# Options to develop international conservation programs: an example with sea turtles

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## ABSTRACT

Some species of sea turtles from the Pacific Ocean have been declining for years, and the numbers of females arriving at the nesting beaches are critically low. As the sources of mortality range from loss or degradation of nesting beaches, to incidental mortality in a variety of fisheries practiced by vessels from a dozen nations only a concerted international effort could address this multiplicity of problems. The survival of the sea turtles depends on putting together a comprehensive program, addressing the problems on the beaches, within the nations EEZs, and in the oceanic commons.

A brief consideration is presented of the options available to those trying to organize the international efforts to conserve sea turtles into a consistent and effective program. A review of the international instruments regarding sea turtles was published recently (Frazier, 2002). The point of view adopted in this document is not a legal one, but a practical and pragmatic one: which is the easiest and fastest way to launch the programs that need to be implemented? How can we build a coalition of the nations, and of the stakeholders involved, under the banner of our Common Responsibility to save the turtles, and our collective interest in preserving the employment and the economic contributions that the fisheries make to so many nations?

As sea turtle bycatches in longline fisheries have been identified as one of the primary factors causing the declines, the mitigation of this source of mortality will be the central focus. Gillnet fisheries are known to be another important source of mortaliy (Eckert, 1997,1999), but they won't be addressed at this time, because there is much less information about them, and more importantly, because their spatial distribution is in general very coastal.

## INTRODUCTION

Many oceanic species have ranges that include sections of the Exclusive Economic Zones of several countries, and they may extend to the High Seas, beyond the 200 miles of all nations. In some cases they undertake transoceanic or very long migrations. Some species of fishes, marine mammals, sea birds, and sea turtles, share these characteristics. When a species with this type of distribution becomes critically endangered, it is necessary to produce a common strategy, bringing together the efforts of all countries involved to face the challenge. The

programs needed may include development and adoption of alternative or modified technology, operational changes and restrictions, and management actions to reduce the negative impacts. Individual countries can apply management schemes within their EEZs with purposes of utilization or conservation, but their effectiveness will be limited without the cooperation and participation of all other nations where the species is found, or that can cause impacts on the populations (e.g. distant water fishing nations, etc.).

Even though long standing instruments such as the United Nation's Law of the Sea Convention (Churchill and Lower, 1999) "mandate" international cooperation, and cooperation with the corresponding regional bodies for fisheries management and conservation, the economic and social situations in different countries result in differences in the levels of priority assigned to these international obligations, or in the ability to carry on the activities required.

In some cases, unilateral actions such as the threat or the imposition of embargoes have been used to influence behavior in other countries (Joseph, 1994, Frazier and Bache, 2002), but they may result in a build up of friction among nations, because of the obvious asymmetries. Only a few nations have the economic power to influence others, and those nations will remain free of similar treatment, and they will be able to impose cultural views on others. The "dolphin-safe" policy is an example where an ecologically unsound approach was used to influence behavior in other nations fleets to address a non-existing conservation issue (Joseph, 1994; Hall, 1998). In the shrimp trawl fisheries, the adoption of the Turtle Excluder Devices (TED) to reduce the bycatch in these fisheries was also based on the threat of unilateral economic sanctions by the US. Countries interested in access to the US market (the major market for shrimp for many countries) had to adopt the same technology that was being mandated on the US fleet to reduce sea turtle bycatch in their fisheries. TEDs are credited with helping the recovery of the Kemp's ridley sea turtle (*Lepidochelys kempii*) in the Gulf of Mexico. This illustrates the advantages and disadvantages of unilateral threats of sanctions from the pragmatic point of view. If the country using them has the economic levers, the threats will result in changes that may be positive, in spite of the undesirable process. But when there are no obvious levers (e.g. market control), or when the country using the "bad practices" has the economic power to ignore any unilateral threat, there are no reasonable ways to bring the countries to the table. It is to be expected that countries that are being pressed to take actions under economic threats will be unwilling to come forward in other cases. Embargoes do not generate a willingness to work together, when that cooperation is needed.

However, in the case of sea turtle bycatches in longlines, as will be discussed later, national agencies of the US such as NOAA-Fisheries, and the Western Pacific Fisheries Management Council (WPFMC) have projected their activities towards other nations within a framework of cooperation. This model brings technical knowledge and transferences of technology, together with assistance to

other nations, accelerating the process of change but with a constructive and positive tone.

The focus of this work will be on species whose ranges extend beyond the borders of a state, and, as an example, the current situation affecting the leatherback sea turtle (*Dermochelys coriacea*) and the loggerhead sea turtle (*Caretta caretta*) populations that inhabit the Pacific coastal waters, and the High Seas off the American continent will be considered.

In this particular case, most of the pelagic long line fleets operating on the High Seas do not depend on the US market for their products, and the lack of leverage precludes the use of the unilateral approaches, unless the threat was extended to products very different from the target species.

## THE CONSERVATION PROBLEM

-Simplified life history

Some leatherback populations nest in Mexico and in Costa Rica. During the nesting season, a group of females comes ashore, and lay eggs in nests dug in the beach. After each nest, the females return to the sea, but stay close to the nesting beach. After 10-14 days, they return to make another nest, and they repeat this process usually 5-7 times in a season (Miller, 1995, 1997). After the last nest, they migrate in a Southwesterly direction, and disperse in foraging grounds that are not well-defined, but that extend probably to waters off Chile, Peru, and Ecuador. The distributions of immature individuals and males are less known.

Another population of leatherback sea turtles nests in the Western Pacific and crosses the ocean close to Hawaii, to forage in areas of Central California.

Loggerhead populations nest in Japan and Australia, and cross the Pacific to forage off Baja California and off northern South America.

Researchers survey the beaches every year, and they count either the number of females coming to nest or the total number of nests laid in the season. These figures show steady declines over the past 15 years for both species, and models predict a high probability of extinction within a few decades. Given the complicated life cycle, there are many factors that can contribute to these declines, such as the loss or degradation of nesting habitats, harvest of eggs, predation of juveniles, pollution, entanglement in marine debris, and incidental mortality in fisheries. As there are no good estimates of the relative significance of each of them, it is necessary to address all of them.

- Scientific evidence

For both species, evidence of population declines is solid, and the patterns consistent in most nesting areas (Chan and Liew, 1996; Kamezake et al., 2003;

Limpus and Limpus, 2003; Sarti et al., 1996, 1997, 1998, 2000, 2002; Sarti, 2002; Sea Turtle Association of Japan, 2002; Spottila et al., 1996, 1998, 2000).

They both undertake long oceanic migrations (Bowen et al., 1995; Eckert, 1998, 1999; Luschi et al., 2003; Morreale et al., 1994; Resendiz et al., 1998a,b), and suffer incidental mortality in pelagic longline fisheries, in coastal gillnet and trawl fisheries (e.g. Arauz, 2001; Bolten and Witerington, 2003; Frazier and Brito Montero, 1990; Eckert, 1997; NMFS-USFWS 1998a,b; National Research Council, 1990; Weidner and Serrano, 1997; Wetherall 1993, 1997).

These and other aspects of sea turtle biology, ecology and conservation have been recently covered by several authors (Bjorndal, 1995; Bolten and Witherington, 2003; Lutz and Musick, 1997; Lutz et al., 2003, Miller 1995, 1997).

- The challenge

The ecological characteristics of these species of sea turtles require actions from all countries where the turtles nest, all those with EEZs where the turtles forage or migrate through, and all those that can affect them in the High Seas. In the examples in question, the list includes:

-every eastern Pacific coastal nation from the United States (West Coast states and Hawaii) to Chile,

-every fishing nation operating in the area (coastal fleets from Latin American countries and distant water fleets from Japan, Korea, Taiwan, China, Spain, etc.),

-countries with nesting areas in the Western Pacific (Australia, Malaysia, Japan, etc.).

From the point of view of controlling other sources of mortality such as entanglement in marine debris, the list of nations is much larger, and the simple mention of the Panama Canal, or the trade China-US or Japan-US, reminds us of the significance of shipping in the region.

So the challenge is how to bring to the table all those parties to implement an effective conservation program in a very short time, because of the critical status of the turtle populations.

## INSTITUCIONAL MODELS

The management of the many species that inhabit the High Seas, has been structured along different models over the years (Birnie and Boyle, 2002; Sands, 2003). A recent review of the international instruments that could be applied to sea turtles is available (Frazier, 2002), and there is no point in replicating that work. The objective of the following discussion is not to analyze the legal characteristics and values of those models, but to assess their potential

effectiveness to provide an umbrella for the coordination of international conservation efforts under a very significant time constraint.

In order to respond to a critical conservation situation, as is the case of these sea turtle populations, an agreement must fulfill some requirements: (1) it must include all, or most of the countries involved in the problem; (2) it must be an "agile" organization, capable of facing a dynamic situation without getting bogged down with time-consuming formalities; (3) it must turn words into actions very rapidly; and perhaps also, (4) it must have the capability to implement and execute a comprehensive program, and (5) if possible, it is preferable that the agreement is a binding one. It is quite clear that the institution must have a level of credibility with the different stakeholders.

Global Conventions:

The International Whaling Commission was created when a small group of nations that harvested whales decided to manage the stocks jointly, and it has evolved into an organization focused on the protection of whales rather than on their sustainable utilization. The divergent views of the IWC members on whether whales are a group of species like any other harvested by humans, and those that have moral or ethical obstacles to their harvest has resulted in an organization that cannot satisfy the expectations of all its members. In view of this experience, it is very unlikely that a majority of world countries will, in the near future, agree to participate in an organization that could follow the IWC model for other species. Countries that harvest or cause incidental mortality or other impacts on the species in question will see no benefit in joining an organization that could only result in restrictions, and negative impacts. The failure of IWC to separate science from the moral agendas of many participants has had a negative impact on those trying to bring together nations when a concerted conservation effort is needed.

The Food and Agricultural Organization of the United Nations (FAO) is another institution working at the global level. In the past, they have provided the framework of their International Plans of Actions (IPOAs), such as those on seabirds, sharks, and others. While these programs have contributed to the improvement of data collection and other efforts, they depend on the development and implementation of many national plans of action. The examples mentioned above have resulted in progress, but it is slow and scattered, as some nations have responded much more diligently than others. The possibility of pushing forward a Sea Turtle Plan of Action should be explored, but only if it is viewed as complementing other initiatives currently under way. The IPOA could include components ranging from data collection to technical recommendations and research projects. An Experts, and a Technical Meeting on sea turtles are on the FAO agenda for the near future, and the IPOA could take shape after those.

Although they are not binding, IPOAs are better received by many nations that actions from other international agencies, and responses have been quite useful in some cases (e.g. provision of data on shark bycatches). An important positive factor is that the membership of FAO includes the vast majority of the nations.

Regional Conventions or Agreements:

--The Inter-American Sea Turtle Convention is an attempt to bring together the countries of the continent in the effort to conserve the sea turtle populations that nest, reside or migrate through the area. It is too early to tell what its impact will be, but unless a fair amount of political power and resources are invested it will be difficult for the Convention to exert the kind of strong influence that is needed to address the conservation crises the sea turtles face in the continent in the limited time available. The Convention is just starting its work, and it hasn't had time to settle as an organization yet, but it has already started advancing the sea turtle conservation agenda along several lines. For the issue of mitigating bycatches in fisheries, it could have a significant role coordinating the regional efforts on the following aspects:

- Tests of alternative technologies (e.g. circle hooks), and dissemination of the results.
- Promotion of the use of the best technology and of all auxiliary instruments (e.g. dehookers, dipnets)
- Organization of workshops and meetings with fishers from the region to promote the change in practices and behavior
- Educational campaign in all coastal communities

Distant water fishing nations that are also important components of any conservation strategy are not Parties to the Convention, and there is no clear basis or incentive for them to join in. Also, as it is a binding instrument, countries of the region, with potential or perceived problems may not join or ratify the Convention. The advantage of an agreement being a binding instrument is only valid for the signatory nations, but it could be a reason deterring countries from joining in. With more time to settle, and with the economic and political support of the countries from the region, the IAC should play a major role on the issue, especially on the critical protection of nesting habitats.

--CMS-based Agreements (Convention for Migratory Species of Wild Animals, the Bonn Convention)

The CMS convention, under UNEP, has been used in some occasions as an umbrella to develop specific regional, not binding, agreements. Two addressing

Cetaceans have been in place for several years (Agreement on the Conservation of Small Cetaceans of the Baltic and North Seas (ASCOBANS), Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and Contiguous Atlantic Area (ACCOBAMS)), and two are directed to sea turtles in the Indian Ocean, and in the Atlantic Coast of Africa (FRETEY, 2001). The Indian Ocean sea turtle Memorandum of Understanding is described in CMS's web page:

"The *Memorandum of Understanding on the Conservation and Management of Marine Turtles and their Habitats of the Indian Ocean and South-East Asia* puts in place a framework through which States of the Indian Ocean and South-East Asian region, as well as other concerned States, can work together to conserve and replenish depleted marine turtle populations for which they share responsibility. This objective will be achieved through the collective implementation of an associated Conservation and Management Plan.

……..The species of marine turtles covered by the MoU are the Loggerhead *Caretta caretta*, Olive Ridley *Lepidochelys olivacea*, Green *Chelonia mydas*, Hawksbill *Eretmochelys imbricata*, Leatherback *Dermochelys coriacea*, and Flatback *Natator depressus*.

In the context of sustainable development, the conservation and management of marine turtles globally and within the Indian Ocean - South-East Asian region presents a formidable challenge. Many communities still utilise marine turtles for their meat and eggs, as a source of protein, and their shell for artisanal crafts. At the same time, marine turtles have both intrinsic and ecological values as important components of marine ecosystems…..

Major threats to marine turtles include unsustainable exploitation, destruction of nesting and feeding habitats, and incidental mortality in fishing operations. The IOSEA MoU's Conservation and Management Plan -- containing 24 programs and 105 specific activities -- focuses on reducing threats, conserving critical habitat, exchanging scientific data, increasing public awareness and participation, promoting regional cooperation, and seeking resources for implementation.

Various international agreements and national regulations strive to conserve and protect marine turtles from excessive exploitation. Ultimately, however, the success of these initiatives depends on effective implementation of measures by a wide range of actors -- governmental (at all levels), non-governmental (NGOs, civil society) and intergovernmental. Not surprisingly, in the face of other pressing development priorities, many countries lack the capacity and resources to undertake conservation measures for these species -- notwithstanding their socio-economic value and intrinsic worth. This makes it all the more important to offer

support, assistance and encouragement to build capacity among those who are the real custodians of these natural resources. The Indian Ocean -- South-East Asian Marine Turtle Memorandum of Understanding is playing its part by developing a well-coordinated network of interested stakeholders, delivering a comprehensive program of necessary interventions, and providing an inclusive forum for regular review of implementation progress.
The MoU came into effect on 1 September 2001, and the Signatory States held their first meeting in Bangkok in January 2003. 16 States signed the MoU; Australia, Cambodia, Comores, Islamic Republic of Iran, Kenya, Madagascar, Mauritius, Myanmar, Philippines, Seychelles, Sri Lanka, Sultanate of Oman, United Kingdom, United Republic of Tanzania, United States of America, Viet Nam."

A very significant point is the recognition that developing nations lack the resources to undertake some of the programs that are needed to conserve sea turtles, while at the same time taking into account their economic priorities. If regional agreements can help funnel economic assistance that is required to implement programs, that would be an incentive for states to join these agreements. However, there are no clear incentives for the major distant water fishing nations to join, and they are not members of the MoU.

--REGIONAL FISHERIES ORGANIZATIONS:

This type of organizations were established to manage fisheries resources that were shared by several nations. Salmon, halibut, and tunas stocks required agreements between coastal and fishing nations, or between nations along a migratory route, to be managed in a sensible way. They are binding agreements, whose membership has changed over the years, but that includes many of the coastal and fishing nations in each region.

The Inter-American Tropical Tuna Commission, the International Commission for the Conservation of Atlantic Tunas (ICCAT), the Indian Ocean Tuna Commission (IOTC), the Convention for the Conservation of Southern Bluefin Tuna (CCSBT), and the Western and Central Pacific Fisheries Commission (WCPFC) are examples of these types of agreements. Even though they share many aspects of their conventions, they have been established following different structural models, with respect to the number of permanent staff, etc. However, they could all develop activities of the types that will be described below, using the example of IATTC which is the first to become involved significantly on the issue of sea turtle bycatches, and the one the author is more familiar with.

The Inter-American Tropical Tuna Commission (IATTC)

In the eastern Pacific, the Inter-American Tropical Tuna Commission was established by a treaty in 1949. The original Convention has been revised very recently. (IATTC web page, Documents, Antigua Convention **www.iattc.org**). Current members include: Costa Rica, Ecuador, El Salvador, France, Guatemala, Japan, Mexico, Panama, Peru, Spain, United States, Vanuatu, Venezuela. Even though the focus is the management of the tuna species taken in the region, it includes mentions of "associated or dependent species" that could, under some interpretations, include most of the species taken as bycatch in the tuna fisheries. Dolphins, sea turtles, many fish species, and even occasionally seabirds, are taken in the purse seine, gillnet, and longline fisheries of the region. The dolphin bycatch issue has been of paramount significance for over 20 years, and the Commission has a program specifically devoted to the handling of these bycatches. The success of this program in reducing dolphin mortality by over 99%, while maintaining the tuna fishery at very high levels of production provides the framework, and the practical experience needed to mount similar programs for other species. The Commission has a Bycatch Working Group addressing all bycatch issues ranging from catches of undersized tunas, to takes of sea turtles, sharks, mahi-mahis, etc.

Current IATTC activities on sea turtle bycatches:

Purse seines: Sea turtles are taken incidentally in purse seine sets. Even though the numbers are very low, the member nations decided to start to take actions to eliminate those bycatches. All previous measures were consolidated in a Resolution in June 2003 (Consolidated resolution on Bycatch, www.iattc.org). Through these Resolutions, and the continuous interactions with the fishers, the mortality has declined from an average of 140 turtles per year, to around 20 in 2003. Research is under way on another source of mortality of sea turtles related to purse seining which is the entanglement of sea turtles in the webbing the fishers hang under the Fish-Aggregating Devices they routinely deploy. In this case the levels of mortality cannot be easily estimated, but some interesting ideas from fishers appear capable of providing an effective alternative, that is harmless to turtles. Experiments need to be run to test the new designs.

Longlines: The longline fleets operating in the eastern Pacific include many sizes of vessels going from large industrial vessels from Japan, Korea, Taiwan, China, Spain, etc. (IATTC, 2002; Okamoto and Bayliff, 2002) to 20-feet long artisanal craft from the coastal nations of the region. The numbers are not well-known for the smaller vessels, but probably are in the tens of thousands if we include the countries from Mexico to Chile. The fisheries from distant-water fishing nations target mainly tunas, and swordfishes, while the coastal fisheries target mainly tunas and mahi-mahis. Sea turtles take the bait in the hooks, or get snagged in them, or get entangled in the lines. Different sizes of hooks are used in

the different fisheries, but they are all of a type called J-hooks because of their shape. These narrow hooks can be swallowed deeply, and result in higher mortality. Concern about the impact of this incidental mortality on the populations resulted in an invitation from the Subsecretaria de Recursos Pesqueros del Ecuador to IATTC to develop a program to reduce the mortality. The Program, currently under way, has received enthusiastic support in personnel and resources from NOAA-Fisheries, USA, the World Wildlife Fund, the Western Pacific Regional Management Council, the Ocean Conservancy, the Fundacion Jatun-Sacha and other Ecuadorian NGOs, FENACOPEC, the National Federation of Ecuadorian artisanal fishers, ASOEXPEBLA, the Asociacion de Exportadores de Pesca Blanca, and other organizations. This is probably one of the broadest coalitions ever put together around a conservation issue in the region.

In only a few months of activity, the program has:

- started a sizable experiment (more than 50 boats) on alternative types of hooks that are less likely to hook turtles, and when they do they do it in a more benign manner,
- mounted an observer program that had already finished its first
- promoted the use of instruments to recover the hooks without harming the turtles,
- organized a series of workshops for fishers all along the coasts, touching almost a dozen of the major fishing villages with a cumulative attendance in the thousands. In these workshops, they have been introduced to the problem, and the solutions, and they have been motivated to search for additional solutions and to modify their behavior to try to eliminate all sources of mortality. The government has participated in all stages of the project, and remains heavily involved. Workshops in Peru and Colombia are planned for the coming months, and a biologist from Colombia has joined in several occasions the group based in Manta to become familiar with the methods, and approaches.

The IATTC has served a role has a rallying point for these efforts. The 50 years of activity in the region, and the success of the Commission in reducing the bycatch of dolphins in the tuna purse-seine fishery, without affecting the effort on dolphins has made it a natural fit to tackle the new program. As the Commission has a tradition of working with both the fishing industry and the environmental groups, it has served as a connection point for the different stakeholders. The model is easily transferred across the region since most countries are members of the Commission, or participate in its activities. However, some of the nations where nesting takes place in the Western side of the Pacific are not members of IATTC

(e.g. Australia for the loggerheads), so a comprehensive conservation program will require ways to address beach protection issues.

The IATTC has received very solid and critically needed support in expertise and economic assistance from the US's NOAA-Fisheries and the Western Pacific Fisheries Management Council. This support, which has been well-received in the nations where the programs have started, is a different model of international cooperation, and it makes easier for the developing nations to undertake programs that may be costly and logistically complex. As part of the process, the IATTC and the national agencies from the US mentioned above are training local scientists who are actually running these programs. The development of human resources in the region is part of the solution for this and for other conservation problems.

The current situation is such that, given the need to produce a very timely response, the RFOs are the best prepared to coordinate the efforts to mitigate bycatch in longline and purse seine fisheries. They have the combination of technical expertise, ability to implement experiments and observer programs, facilities and a solid network in the region. In some cases the Conventions include explicitly the conservation of bycatch species among their objectives; in others, it is a question of a liberal interpretation of the text, and the political will to undertake the work.

Other options

National Agencies with international projection: The fact that the effort should at some point become international doesn't preclude national agencies from attempting to reach other countries to share their concerns and develop joint programs when there is agreement on the objectives. The Western Pacific Fishery Management Council has developed an extensive network of cooperative projects across the Pacific, bringing together all nations crossed or interacting with the sea turtle species during their migrations. This is an advanced view of the application of ecosystem management to fisheries, recognizing the need to address the problems in a comprehensive way.

"ECOSYSTEM ORGANIZATIONS" (CCAMLR, **www.ccamlr.org**)

One of the more recent organizations created for the international management of resources is the Convention for the Conservation of Antarctic Marine Living Resources. Perhaps the first difference is that it is not named after a particular target species or group, and that reflects the intention of focusing on the ecosystem as a whole. As stated in their web page:

"In contrast to other multilateral fisheries conventions, CCAMLR is concerned not only with the regulation of fishing, but also has a mandate to conserve the

ecosystem. This 'ecosystem approach', which considers the whole Southern Ocean to be a suite of interlinked systems, is what distinguishes CCAMLR from other multilateral fisheries conventions".

## THE FUTURE

With the current regional organization and areas of coverage of the RFOs there are major gaps in the international management of resources. Besides the sea turtles, sea birds, marine mammals other than large whales, squids, sharks, rays, mahi-mahis (Coryphaena hippurus), wahoos (Acanthocybium solandri), and other species that are harvested or under some conservation threat, fall in the cracks of the system. Sharks and sea birds have been the object of IPOAs which are at uneven levels of development in the different nations. Other CMS-based agreements address other small cetacean cases. But the management and conservation of these species will require well-organized, systematic data collection programs across the whole range of their distributions that in some cases is unknown. Their migrations need to be studied, together with catches, bycatches, and many aspects of their biology and ecology. The jurisdictions of the RFOs has been based on the distribution of their objective species, and it may not match the coverage needed for these other species.

Perhaps the future model for ocean governance is one of "Basin Commissions" established with reference to ecosystem characteristics, oceanography, etc., where the objectives are not the management of individual species but of the whole. These Commissions, perhaps an evolutionary development from the current RFOs, would deal with fisheries and conservation issues, pollution, marine debris, and all those issues with transboundary or High Seas components. They would also try to harmonize and coordinate the development of aquaculture, regional tourism, coastal zone management policies and actions, as well as other issues that are better handled at the regional level. Even these Basin Commissions will have to interact with each other in some cases, but at least there will be an umbrella including all the ecosystem components.

## REFERENCES


Arauz, R. 2001. Impact of high seas longline fishery operations on sea turtle populations in the Exclusive Economic Zone (EEZ) of Costa Rica – A second look. P.62-64. In Kalb, H. J. and T. Wibbels, (Compilers): Proc. Nineteenth Annual Symposium on Sea Turtle Biology and Conservation. U.S. Dept. Commerce. NOAA Tech. Memo. NMFS-SEFSC-443. 291 pp.

Birnie, P.W. and A.E. Boyle. 2002. International law and the environment. Oxford Univ. Press. 2nd ed. 832 pp.

Bjorndal, K.A. (ed.) 1982. Biology and conservation of sea turtles. Smithsonian Institution Press, Washington, D.C. 583pp.

Bjorndal, K.A. (ed.) 1995. Biology and conservation of sea turtles. Revised edition. Smithsonian Institution Press, Washington, D.C. 620 pp.

Bolten, A.B. and B.E.Witherington (eds.) 2003. Loggerhead Sea Turtles. Smithsonian Institution Press. Washington D.C. 352 pp.

Bowen, B.W., Abreu-Grobois, F.A., Balazs, G.H., Kamezaki, N., Limpus, C.J. and R.J. Ferl. 1995. Trans-Pacific migration of the loggerhead turtle (*Caretta caretta*) demonstrated with mitochondrial DNA markers. Proc. Natl Acad. Sci. 92: 3731-3734.

Burke, W., Freeberg, M. and Miles, E. 1994. United Nations resolution on driftnet fishing: an unsustainable precedent for high seas and coastal fisheries management. Ocean Development and International Law, 25:127-186.

Chan, E.H., and H.C. Liew. 1996. Decline of the leatherback population in Terengganu, Malaysia, 1956-1995. Chelonian Conservation and Biology 2(2): 196-203.

Churchill, R.R. and A.V. Lower. 1999. The Law of the Sea. 3rd. ed. Juris Publishing Inc. 500 pp.

Eckert, S.A. 1997. Distant fisheries implicated in the loss of the world's largest leatherback nesting population. Marine Turtle Newsletter. No 78. p.2-7.

Eckert, S.A. 1998. Perspectives on the use of satellite telemetry and other electronic technologies for the study of marine turtles, with reference to the first year long tracking of leatherback sea turtles. P. 44. In Epperly, S. and J. Braun (Compilers): Proc. Seventeenth Annual Symposium on Sea Turtle Biology and Conservation. U.S. Dept. Commerce. NOAA Tech. Memo. NMFS-SEFSC-415. 342 pp.

Eckert, S.A. 1999. Habitats and migratory pathways of the Pacific leatherback sea turtle. Hubbs Sea World Research Institute Technical Report 99-290.

Frazier, J. and S. Bache. 2002. Sea turtle conservation and the "big stick": the effects of unilateral US embargoes on international fishing activities. In A. Foley and A. Moser (compilers) Proc. 20th Annual Symposium on Sea Turtle Biology and Conservation. NOAA Tech. Memo NMFS-SEFSC-447:118-121.

Frazer, N.B., Limpus, C.J. and J.L. Greene. 1994. Growth and estimated age at maturity of Queensland loggerheads. Pp. 42-46, In Bjorndal, K.A., Bolten, A.B., Johnson, D.A. and P.J. Eliazar (Compilers.): Proc. Fourteenth Annual Symposium on Sea Turtle Biology and Conservation. U.S. Dept. Commerce. NOAA Tech. Memo. NMFS-SEFSC-351. 337 pp.

Frazier, J.G. and J.L. Brito Montero, 1990. Incidental capture of marine turtles by the swordfish fishery at San Antonio, Chile. Marine Turtle Newsletter. 49:8-13.

Fretey, J. 2001. Biogeography and conservation of marine turtles of Atlantic coast of Africa. Convention of Migratory Species: Technical Series publications. UNEP/CMS Secretariat, Bonn, Germany. Vol. 6. 429 pp.

Hall, M.A. 1996. On bycatches. Rev. Fish. Biol. and Fisheries, 6:319-352.

Hall, M.A. 1998. An ecological view of the tuna-dolphin problem: impacts and trade-offs. Rev. Fish. Biol. and Fisheries, 8:1-34.

Hatase, H.M., Kinoshita, T., Bando, N., Kamezaki, K., Sato, Y. Matsuzawa, K., Goto, K., Omuta, Y., Nakashima, H., Takeshita, and W. Sakamoto. 2002. Population structure of loggerhead turtles, *Caretta caretta*, nesting in Japan: bottlenecks on the Pacific population. Mar. Biol. 141:299-305. Heppell, S.S. 1998. Application of life-history theory and population model analysis to turtle conservation. Copeia 2: 367-375.

Heppell, S.S., L.B. Crowder, and T.R. Menzel. 1999. Life table analysis of long-lived marine species with implications for conservation and management. American Fisheries Society Symposium 23: 137-148.

Joseph, J. (1994). The tuna-dolphin controversy in the eastern Pacific Ocean: biological, economic and political impacts. Ocean Development and International Law, 25:1-30.

Kamezake, N., Matsuzawa, Y., Abe, O., Asakawa, H., Fujii, T., Goto, K., Hagino, S., Hayami, M., Ishii, M., Iwamoto, T., Kamata, T., Kato, H., Kodama, J., Kondo, Y., Miawaki, I., Mizobuchi, K., Makamura, Y., Nakashima, Y., Naruse, H., Omuta, K., Samejima, M., Suganuma, H., Takeshita, H., Tanaka, T., Toji, T., Uematsu, M., Yamamoto, Q., Yamato, T., and I. Wakabayashi. 2003. Loggerhead turtles nesting in Japan. P. 210-217. In Bolten, A.B. and B.E.Witherington (eds.). Loggerhead Sea Turtles. Smithsonian Institution Press, Washington D.C. 352 pp.

Limpus, C.J. and D.J. Limpus. 2003. Loggerhead turtles in the Equatorial and Southern Pacific Ocean: A species in decline. P.199-209. In Bolten, A.B. and Witherington, B.E. (eds.) Loggerhead Sea Turtles. Smithsonian Institution Press, Washington, D.C. 352 pp.

Luschi, P., Hays, G.C., and F. Papi. (2003). A review of long-distance movements by marine turtles and the possible role of ocean currents. Oikos 103, 293-302.

Lutz, P.L. and J.A. Musick (eds.). The biology of sea turtles. 1997. CRC Press, Boca Raton, Florida. 432 pp.

Lutz, P.L. J.A. Musick and J. Wyneken (eds.). The biology of sea turtles. Vol. II. 2003. CRC Press, Boca Raton, Florida. 455 pp.

Miller, J.D. 1995. Nesting biology of sea turtles. In Biology and conservation of sea turtles. 2nd edition. Bjorndal, K.A. (ed.) Smithsonian Institution Press. 620 pp.

Miller, J.D. 1997. Reproduction in sea turtles. P. 51-82. In Lutz, P.L. and Musick, J.A. (eds.) The biology of sea turtles. CRC Press, 432pp.

Morreale, S., Standora, E., Paladino, F. and J. Spotila. 1994. Leatherback migrations along deepwater bathymetric contours. P.109. *In* Schroeder, B.A. and B.E. Witherington, (Compilers): Proc. Thirteenth Annual Symposium on Sea Turtle Biology and Conservation. U.S. Dept. Commerce. NOAA Tech. Memo. NMFS-SEFSC-341. 339 pp.

National Marine Fisheries Service and U.S. Fish and Wildlife Service. 1998c. Recovery Plan for U.S. Pacific Populations of the Leatherback Turtle. Prepared by the Pacific Sea Turtle Recovery Team.

National Marine Fisheries Service and U.S. Fish and Wildlife Service. 1998d. Recovery Plan for U.S. Pacific Populations of the Loggerhead Turtle. Prepared by the Pacific Sea Turtle Recovery Team.

National Marine Fisheries Service and U.S. Fish and Wildlife Service. 1998e. Recovery Plan for U.S. Pacific Populations of the Olive Ridley Turtle. Prepared by the Pacific Sea Turtle Recovery Team.

NMFS Southeast Fisheries Science Center. 2001. Stock assessments of loggerhead and leatherback sea turtles and an assessment of the impact of the pelagic longline fishery on the loggerhead and leatherback sea turtles of the Western North Atlantic. U.S. Department of Commerce, National Marine Fisheries Service, Miami, FL, SEFSC Contribution PRD-00/01-08; Parts I-III and Appendices I-V1.

National Research Council. 1990. Magnuson, J.J. et al. (eds.) Decline of the Sea Turtles: Causes and Prevention. National Academy Press. Washington, D.C. 259 pp.

Okamoto, H. and W.B. Bayliff. 2003. A review of the Japanese longline fisheries for tunas and billfishes in the eastern Pacific Ocean, 1993-1997. Bull. InterAmerican Tropical Tuna Commission, 22(4) 218 pp.

Peñaflores S., C., Vasconcelos P., J, Albavera P., E., and R. Marquez M. 1998. Nesting of olive ridley sea turtle *Lepidochelys olivacea* during twenty four years at La Escobilla Beach, Oaxaca, Mexico. P.27-29. In Abreu-Grobois, F.A., Briseño-Dueñas,R., Márquez, R. and L.Sarti (Compilers). Proc. Eighteenth International Sea Turtle Symposium. U.S. Dept. Commerce, NOAA Tech. Memo. NMFS-SEFSC-436. 293 pp.

Resendiz, A., Nichols, W.J., Seminoff, J. and N. Kamezaki. 1998a. One-way transpacific migration of loggerhead sea turtles (Caretta caretta) as determined through flipper tag recovery and satellite tracking. P. 253. In Epperly, S. and J. Braun (Compilers): Proc. Seventeenth Annual Symposium on Sea Turtle Biology and Conservation. U.S. Dept. Commerce. NOAA Tech. Memo. NMFS-SEFSC-415. 342 pp.

Resendiz, A., Resendiz, B., Nichols, W.J., Seminoff, J. and N. Kamezaki. 1998b. First confirmed east-west transpacific movement of a loggerhead sea turtle, *Caretta caretta*, released in Baja California, Mexio. Pacific Science 52: 151-153.

Sarti, L. 2002. Current population status of *Dermochelys coriacea* in the Mexican Pacific Coast. Presented at the Western Pacific Sea Turtle Cooperative Research & Management Workshop, Honolulu, Hawaii, February 5-8, 2002.

Sarti, L., Jiménez, B., Carranza, J., Villaseñor, A. and M. Robles. 1989. V Informe de trabajo, Investigacion y Conservacion de las turtugas laud (*Dermochelys coriacea*) y golvina (*Lepidochelys olivacea*) en Mexiquillo, Michoacan. Annual Report, Sec. Desarrollo Urbano Ecol. (SEDUE), Sub-delegacion Ecologia, Michoacan. 39 pp.

Sarti, L., Eckert, S.A., García, N.T. and A.R. Barragán. 1996. Decline of the world's largest nesting assemblage of leatherback turtles. Marine Turtle Newsletter. Nr 74. July 1996.

Sarti, L., Eckert, S.A. and N.T. García. 1997. Results of the 1996-97 Mexican leatherback nesting beach census. NOAA/NMFS Final Report for Contract: 43AANF604301.

Sarti, L., Eckert, S.A. and N.T. García. 1998. Estimation of the nesting population size of the leatherback sea turtle, *Dermochelys coriacea*, in the Mexican Pacific during the 1997-98 nesting season. Final Contract Report to National Marine Fisheries Service; La Jolla, California.

Sarti, L., Eckert, S.A.,Dutton, P.H., Barragán, A. and N.T García. 2000. The current situation of the leatherback population on the Pacific coast of Mexico and central America, abundance and distribution of the nestings: an update. P. 85-87. In Kalb, H. J. and T. Wibbels, (Compilers): Proc. Nineteenth Annual Symposium on Sea Turtle Biology and Conservation. U.S. Dept. Commerce. NOAA Tech. Memo. NMFS-SEFSC-443. 291 pp.

Sarti, L., Barragán, A., Huerta, P., Vargas, F., Tavera, A., Ocampo, E., Escudero, A., Pérez, O., Licea, M.A., Morisson, M., Vasconcelos, D., Angeles, M.A. and P.H. Dutton. 2002. Distriución y estimación del tamaño de la población anidadora de la tortuga laúd *Dermochelys coriacea* en el Pacífico Mexicano y centroamericano. Temporada 2001-2002. Informe final de investigación. DGVS-SEMARNAT, NMFS, CI-México, US Geological Survey. 53 pp.

Sea Turtle Association of Japan. 2002. Population trends and mortality of Japanese loggerhead turtles, *Caretta caretta* in Japan. Presented at the Western Pacific Sea Turtle Cooperative Research & Management Workshop, Honolulu, Hawaii, February 5-8, 2002.

Spotila, J.R., Dunham, A.E., Leslie, A.J., Steyermark, A.C., Plotkin, P.T. and F.V. Paladino. 1996. Worldwide population decline of *Dermochelys coriacea*: Are leatherback turtles going extinct? Chelonian Conserv. Biol. 2(2):209-222.

Spotilla, J.R., Steyermark, A.C. and F.V. Paladino. 1998. Loss of leatherback turtles from the Las Baulas population, Costa Rica from 1993-1998: Causes and corrective actions. March 31, 1998.

Spotila, J.R., Reina, R.D., Steyermark, A.C., Plotkin, P.T. and F.V. Paladino. 2000. Pacific leatherback turtles face extinction. Nature. Vol. 405:529-530. Weidner, D. and J. Serrano. 1997. South America: Pacific, Part A, Section 1 (Segments A and B) in Latin America, World swordfish fisheries: an analysis of swordfish fisheries, market trends and trade patterns, Vol. IV. NMFS: Silver Spring, Maryland, November, 1997.

Wetherall, J.A. 1993. Pelagic distribution and size composition of turtles in the Hawaii longline fishing area. In: Research plan to assess marine turtle hooking mortality: results of an expert workshop held in Honolulu, Hawaii, November 16-18, 1993. Balazs, G.H. and S.G. Pooley, (Eds.). Southwest Fish. Sci. Cent. Admin. Rep. H-93-18.

Wetherall, J.A. 1997. Mortality of sea turtles in the Hawaii longline fishery: a preliminary assessment of population impacts. NOAA, NMFS, SWFSC, Honolulu Laboratory, Honolulu, HI. Administrative Report H-97-07; Aug. 1977, 51 pp.