significance of the threats is generally not available; however, the responses and cited sources indicate that the significance of the threats varies from region to region in Thailand and from species to species. Further, to the extent that shrimp trawling is identified as a threat in Thailand, it is identified as a threat in certain locations and/or in conjunction with other threats. Moreover, the threat appears to be associated with trawlers operating too close to shore - a situation that is addressed by Thai legislation banning commercial fishing within 3 km.

5.373. Mr. Liew presented a table summarizing the findings presented by C. Limpus in a 1997 paper. The table indicates that excessive egg harvest is an issue that must be addressed for all species of sea turtle found in Thailand; however, fisheries bycatch mortality is not listed as a threat to any species in Thailand.[96] Mr. Guinea listed four anthropogenic threats to sea turtle populations in Thailand: (i) the over-use of marine turtles and their eggs as food in the past; (ii) the sale of marine turtle products to tourists and for international trade; (iii) the deterioration of nesting habitats and marine pollution; and (iv) the incidental capture of marine turtles in commercial fishing operations.[97] Shrimp trawling is not singled out in this list as a threat in Thailand, as it is in Mr. Guinea's list of US anthropogenic threats, suggesting that the reference to "commercial fishing operations" is not specifically targeted to shrimp trawling.

5.374. Dr. Poiner also identified several human-induced threats to sea turtles in Thailand: egg harvests, adult harvests, shrimp trawling, pelagic fishing gear, gill nets, debris ingestion, entanglement, and habitat alteration and loss.[98] With respect to Thailand, the chart presented by Dr. Poiner is based on three sources. The Limpus article (Limpus, 1997) has previously been discussed and does not identify shrimp trawling as a threat that must be addressed in

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[94]Guinea para. 5.18.

[95]Guinea para. 5.124 (noting a single gill net killed more sea turtles in four days in Northern Australia than are killed annually in the same location in shrimp trawls).

[96]Liew para. 5.139. In the source material provided by Mr. Liew, Dr. Limpus notes that the small nesting population of hawksbills at Ko Khram appears to have stabilized in the last 20 years. While, as discussed below, the majority of experts agree that TEDs are not a required conservation measure, this evidence further demonstrates that alternatives such as area closures can be used to achieve conservation purposes.

[97]Guinea para. 5.106. It should also be noted that while Mr. Guinea states that any ranking given is indicated in the references listed, no such references appear to have been listed and therefore further comment is not possible.

[98]Poiner para. 5.71.

Thailand. The Settle article[99] states that the study upon which the article is based did not address threats at sea, that the dominant threat to sea turtle survival includes egg collection and turtle hunting, that indirect take in numerous types of fishing gear, such as trawls, drift nets, and purse seines, plays a significant role, and that loss of nesting habitat to beach from development is another serious threat. Further, the Monanunsap article[100] identifies shrimp trawling as an issue only in some locations in Thailand and states that the ban on in-shore fishing and regulations controlling the number of trawls and pushnets have reduced incidental sea turtle capture in trawls. In general, Dr. Poiner stated that it is difficult to rank the various sources of mortality.[101]

5.375. Dr. Frazier similarly identified a variety of threats to various species and in various locations in Thailand.[102] He noted that "the most recent review of the status of marine turtles in Thailand identifies [the threats as] commercial exploitation of sea turtles and their eggs, coastal development, heavy fishing activities (trawling, gill nets, and long lines)".[103] Dr. Frazier also cites a 1996 press report by Matchima as indicating that sea turtles have been caught and killed by trawlers. In this respect, we note the 1996 article by Matchima indicates that small trawlers, not deep-sea large trawlers, are responsible for netting and killing most sea turtles and that the small boats are using longline hooks and gill nets.[104] Further, Dr. Frazier indicates that excessive exploitation may be occurring with respect to green and ridley turtles in Thailand.[105]

5.376. Dr. Eckert stated that there are a number of threats to sea turtle populations in Thailand, and that the most serious appear to be "shrimp trawling and killing of turtles and taking of eggs".[106] However, there is substantial evidence calling into question Dr. Eckert's identification of shrimp trawling, as opposed to other forms of incidental take, as one of the three most serious threats in Thailand. In this respect, the sources cited by Dr. Eckert do not rank trawling *vis-à-vis* other human-induced threats, and cite trawling as a factor only in certain areas of Thailand and generally in conjunction with other threats. Further, the sources identify the threat as trawling too close to shore - a threat addressed by Thai legislation. In Hill (1991), the complaint voiced by one villager on the Andaman Sea coast is that "large trawling boats ... illegally lay their seines too close to shore, within the legal three kilometres limit".[107] The K. Eckert (1993) source[108] cited by Dr. Eckert is a compilation of available sources

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[99]Settle S., (1995), *Status of Nesting Populations of Sea Turtles in Thailand and their Conservation*, Marine Turtle Newsletter 68:8-13.

[100]Monanunsap, S., (1997), *Country Paper - Thailand*, Proceedings of the Workshop on Marine Turtle Research and Management in Indonesia, Jember, East Java, Indonesia, November 1996, pp. 139-149.

[101]Poiner para. 5.90.

[102]Frazier paras. 5.56 and 5.96.

[103]Frazier para. 5.96.

[104]Matchima Chanswangpuwana, Thailand: *Small Trawlers Blamed for Sea Turtle Losses*, Bangkok Post, 11 March 1996.

[105]Frazier para. 5.134.

[106]Eckert para. 5.94.

[107]Hill, G., (1991), *Villagers in Thailand Protect Turtle Eggs, Bring Conservation Home*, Marine Turtle Newsletter, 53:8-9.

[108]Eckert, K., (1993), T*he Biology And Status Of Marine Turtles In The North Pacific Ocean*, NOAA Tech Memo, NOAA-TM-NMFS-SWFSC-186. 156p.

concerning threats to sea turtles undertaken for purposes of analysing threats posed by high sea drift nets. As an initial matter, we note that this compilation of available data occurred prior to the report on the *Night Trawl Study*[109] or the study by Sujittosakul and Senaluk[110], that demonstrated a lack of interaction between shrimp and trawlers around Kram Island and therefore could not include these sources in the discussion on Thailand. Further, this source similarly identifies the problem as interaction between shrimp and trawlers in shallow waters. With respect to quantification threats, the source identifies the impact of both trawling and longlining as "unknown" but possibly large. The full quote from that article is that

> "[t]he magnitude of the take incidental to other forms of fishing, notably trawling and long-lining in modern times, has not been quantified. Catch rates for single trawlers in the Java Sea ... and southern China Sea ... appear low, but the effect of the entire fishing effort could be large".[111]

Notably, the K. Eckert compilation of sources omits reference to the fact that catch rates from single trawlers appear low. Moreover, it is not even clear that the statement made in the Polunin and Nuitjy article is referring to the effect of individual Thai trawlers in Thai waters; one of the sources referred to in that article relates to single trawlers in the south China Sea and is entitled *Variations in size and composition of demersal trawler catches from the North coast of Java with estimated growth parameters for three import and food-fish species*.[112] Similarly, in another source entitled *Report on the Java Sea Southeast Monsoon trawl survey June-December 1976*, the authors explained in the introduction that because Indonesia "is far richer in sea turtles than is Thailand; most of this account therefore deals with Indonesia".[113] Finally, it is important to note that in the section of the article on conservation methods, the authors do not even mention TEDs or any regulation of the fishing industry. Instead, they focus on measures to address direct exploitation.

5.377. Dr. Eckert also cites *Status of Marine Turtles in Thailand*, by Chantrapornsyl.[114] Thailand already has discussed this source in detail. With respect to green and hawksbill turtles located in the Gulf of Thailand at Khram Island, the article states that a reduction in the number of sea turtles is due to "heavy fishing activities" including trawling, drift gill nets and long-lines. No statement is made as to which particular activity has the greatest impact. With respect to the Andaman Sea Coast, trawling is cited as a problem only near Phrathong island and in conjunction with egg collection, gill nets, and housing and hotel development. The article notes that the prohibition against commercial fishing within 3 km of the coastline was enacted because of a finding that most sea turtles in Thailand are caught from shallow water trawling

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[109]*The Night-Trawled Monitoring Survey During 1967-1996*, Marine Fisheries Division, Department of Fisheries, Thailand, January 1997.

[110]Sujittosakul, T. and Senaluk, S., (1997), *Relationship Between Sea Turtle Nesting and Number of Shrimp Trawlers Around Kram Island*, Technical Paper No. 6, Marine Fisheries Division, Department of Fisheries, Thailand.

[111]N.V.C. Polunin and N.S. Nuitja, (1995 rev. ed.), *Sea Turtle Populations of Indonesia and Thailand*, K.A. Bjorndal, Biology and Conservation of Sea Turtles, p. 359.

[112]Sudrajat, A. and U. Beck, (1978), *Variations in Size and Composition of Demersal Trawlers Catches from the North Coast of Java with Estimated Growth Parameters for Three Important Foodfish Species*, Laporan Penelitian Perikanan Laut, 4:1-80.

[113]Losse, G. F. and A. Dwiponggo, (1977), *Report on the Java Sea Southeast Monsoon Trawl Survey, June-December 1976*, Laporan Penelitian Perikanan Laut (Special Report), 3:1-119.

[114]Phuket Marine Biological Center, (1997).

boats. Finally, Dr. Eckert cites Hill (1992), which is another story about the same Andaman sea village involved in the 1991 Hill story. As is the case with the other sources, the article states that "the main problem remaining is that of the large trawling boats seining within 3 km of shore".[115]

5.378. Based on the responses of the experts, it is clear that the threats and their intensities vary both throughout the world and throughout Thailand. The responses therefore establish that the US assertion that shrimp trawls cause the greatest human-induced mortality to sea turtles is simply not correct with respect to either the world at large, or Thailand.

5.379. The other factual assertion relied upon by the United States to demonstrate that its conservation measures are "necessary" within the meaning of Article XX(b) is that other measures are not sufficient to protect sea turtles. However, since threats and the intensity of threats vary from region-to-region, priority responses also vary. In fact, a majority of the experts concluded that an obligatory TEDs requirement is not an essential conservation measure in all areas where sea turtles occur. Further, some experts provided evidence of conservation programmes that do not include TEDs and nonetheless have produced positive results.

5.380. The majority of the experts' responses indicate that priority responses that should be enacted in any particular jurisdiction depend on the threats present - the most serious threats should be addressed first. For example, Dr. Poiner stated that "priority conservation measures for sea turtle conservation will not be the same for all sea turtle populations and all countries concerned. It would be inappropriate to implement uniform measures".[116] Mr. Guinea stated that the conservation measure that should be implemented on a priority basis is the preservation of nesting habitats and the offshore refuge habitats for nesting females[117] - steps that Thailand has already taken in several areas. He further stated that only fishing activities that do not harm adult sea turtles or hatchlings should be permitted within the offshore sanctuary[118] - in effect, advocating an area closure alternative similar to Thailand's ban on fishing within 3 km of the coast.

5.381. Mr. Liew suggested that every measure that prevents sea turtles from being killed is a priority. He noted however, that "in places where exploitation of eggs is still substantial, they would still be ranked high. Differences in priority would exist for different populations, regions and species...".[119] He also noted that if coastal areas are protected during nesting season, the threat caused by fishing may be reduced.[120] Dr. Eckert noted that "of greatest importance to any sea turtle conservation programme is to address the problem that led to the 'endangered' status of the stock or population as a first priority in conservation".[121] Since the experts seem to agree that the factor that has lead to the endangered status of all species in

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[115]Hill, G., (1992), *The Sustainable Sea Turtle*, Marine Turtle Newsletter, 58:2-5.

[116]Poiner para. 5.185.

[117]Guinea para. 5.181.

[118]Guinea, ibid.

[119]Liew para. 5.183-184.

[120]Liew para. 5.115.

[121]Eckert para. 5.240.

Thailand is historic and continued direct exploitation of turtles and eggs, measures addressing the direct exploitation of turtles and eggs should be Thailand's highest priority. As this review of comments demonstrates, priority responses to sea turtle mortality can vary by location. A conservation programme designed to address the most significant threat in one area is not likely to address the most significant threat in other areas. Therefore, uniform conservation measures are not advisable.

5.382. In addition to noting that priority responses to sea turtle mortality will vary, the majority of experts stated that obligatory use of TEDs is not an essential conservation measure in all areas. In fact, some experts provided examples of successful conservation management programmes that did not include TEDs. Finally, although one expert indicated that TEDs were a necessary conservation measure, the rationale provided is unpersuasive.

5.383. Even in areas where shrimp trawling poses a threat to the sea turtle population, a majority of the experts agree that there are many alternatives to the use of TEDs. Specifically, in response to the Panel's question on whether obligatory use of TEDs for shrimp trawling is an essential conservation measure in all areas where sea turtles occur, both Dr. Poiner and Mr. Guinea referred to TEDs as one of several available management tools.[122] Other options include "exclusion zones, time of trawl activity, vessel size, number of nets, net mesh size and duration of individual trawls".[123] The conservation measures chosen depend on a number of factors, including "management objectives, the nature of the fishery and ease of surveillance and enforcement".[124]

5.384. Mr. Liew stated that TEDs, or other similar devices, should only be required on shrimp trawls operating in areas where the likelihood of incidental turtle capture is high[125], and cautioned as follows:

> "Proper studies need to be conducted to determine where these areas occur and the seasons involved. Fishermen would not respond positively to the use of TEDs if they hardly catch turtles in their operations. Neither would they use TEDs if they have intentions of eating or selling the turtle".[126]

In conclusion, he noted that "TEDs use should not be mandated blindly without proper studies".[127] As is clear from his comments, TEDs are not necessary on every shrimp trawl.

5.385. Several of the experts also provided specific examples of management programmes that did not require TEDs but nonetheless produced positive results.[128] For example, Mr. Liew

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[122]Poiner para. 5.231 and Guinea para. 5.229.

[123]Guinea para. 5.65. Mr. Guinea also noted that "high technology approach to conservation of so called developed countries appears at odds when dealing with artisanal fishers and trawl fleets of countries that are still developing." Guinea para. 5.66 See also, Guinea para. 5.124 (noting that "short [shrimp trawl] tows of less than 60 minutes pose little threat to sea turtles").

[124]Poiner para. 5.231.

[125]Liew para. 5.207.

[126]Ibid. See also Liew para. 5.230 ("In certain areas, TEDs use is essential, but scientific studies must be conducted with unbiased data to show its necessity and to convince the fishermen in those areas why the should use them").

[127]Liew, ibid.

noted that stocks of green turtles and hawksbill turtles from Malaysia/Philippines may be showing recovery after many years of intensive conservation management that involved beach protection and hatcheries.[129] This recovery has occurred without a TEDs requirement even though shrimping occurs in the area.[130] In addition, studies were cited that indicated that in areas where the impact of egg harvest is great, conservation measures that focus on preventing egg harvest may have a significant impact.[131] In materials submitted by Mr. Liew, Dr. Limpus identified the Ko Khram rookery (which is a protected nesting beach and offshore refuge due to its location inside a Thai naval base security zone in the Northern Gulf of Thailand) as "the only long-term, stable nesting green turtle population in Southeast Asia".[132] The experience at Ko Khram indicates that Thailand's chosen conservation measures of beach protection, egg and turtle protection, and the ban on commercial fishing within 3 km off shore should effectively protect sea turtles in Thai waters assuming resources do not have to be diverted from enforcing these measures. The majority of the experts, therefore, specifically refuted the US claim that, without TEDs, other measures to protect sea turtles are not sufficient.

5.386. Only one of the experts, Dr. Eckert, considered use of TEDs and essential conservation measure.[133] However, as the following discussion indicates, the rationale Dr. Eckert provides a support for this opinion is unpersuasive. Dr. Eckert indicated that TEDs use should be obligatory because TEDs "provide the best opportunity to reduce turtle bycatch with the greatest efficiency and lowest cost to the fishing industry".[134] Dr. Eckert then indicated that obligatory TEDs requirements should be pursued before other alternatives because of ease of enforcement. He further noted that

> "the problem with seasonal and time closures are that [a)] enforcement requires extensive and continual law enforcement presence on the water in the closed area. With the costs of operating enforcement vessels and the extensive areas fished, this is generally beyond the capacity of most countries (including the US to support)...".[135]

(..continued)

[128]Guinea para. 5.189 (noting the recovery of green turtles and hawksbills on the Turtle Islands of Sabah based on protection of nesting beaches and offshore refuges); Liew para. 5.246 (noting that protection of turtle nesting beaches, eggs and hatchlings has lead to recoveries for greens and hawksbills in the Turtle Islands, leatherbacks in South Africa, leatherbacks in St. Croix and Surinam and greens in the French Frigate Scholes, Hawaii.).

[129]Liew para. 5.191.

[130]Although Mr. Liew cautioned that urgent attention would be needed if it were determined that the impact of the trawling was significant, mandatory TED use was not required in order to produce these conservation gains.

[131]Poiner para. 5.201. Specifically Dr. Poiner discussed two separate studies indicating that protection of eggs/hatchlings could have a major impact on long-term stock viability. The conclusion was based on the fact that the study adopted a higher egg/hatchling stage mortality rate than used in a study on a US loggerhead population, an assumption that coincides with the fact that the threat of egg harvest is much greater in countries other than in the United States.

[132]Limpus, C.J., (1997), *Marine Turtle Populations o f Southeast Asia and the Western Pacific Region: Distribution and Status*, Proceedings of the Workshop on Marine Turtle Research and Management in Indonesia, Jember, East Java, Nov. 1996, pp. 37-73.

[133]Dr. Frazier considered TEDs to be only a "stop-gap" measure and instead called for a ban on trawling in all developing countries. Frazier para. 5.225. Further, he stated that "[W]ith or without TEDs, with or without integrated sea turtle conservation plans, there will be no lasting conservation of sea turtles on this planet while the majority of humanity slides even deeper into poverty and finds even fewer alternatives for survival." Frazier para. 5.145. Therefore, apparently Dr. Frazier believes that TEDs are not sufficient to protect sea turtles.

[134]Eckert para. 5.223.

[135]Ibid. Dr. Frazier also stated that area closures do not work because of lack of enforcement. Frazier para. 5.226.

5.387. With respect to efficiency, in actual use TEDs have not been shown to be efficient at excluding sea turtles. Furthermore, no support has been offered for the assertion that TEDs enforcement is more easily accomplished, or less expensive, than enforcement of other measures such as area closures. Due to the ease with which TEDs can be disengaged, the only way to enforce use is for enforcement officers to visit operating trawls individually and inspect the net - even then an inspector may not be able to detect that the TED has been tampered with.[136] In fact, the United States' own experience calls into doubt the assertion that enforcing TEDs usage is easy or inexpensive.[137] Thus, the rationale for Dr. Eckert's preference for TEDs is unpersuasive. On whole, the experts' responses refute the United States' claim that without TEDs other conservation measures are insufficient.

5.388. In its presentations to the Panel, the United States has argued that the measures at issue "relate to" the conservation of sea turtles within the meaning of Article XX(g) because shrimp trawl nets are the greatest cause of human-induced sea turtle deaths and because TEDs are highly effective in preventing such mortality. Specifically, the United States cited these "facts" to demonstrate a "substantial relationship" between the measures at issue and the conservation of sea turtles. The information presented by the experts contradicts the factual assertions offered by the United States. As previously discussed, the experts' reports conclude that threats to sea turtles vary by region and species. Therefore, the responses do not support the US contention that shrimp trawling is the greatest human-induced cause of sea turtle mortality, one basis for the US claim that there is a substantial relationship between its measures and sea turtle conservation. In fact, the responses indicate that a uniformly imposed measure not targeted to the most significant threats in an area or region may have a negative conservation effect, since, given scarce resources, more serious threats may then go unaddressed.

5.389. Further, evidence presented indicates that while TEDs may be highly effective in theory, they have not been highly effective in practice. Specifically, the evidence presented indicates that, for a variety of reasons, TEDs have not been effective throughout the United States, even though US efforts to develop and implement a TEDs requirement have been underway for at least a decade. Therefore, the responses do not support the second factual premise for the US claim that a substantial relationship exists between the US measures and conservation of sea turtles. The United States has argued that TEDs effectively prevent the drowning of sea turtles in shrimp trawl nets -- noting that properly installed TEDs approach 97 per cent efficiency in allowing sea turtles to escape from shrimp trawl nets. Evidence presented by the experts indicates that while TEDs may be effective in tests, in actual use, trawling with TEDs may not lead to a reduction in strandings. For example, Dr. Poiner noted a 1995 study that compared the relationship between sea turtle standing rates and shrimp fishing intensities in the Gulf of Mexico for pre-TEDs and post-TEDs periods and found no

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[136]See *Decline Of The Sea Turtles Causes and Prevention*, National Research Council, National Academy of Sciences, (1990), p. 134 ("Enforcing proper use of TEDs is also a major concern, because TEDs can be readily disabled by altering the tension of spring cords or tying them in a fashion virtually undetectable by inspectors."). Further, as indicated in an article of the Bangkok Post (*Troubled Waters*, 17 April 1997), inspection in the United States involves visits by the US Coast Guard, and since the shrimpers know when an inspection will take place, the US Coast Guard is not likely to catch violators.

[137] See Poiner para. 5.222 (after discussing a study that revealed no difference in stranding rates in pre-TEDs and post-TEDs time periods in the Gulf of Mexico, Dr. Poiner stated that "[a] variety of hypotheses were suggested to explain the continuation of the statistical relationship including violation of TED regulations in the fisheries."); Guinea para. 5.220 (noting that in the United States compliance appears to be a problem).

difference in stranding rates.[138] Mr. Guinea also noted that sea turtles continue to wash ashore in the United States even though TEDs are compulsory.[139]

5.390. Mr. Liew noted that use of TEDs by commercial fishermen has been in force in the United States for the longest time, but that as recently as 1997 there were still large numbers of sea turtle strandings - even though compliance was stated to be 96.9 per cent.[140] Further, he noted that there was a big decline in turtle strandings when the Gulf of Mexico was temporarily closed to shrimping. He concluded that "[a]ll of these examples indicate that problems still exist in the use of TEDs and mandating fishermen to use them does not guarantee that sea turtles will be safe from shrimp trawls".[141] Dr. Frazier's comments evidence a mixed record on TEDs efficiency in the United States. He indicated that studies in South Carolina indicate that TEDs have significantly reduced turtle mortality. However, he also noted that there where high levels of strandings in Louisiana and Texas and stated that they are attributed to "improper use of TEDs, use of inadequate TEDs and intense pulse fishing".[142] This information demonstrates that, even with TEDs, high levels of strandings still occur in the United States. Therefore, in actual use, TEDs have not been nearly as effective at reducing sea turtle mortality as claimed by the United States. Based on this information, the United States cannot support its second factual basis for asserting that there is a substantial relationship between the measures at issue and the conservation of sea turtles.

5.391. A common thread throughout the majority of responses is that to have a positive conservation effect, the development of particular conservation practices must involve the communities that will engage in such practices. On an international level, the issues at hand call for cooperation, not coercion.[143] A conservation measure unilaterally imposed by a foreign country will not have a positive effect because if will not enjoy the support of the community. As the experts make clear, conservation measures must be "owned" by the involved community in order to have a positive effect. Specifically, "[c]onservation programmes should emanate from within a country so that implications on cultural, economic and social issues can be addressed at the same time".[144] Further, "it is important for each region, country or state to assess their own sea turtle population, examine the threats affecting them and prioritize conservation strategies accordingly".[145] Moreover, a participatory solution to trawl bycatch

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[138]Poiner para. 5.222.

[139]Guinea para. 5.220 (also noting that in the United States, compliance appears to be a problem). Mr. Guinea further suggested that TEDs will not be effective in all shrimp trawls, stating that "when properly installed and used, a TED will significantly reduce, but not eliminate, the mortality of sea turtles in some shrimp trawls." Guinea para. 5.206.

[140]Liew 5.221; see also, Liew para. 5.207 ("even though TED use is mandatory in the United States and in their neighbouring countries, large numbers of turtle strandings still occur there").

[141]Liew para. 5.221. Further, he noted that in the United States studies are underway to determine if TEDs should be required in all US waters where shrimping occurs. Liew para. 5.208.

[142]Frazier para. 5.203, referring to Crowder et al. (1995) and para. 5.217. Thailand noted that the same study, which concludes that TEDs reduce strandings by about 44 per cent, is cited by Dr. Eckert (para. 5.210).

[143]Frazier para. 5.13 ("The issue at hand involves many other nations neighbouring those five [United States, Thailand, Malaysia, Pakistan and India]; the conservation and management of migratory animals - marine turtles in this case - can only be accomplished through full international cooperation").

[144]Guinea para. 5.166.

[145]Liew para. 5.192.

that includes negotiation and mediation with the industry can have substantial advantages over a litigation and legislation approach.[146] The US measures, however, are based on coercion and, therefore, are not "owned" by the affected communities. Based on these comments, and because the US measures are unilateral and externally imposed, it does not appear that the measures will have the intended effect on the conservation of sea turtles. The United States has usurped each State's ability to address cultural and societal factors, to prioritize conservation measures, and to engage in a dialogue with the affected industry aimed at resolving any incidental sea turtle capture that may occur.

5.392. The information presented by the experts also refutes the contention that Thailand and the other newly affected nations received even-handed treatment as a result of the application of Section 609. Specifically, the responses of several of the experts indicate that there are significant differences between the US shrimp fishery and the geographical area within which it operates and other shrimp fisheries and their area of operations. The technology developed in the United States must be adapted before it can be used in other locations.[147] In addition, development of a "local" TED is tied to acceptance by the local fishery and "[t]here needs to be considerable modification and trial before TEDs or any bycatch reduction device, e.g. fish eye, etc., is accepted by the fishery".[148] Thus, implementation of a TEDs programme takes a substantial amount of time, as noted by Mr. Liew.[149] Dr. Poiner also noted that a requirement imposed through involvement of the stakeholders and negotiation and mediation has worked better in some situations than the litigation/legislation model adopted by the United States.[150] Based on these statements, the United States was not justified in providing Thailand with only four months (a phase-in period that Thailand could not meet) in which to implement a TEDs requirement simply because the United States has developed a TED for use in US waters by US fishermen.

5.393. In defending its contention that the measures at issue are in accordance with the Preamble of Article XX, the United States argued that the shorter phase-in period provided Thailand and the other newly-affected nations *vis-à-vis* the originally affected nations was justified. The basis for this argument was that TEDs technology was not well developed or easily available, especially for developing countries, when the requirement was applied to the originally affected nations, but that extraordinarily effective TEDs were available by the time the requirement was applicable to newly-affective nations.

5.394. As previously noted, TEDs developed in the United States are not extraordinarily effective in practice. Even putting aside this question, as Thailand has just described, the evidence presented by the experts indicates that TEDs designed for US shrimpers in US waters must be modified before they can be used in other waters. This process, which is closely tied to acceptance of the technology, takes time. Therefore, the United States cannot prove that it was justified in providing US shrimpers and shrimpers from originally-affected nations a substantial period of time to implement the TEDs requirement, while provided the newly-affected nations with only four months. Application of the US measures, thus, resulted

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[146]Poiner para. 5.231.

[147]Poiner para. 5.239; Frazier para. 5.233.

[148]Guinea para. 5.236.

[149]Liew para. 5.208.

[150]Poiner para. 5.231.

in arbitrary or unjustified discrimination between Members where the same conditions prevail (in this case, implementation of a conservation measure not previously required) and is a disguised restriction on international trade.

5. Comments by the United States

5.395. The United States appreciates this opportunity to provide comments on the responses received from the five experts selected by the Panel. The United States greatly appreciates the time and attention that the experts have devoted to the preparation of their responses. As discussed below, the responses of the experts can make a valuable contribution toward the resolution of this dispute.

5.396. Experts may provide a panel information, advice, and their opinions on certain aspects of the matter that is the subject of the dispute.[151] Experts can provide a panel with vital perspectives, information and advice on technical issues. At the same time, a panel cannot ask experts to advise it on issues or measures which are beyond the panel's own terms of reference, including issues which are outside the scope of any agreement to be interpreted by the panel. Furthermore, it is clear that a panel cannot delegate to experts the panel's central task of interpreting the agreement(s) at issue in a dispute. Experts may advise only on factual issues, not on questions of law nor on the application of the legal standards in the agreement(s) to the facts at hand. The Panel has recognized this principle by selecting persons with expertise in scientific and technical matters, rather than in the *Marrakesh Agreement Establishing the World Trade Organization* ("WTO Agreement").

5.397. Resolution of this dispute depends primarily on a determination of whether the US measures in question relate to the conservation of an exhaustible natural resource which are made effective in conjunction with restrictions on domestic production, or whether the measures are necessary to protect animal life or health. To aid the Panel in making this determination, the parties have presented a substantial amount of factual information that is scientific or technical in nature. The United States believes that, consistent with the WTO Agreement and the Understanding on Rules and Procedures Governing the Settlement of Disputes, the Panel can use the responses received from the experts to better inform their judgment concerning the key scientific or technical questions which lie at the heart of this dispute:

-Are sea turtles threatened or endangered worldwide, including in Complainants' waters?
-Does shrimp trawl fishing without TEDs result in the death of large numbers of sea turtles?
-Do TEDs, when properly installed and used, significantly reduce the mortality of sea turtles caused by shrimp trawl nets?

5.398. The following discussion reviews relevant aspects of the experts' responses as they pertain to these core questions. Subsequently, the United States comments on certain specific responses of the experts (see paragraphs 5.420 to 5.431).

5.399. The experts agree with virtual unanimity that sea turtles are endangered worldwide, including in complainants' waters. Dr. Frazier and Mr. Guinea note that the International Union for the Conservation of Nature lists all species of sea turtles, except the Australian flatback, as either "endangered" or "critically endangered".[152] Dr. Eckert concurs: "[G]lobal sea

[151]See Article 13 of the *Understanding on Rules and Procedures Governing the Settlement of Disputes*.

[152]Frazier para. 5.42 and Guinea para. 5.60.

turtle populations have declined significantly to the point where all species are in danger of extinction".[153] Dr. Poiner adds "most sea turtle populations in the world are severely depleted."[154] Finally, Mr. Liew reports that "some populations have disappeared, some [are] near extinction, some [are] threatened but a few have shown some apparent recovery".[155] As discussed below in more detail, most of the experts believe that there is insufficient evidence for a determination that any sea turtle species or population has recovered.

5.400. Data provided by the experts also underscores that, because of the long-range migrations of sea turtles, efforts by one nation to protect endangered or threatened sea turtles can only succeed if other nations cooperate. Dr. Frazier explains that "all of the six listed species of marine turtles disperse and migrate over vast distances, with no respect to national boundaries ... during its long life, an individual sea turtle will pass through many different environments, traversing a substantial - often vast - surface of the planet".[156] Mr. Guinea agrees: "All sea turtle species except the Australian flatback undergo extensive ocean migrations during their life".[157] Dr. Poiner reports that breeding adults usually migrate relatively long distances from the foraging areas to the traditional breeding rookeries".[158]

5.401. Dr. Eckert provides valuable insight on the migratory habits of leatherback sea turtles:

Based on very recent data, "leatherback nesting stocks from Malaysia (and probably Thailand as well) ... distribute throughout the [Pacific] ocean basin.... It is likely that mature female leatherbacks circumnavigate the Pacific Ocean during the 2 or 3 years between nesting seasons. ... It is highly probable that Malaysia, Thailand and the United States all share responsibility for Pacific leatherbacks during a single nesting migration".[159]

5.402. In this respect, the experts directly call into question the premise of the complainants that the sea turtles which nest on their beaches are somehow "their" sea turtles, and that the efforts of each of the complainants to protect sea turtles can succeed without regard to the circumstances affecting the same turtles in areas under the jurisdiction of other nations. Instead, as the United States has argued throughout these proceedings, endangered sea turtles are a shared global resource in the sense that they can be effectively protected only through the combined actions of many nations. We therefore concur with the conclusion of Dr. Frazier that "the conservation and management of migratory marine animals - marine turtles in this case - can only be accomplished through full international cooperation".[160]

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[153]Eckert para. 5.19.

[154]Poiner para. 5.71.

[155]Liew para. 5.68.

[156]Frazier paras. 5.13 and 5.39.

[157]Guinea, para. 5.262.

[158]Poiner para. 5.141.

[159]Eckert paras. 5.21 and 5.256.

[160]Frazier para. 5.13.

5.403. The experts also agree that shrimp trawl nets used without TEDs in areas and at times where sea turtles occur will capture and drown large numbers of sea turtles, including in complainants' waters. As the United States has previously explained, shrimp trawl nets are dragged along the sea floor for long periods and will capture virtually anything in their path, including endangered sea turtles. Unless the trawl nets are equipped with TEDs, captured animals and debris will remain in the nets until they are emptied on deck. In the words of Dr. Frazier, "bottom trawling is known to cause major impacts on non-target species because it is an unselective method of fishing. Shrimp trawls are notoriously unselective".[161] Mr. Guinea adds that, "trawls of long duration over areas inhabited by benthic feeding sea turtles; i.e., loggerhead, olive ridley, Kemp's ridley, flatback and some adult greens or in waters adjacent to their rookeries will capture a proportion of the sea turtles present".[162]

5.404. Dr. Eckert reports that the incidental mortality of sea turtles in fishing operations is one of the two most significant anthropogenic threats to sea turtle species, the other being direct harvest of sea turtles (which all parties to this dispute have outlawed). He further notes that, while other kinds of fishing gear, including coastal gillnets and longlines, result in some incidental mortality of sea turtles, "by far the most serious threat to sea turtle stocks living in coastal environments are trawl fisheries".[163] On this point, Dr. Frazier discusses the reasons why shrimp trawling (without TEDs) is a particularly dangerous fishing method for sea turtles:

> "The special concern from shrimp trawling stems from several points. Because shrimp are generally most concentrated in coastal waters, trawling tends to concentrate in coastal waters (this occurs routinely, despite regulations and bans on trawling in these waters) ... shrimp trawling is generally carried out with considerable intensity, resulting in large areas of the benthos having the trawl pulled across them repeatedly ... Where shrimp trawling is intense, and concentrated in coastal waters, there is a high probability that sea turtles will be caught and incidentally drowned. If these fishing activities occur near to breeding grounds (nesting beaches or mating areas) or in the migratory routes used by turtles to get to and from the breeding areas, or in feeding grounds, there is an extremely high probability that large numbers of turtles will be caught and drown. Where this happens, the numbers of turtle that are breeders or near-breeders killed incidentally can be relatively large. If this sort of operation continues, it can decimate a healthy population, make it impossible for a recovering population to recover, or even finally exterminate a population".[164]

5.405. Material provided by the experts further supports the contention of the United States that the mortality of sea turtles in shrimp trawl nets is not a phenomenon restricted to US waters or to the Western Hemisphere, but in fact occurs wherever sea turtles and shrimp trawling occur together, including in the complainants' region.

5.406. Dr. Poiner identifies the incidental capture of sub-adult and adult sea turtles in shrimp nets as one of the "major sources" of loggerhead and green sea turtle mortality in the Indo-Pacific region, particularly Malaysia and Thailand.[165] Dr. Eckert finds that, in Thailand,

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[161]Frazier para. 5.122.

[162]Guinea para. 5.65.

[163]Eckert paras. 5.33 and 5.119.

[164]Frazier paras. 5.100-101.

[165]Poiner para. 5.185.

shrimp trawling is one of the most serious threats to sea turtle populations and is a significant cause of sea turtle mortality, particularly for green sea turtles.[166] Many of the experts describe the large-scale killings of sea turtles caused by the shrimp trawl industry in India. Dr. Frazier notes that, "for over a decade, incidental capture and drowning in fishing gear has been known to be an important source of mortality of adult turtles, particularly in the Bay of Bengal; and trawlers, especially shrimp trawlers in Tamil Nadu, Andhra Pradesh, Orissa and West Bengal have consistently been singled out for impacts that they cause".[167]

5.407. According to Dr. Eckert, olive ridleys, in particular, are "heavily impacted" by shrimp trawl fishing in India. "The incidental take of olive ridleys in India is exceptionally severe ... Annually 5,000 - 8,000 dead turtles wash up on the beaches of Orissa which are attributable to incidental take in shrimp trawls. Despite laws banning such fishing, large scale shrimp fishing is occurring within the Bhitara Kinika Sanctuary (the primary nesting area for olive ridleys in India) and more than 4,000 olive ridleys stranded dead on the beach during 1996/7 ... The large numbers of olive ridleys killed by legal and illegal trawling operations is extraordinary and must represent the single largest threat to sea turtle populations in India".[168] Mr. Liew states that, "thousands of olive ridleys are also killed in Orissa, India each year which conservationists attributed largely to shrimp trawlers".[169] Citing a study by E.C. Chan, Dr. Eckert also reports that incidental capture in fishing gear, including shrimp trawl gear, "is now recognized as one of the most serious threats to the survival of the remaining sea turtles in Malaysia".[170]

5.408. The responses of the experts also reflect widespread agreement that TEDs, when properly installed and used, substantially reduce the mortality of sea turtles caused by shrimp trawls. "Studies of TEDs ... demonstrate that properly installed TEDs are very effective at virtually eliminating the trawl catch of sea turtles".[171] "[T]here can be no question that TEDs reduce sea turtle mortality when installed and operated properly".[172] "[W]hen properly installed and used, different kinds of TEDs can significantly reduce the incidental capture and mortality of sea turtles in shrimp trawl nets".[173] "TEDs will allow the majority of adult turtles to escape [from shrimp trawl nets]".[174]

5.409. Beyond this general conclusion, the experts elaborate a number of specific points that the United States has advanced throughout these proceedings:

-TEDs help to protect sea turtle populations.

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[166]Eckert paras. 5.94 and 5.35.

[167]Frazier para. 5.96.

[168]Eckert paras. 5.37 and 5.95.

[169]Liew para. 5.113.

[170]Eckert para. 5.93.

[171]Poiner para. 5.209.

[172]Eckert para. 5.202.

[173]Frazier para. 5.203.

[174]Guinea para. 5.65.

-TEDs are inexpensive and easy to use.
-TEDs cause minimal shrimp loss and produce other benefits.
-TEDs are adaptable to different shrimp fishing environments.
-Other methods to protect sea turtles are insufficient, unless coupled with the use of TEDs.

5.410. The experts describe how the required use of TEDs by shrimp trawlers in the United States has produced significant benefits for sea turtle populations. Dr. Eckert reports that, "for green, loggerhead and Kemp's ridley sea turtles in the Atlantic, the most serious threat was shrimp trawling. ... The requirement that TEDs be utilized in all waters at all times has reduced this threat".[175] Dr. Frazier also states that, "during the last few years there have been clear indications from the commercial shrimp fishery in the United States that TEDs have significantly reduced turtle mortality. Stranding data from South Carolina for the period 1980 to 1993 show remarkable declines, particularly when TED regulations were in place. Crowder et. al. (1995) concluded that the decline in strandings was because of reduced mortality from TED use".[176]

5.411. Similarly, many of the experts attest to the fact that TEDs are inexpensive and easy to use. Dr. Eckert, for example, explains that:

"TEDs are incredibly simple devices to construct from local materials, require little special skills above what is already in use by shrimp fishermen and plans for their construction are available. Considering the costs of fuel, nets and other required equipment for such a fishery, it is doubtful that TEDs would add significantly to the cost of fishing and may actually be advantageous ... [D]eploying and operating these devices take very little special skills and handling ... The first TEDs were developed and used by shrimp fishermen as a way to reduce fouling and bycatch problems, long before sea turtles were of concern ... Most experienced fishermen understand net deployment methodology very well irrespective of formal education and thus I would expect that deploying a TED equipped net would pose no particular challenges".[177]

5.412. Mr. Guinea adds that, "it would be condescending and culturally insensitive to suggest that any fisherman could not operate a net fitted with a TED". Dr. Frazier concurs that neither socio-economic distinctions nor level of formal education is likely to be relevant to the ability of a shrimp fishermen to use a TED successfully.[178]

5.413. A number of the complainants have alleged that TEDs cause significant losses of shrimp. The experts disagree. Dr. Eckert, for example, reviews studies from the United States which show that "commercial catch rates were higher in years after TEDs were required (though it is probably not valid to suggest that TED use necessarily resulted in increased catch rates)". According to Dr. Eckert, the study submitted by Thailand which purports to show otherwise "is probably invalid due to poor data gathering methodology and data analysis". By contrast, Dr. Eckert found that a recent study in Malaysia on TEDs and the Thai Turtle Free Device, which "showed that TEDs will prevent marine turtles from being trapped in the net without effecting [sic] the catch of shrimp and fish", cannot be considered conclusive due to

[175]Eckert para. 5.92.

[176]Frazier para. 5.215.

[177]Eckert paras. 5.144 and 5.202.

[178]Guinea para. 5.296 and Frazier para. 5.205.

the very small sample size; however, it does seem to be a very well executed and analyzed preliminary experiment".[179]

5.414. Mr. Guinea, summarizing the results of TEDs trials in the Northern Prawn Fishery in Australia, reports: "a reduction in small fish bycatch by about 30 per cent, a reduction in large fish, no sea turtles were captured during trials. Other studies reported a slight increase in prawn catch (4 per cent and 7 per cent) ... The catch was of better quality with fewer broken or damaged shrimp. The better catch of unbroken shrimp could command a higher price".[180] The comments of Mr. Guinea in this regard also demonstrate, as the United States has argued, that TEDs are adaptable to different shrimp fishing environments. Dr. Frazier further mentions studies in Malaysia which "indicated that the gear was suitable for use by local fishermen... [and] a preliminary trial recently carried out in Orissa showed that TEDs installed in local trawls successfully excluded turtles". Dr. Frazier goes on to cite another expert in the use of TEDS: "According to Randall Arauz, who has been working on TEDs in Costa Rica for the last four years: 'with proper modifications of the TED technology and fishing practices, together with scientific documentation, research [can] make TEDs work efficiently under virtually any fishing conditions, as we have proven in Costa Rica'".[181] In light of these findings, it should not be surprising that the experts also generally agree that TEDs should be used wherever there is a likelihood that sea turtles will be incidentally caught in commercial shrimp trawl nets.

5.415. Mr. Guinea argues that the use of TEDs should be one of the management regulations adopted where trawling is responsible for the deaths of sea turtles. "Trawls over areas where sea turtles occur should be of short duration (60 minutes) and employ TEDs".[182] Dr. Eckert simply says that, "TEDs provide the best opportunity to reduce turtle bycatch with the greatest efficiency and lowest cost to the fishing industry ... It is the most easily enforced conservation measure available".[183] Dr. Frazier, summarizing reports of other researchers (including Dr. Poiner), concludes that the use of TEDs, together with other conservation measures, would be instrumental in the survival of marine species, including sea turtles.[184] Mr. Liew concurs that the use of TEDs in trawl nets should be implemented as a matter of "priority" to reduce the incidental catch of adult and juvenile turtles. "All shrimp trawlers operating in areas where the likelihood of incidental turtle capture is high should be encouraged to use TEDs or other similar devices".[185]

5.416. Most of the experts also concur that, while other methods to protect sea turtles may have value, they will not succeed in producing the recovery of decimated sea turtle populations unless they are coupled with the use of TEDs in areas where sea turtles are subject to capture in shrimp trawl nets. For example, Mr. Liew states emphatically that, "saving the

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[179]Eckert paras. 5.211-213.

[180]Guinea para. 5.219.

[181]Frazier paras. 5.204 and 5.233.

[182]Guinea paras. 5.86 and 5.181.

[183]Eckert para. 5.223.

[184]Frazier paras. 5.84 and 5.225.

[185]Liew paras. 5.183 and 5.207.

eggs and protecting nesting turtles on the beach alone while allowing them to be killed in the sea will not work ... Egg protection methods alone are not sufficient especially if other threats are still present and have significant impact on the population".[186] Dr. Frazier is equally pessimistic about the likelihood of success of these approaches: "focusing on protection of just eggs and hatchlings, and not reducing mortality in older animals, will be doomed to failure."[187] Dr. Eckert also agrees: "It is simply not adequate to concentrate all efforts on protecting reproducing females and eggs ... no population can be preserved by such methods alone. ... Nesting beach protection alone is not enough to restore sea turtle populations". As evidence of the failure of such methods, Dr. Eckert notes that extensive efforts by Mexico to protect nesting stocks of leatherbacks did not prevent a 95 per cent decline in the population over 10 years caused by incidental mortality in fishing operations.[188]

5.417. The experts similarly disfavour the practice of "headstarting", which involves the keeping of hatchlings in protected captivity for some period of time before releasing them into the wild. Mr. Liew describes headstarting as "the wrong conservation strategy".[189] Dr. Eckert adds that headstarting "has not yet proven successful ... at this time, headstarting is not considered a valid conservation tool". According to Dr. Eckert, one primary reason why such other methods cannot work by themselves is that, unlike TEDs, they do not adequately protect adult, subadult and large juvenile sea turtles, which have much higher reproductive values than eggs and hatchlings. These latter classes of sea turtles are most vulnerable to incidental mortality in trawl fisheries.[190] Dr. Frazier further explains that:

> "[A]dult animals are the immediate key to the future of the population.... The closer to maturity the turtles get, the more they are worth to the population, and the less it can afford to lose them.... Hence, sources of mortality that affect animals that are mature, or nearly mature, have far greater instantaneous impact on the status of the population than taking the same number of eggs or young animals, for they reduce levels of reproduction very quickly. Harvesting or breeding animals, or incidental capture in fishing gear, are examples of these very 'costly' sources of mortality. Modern fishing practices have been repeatedly documented to cause mortality.... [S]ince mortality of animals that are breeding or near breeding is most costly to the population, a general priority is to reduce mortality on those animals that have a high reproductive value".[191]

5.418. Furthermore, the experts cast serious doubts on the efficacy of methods, asserted by some Complainants to be effective, consisting of prohibitions on trawling in certain areas or at certain times ("area and time closures") or of requirements that trawling times not exceed a certain duration ("tow-time limitations"). "Area closures do not work because of a lack of enforcement. This has been widely documented in many countries, including those involved in this dispute". Seasonal and time closures are ineffective for similar reasons. "Tow-time limitations are least enforceable of all measures".[192] Similarly, "tow-time limitations are almost

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[186]Liew paras. 5.192 and 5.252.

[187]Frazier paras. 5.242.

[188]Eckert paras. 5.73, 5.171 and 5.34.

[189]Liew para. 5.113.

[190]Eckert paras. 5.173, 5.73-74.

[191]Frazier paras. 5.77, 5.82 and 5.171.

[192]Frazier paras. 5.226-27.

impossible to enforce and actually do not provide much protection to turtles subject to multiple captures".[193]

5.419. There is some disagreement among the experts as to the validity of claims by some of the Complainants that they have produced population recoveries through methods not involving the use of TEDs. Mr. Guinea believes that "conservation measures devoted to eggs and hatchlings have been successful for some breeding units of some species e.g., olive ridleys in Orissa", that green and hawksbill turtles nesting on the Turtle Islands of Sabah have recovered and that, in general, the conservation measures of Malaysia and Thailand "appear to be successful".[194] Most of the other experts flatly reject these assessments. Dr. Poiner states that "there is no clear documented case of recovery in the world. ... Some countries (e.g., Malaysia and Thailand) have instigated management measures to prohibit or control egg harvests as a conservation measure but there is no evidence of recovery of any of these populations".[195] Dr. Frazier concurs: "I am unaware of conclusive evidence for the recovery of any sea turtle population in any of the five countries involved in this dispute so that there is not or will soon not be a risk of extinction".[196] Dr. Eckert, for his part, states that, "to the best of my knowledge, no nesting population of sea turtles has shown any recovery in any of the countries of dispute. There are encouraging signs that the Kemp's ridley nesting population may be growing ... If there is a recovery [of Kemp's ridleys], it is likely due to the required use of TEDs in the United States and Mexico and the protection afforded nesting females". Referring to arguments presented by Malaysia in this dispute, he adds that it is erroneous to assume that a trend in green turtle populations can be determined after only a few years. This is simply not the case.... The trend described in this study will not be valid for at least another 15 or more years depending on the maturity time of the turtles within this population".[197]

5.420. To conclude, the United States notes that it is natural that in five sets of separate responses for the experts there would be some differences of view expressed. What is remarkable about these particular responses is the high degree of consensus among the experts on the core factual issues in question. In the view of the United States, the responses of the experts emphatically support our contentions that the measures at issue in this dispute relate to the conservation of an exhaustible natural resource and that they are necessary to protect animal life and health.

5.421. The United States also wishes to comment on certain specific responses of the experts. The responses of Mr. Guinea call for the following comments.

5.422. The concept of sea turtles as a shared global resource may be "cumbersome", as Mr. Guinea puts it, but global efforts are necessary for sea turtle conservation to succeed. In fact, Mr. Guinea's very first observation (Introductory Comment #1) is that sea turtle conservation must be based on the "breeding unit", and he notes that "breeding units" may be found in the waters of other countries.[198] As noted in a Limpus study (widely quoted by the experts in this

[193]Eckert para. 5.223.

[194]Guinea paras. 5.189, 5.243-44.

[195]Poiner paras. 5.71 and 5.247.

[196]Frazier para. 5.188.

[197]Eckert para.186.

[198]Guinea para. 5.14.

case), "Marine turtles are internationally migratory species that cannot be managed at single localities. Indeed they cannot be successfully managed even at the level of a single country. They are internationally shared resources that need to be managed at the level of individual stocks".[199] Further, in response to Question 5(a), all of the experts, including Mr. Guinea, note that sea turtles commonly feed over 1000 km from their nesting grounds.

5.423. Mr. Guinea also notes that "most greens and usually hawksbills and leatherbacks are relatively unaffected by trawling". While it is true that loggerheads, olive ridleys, Kemp's ridleys and flatbacks may be more susceptible to incidental capture in shrimp trawls, greens, hawksbills and leatherbacks have been documented as bycatch in shrimp trawls. In fact, the paper he refers to in his answer to question 6(c) (Sachse and Wallner, in press) notes that in one study, green sea turtles were the second most captured species of sea turtles. There was also a significant catch of hawksbill sea turtles (368 green and 62 hawksbill sea turtles captured - p. 3). Further, in his response to question 1(c), Mr. Guinea identifies the flatback, olive ridley, loggerhead, green and hawksbill turtles as bycatch in Australian prawn fisheries. He lists greens as the second most prominent sea turtle species found in the bycatch in the Queensland Trawl fishery.[200] Other experts in this case also address the mortality of all sea turtle species in shrimp trawl nets. Dr. Eckert identifies trawl fisheries as a contributing source of decline of leatherbacks[201] and shrimp trawling as a significant source of mortality for greens and hawksbills on the Pacific coast of Mexico, in North Eastern South America and Thailand. Mr. Liew writes, "[f]eeding habitats of different sea turtles would differ depending on their diet but these habitats may overlap. An area of seabed may have green turtles, hawksbills, loggerheads and ridleys occurring together as the area may have pockets of seagrass, sponges, crabs, shrimps, mollusc and fish there".[202] Furthermore, Guinea's statement only takes into account the feeding habitats of sea turtles, it does not consider threats to sea turtles when they migrate from their feeding grounds to the nesting beach or when they are in coastal waters during the internesting period. In discussing the various feeding habitats of different species and the risks they face from incidental capture in fisheries in those habitats, Dr. Liew writes, "[h]owever, for all these species of turtles, they are also vulnerable in the waters off their nesting grounds during the nesting season where they aggregate in numbers depending on the size of the nesting population".[203]

5.424. In his introductory, Mr. Guinea further argues that the US measure is ineffective because affected countries may circumvent the US measures by various means, such as by transshipping their shrimp through certified countries. To support this argument, he cites a statement purportedly made by a delegate of India at an FAO Workshop.[204] The United States responds that this issue is outside the purview of the Panel's questions, and, moreover, each one of the Complainants - including India - claims that they have been substantially affected by the US measure. Finally, Section 609 applies to shrimp based on the country of harvest, regardless of whether the shrimp is processed in or shipped through a third country. Thus, it

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[199]C.J. Limpus, (1997), *Marine Turtle Populations of Southeast Asia and the Western Pacific Region: Distribution and Status*, Proceedings of the Workshop on Marine Turtle Research and Management in Indonesia, Jember, East Java, November 1996.

[200]Guinea, paras. 5.15, 5.291 and 5.112.

[201]Eckert para. 5.34.

[202]Liew para. 5.282.

[203]Liew para. 5.115.

[204]Guinea para. 5.16-17.

should not be possible for a nation to avoid the requirements of Section 609 simply by transshipping its shrimp through another country.

5.425. In his answer to question 1(c), Mr. Guinea states that he relies on certain cited sources for his ranking of threats to sea turtles. However, Mr. Guinea's ranking of threats to sea turtles in the United States is incorrect. The source he cites, Lutceavage, M.E. et. al. (1997), simply delineates the threats to sea turtles without ranking them. In fact, the authors note that the National Academy of Science study ("Decline of Sea Turtles") found incidental capture in shrimp trawls to be the leading cause of sea turtle mortalities due to human activities. Moreover, his ranking of threats to sea turtles in the other countries that are parties to this dispute supports the United States contention that shrimp trawling is a significant source of mortality for sea turtles. For each of the complainant countries, incidental capture of marine turtles in fishing operations is ranked within the top four threats to sea turtles.

5.426. In answering question 2(d), Mr. Guinea does not provide a citation for his contention that the green and hawksbill turtles on the Sabah Turtle Islands have staged a "remarkable recovery". He seems to be contradicted by other experts. Limpus writes, "[i]t appears that all marine turtle populations in the Indo-Pacific region outside Australia are severely depleted and/or subject to overharvest and/or to excessive incidental mortality".[205] Drs. Eckert and Frazier in their response conclude that there are no sea turtle populations in the countries involved in this dispute that have recovered. Dr. Poiner states, "there is no clear documented cases of recovery in the world." Poiner specifically mentions the sea turtle conservation efforts in Malaysia and Thailand and the fact that there is no evidence of recovery of these populations.[206]

5.427. Answering question 2(e), Mr. Guinea reasons that 5000 deaths in shrimp-trawl nets per year is a sustainable level of mortality for Indian olive ridley turtles. This reasoning is without foundation. Mr. Guinea transfers Dr. Crouse's conclusions on loggerhead sea turtles to olive ridleys which is biologically unsound. The major flaws with this approach are age to maturity differences, reproductive strategy differences (i.e. arribada or mass nesting vs. solitary nesting) and stage-based mortality differences. Under question 3(c), Mr. Guinea's response is misleading. The quoted source, Todd Steiner of Earth Island Institute, said that TEDs are part of an integrated approach to sea turtle conservation and restoration, not that TEDs were simply one option available to managers, as Mr. Guinea asserts. In his answer to question 3(d), Mr. Guinea states that TEDs, without modification to local conditions, have unacceptably poor performance. The sources cited by Mr. Guinea do not support his contention.

5.428. In answering question 4(a), Mr. Guinea makes a very broad and generalized statement that is not supported by any further facts when he states that the egg/hatchling conservation measures employed by Malaysia and Thailand appear to be successful. Drs. Eckert, Frazier and Poiner contradict his response in their statements. They conclude that there are no sea turtle populations in the countries involved in this dispute that have recovered. Dr. Poiner writes, "[s]ome countries (e.g., Malaysia and Thailand) have instigated management measures to prohibit or control egg and sea turtle harvests but there is no evidence of recovery of these populations.[207] In particular regard to Thailand, it has been noted that "there is no clear link between the high numbers of turtles at Khram island and the headstart programme there. The

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[205]C.J. Limpus, (1997), *Marine Turtle Populations of Southeast Asia and the Western Pacific Region: Distribution and Status*, Proceedings of the Workshop on Marine Turtle Research and Management in Indonesia, Jember, East Java, November 1996.

[206]Poiner paras. 5.71 and 5.140.

[207]Poiner para. 5.140.

effects, positive or negative, of headstarting will only be seen after two or four decades if and when the raised creatures return to breed and nest. In the interim, Thailand will lose its sea turtles for sure if 'conservation' is limited to headstarting. ... Simply raising more turtles and introducing them into habitat ill-suited to support them is a waste".[208] Limpus writes, "[i]t appears that all marine turtle populations in the Indo-Pacific region outside Australia are severely depleted and/or subject to overharvest and/or to excessive incidental mortality".[209] Mr. Guinea himself equivocates on this issue later in his statement when he writes, "the relative significance of egg protection is difficult to determine without knowing the other threatening processes impacting on the breeding unit".[210]

5.429. Under question 6(a), Mr. Guinea implies that time and area closures near turtle rookeries may be sufficient measures to protect sea turtles, but he never addresses the serious difficulties with this approach. Time and area closures only protect large juvenile or adult turtles while they are in the closed area near the rookery, or during the time when shrimping is banned and not at other times or places, such as when turtles are feeding in shrimp grounds. In fact, time/area specific closures and sanctuaries are not sufficient to protect sea turtles from incidental mortality in shrimp fisheries.[211] Two other experts in this case, Drs. Eckert and Frazier, disagree that time/area closures are viable management tools in and of themselves. Eckert points out the various problems with seasonal and time closures: (a) they are difficult and expensive to enforce, (b) they do not facilitate rapid adjustment for stochastic fluctuations in the migratory patterns of turtles, and (c) tow time limitations are almost impossible to enforce and actually do not provide much protection to turtles subject to multiple captures.[212] Dr. Frazier also points out the problems with these approaches. Both area closures and tow times are difficult to enforce. Additionally, seasonal and time closures tend to "concentrate fishing effort just before and just after the closure ('pulse fishing'). In general, seasonal and time closures simply offset mortality around the time of the closure".[213]

5.430. The United States also wishes to comment on some aspects of Dr. Poiner's answers.

5.431. In his answer to question 3(c), Dr. Poiner states that although the "obligatory" use of TEDs is one management tool that can be used, he cites with approval a source noting that voluntary TEDs use may be a better alternative, at least for Australia. However, the factual matter at issue in this case is whether TEDs reduce sea turtle mortality, not whether TEDs should be adopted voluntarily, or by regulation. None of the four Complainants claims that their shrimp trawlers voluntarily use TEDs. Furthermore, the Sachse and Wallner study, cited by Mr. Guinea[214], notes,

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[208]Settle, *(1995), Status of Nesting Populations of Sea Turtles in Thailand and their Conservation*, Marine Turtle Newsletter, No. 68, p. 11.

[209]C.J. Limpus, (1997), *Marine Turtle Populations of Southeast Asia and the Western Pacific Region: Distribution and Status*, Proceedings of the Workshop on Marine Turtle Research and Management in Indonesia, Jember, East Java, November 1996.

[210]Guinea para. 5.251.

[211]Crowder et al., (1994), *Predicting the Impact of Turtle Excluder Devices on Loggerhead sea Turtle Populations*, 4(3) Ecological Applications, p. 437; Statement of Deborah Crouse, Ph.D. 23 July 1997 (document submitted to the Panel by the United States).

[212]Eckert para. 5.223.

[213]Frazier para. 5.226.

[214]Guinea paragraph 5.291.

"we accept that after the current research, development and voluntary use phases, it may be appropriate to formally include TED use in management arrangements for the fishery. To this end, AFMA [Australian Fisheries Management Authority] and NORMAC (the management advisory committee established to provide management advise to AFMA for the NPF [Northern Prawn Fishery]) are in the process of developing bycatch action plans. These plans are likely to include an implementation timetable for TEDs".

Thus, the study itself seems to call into question the effectiveness of the voluntary approach.

5.432. Dr. Poiner also states that there are other measures such as area, seasonal and time closures and tow-time limitations that can be used to prevent sea turtle mortality. But, like Mr. Guinea's response, his response does not address the sea turtle mortality due to shrimp trawling in areas outside the banned area, or due to trawling at times when the ban is not in effect (see paragraph 5.0).

VI. INTERIM REVIEW

6.1. On 16 March 1998, Malaysia submitted comments regarding the interim report in accordance with Article 15.2 of the Understanding on Rules and Procedures Governing the Settlement of Disputes (hereafter "DSU"). Malaysia added that, in the event the United States would provide any comments on the interim report, Malaysia, together with the other co-complainants, reserved their rights to respond to such comments and to request a further meeting with the parties to discuss those comments. India, Pakistan and Thailand did not request a review. On 16 March 1998, the United States requested the Panel to review, in accordance with Article 15.2 of the DSU, the interim report that had been issued to the parties on 2 March 1998. The United States also requested the Panel to hold a meeting with the parties to discuss the issues raised in its comments. We met with the parties on 31 March 1998, reviewed the entire range of arguments presented by the parties, and finalized our report, taking into account the specific aspects of these arguments we considered to be relevant.

6.2. With respect to the comments made by Malaysia on the descriptive part, we have taken a number of them into account and accordingly modified paragraph 2.2, paragraph 3.9(f), footnote 80 to paragraph 3.38, and paragraphs 3.84, 3.131, 3.221 and 3.286.

6.3. With respect to the findings, Malaysia and the United States make several specific comments. We have accepted most of them and accordingly have made the appropriate changes in paragraphs 7.2, 7.5, 7.6, 7.19 and 7.48. However, we have not modified paragraph 7.46, as requested by the United States. We agree with the United States that none of the parties cited or discussed the 1952 *Belgian Family Allowances* case[215], but in our view a reference to that case is relevant to our findings because, even though it did not relate to Article XX, it addressed a situation similar to this case, where a country had imposed conditions on access to its market based on the existence in the exporting countries of a family allowance system meeting specific requirements. Finally, we cannot agree with the comment of the United States on paragraph 7.52 that we should review the statement that the 1992 Rio Declaration "stresses the diversity of environmental situations and responsibilities". When we refer to diversity of responsibilities, we do not base ourselves on Principle 2 only, to which the United States seems to refer exclusively, but also to Principle 11 as well. Both Principles are quoted in footnote 661 and our purpose is to illustrate the right of States to design their own environmental policies on the basis of their particular environmental and developmental situations and responsibilities. We have clarified the relevant part of paragraph 7.52 accordingly.

6.4. The United States also makes comments of a more general nature. We address them successively hereafter. First, the United States considers that the findings of the Panel never identified or analysed the particular terms of the chapeau of Article XX and disregarded the relevant language of the GATT 1994. In response, we have expanded the discussion of the terms of the chapeau in paragraphs 7.33 and 7.34.

6.5. The United States also claims that the Panel adopted a new test based on the Panel's view of the object and purpose of the Article XX chapeau. However, this mischaracterizes our findings, which do not rely solely on the object and purpose of Article XX. They are based on an analysis, pursuant to Article 31(1) of the Vienna Convention on the Law of Treaties (1969), of the ordinary meaning of the terms of the chapeau of Article XX, *taken in their context and in the light of the object and purpose of the WTO Agreement*. Moreover, in our reasoning, we rely also on general principles of public international law such as *pacta sunt servanda*. Consequently, our

[215] Adopted on 7 November 1952, BISD 1S/59.

findings are the result of the application of interpretative methods required by Article 3.2 of the DSU. In our view, our process of interpretation of Article XX in this case does not add to Members' obligations in contravention of Article 3.2 of the DSU.

6.6. The United States further claims that the Panel has adopted a so-called "threat to the multilateral trading system" test that is tautological and undermines Article XX. In our view, the concept of "threat to the multilateral trading system" is an application in this case of the principle according to which Members should not deprive the WTO Agreement of its object and purpose. This concept is elaborated in paragraphs 7.44 and 7.45. We have not imposed a new test, but merely found that the type of measure at issue in this case deprives the WTO Agreement of its object and purpose and, thus, is beyond the scope of Article XX. The analysis is not tautological, since it elaborates on the function of Article XX in the WTO framework. As the United States put it in its request for interim review: "A measure meeting the provisions of Article XX, by definition, cannot be a 'threat to the multilateral trading system'." Thus, where a panel believes that a measure does constitute such a threat, it is appropriate to interpret Article XX so as not to permit it. We do not believe that the notion of "threat to the multilateral trading system" entrusts panels with unfettered discretion as to what measure would satisfy the conditions of Article XX. On the contrary, it preserves the right of Members to implement the environmental policies of their choice through trade measures, as long as those trade measures do not affect the multilateral system to the point where the WTO Agreement is deprived of its object and purpose.

6.7. The United States argues in addition that "the interim report contains troubling language indicating that under the object and purpose of the WTO, trade concerns outweigh environmental concerns" and that the Panel's categorical language according to which measures are only allowed if they do not undermine the WTO system is much broader than necessary for the resolution of this dispute. We do not believe that our findings reflect such a view. Our examination of the object and purpose of the WTO Agreement led us to conclude that the central focus of that agreement is the promotion of economic development through trade. That means that there is room for other concerns, and, in particular, environmental concerns, as underlined by the wording of the preamble and the existence of exceptions. Moreover, we have not in any way passed judgement on the relative importance of trade and environmental policies.

6.8. Finally, we reject the US assertion that we have used unnecessarily broad language in our findings. Indeed, our findings have been written narrowly to address certain specific attributes of the US measure at issue, attributes which we do not believe would typically be found in environmental regulations. Indeed, as the United States concedes in its request for interim review, we stated that "there should not be nor need be any policy contradiction between upholding and safeguarding an open, equitable and non-discriminatory multilateral trading system on the one hand and acting for the protection of the environment on the other". In light of such statements, we see no scope for a future panel to misconstrue our narrowly drafted findings in this case.

VII. FINDINGS

A. INTRODUCTION

7.1 We note that the dispute arose from the following facts.[216] Most sea turtles are distributed around the world, in sub-tropical or tropical areas. Sea turtles are affected by human activity. They have been exploited for their meat, shell and eggs but they are also affected by the pollution of the oceans and the destruction of their habitats. In addition, they are subject to incidental capture in fisheries. Presently, most populations of sea turtles are considered to be endangered or threatened. In this respect, all marine turtles are included in Appendix I to the 1973 Convention on International Trade in Endangered Species (hereafter "CITES")[217] as species threatened with extinction.

7.2 Pursuant to the US Endangered Species Act of 1973 (hereafter "ESA"), all sea turtles that occur in US waters are listed as endangered or threatened species. Research programmes carried out by the United States have led to the conclusion that incidental capture and drowning of sea turtles by shrimp trawlers is a significant source of mortality for sea turtles. The United States National Marine Fisheries Service (hereafter "NMFS") has developed, within a programme aimed at reducing the mortality of sea turtles in shrimp trawls, turtle excluder devices (hereafter "TEDs").[218] In 1987, the United States issued regulations under the ESA whereby shrimp fishermen are required to use TEDs or tow time restrictions in specified areas where there is a significant mortality of sea turtles in shrimp trawls. Since December 1994, these regulations have eliminated the option for small trawl vessels to restrict tow times in lieu of using TEDs.

7.3 In 1989, the United States enacted Section 609 of Public Law 101-162 (hereafter "Section 609"). Section 609 calls upon the US Secretary of State, in consultation with the US Secretary of Commerce, *inter alia* to initiate negotiations for the development of bilateral or multilateral agreements for the protection and conservation of sea turtles, in particular with governments of countries engaged in commercial fishing operations likely to have a negative impact on sea turtles. Section 609 further provides that shrimp harvested with technology that may adversely affect certain sea turtles protected under US law may not be imported into the United States, unless the President annually certifies to the Congress that the harvesting country concerned has a regulatory programme governing the incidental taking of such sea turtles in the course of such harvesting that is comparable to that of the United States, that the average rate of that incidental taking by the vessels of the harvesting country is comparable to the average rate of incidental taking of sea turtles by United States vessels in the course of such harvesting, or that the fishing environment of the harvesting country does not pose a threat of incidental taking to sea turtles in the course of such harvesting.

7.4 The United States issued guidelines in 1991 and 1993 for the implementation of Section 609. Pursuant to these guidelines, Section 609 was applied only to countries of the Caribbean/Western Atlantic. In September 1996, the United States concluded the Inter-American Convention for the Protection and Conservation of Sea Turtles with a number of countries of that region. In December 1995, the US Court of International Trade (hereafter "CIT") found the 1991 and 1993 guidelines illegal insofar as they limited the geographical scope of Section 609 to shrimp harvested in the wider Caribbean/Western Atlantic area. The CIT directed the US Department of State to prohibit, no later than 1 May 1996, the importation of shrimp or products of shrimp wherever harvested in the wild with commercial fishing

[216]For a more detailed presentation of the factual aspects of this case, see Section II of this Report.

[217]Done at Washington, on 3 March 1973, 993 UNTS 243, 12 ILM 1085 (1973), entered into force on 1 July 1975.

[218]A TED is a grid trapdoor installed inside a trawling net that is designed to allow shrimp to pass to the back of the net while directing sea turtles and other unintentionally caught large objects out of the net.

technology which may affect adversely those species of sea turtles the conservation of which is the subject of regulations of the Secretary of Commerce.

7.5 In April 1996, the Department of State published revised guidelines to comply with the CIT order of December 1995. The new guidelines extended the scope of Section 609 to shrimp harvested in all countries. The Department of State further determined that, as of 1 May 1996, all shipments of shrimp and shrimp products into the United States must be accompanied by a declaration attesting that the shrimp or shrimp product in question has been harvested "either under conditions that do not adversely affect sea turtles ... or in waters subject to the jurisdiction of a nation currently certified pursuant to Section 609." The 1996 guidelines define "shrimp or shrimp products harvested in conditions that do not affect sea turtles" to include: "(a) Shrimp harvested in an aquaculture facility ...; (b) Shrimp harvested by commercial shrimp trawl vessels using TEDs comparable in effectiveness to those required in the United States; (c) Shrimp harvested exclusively by means that do not involve the retrieval of fishing nets by mechanical devices or by vessels using gear that, in accordance with the US programme, would require TEDs; (d) Species of shrimp, such as the pandalid species, harvested in areas in which sea turtles do not occur". The 1996 guidelines provided that certification could be granted by 1 May 1996, and annually thereafter to harvesting countries other than those where turtles do not occur or that exclusively use means that do not pose a threat to sea turtles "only if the government of [each of those countries] has provided documentary evidence of the adoption of a regulatory program governing the incidental taking of sea turtles in the course of commercial shrimp trawl harvesting that is comparable to that of the United States and if the average take rate of that incidental taking by vessels of the harvesting nation is comparable to the average rate of incidental taking of sea turtles by United States vessels in the course of such harvesting." For the purpose of these certifications, a regulatory programme must include, *inter alia*, a requirement that all commercial shrimp trawl vessels operating in waters in which there is a likelihood of intercepting sea turtles use TEDs at all time. TEDs must be comparable in effectiveness to those used by the United States. Moreover, the average incidental take rate will be deemed comparable to that of the United States if the harvesting country requires the use of TEDs in a manner comparable to that of the US programme.

7.6 In October 1996, the CIT ruled that the embargo on shrimp and shrimp products enacted by Section 609 applies to "all shrimp and shrimp products harvested in the wild by citizens or vessels of nations which have not been certified." The CIT found that the 1996 guidelines are contrary to Section 609 when allowing, with a shrimp exporter declaration form, imports of shrimp from non-certified countries, if the shrimp was harvested with commercial fishing technology that did not adversely affect sea turtles. The CIT later clarified its decision in ruling that shrimp harvested by manual methods which do not harm sea turtles, by aquaculture and in cold water, could continue to be imported even from countries which have not been certified under Section 609.

B. RULINGS MADE BY THE PANEL IN THE COURSE OF THE PROCEEDINGS

7.7 In the course of the proceedings, we received two documents called *amicus briefs* and submitted by non-governmental organizations. These documents were also communicated by their authors to the parties to the dispute. In a letter dated 1 August 1997 and at the second substantive meeting of the Panel, India, Malaysia, Pakistan and Thailand requested us not to consider the content of these documents in our examination of the matter under dispute. At the second substantive meeting of the Panel, the United States, stressing that the Panel could

seek information from any relevant source under Article 13 of the Understanding on Rules and Procedures Governing the Settlement of Disputes (hereafter "DSU"), urged us to avail ourselves of any relevant information in the two documents, as well as in any other similar communications.

7.8 We had not requested such information as was contained in the above-mentioned documents. We note that, pursuant to Article 13 of the DSU, the initiative to seek information and to select the source of information rests with the Panel. In any other situations, only parties and third parties are allowed to submit information directly to the Panel. Accepting non-requested information from non-governmental sources would be, in our opinion, incompatible with the provisions of the DSU as currently applied. We therefore informed the parties that we did not intend to take these documents into consideration. We observed, moreover, that it was usual practice for parties to put forward whatever documents they considered relevant to support their case and that, if any party in the present dispute wanted to put forward these documents, or parts of them, as part of their own submissions to the Panel, they were free to do so. If this were the case, the other parties would have two weeks to respond to the additional material. We noted that the United States availed themselves of this opportunity by designating Section III of the document submitted by the Center for Marine Conservation and the Center for International Environmental Law as an annex to its second submission to the Panel.

7.9 None of the parties to the dispute requested the Panel to consult experts. However, we noted that parties had submitted a number of studies by experts and often quoted the same scientific documents to support opposite views. Under those circumstances, we decided, acting on our own initiative, to seek scientific and technical advice pursuant to paragraph 1 and paragraph 2, first sentence of Article 13 of the DSU.[219]

7.10 Parties to the dispute were given time to comment in writing on the replies of the experts to the questions of the Panel. However, before and during the hearing of the experts, we recalled that parties should limit their intervention to questions and comments strictly related to the issues raised by the experts. Accordingly, we decided not to take into account in our findings any comment or question raised in relation with the consultation of the experts which would not be strictly related to the scientific issues under discussion with the experts.

C. VIOLATION OF ARTICLE XI:1 OF GATT 1994[220]

7.11 We note that all four complainants[221] raise claims regarding the violation of Article XI GATT 1994. India, Pakistan and Thailand submit that the scope of Article XI:1, which provides for general elimination of quantitative restrictions, is comprehensive and applies to all measures instituted or maintained by a Member prohibiting or restricting the importation, exportation or sale for export of products other than measures that take the form of duties, taxes or other charges. Measures prohibited by Article XI:1 include outright quotas and quantitative restrictions made effective through import or export licences. The embargo applied by the United States on the basis of Article 609 constitutes a prohibition or restriction on the importation of shrimp or shrimp products from the complainants and is not in the nature of a "duty, tax, or other charges" within the meaning of Article XI:1. India, Pakistan and

[219]For a detailed account of the Panel's consultation with scientific experts, see Section V of this Report.

[220]For a more detailed presentation of the main arguments of the parties, see Section III of this Report.

[221]India, Pakistan, Malaysia and Thailand are hereafter referred to as the "complainants".

Thailand consider that the 1991 and 1994 reports on *United States - Restrictions on Imports of Tuna*[222] involve a measure virtually identical to the restriction on imports of shrimp and shrimp products at issue in this case. In those cases, the embargo was applied by the United States to imports of tuna from countries that had not implemented conservation programmes comparable to those of the United States to protect dolphins incidentally taken by commercial fishermen harvesting tuna. In both cases, the panels found that the restriction constituted a violation of Article XI.

7.12 Malaysia argues that the import prohibition imposed by the United States under Section 609 falls under Article XI as it bans import of shrimp or shrimp products from any country not meeting certain policy conditions, and are not duties, taxes or other charges. The findings of the *Tuna I* and *Tuna II* cases are equally applicable to the facts of this case. The US prohibition on imports of shrimp and shrimp products is therefore contrary to Article XI:1 and cannot be justified under Article XI:2, as this provision does not address the situation at issue.

7.13 The United States argues that since under Article XX nothing in GATT 1994 is to be construed to prevent the adoption or enforcement of the measures at issue, it need not address Article XI. The United States also considers that the complainants have the burden of establishing any alleged violation of GATT 1994. However, the United States does not dispute that, with respect to countries not certified under Section 609, Section 609 amounts to a restriction on the importation of shrimp within the meaning of Article XI:1 of GATT 1994.

7.14 The arguments put forward by the parties raise the general question of the burden of proof, in terms of who bears this burden and in terms of how much has to be proved in the circumstances of this case. Regarding who bears the burden of proof, we recall the well established general principle of law referred to by the Appellate Body in its report on *United States - Measure Affecting Imports of Woven Wool Shirts and Blouses from India*[223]: "the burden of proof rests upon the party, whether complaining or defending, who asserts the affirmative of a particular claim or defence". We consequently consider that it is up to the complainants to demonstrate that the US measure at issue violates Article XI:1 of GATT 1994. The arguments of the parties also raise the question of when a panel should consider that a party has provided sufficient evidence in support of a particular claim or defence. We recall that the Appellate Body in the *Wool Shirts* case found that "precisely how much and precisely what kind of evidence will be required to establish [a presumption that a claim is valid] will necessarily vary ... from case to case".[224] We therefore have to assess the evidence before us in the light of the particular circumstances of this case. This implies that we may consider any type of evidence, and also that we may reach our conclusions regarding a particular claim on the basis of the level of evidence that we consider sufficient.

7.15 In this respect, we note that the United States, in reply to one of our questions, "does not dispute that with respect to countries not certified under Section 609, Section 609 amounts to a restriction on the importation of shrimp within the meaning of Article XI:1 of GATT 1994".[225] This statement of the United States creates a particular situation where the defendant

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[222]Panel Report on *United States - Restrictions on Imports of Tuna*, 3 September 1991, DS21/R, not adopted (hereafter *"Tuna I"*), and Panel Report on *United States - Restrictions on Imports of Tuna*, 16 June 1994, DS29/R, not adopted (hereafter *"Tuna II"*).

[223]Adopted on 23 May 1997, WT/DS33/AB/R (hereafter *"Wool Shirts"*), p. 14.

[224]Op. Cit., p. 14.

[225]See para. 3.143 of this Report.

basically admits that a given measure amounts to a restriction prohibited by GATT 1994. It is usual legal practice for domestic and international tribunals, including GATT panels[226], to consider that, if a party admits a particular fact, the judge may be entitled to consider such fact as accurate.

7.16 Even if the above-mentioned US declaration does not amount to an admission of a violation of Article XI:1, we consider that the evidence made available to the Panel is sufficient to determine that the United States prohibition of imports of shrimp from non-certified Members violates Article XI:1. Article XI:1 reads in part as follows:

"No prohibitions or restrictions other that duties, taxes or other charges, whether made effective through quotas, import or export licences or other measures, shall be instituted or maintained by any contracting party on the importation of any product of the territory of any other contracting party ...".

We note that Section 609(b)(1) provides that:

"The importation of shrimp or products from shrimp which have been harvested with commercial fishing technology which may affect adversely such species of sea turtles shall be prohibited no later than May 1, 1991, except as provided in paragraph (2) [i.e. the exporting country is certified]".

Thus, Section 609 expressly requires the imposition of an import ban on imports from non-certified countries. We further note that in its judgement of December 1995, the CIT directed the US Department of State to prohibit, no later that 1 May 1996, the importation of shrimp or products of shrimp wherever harvested in the wild with commercial fishing technology which may affect adversely those species of sea turtles the conservation of which is the subject of regulations of the Secretary of Commerce.[227] Furthermore, the CIT ruled that the US Administration has to apply the import ban, *including to TED-caught shrimp*, as long as the country concerned has not been certified. In other words, the United States bans imports of shrimp or shrimp products from any country not meeting certain policy conditions. We finally note that previous panels have considered similar measures restricting imports to be "prohibitions or restrictions" within the meaning of Article XI.[228]

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[226]See Panel Report on *EEC - Programme of Minimum Import Prices, Licences and Surety Deposits for Certain Processed Fruits and Vegetables*, adopted on 18 October 1978, BISD 25S/68, where the panel, at para. 4.9, *inter alia* "noted the assertion by the representative of the Community that this system was a system which fell within the purview of Article XI and XI alone ... Having noted the foregoing, the Panel considered that the minimum import price system, as enforced by the additional security, was a restriction 'other than duties, taxes or other charges' within the meaning of Article XI:1". In *EEC - Quantitative Restrictions against Imports of Certain Products from Hong Kong*, adopted on 12 July 1983, BISD 30S/129, the panel noted, in para. 31, that the EC itself referred to the products concerned as subject to quantitative restrictions. The panel further noted that "no GATT justification had been advanced for the quantitative restrictions referred to in paragraph 31 above" and concluded that "the relevant provisions of Article XI were not complied with".

[227]United States Court of International Trade: *Earth Island Institute v. Christopher*, ruling of 29 December 1995 (913 F. Supp. 559).

[228]See Panel Report in the *Tuna I* case, Op. Cit., para. 5.17-5.18, and Panel Report in the *Tuna II* case, Op. Cit., para. 5.10. Speaking of the relevance for panels of previous reports, the Appellate Body has stated, with respect to adopted panel reports:

"Adopted panel reports are an important part of the GATT *acquis*. They are often considered by subsequent panels. They create legitimate expectations among WTO Members, and, therefore, should be taken into account where they are relevant to any dispute". (Appellate Body Report on *Japan - Taxes on Alcoholic Beverages*, adopted on 1 November 1996, WT/DS8, DS10, DS11/AB/R, p. 14)

Regarding unadopted panel reports, the Appellate Body agreed with the panel in the same case that:

7.17 Therefore, we find that the United States admits that, with respect to countries not certified under Section 609, the measures imposed in application of Section 609 amount to "prohibitions or restrictions" on the importation of shrimp within the meaning of Article XI:1 of GATT 1994. Even if one were to consider that the United States has not admitted that it imposes an import prohibition or restriction within the meaning of Article XI:1, we find that the wording of Section 609 and the interpretation made of it by the CIT are sufficient evidence that the United States imposes a "prohibition or restriction" within the meaning of Article XI:1. We therefore find that Section 609 violates Article XI:1 of GATT 1994.

D. VIOLATION OF ARTICLE XIII:1 AND OF ARTICLE I:1 OF GATT 1994[229]

7.18 India, Pakistan and Thailand claim that the import prohibition on shrimp and shrimp products from non-certified countries is inconsistent with the most-favoured-nation principle embodied in Article I:1 GATT 1994 because physically identical shrimp and shrimp products from different Members are treated differently by the United States upon importation. This differentiated treatment is based solely on the method of harvest and the conservation policies of the government under whose jurisdiction the shrimp is harvested. Further, even if one were to assume *arguendo* that the method of harvest does affect the nature of the shrimp, the embargo violates Article I:1 because, pursuant to the embargo, wild shrimp harvested by use of TEDs are forbidden entry into the United States if harvested by a national of a non-certified country, while shrimp harvested by the same method by a national of a certified country is permitted entry into the United States.

7.19 India, Pakistan and Thailand also claim that the embargo as applied is also inconsistent with Articles I:1 and XIII:1 of the GATT 1994 because initially affected countries were given a phase-in period of three years, while newly affected nations were not given a similar period of time. Malaysia further argues that, while newly affected nations generally received only a four month notice, Malaysia actually was given three months (i.e., until 1 April 1996) to adopt a programme complying with the US requirements. For Malaysia, this differential treatment is also discriminatory and inconsistent with Article XIII:1. According to India, Pakistan and Thailand, initially affected countries were given the opportunity to implement the required use of TEDs without substantially interrupting shrimp trade to the United States. Products from these countries have therefore been given an "advantage, favour, privilege or immunity" over like products originating in the territories of other Members, in violation of Article I:1. Likewise, importation of like products from initially affected countries was not similarly prohibited, in violation of Article XIII:1.

7.20 India, Pakistan and Thailand also argue that Section 609 is inconsistent with Article XIII:1 of GATT 1994 because it restricts the importation of shrimp and shrimp products from countries which have not been certified, while like products from other countries which have been certified can be imported freely into the United States. The United States denies entry of shrimp and shrimp products based on the method of harvest, even though it does not affect the nature of the product. Indeed, all foreign shrimp and shrimp products have the same physical characteristics, end-uses and tariff classifications and are perfectly substitutable. Thus, shrimp products which may be imported into the United States pursuant to Section 609

(..continued)

"a panel could nevertheless find useful guidance in the reasoning of an unadopted panel report that it considered to be relevant". (Appellate Body Report on *Japan - Taxes on Alcoholic Beverages*, Op. Cit., p. 15)

[229]For a more detailed presentation of the main arguments of the parties, see Section III of this Report.

are like shrimp products from non-certified countries which are denied entry. The differential treatment of like products from certified and non-certified countries violates Article XIII:1. Even assuming that the method of harvest does affect the nature of the product, the embargo violates Article XIII because wild shrimp harvested by use of TEDs are forbidden entry into the United States if harvested by a national of a non-certified country, while shrimp harvested by use of TEDs by a national of a certified country are permitted entry into the United States.

7.21 The United States does not agree with the complainants' claims under Articles I and XIII, particularly since, in the US view, the US measure applies equally to all harvesting Members. The United States further argues that, if the Panel makes a finding with respect to Article XI, there will be no need to reach the claims under Articles I and XIII.

7.22 Given our conclusion in paragraph 7.17 above that Section 609 violates Article XI:1, we consider that it is not necessary for us to review the other claims of the complainants with respect to Articles I:1 and XIII:1. This is consistent with GATT[230] and WTO[231] panel practice and has been confirmed by the Appellate Body in its report in the *Wool Shirts* case, where the Appellate Body mentioned that "A panel need only address those claims which must be addressed in order to resolve the matter in issue in the dispute."[232]

7.23 Therefore we do not find it necessary to review the allegations of the complainants with respect to Articles I:1 and XIII:1. On the basis of our finding of violation of Article XI:1, we move to address the defence of the United States under Article XX.

E. ARTICLE XX OF GATT 1994[233]

1. Preliminary remarks

7.24 The United States claims that the measures at issue adopted pursuant to Section 609, which were found to be inconsistent with Articles XI:1 GATT 1994, are justified under Article XX(b) and (g) of GATT 1994. India, Pakistan and Thailand argue that Article XX(b) and (g) cannot be invoked to justify a measure which applies to animals not within the jurisdiction of the Member enacting the measure. Malaysia contends that, since Section 609 allows the United States to take actions unilaterally to conserve a shared natural resource, it is therefore in breach of the sovereignty principle under international law. The United States responds that Article XX(b) and (g) contain no jurisdictional limitations, nor limitations on the location of the animals or natural resources to be protected and conserved and that, under general principles of international law relating to sovereignty, States have the right to regulate imports within their jurisdiction.

7.25 The relevant parts of Article XX provide as follows:

Article XX
General exceptions

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[230]See, e.g., Panel report on *Canada - Administration of the Foreign Investment Review Act*, adopted on 7 February 1984, BISD 30S/140, para. 5.16.

[231]See, e.g., Panel Report on *Brazil - Measures Affecting Desiccated Coconut*, adopted on 20 March 1997, WT/DS22/R, para. 293.

[232]Op. Cit., p. 19.

[233]For a more detailed presentation of the main arguments of the parties, see Section III of this Report.

Subject to the requirement that such measures are not applied in a manner that would constitute a means of arbitrary or unjustifiable discrimination between countries where the same conditions prevail, or a disguised restriction on international trade, nothing in this Agreement shall be construed to prevent the adoption or enforcement by any contracting party of measures:

...

(b) necessary to protect human, animal or plant life or health;

...

(g)relating to the conservation of exhaustible natural resources if such measures are made effective in conjunction with restrictions on domestic production or consumption;

...

7.26 The arguments of the parties raise the general question of whether Article XX(b) and (g) apply at all when a Member has taken a measure conditioning access to its market for a given product on the adoption of certain conservation policies by the exporting Member(s). We note that Article XX can accommodate a broad range of measures aiming at the conservation and preservation of the environment.[234] At the same time, by accepting the WTO Agreement, Members commit themselves to certain obligations which limit their right to adopt certain measures. We therefore consider it important to determine first whether the *scope* of Article XX encompasses measures whereby a Member conditions access to its market for a given product on the adoption of certain conservation policies by the exporting Member(s).

7.27 Pursuant to Article 3.2 of the DSU and in accordance with Appellate Body decisions[235], we should, when trying to clarify the scope of Article XX, have recourse to customary rules of interpretation of public international law. We note that Article 31(1) of the Vienna Convention on the Law of Treaties (1969) (hereafter the "Vienna Convention") provides that:

"A treaty shall be interpreted in good faith in accordance with the ordinary meaning to be given to the terms of the treaty in their context and in the light of its object and purpose".

Therefore, in order to determine the scope of Article XX, it is necessary to consider not only the terms in their ordinary meaning, but also their context and the object and purpose of GATT 1994 and the WTO Agreement itself.[236]

7.28 Article XX contains an introductory provision, or *chapeau*, and a number of specific requirements contained in successive paragraphs. As mentioned by the Appellate Body in its

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[234]See, e.g., Appellate Body report on *United States - Standards for Reformulated and Conventional Gasoline* (hereafter "*Gasoline*"), WT/DS2/AB/R, adopted on 20 May 1996, which provides, at p. 30:

"WTO Members have a large measure of autonomy to determine their own policies on the environment (including its relationship with trade), their environmental objectives and the environmental legislation they enact and implement. So far as concerns the WTO, that autonomy is circumscribed only by the need to respect the requirements of the *General Agreement* and the other covered agreements".

[235]See, e.g., Appellate Body Report in the *Gasoline* case, Op. Cit., p. 17-18.

[236]See Appellate Body report on *Brazil - Measures Affecting Desiccated Coconut*, adopted on 20 March 1997, WT/DS22/AB/R, p. 15. Where appropriate, we must also consider GATT and WTO panel and Appellate Body reports. See footnote 623 above.

report in the *Gasoline* case[237], in order for the justification of Article XX to be extended to a given measure, it must not only come under one or another of the particular exceptions - paragraphs (a) to (j) - listed under Article XX; it must also satisfy the requirements imposed by the opening clause of Article XX. We note that panels have in the past considered the specific paragraphs of Article XX before reviewing the applicability of the conditions contained in the chapeau. However, as the conditions contained in the introductory provision apply to any of the paragraphs of Article XX, it seems equally appropriate to analyse first the introductory provision of Article XX.

7.29 We also recall that the Appellate Body considered, in the *Gasoline* case[238], that the chapeau by its express terms addresses, not so much the questioned measure or its specific contents, but rather the manner in which that measure is applied.[239] The Appellate Body further underscored that "the purpose and object of the introductory clause of Article XX is generally the prevention of 'abuse of the exceptions of [what was later to become] Article [XX]'". Hence, the chapeau determines to a large extent the context of the specific exceptions contained in the paragraphs of Article XX. Therefore, we shall first determine whether the measure at issue satisfies the conditions contained in the chapeau. If we find this to be the case, we shall then examine whether the US measure is covered by the terms of Article XX(b) or (g).

7.30 Finally, we keep in mind the well-established practice according to which when an affirmative defence, such as Article XX, is invoked, the burden of proof should rest on the party asserting it.[240] We therefore consider that the burden of proving that the measure at issue is justified under Article XX rests on the United States, as the party asserting this affirmative defence.

2. Chapeau of Article XX

7.31 India, Pakistan and Thailand argue that the embargo applied by the United States is implemented in a manner that constitutes a means of arbitrary or unjustifiable discrimination between countries where the same conditions prevail insofar as the newly affected nations, including India, Pakistan and Thailand, have been given substantially less notice than the other countries, whether the United States or initially affected countries, before being forced to comply with TEDs requirements. They maintain that there is not only a discrimination between exporting countries, but also between exporting countries and the United States. Furthermore, India, Pakistan and Thailand consider that, before requiring TEDs application from them, the United States should have demonstrated that the same conditions do not prevail between India, Pakistan or Thailand and the countries with no TEDs requirement. Moreover, for these complainants, the legislative history of Section 609, which includes

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[237]Op. Cit., p. 22.

[238]Ibid., p. 22.

[239]See also the panel report on *United States - Imports of Certain Automotive Spring Assemblies*, adopted on 26 May 1983, BISD 30S/107, which specified, at para. 56, that "the preamble of Article XX made it clear that it was the application of the measure and not the measure itself that needed to be examined."

[240]See Appellate Body Report in the *Wool Shirts* case, Op. Cit., p. 16, and the GATT cases cited in footnote 23 to that report. In that case, the Appellate Body mentioned that "Articles XX and XI:2(c)(i) are limited exceptions from obligations under certain other provisions of the GATT 1994, not positive rules establishing obligations in themselves. They are in the nature of affirmative defences. It is only reasonable that the burden of establishing such a defence should rest on the party asserting it". Therefore, we shall apply this principle when we review the US arguments under Article XX.

discussions of this section in terms of the competitive position of the US shrimp industry, further supports the conclusion that the embargo is a disguised restriction on international trade. The effect of the restriction was not so much reduced importation as the additional cost on the foreign industry, making it less competitive, and the risk that the right to export might be revoked. Malaysia claims that disguised restrictions include disguised discrimination in international trade, and that it has been subject to such discrimination because it was given only a few months to comply with the US requirements as opposed to three years in the case of the initially affected countries.

7.32 The United States argues that the measures related to import of shrimp were carefully and justifiably tied to the particular conditions of each country exporting shrimp to the United States. All exporting nations with the same shrimp harvesting conditions are treated equally, with no discrimination. For the United States, the evidence is overwhelming that the conservation measures under Section 609 are not some artifice intended to protect the US fishing industry. The United States argued that the strong and growing international consensus regarding sea turtle conservation and the mandatory use of TEDs belies any claim that the US measures are some sort of disguised restriction on trade. In addition, the United States maintains that the extension of the application of Section 609 to other countries than the United States and the wider Caribbean/Western Atlantic area has not led to a decrease in the quantities imported nor to an increase in prices.

7.33 In order to apply Article XX in this case, we must, as mentioned in paragraph 7.27 above, interpret it in line with Article 31(1) of the Vienna Convention. More particularly, the chapeau of Article XX must be interpreted on the basis of the ordinary meaning of its terms, in their context and in the light of the object and purpose of GATT 1994 and the WTO Agreement. We consider first if the terms of the chapeau of Article XX explicitly address the issue of whether Article XX contains any limitation on a Member's use of measures conditioning market access to the adoption of certain conservation policies by the exporting Member. In this connection, we note that the chapeau prohibits such application of the measure at issue as would constitute "arbitrary or unjustifiable discrimination" between countries where the same conditions prevail. We note that the US measure at issue applies to all Members seeking to export to the United States wild shrimp retrieved mechanically from waters where sea turtles and shrimp occur concurrently. We consider those Members to be "countries where the same conditions prevail", within the meaning of Article XX. We further note that some of those countries have been "certified" and can export shrimp to the United States whereas some have not and are subject to an import ban. Consequently, discriminatory treatment is applied to shrimp from non-certified countries. Pursuant to the chapeau of Article XX, a measure may discriminate, but not in an "arbitrary" or unjustifiable" manner.

7.34 We therefore move to consider whether the US measure conditioning market access on the adoption of certain conservation policies by the exporting Member could be considered as "unjustifiable" discrimination. As was recalled by the Appellate Body in the *Gasoline* case, "the text of the chapeau of Article XX is not without ambiguity". The word "unjustifiable" has never actually been subject to any precise interpretation.[241] The ordinary meaning of this term is susceptible to both narrow and broad interpretations. While the ordinary meaning of "unjustifiable" confirms that Article XX is to be applied within certain boundaries, it does not

[241]Previous panels considered situations of discrimination related to import prohibitions. The Panel Report on *United States - Prohibition on Imports of Tuna and Tuna Products from Canada*, adopted on 22 February 1982, BISD 29S/91, considered, at para. 4.8, that the measure had been taken exclusively against imports from Canada, but that *similar actions* had been taken against imports from other countries, and then for similar reasons. The panel concluded that if Canada had been discriminated against, it might not necessarily have been in an arbitrary or unjustifiable manner.

explicitly address the issue of whether Article XX should be interpreted to contain any limitation on a Member's use of measures conditioning market access on the adoption of certain conservation policies by the exporting Member. For that reason, it is essential that we interpret the term "unjustifiable" within its context and in the light of the object and purpose of the agreement to which it belongs.

7.35 Turning to an examination of the context of the terms and the object and purpose of the WTO Agreement, we note that the notion of "context", on the one hand, and of "object and purpose", on the other hand, are intimately linked. Indeed, Article 31(2) of the Vienna Convention provides that the context for the purpose of treaty interpretation comprises the text of the agreement, including its preamble and annexes. By the same token, determining the object and purpose of an agreement implies an examination of the text of the agreement and of its preamble. Consequently, we consider that the context of the chapeau of Article XX cannot be distinguished from that of Article XX as a whole. Furthermore, as the WTO Agreement is an integrated system including GATT 1994[242], we shall consider as the context of the chapeau and of Article XX as a whole not only the other relevant provisions of GATT 1994 together with its preamble and annexes, but also the WTO Agreement, including its preamble and its other annexes. For the same reasons, the object and purpose to be considered is not only that of GATT 1994, but that of the WTO Agreement as a whole.

7.36 GATT panels had the occasion to address the context and the object and purpose of Article XX. The 1989 panel on *United States - Section 337 of the Tariff Act of 1930* considered that:

> " ... Article XX is entitled 'General Exceptions' ... Article XX(d) thus provides for a *limited and conditional exception* from obligations under other provisions".[243]

Referring, *inter alia*, to the above-mentioned report, the panel in the *Tuna I* case found that:

> " ... previous panels had established that Article XX is a limited and conditional exception from obligations under other provisions of the General Agreement, and *not a positive rule establishing obligations in itself*. Therefore, the practice of panels has been to interpret Article XX narrowly ... ."[244]

7.37 The Appellate Body also described Article XX in very similar language. In the *Wool Shirts* case, it found that:

> "Articles XX and XI:1(2)(c)(i) are limited exceptions from obligations under certain other provisions of the GATT 1994, not positive rules establishing obligations in themselves".[245]

7.38 The Appellate Body has also discussed the relationship of Article XX(g) to GATT as a whole, in terms that would apply to the relationship to GATT of Article XX taken in its entirety:

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[242]See Appellate Body Report on *Brazil - Measures Affecting Desiccated Coconut*, Op. Cit., pp. 11-12.

[243]Adopted on 7 November 1989, BISD 36S/345, para. 5.9 (emphasis added).

[244]Op. Cit., para. 5.22 (emphasis added, footnote omitted). See, also, Panel Report on *Canada - Administration of the Foreign Investment Review Act*, Op. Cit., para. 5.20.

[245]Op. Cit., p. 16.

"... Article XX(g) and its phrase, 'relating to the conservation of exhaustible natural resources,' need to be read in context and in such a manner *as to give effect to the purposes and objects of the General Agreement*. The context of Article XX(g) includes the provisions of the rest of the General Agreement, including in particular Articles I, III and XI; conversely, the context of Articles I and III and XI includes Article XX. Accordingly, the phrase 'relating to the conservation of exhaustible natural resources' may not be read so expansively as seriously to subvert the purpose and object of Article III:4. Nor may Article III:4 be given so broad a reach as effectively to emasculate Article XX(g) and the policies and interests it embodies. The relationship between the affirmative commitments set out in, *e.g.*, Articles I, III and XI, and the policies and interests embodied in the "General Exceptions" listed in Article XX, can be given meaning *within the framework of the General Agreement and its object and purpose by a treaty interpreter only on a case-to-case basis*, by careful scrutiny of the factual and legal context in a given dispute, without disregarding the words actually used by the WTO Members themselves to express their intent and purpose."[246]

7.39 While the Appellate Body has noted that the rights that Members do have under Article XX must, of course, be respected, it has also noted the existence of limits and conditions on the scope of Article XX. It has expressed those limits and conditions as follows in respect of its analysis of the object and purpose of the chapeau of Article XX:

"... while the exceptions of Article XX may be invoked as a matter of legal right, they should not be so applied as to frustrate or defeat the legal obligations of the holder of the right under the substantive rules of the *General Agreement*. If those exceptions [contained in Article XX] are not to be abused or misused, in other words, the measures falling within the particular exceptions must be applied reasonably, with due regard both to the legal duties of the party claiming the exception and the legal rights of the other parties concerned."[247]

7.40 We note that the chapeau to Article XX provides that "nothing in [GATT 1994] shall be construed to prevent the adoption or enforcement ... of measures" otherwise in conformity with Article XX conditions. However, we consider that this wording is not affected by the findings quoted above. As the Appellate Body also put it, Article XX "needs to be read in its context and in such a manner as to give effect to the purposes and objects of the General Agreement" and "the purpose and object of the introductory clauses of Article XX is generally the prevention of 'abuse of the exceptions of ... [Article XX]'."[248] We deduce from this that, when invoking Article XX, a Member invokes the right to derogate to certain specific substantive provisions of GATT 1994 but that, in doing so, it must not frustrate or defeat the purposes and objects of the General Agreement and the WTO Agreement or its legal obligations under the substantive rules of GATT by abusing the exception contained in Article XX.

7.41 We consider this finding of the Appellate Body to be an application of the international law principle according to which international agreements must be applied in good faith, in

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[246]Appellate Body Report in the *Gasoline* case, Op. Cit., p. 18 (emphasis added).

[247]Ibid., p. 22.

[248]Ibid., referring to EPTC/C.11/50, p. 7; quoted in GATT, Analytical Index: Guide to GATT Law and Practice, Updated 6th Edition (1995), Volume I, p. 564.

light of the *pacta sunt servanda* principle.[249] The concept of good faith is explained in Article 18 of the Vienna Convention which states that "A State is obliged to refrain from acts which would defeat the object and purpose of a treaty".[250]

7.42 We consequently turn to the consideration of the object and purpose of the WTO Agreement, of which GATT 1994 and Article XX thereof are an integral part. We note that the preamble of an agreement may assist in determining its object and purpose.[251] On the one hand, the first paragraph of the Preamble of the WTO Agreement acknowledges that the optimal use of the world's resources must be pursued "in accordance with the objective of sustainable development, seeking both to protect and preserve the environment and to enhance the means of doing so in a manner consistent with [Members'] respective needs and concerns at different levels of economic development". On the other hand, the second paragraph of the Preamble of GATT and the third paragraph of the WTO Preamble refer to "entering into reciprocal and mutually advantageous arrangements directed to the substantial reduction of tariffs and other barriers to trade and to the elimination of discriminatory treatment" in international trade relations. While the WTO Preamble confirms that environmental considerations are important for the interpretation of the WTO Agreement, the central focus of that agreement remains the promotion of economic development through trade; and the provisions of GATT are essentially turned toward liberalization of access to markets on a nondiscriminatory basis.

7.43 We also note that, by its very nature, the WTO Agreement favours a multilateral approach to trade issues. The Preamble to the WTO Agreement provides that Members are "resolved ... to develop an integrated, more viable and durable *multilateral trading system* [and] ... determined to preserve the basic principles and to further the objectives underlying this *multilateral trading system*" (emphasis added). Article III:2 of the WTO Agreement also mentions that:

> "The WTO shall provide the forum for negotiations among its Members concerning their multilateral trade relations in matters dealt with under the agreements in the Annexes to this Agreement. The WTO may also provide for a forum for further negotiations among its Members concerning their multilateral trade relations ...".[252]

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[249]Good faith in the application of treaties is generally considered as a fundamental principle of treaty law. See Article 26 (*Pacta Sunt Servanda*) of the Vienna Convention, which provides that "Every treaty in force is binding upon the parties to it and must be performed by them in good faith." See judgement of the International Court of Justice of 27 August 1952 in the *Case Concerning Rights of Nationals of the United States of America in Morocco (France v. United States)*, ICJ Report 1952, p. 176, at p. 212, where the Court stated that "The power of making the valuation [a power granted by the 1906 Act of Algesiras] rests with the customs authorities, but it is a power *which must be exercised reasonably and in good faith*" (emphasis added).

[250]This rule, which applies to the period between the moment when a State has expressed its consent to be bound by a treaty and its entry into force, nevertheless seems to express a generally applicable principle. See Patrick Daillier & Alain Pellet, Droit International Public (1994), p. 216.

[251]See, e.g., Ian Sinclair, The Vienna Convention on the Law of Treaties, 2nd edition (1984), p. 130.

[252]The emphasis on multilateralism is also found in the General Agreement on Trade in Services, where the second paragraph of its Preamble states that Members wish to "establish a *multilateral* framework of principles and rules for trade in services ... " (emphasis added). Similarly, the Preamble to the Agreement on Trade-Related Aspects of Intellectual Property Rights stresses the need for a multilateral approach (TRIPS Agreement, Preamble, paras. 3 and 7). See also Marrakesh Declaration, 15 April 1994, para. 2.

This approach is also expressed in Article 23.1 of the DSU which stresses the primacy of the *multilateral* system and rejects unilateralism as a substitute for the procedures foreseen in that agreement.

7.44 Therefore, we are of the opinion that the chapeau Article XX, interpreted within its context and in the light of the object and purpose of GATT and of the WTO Agreement, only allows Members to derogate from GATT provisions so long as, in doing so, they do not undermine the WTO multilateral trading system, thus also abusing the exceptions contained in Article XX. Such undermining and abuse would occur when a Member jeopardizes the operation of the WTO Agreement in such a way that guaranteed market access and nondiscriminatory treatment within a multilateral framework would no longer be possible. As was recalled by previous panels, GATT rules "are not only to protect current trade but also to create the predictability needed to plan future trade".[253] The protection of expectations of Members as to the competitive relationship between their products and the products of other Members is therefore an important principle to be taken into account by panels when reviewing a particular measure. We are of the view that a type of measure adopted by a Member which, on its own, may appear to have a relatively minor impact on the multilateral trading system, may nonetheless raise a serious threat to that system if similar measures are adopted by the same or other Members. Thus, by allowing such type of measures even though their individual impact may not appear to be such as to threaten the multilateral trading system, one would affect the security and predictability of the multilateral trading system. We consequently find that when considering a measure under Article XX, we must determine not only whether the measure *on its own* undermines the WTO multilateral trading system, but also whether such type of measure, if it were to be adopted by other Members, would threaten the security and predictability of the multilateral trading system.

7.45 In our view, if an interpretation of the chapeau of Article XX were to be followed which would allow a Member to adopt measures conditioning access to its market for a given product upon the adoption by the exporting Members of certain policies, including conservation policies, GATT 1994 and the WTO Agreement could no longer serve as a multilateral framework for trade among Members as security and predictability of trade relations under those agreements would be threatened. This follows because, if one WTO Member were allowed to adopt such measures, then other Members would also have the right to adopt similar measures on the same subject but with differing, or even conflicting, requirements. If that happened, it would be impossible for exporting Members to comply at the same time with multiple conflicting policy requirements. Indeed, as each of these requirements would necessitate the adoption of a policy applicable not only to export production (such as specific standards applicable only to goods exported to the country requiring them) but also to domestic production, it would be impossible for a country to adopt one of those policies without running the risk of breaching other Members' conflicting policy requirements for the same product and being refused access to these other markets. We note that, in the present case, there would not even be the possibility of adapting one's export production to the respective requirements of the different Members. Market access for goods could become subject to an increasing number of conflicting policy requirements for the same product and this would rapidly lead to the end of the WTO multilateral trading system.[254]

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[253]Panel Report on *United States - Taxes on Petroleum and Certain Imported Substances*, adopted on 17 June 1987, BISD 34S/136, para. 5.2.2.

[254]We note that the United States referred to Article XX(e) as evidence that GATT refutes any argument that trade measures generally should not have effects on the internal affairs of exporting countries. We note however that this provision does not permit a Member to make entry of imported goods into its territory conditional upon the exporting Member's policy on prison labour. This paragraph only refers to the products of prison labour.

7.46 We find support for our reasoning in the *Tuna II* case[255] where the panel considered a similar issue and found as follows:

> "5.26 The Panel observed that Article XX provides for an exception to obligations under the General Agreement. The long-standing practice of panels has accordingly been to interpret this provision narrowly, in a manner that preserves the basic objectives and principles of the General Agreement.[256] If Article XX were interpreted to permit contracting parties to deviate from the obligations of the General Agreement by taking trade measures to implement policies, including conservation policies, within their own jurisdiction, the basic objectives of the General Agreement would be maintained. If however Article XX were interpreted to permit contracting parties to take trade measures so as to force other contracting parties to change their policies within their jurisdiction, including their conservation policies, the balance of rights and obligations among contracting parties, in particular the right of access to markets, would be seriously impaired. Under such an interpretation the General Agreement could no longer serve as a multilateral framework for trade among contracting parties."[257]

The principle underlying our interpretation of Article XX of GATT 1994 was apparently also at the origin of the findings of the 1952 panel on *Belgian Family Allowances*. This panel addressed a charge imposed by Belgium on imported products purchased by public bodies when these goods originated in a country whose system of family allowances did not meet specific requirements. In that context, the panel considered that "the Belgian legislation on family allowance was not only inconsistent with the provisions of Article I ... , but was based on a concept which was difficult to reconcile with the spirit of the General Agreement".[258]

7.47 In light of this analysis of the terms and context of the chapeau of Article XX in the light of the object and purpose of the WTO Agreement, we turn to a consideration of whether the US measure challenged in this case falls within the scope of Article XX.

7.48 The United States argues that the intent of Section 609 is to protect and conserve the life and health of sea turtles by requiring that shrimp imported into the United States has not been harvested in a manner that will harm sea turtles. As a result of judgements of the US Court of International Trade (hereafter "CIT"), the US Administration currently has to apply the import ban, including on TED-caught shrimp, as long as the country concerned has not been certified.[259] In addition, certification is only granted if comprehensive requirements regarding

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[255]Op. Cit.

[256]The footnote in the report referred to the Panel Report on *Canada - Administration of the Foreign Investment Review Act*, Op. Cit., para. 5.20 and to the Panel Report on *United States - Section 337 of the Tariff Act of 1930*, Op. Cit., para. 5.27.

[257]The report of the panel in the *Tuna II* case was not adopted. We nonetheless recall the findings of the Appellate Body in its report on *Japan - Taxes on Alcoholic Beverages*, Op. Cit., that unadopted panel reports have no legal status in the GATT or WTO system but that a panel can nevertheless *find useful guidance in the reasoning of an unadopted panel report that it considers to be relevant.* We consider that the reasoning of the panel in the *Tuna II* case, in the light of the similarities between the issues addressed by that panel and the present Panel, is relevant in the present case and provides useful guidance.

[258]Adopted on 7 November 1952, BISD 1S/59, para. 8.

[259]United States Court of International Trade: *Earth Island Institute v. Christopher*, rulings of 8 October (942 F. Supp. 597) and 25 November 1996 (948 F. Supp. 1062).

use of TEDs by fishing vessels are applied by the exporting country concerned, or if the shrimp trawling operations of the exporting country take place exclusively in waters in which sea turtles do not occur. Consequently, Section 609, as applied, is a measure[260] conditioning access to the US market for a given product on the adoption by exporting Members of conservation policies that the United States considers to be comparable to its own in terms of regulatory programmes and incidental taking.

7.49 Accordingly, it appears to us that, in light of the context of the term "unjustifiable" and the object and purpose of the WTO Agreement,[261] the US measure at issue constitutes unjustifiable discrimination between countries where the same conditions prevail and thus is not within the scope of measures permitted under Article XX. However, before making a definitive finding on this issue, we must consider several arguments put forward by the United States that relate generally to our analysis of Article XX.

7.50 The United States argues that the Panel should consider the many examples of import bans under various international agreements that show that Members may take actions to protect animals, whether they are located *within or outside their jurisdiction*. We are of the view that these treaties show that environmental protection through international agreement - as opposed to unilateral measures -have for a long time been a recognized course of action for environmental protection.[262] We note that this US argument addresses the issue of a potential jurisdictional scope of Article XX. However, we consider that this argument bears no direct relation to our finding, which rather addresses the inclusion of certain unilateral measures within the scope *ratione materiae* of Article XX. In addition, in the present case, we are not dealing with measures taken by the United States in application of an agreement to which it is party, as the United States does not claim that it is allowed or required by any international agreement (other than GATT 1994) to impose an import ban on shrimp in order to protect sea turtles. Rather, we are limiting our finding to measures - taken independently of any such international obligation - conditioning access to the US market for a given product on the adoption by the exporting Member of certain conservation policies. In this regard, we note that banning the importation of a particular product does not *per se* imply that a change in policy is required from the *country* whose exports are subject to the import prohibition. For instance, a Member may ban a product on the ground that it is dangerous, and accept a similar product that is safe. This is clearly different from adopting a policy pursuant to which only countries that adopt measures restricting all of their production to products considered safe by a particular Member may export to the market of that Member. We note that a judgement of the CIT interpreting Section 609[263] ruled that the US Administration has to apply the import ban, including on TED-caught shrimp, as long as the country concerned has not been certified. Currently, certification is only granted if *comprehensive requirements* regarding use of TEDs by fishing vessels are applied by the exporting country concerned.

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[260] As described in para. 7.45.

[261] See paragraph 7.34.

[262] We note in this respect that the WTO Committee on Trade and Environment endorsed and supported "multilateral solutions based on international cooperation and consensus as the best and most effective way for governments to tackle environmental problems of a transboundary or global nature. WTO Agreements and multilateral environmental agreements (MEAs) are representative of efforts of the international community to pursue shared goals, and in the development of a mutually supportive relationship between them due respect must be afforded to both". (Report (1996) of the Committee on Trade and Environment, WT/CTE/1, 12 November 1996, para. 171).

[263] United States Court of International Trade: *Earth Island Institute v. Christopher*, rulings of 8 October and 25 November 1996, Op. Cit.

7.51 The United States further argues that the complainants confuse the difference between extrajurisdictional application of a country's law and the application by a country of its law, within its jurisdiction, in order to protect resources located outside its jurisdiction. However, we note that we are not basing our finding on an extra-jurisdictional application of US law. Many domestic governmental measures can have an effect outside the jurisdiction of the government which takes them. What we found above was that a measure cannot be considered as falling within the scope of Article XX if it operates so as to affect other governments' policies in a way that threatens the multilateral trading system, as described in paragraph 7.45 above. For instance, a US requirement, that US norms regarding the characteristics of a given product be met for that product to be allowed on the US market, would not constitute such a threat. Such types of measures are contemplated by the WTO Agreement on Technical Barriers to Trade and the Agreement on Sanitary and Phytosanitary Measures. However, requiring that other Members adopt policies comparable to the US policy for their domestic markets and all other markets represents a threat to the WTO multilateral trading system. As affirmed by the Appellate Body in its report in the *Gasoline* case, "Members have a large measure of autonomy to determine their own policies on the environment ..., their environmental objectives and the environmental legislation they enact and implement"[264], circumscribed only, so far as concerns the WTO, by the need to respect the requirements of the General Agreement and the other covered agreements. Therefore, a Member's measure which conditions access to its market on the adoption by the exporting Member of certain conservation policies is a denial of such autonomy.

7.52 The United States argues that the right of WTO Members to take measures under Article XX to conserve and protect natural resources is reaffirmed and reinforced by the Preamble to the WTO Agreement. Although we do not disagree in general with this statement, we are not persuaded that this argument is a reason to change our finding. Whilst the central focus of that Agreement is to promote economic development through trade, we note that the Preamble acknowledges that the optimal use of the world's resources must be pursued "in accordance with the objective of sustainable development, seeking both to protect and preserve the environment and to enhance the means of doing so in a manner consistent with [Members'] respective needs and concerns at different levels of economic development". Thus the Preamble endorses the fact that environmental policies must be designed taking into account the situation of each Member, both in terms of its actual needs and in terms of its economic means. Moreover, the record before us and, in particular, the answers of the experts to the questions of the Panel, strongly suggest that the environmental issues at stake in this case should be evaluated to a large degree in light of local and regional conditions. They also suggest that conservation measures should be adapted, *inter alia*, to the environmental, social and economic conditions prevailing where they are to be applied. We further note that the 1992 Rio Declaration on Environment and Development[265] recognises the right of States to design their own environmental policies on the basis of their particular environmental and developmental situations and responsibilities.[266] It also stresses the need for international

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[264]Op. Cit., p. 30.

[265]See Rio Declaration on Environment and Development, The Final Text of Agreements Negotiated by Governments at the United Nations Conference on Environment and Development (UNCED), 3-14 June 1992, Rio de Janeiro, Brazil.

[266]Rio Declaration on Environment and Development, Op. Cit., Principle 2:

"States have, in accordance with the Charter of the United Nations and the principles of international law, the sovereign right to exploit their own resources pursuant to their *own* environmental and developmental policies, and the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States or of areas beyond the limits of national jurisdiction." (Emphasis added)

cooperation[267] and for avoiding unilateral measures. In this light, we consider that the Preamble does not justify interpreting Article XX to allow a Member to condition access to its market for a given product on the adoption of certain conservation policies by exporting Members in order to bring them into line with those of the importing Member. On the contrary, the diversity of the environmental and development situations underlined by the Preamble can best be taken into account through international cooperation. The Preamble also implies that attempts to generalize standards of environmental protection would require multilateral discussion, especially when, as here, developing countries are involved. Therefore, we do not consider that the wording of the Preamble referred to by the United States should lead us to a different conclusion than the one reached above.

7.53 The United States further claims that sea turtles are a shared global resource and that, therefore, it has an interest and a right to impose the measures at issue. Firstly, the United States argues that sea turtles are a shared global resource because they are highly migratory creatures which travel through large expanses of sea, within the range of thousands of kilometres, from the jurisdiction of one Member to those of other Members. Secondly, the United States also argues that, even if sea turtles were not migratory at all, they may still represent a shared global resource in terms of biological diversity in the protection of which the United States may have a legitimate interest. Information brought to the attention of the Panel, including documented statements from the experts, tends to confirm the fact that sea turtles, in certain circumstances of their lives, migrate through the waters of several countries and the high sea. This said, even assuming that sea turtles were a shared global resource, we consider that the notion of "shared" resource implies a common interest in the resource concerned. If such a common interest exists, it would be better addressed through the negotiation of international agreements than by measures taken by one Member conditioning access to its market to the adoption by other Members of certain conservation policies. We note in this respect that Article 5 of the 1992 Convention on Biological Diversity provides that:

> "each contracting party shall, as far as possible and as appropriate, cooperate with other contracting parties directly or, where appropriate, through competent international organizations, in respect of areas beyond national jurisdiction and on other matters of mutual interest, for the conservation and sustainable use of biological diversity." [268]

(..continued)

Principle 11 states that:

> "States shall enact effective environmental legislation. Environmental standards, management objectives and priorities should reflect the environmental and development context to which they apply. Standards applied by some countries may be inappropriate and of unwarranted economic and social cost to other countries, in particular developing countries."

In this respect, we note that whilst incidental drowning in shrimp nets may be the single most important source of turtle mortality along the East coast of the United States, in other countries egg harvesting and direct sea turtle harvest are factors affecting significantly the survival of sea turtles.

[267]Rio Declaration on Environment and Development, Op. Cit., Principle 12: "Environmental measures addressing transboundary or global environmental problems should, as far as possible, be based on an international consensus".

[268]We also note that the 1979 Bonn Convention on the Conservation of Migratory Species of Wild Animals (to which some parties to this dispute are not parties) lists the relevant species of sea turtles in Annex I as "Endangered Migratory Species" and provides in its preamble as follows:

> "The contracting parties [are] convinced that conservation and effective management of migratory species of wild animals requires the concerted action of all States within the national boundaries of which such species spend any part of their life cycle;"

We consider that this provision is evidence that "matters of mutual interest" have normally to be addressed primarily through international cooperation.[269] Therefore, we find that if, as alleged by the United States, sea turtles are shared global resources, that would not call for a change in our finding. Instead, it suggests that the United States should have entered into international cooperation with the aim of developing internationally accepted conservation methods, including with the complainants.

7.54 In addition, the United States argues that nothing in Article XX requires a Member to seek negotiation of an international agreement instead of, or before adopting unilateral measures. In any event, the United States claims it offered to negotiate but the complainants did not reply.

7.55 Regarding whether there is an obligation for a Member to negotiate, we recall our finding in paragraph 7.45 above that the WTO multilateral trading system would be undermined if Members were allowed to adopt measures making access of other Members to their market conditional upon the adoption by the exporting Members of certain conservation policies because it would not be possible for Members to meet conflicting requirements of such a nature. This is clearly a situation where elaboration of international standards would be desirable. We note in that respect that the WTO Agreements on Technical Barriers to Trade and on Sanitary and Phytosanitary Measures promote the use of international standards.[270] We also recall our consideration in paragraph 7.52. The nature of the measures that the United States was seeking to obtain from the exporting countries concerned and the principles recalled in several international environmental agreements[271] imply that a country seeking to promote environmental concerns of such a nature should engage into international negotiations. The negotiation of a multilateral agreement or action under multilaterally defined criteria is clearly a possible way to avoid threatening the multilateral trading system.

7.56 We note that Section 609 contains provisions calling upon the US Secretary of State to initiate negotiations as soon as possible for the development of bilateral or multilateral agreements for the protection and conservation of the species of sea turtles covered by that Section.[272] The judgement of the CIT which was handed over on 29 December 1995 required the US Administration to apply Section 609 on a world-wide basis (and no longer only to the Wider Caribbean/Western Atlantic region) by no later than 1 May 1996. This implied that, unless the exporting countries decided to use TEDs in their shrimp trawling activities - either of their own initiative or through negotiations - the import ban on wild shrimp would be applied to them as of that date. The United States told us of its efforts to have the deadline set in the CIT judgement postponed. However, we have no evidence that the United States actually undertook negotiations on an agreement on sea turtle conservation techniques which would have included the complainants *before* the imposition of the import ban as a result of the CIT judgement. From the replies of the parties to our question on this subject, in particular that of the United States, we understand that the United States did not propose the negotiation of an agreement to any of the complainants until after the conclusion of negotiations on the Inter-

[269]It appears that WTO bodies support this multilateral approach. See footnote 657 to para. 7.50 above.

[270]See, e.g., Agreements on Technical Barriers to Trade, fourth preambular paragraph and Articles 2 and 9, Agreement on Sanitary and Phytosanitary Measures, Article 3.

[271]See, e.g., the 1992 Convention on Biological Diversity, the 1979 Bonn Convention on the Conservation of Migratory Species of Wild Animals. See, also, the 1992 Rio Declaration on Environment and Development.

[272]Section 609(a)(1) to (4).

American Convention for the Protection and Conservation of Sea Turtles, in September 1996, i.e. well after the deadline for the imposition of the import ban of 1 May 1996. Even then, it seems that the efforts made merely consisted of an exchange of documents. We therefore conclude that, in spite of the possibility offered by its legislation, the United States did not enter into negotiations before it imposed the import ban.[273] As we consider that the measures sought by the United States were of the type that would normally require international cooperation, we do not find it necessary to examine whether parties entered into negotiations in good faith and whether the United States, absent any result, would have been entitled to adopt unilateral measures.

7.57 Finally, we note that the United States argues that the use of TEDs has become a recognized multilateral environmental standard. In support of this, the United States firstly contends that the international community has long recognized the need to protect endangered species such as sea turtles. Secondly, several international conventions require parties to adopt conservation policies and urge them to ensure, through proper conservation measures, the maintenance of living resources, including non-target species caught in fishing operations. In support of these statements, the United States refers to the 1982 United Nations Convention on the Law of the Seas[274] and to paragraph 17.46(c) of the 1992 Agenda 21.[275] Thirdly, the United States claims that, either as a result of the Inter-American Convention on the Protection and Conservation of Sea Turtles or of their own initiative, 19 countries currently require TEDs on shrimp trawl vessels subject to their jurisdiction.

7.58 Moving to examine whether international obligations exist with regard to the protection of sea turtles, we first note that both the United States and the complainants have elaborated at length on the policies they have developed to protect sea turtles. Both the United States and the complainants have referred to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). Parties to the dispute are all parties to CITES and the turtles species covered by the US measures at issue are all listed in Appendix I (Species threatened with extinction). The endangered nature of the species of sea turtles mentioned in Annex I as well as the need to protect them are consequently not contested by the parties to the dispute. However, CITES is about *trade in endangered species* and the subject of the US import prohibition (shrimp) is not the endangered species whose protection is sought through the import ban. We also note that the United States has mentioned that CITES neither authorizes nor prohibits the sea turtles conservation measures which are at issue in this dispute.[276] Therefore, we consider that CITES, even though its object is to contribute to the protection of certain species, does not impose on its members specific methods of conservation such as TEDs.

7.59 We also note that the development of the use of TEDs is the result of regional agreements or voluntary individual practices of States. In our opinion, the existence of regional

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[273]We note in this respect that, in the *Gasoline* case, the Appellate Body considered that a strong implication arose from the fact that the United States had not pursued the possibility of entering into cooperative arrangements, which would have been a means of alleviating the discrimination suffered by foreign refiners *vis-à-vis* US refiners. In that case, the Appellate Body concluded that the discrimination was not "inadvertent or unavoidable" and that the measure at issue constituted "unjustifiable discrimination" and a "disguised restriction on international trade".

[274]UN Doc.A.CONF.62/122, Articles 61(2), 61(4) and 119(1)(b).

[275]Agenda 21: Programme of Action for Sustainable Development, United Nation Conference on Environment and Development (UNCED), 3-14 June 1992, Rio de Janeiro, Brazil.

[276]See para. 3.168 of this Report.

agreements and individual practices may not as such suffice to reach the conclusion that the use of TEDs has become a recognized multilateral environmental standard applicable to the complainants. We derive from the submissions of the United States that the application of TEDs based on a convention is only regional. Moreover, if the provisions of the multilateral agreements referred to by the United States (the 1982 United Nations Convention on the Law of the Seas and the 1992 Agenda 21) effectively address the objective of limiting by-catches of non-target species in trawling operations, they do not require the application of specific methods nor, *a fortiori*, the use of TEDs.[277] Finally, even if a number of countries individually require TEDs on their shrimp trawlers, the fact that the complainants and third parties have objected to their use makes it difficult to conclude that the mandatory use of TEDs has been customarily accepted as a multilateral environmental standard applicable to the complainants.[278]

7.60 In conclusion, we do not consider that any of the arguments raised by the United States would justify a finding different from that reached in paragraph 7.49 above. We consider that our findings do not question the legitimacy of environmental policies, including those promoted through multilateral conventions.[279] We consider our findings to be in line with the principles embodied in many international agreements pursuant to which international cooperation is to be sought before having recourse to unilateral measures. Furthermore, the risk of a multiplicity of conflicting requirements clearly is reduced when requirements are decided in multilateral fora. Moreover, we do not suggest that import markets must exist as an incentive for the destruction of natural resources. Rather, we address a particular situation where a Member has taken unilateral measures which, by their nature, could put the multilateral trading system at risk.

7.61 In reaching our conclusions, we based ourselves on the current status of the WTO rules and of international law. As far as the WTO Agreement is concerned, we considered that certain unilateral measures, insofar as they could jeopardize the multilateral trading system, could not be covered by Article XX. Our findings with respect to international norms confirm our reasoning regarding the WTO Agreement and GATT. General international law and international environmental law clearly favour the use of negotiated instruments rather than

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[277]One of the experts referred to the FAO *Code of Conduct for Responsible Fisheries*, unanimously adopted on 31 October 1995 by the FAO Conference. This non-binding text provides for a broad range of guidelines for governments and those involved in fisheries activities with the aim of promoting responsible, sustainable fisheries. We note that the provisions of this document promote, *inter alia*, the further development and application of selective and environmentally safe fishing gear and practices in order to maintain biodiversity and to conserve the population structure and aquatic ecosystems. Existing proper selective and environmentally safe fishing gear and practices should be recognized and accorded a priority in establishing conservation and management measures. Catches of non-target species, both fish and non fish species, should be minimized (Article 6.6). The Code also provides that its provisions should be interpreted and applied in accordance with the principles, rights and obligations established in the WTO Agreement (Article 11.2.1) and mentions that States should cooperate to develop internationally acceptable rules or standards for trade in fish and fishery products in accordance with the principles, rights and obligations established in the WTO Agreement (Article 11.2.13). Finally, the Code also provides that when a State introduces changes to its legal requirements affecting trade in fish and fishery products with other States, sufficient information and time should be given to allow the States and producers affected to introduce, as appropriate, the changes needed in their processes and procedures. In this connection, consultations with affected States on the time frame for implementation of the changes would be desirable (Article 11.3.4). This Code, even though it is not binding, is evidence of the methods currently favoured for the promotion and development of conservation methods (see, *inter alia*, the 1992 Convention on Biodiversity or the 1982 Convention on the Law of the Seas).

[278]See Article 38.1(b) of the Statute of the International Court of Justice and Brownlie, Principles of Public International Law, 4th edition (1990), pp. 4-5, quoting Brierly: "what is sought for [a custom to be considered as a general practice accepted as law] is a general recognition among States of a certain practice as obligatory".

[279]We do not question either the fact generally acknowledged by the experts that TEDs, when properly installed and used and adapted to the local area, would be an effective tool for the preservation of sea turtles.

unilateral measures when addressing transboundary or global environmental problems, particularly when developing countries are concerned. Hence a negotiated solution is clearly to be preferred, both from a WTO and an international environmental law perspective. However, our findings regarding Article XX do not imply that recourse to unilateral measures is always excluded, particularly after serious attempts have been made to negotiate; nor do they imply that, in any given case, they would be permitted. Nevertheless, in the present case, even though the situation of turtles is a serious one, we consider that the United States adopted measures which, irrespective of their environmental purpose, were clearly a threat to the multilateral trading system and were applied without any serious attempt to reach, beforehand, a negotiated solution.

7.62 We therefore find that the US measure at issue is not within the scope of measures permitted under the chapeau of Article XX.

3. Article XX(b) and (g)

7.63 In line with our approach described in para. 7.29 above, we do not find it necessary to examine whether the US measure is covered by the terms of Article XX(b) or (g).

F. ARTICLE XXIII:1(a) OF GATT 1994

7.64 We note that India, Pakistan and Thailand claim that the measure at issue represents a clear infringement of Articles I, XI and XIII of GATT 1994 and that it is well established that "in cases where there is a clear infringement of the provisions of the General Agreement, or in other words, where measures are applied in conflict with the provisions of GATT ... the action would, *prima facie*, constitute a nullification or impairment ..." within the meaning of Article XXIII of GATT.[280]

7.65 We have found that the US measure at issue violates Article XI and is not justified under Article XX. We therefore conclude that there is a presumption of nullification or impairment within the meaning of Article 3.8 of the DSU, and that it is for the United States to rebut it. We do not consider that the United States has succeeded in rebutting the presumption that its breach of GATT has nullified or impaired benefits accruing to the complainants under GATT 1994.

VIII. CONCLUSIONS

8.1 In the light of the findings above, we conclude that the import ban on shrimp and shrimp products as applied by the United States on the basis of Section 609 of Public Law 101-162 is not consistent with Article XI:1 of GATT 1994, and cannot be justified under Article XX of GATT 1994.

8.2 The Panel *recommends* that the Dispute Settlement Body request the United States to bring this measure into conformity with its obligations under the WTO Agreement.

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[280]The complainants referred to the Panel Report on the *Uruguayan Recourse to Article XXIII*, adopted on 16 November 1962, BISD 11S/95, para. 15.

IX. CONCLUDING REMARKS

9.1 We note that the issue in dispute was not the urgency of protection of sea turtles. The matter we have been asked to review is Section 609 as interpreted by the CIT and as applied by the United States on the date this Panel was established. It was not our task to review generally the desirability or necessity of the environmental objectives of the US policy on sea turtle conservation. In our opinion, Members are free to set their own environmental objectives. However, they are bound to implement these objectives in such a way that is consistent with their WTO obligations, not depriving the WTO Agreement of its object and purpose. We recall the statement contained in the 1996 report of the Committee on Trade and Environment for the Singapore Ministerial Conference to the effect that there should not be nor need be any policy contradiction between upholding and safeguarding an open, equitable and non-discriminatory multilateral trading system on the one hand and acting for the protection of the environment on the other.[281] We also note that we are bound to make findings on the basis of the existing norms, without prejudice to any potential developments in the relevant fora. In our view, and based on the information provided by the experts, the protection of sea turtles throughout their life stages is important and TEDs are one of the recommended means of protection within an integrated conservation strategy. We consider that the best way for the parties to this dispute to contribute effectively to the protection of sea turtles in a manner consistent with WTO objectives, including sustainable development[282], would be to reach cooperative agreements on integrated conservation strategies, covering, *inter alia*, the design, implementation and use of TEDs while taking into account the specific conditions in the different geographical areas concerned.

[281]See Report (1996) of the Committee on Trade and Environment, Op. Cit., para. 167.

[282]See para. 7.42.