SUSTAINABLE USE OF HAWKSBILL TURTLES:

Contemporary Issues in Conservation

by
N. Mrosovsky

Key Centre for Tropical Wildlife Management

Issues in Wildlife Management No. 1

SUSTAINABLE USE OF HAWKSBILL TURTLES:

Contemporary Issues in Conservation

illustrated by the case of
Cuba's proposal to CITES,
together with remarks about
whales,
rhinos,
elephants,
crocodiles,
and hutias

by

N. Mrosovsky FRSC
Professor of Zoology, University of To ronto;
member and former co-chairman of the IUCN Marine Turtle
Specialist Group

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"There is no other basis for sound political decisions than the best available scientific evidence. This is especially true in the fields of resource management and environmental protection."

Gro Harlem Brundtland
(1997)

The Author

Nicholas Mrosovsky obtained a first-class degree in Natural Sciences at the University of Cambridge in 1958, and a doctorate at University College London in 1962. He moved to the University of Toronto, Canada, in 1967. His early work on turtles analysed the ability of the hatchlings to find the sea rapidly after they emerge from the nest. His recent research concerns the influence of incubation temperature on the sex ratio, a phenomenon with many implications for conservation. Professor Mrosovsky is the author of numerous papers on sea turtles, published in Science, Nature, Canadian Journal of Zoology, Animal Behaviour, Biological Conservation, American Zoologist, and other journals.

His scientific work on turtles and that on biological rhythms has been recognized by various honours: a John Simon Guggenheim Memorial Fellowship, a Killam Research Fellowship, the Baerends Visiting Professorship at the University of Groningen, a Visiting Fellowship at Gonville and Caius College, Cambridge, and election to the Royal Society of Canada.

He has long been interested in conservation and has participated in CITES conferences as a member of the Canadian delegation and on other occasions as an NGO observer. In 1976 he founded the Marine Turtle Newsletter through which he launched international letter-writing campaigns on behalf of turtles in Mexico and in India. He was co-chairman of the IUCN Marine Turtle Specialist group from 1976 to 1979, and is currently a member of that group. His book on Conserving Sea Turtles (1983 British Herpetological Society) provided a critical analysis of practices used in turtle conservation. Professor Mrosovsky's outspoken views on this topic are the outcome of research in various countries (Costa Rica, Suriname, French Guiana, United States, Malaysia, Mexico, and Brazil), and of many years of reading and thinking about turtles and their conservation.

Foreword

The Key Centre for Tropical Wildlife Management was established at the Northern Territory University in Darwin in early 1999, to undertake research and teaching related to the management of wildlife in northern Australia and the wider region. The Key Centre and the associated Centre for Indigenous Natural and Cultural Resource Management have particular interests in supporting traditional uses of wildlife with scientific analysis, education and training.

In addition, the Key Centre has accepted a role to promote debate and better understanding of the contemporary role of wildlife use in conservation and sustainable development. It is in this spirit that it has become associated with this publication. The Cuban proposal to alter the status of a small harvest of the Hawksbill Turtle is of no direct interest to the Key Centre. However, the proposal has provided a focus for a detailed treatment of the issues surrounding sustainable use of 'charismatic' wildlife by a distinguished biologist and conservationist.

Consultation with Aboriginal people from across northern Australia reveals a deep sense of frustration. They are dismayed at the frequency with which resource management decisions with profound implications for their social and economic well-being are made without reference to their knowledge, opinions or aspirations. The right to continue harvests of wildlife and exploring options for economic development are critical, closely linked issues for many of the Key Centre's indigenous stakeholders. The manner in which the international community handles issues such as the Cuban proposal will therefore be of particular interest to them, in addition to its general relevance to the wider conservation and resource management community.

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Preface

Wildlife management is a challenging field of endeavour and in the presence of growing threats to the survival of many species of animals and plants, it is a challenge that must be accepted. However, such challenges are not for the faint-hearted.

Three threats to wildlife emanate from human beings - the first is the traditional threat of overexploitation for either need or greed, both exacerbated by an exponential growth in human populations. Whilst this growth continues no wildlife population of either plants or animals is safe from extinction.

The second threat is similarly linked to growth in numbers of humans causing massive habitat transformation, driving more species towards endangered status and possible extinction.

The third threat comes from growing human urbanisation and the popularisation of a cult against sustainable use. This is an unfortunate trend which seems contrary to a widely held belief that sustainable use is the one tool that can be depended upon to ensure the long-term survival of many species. There are already many examples of successful sustainable use programmes, some of which are described in this book, and a feature of all such programmes is the acknowledgement that common sense is an essential ingredient that must be used in adaptive management.

And, of course, there must be a dash of courage.

Putting in place wildlife management programmes with the goal of sustainable use requires real commitment and hard work. This contrasts strongly with the simpler "do nothing" or "hands off" philosophy which has in many cases, and especially with sea turtles, seen some populations sliding slowly and inexorably towards extinction.

Of course the irrational and exploitative plundering of wildlife resources in the 19th and early 20th centuries had catastrophic effects on many

species, and no where more so than in the United States of America and South Africa. But this is now the 21st Century. We have great skills and knowledge at our disposal and, more importantly, a better and still improving environmental ethic.

What is needed today is more than a spirit of tolerance in government and non-government circles, but rather enthusiastic support and encouragement of experimentation and the promotion of sound policies of adaptive management. More species will survive as a result.

Sustainable use is an invaluable tool for wildlife conservation in the new millennium and it will work provided there are biologists and managers with the breadth of vision and the courage to do the job properly. This book provides examples of this spirit.

One of the important elements that should not be overlooked is Dr Mrosovsky's vision of sustainability, especially in the sea turtle field, which he has promoted with admirable consistency over several decades. It is, I believe, the sign of an outstanding scientist when he is prepared to not only to keep, but also promote the maintenance of an open mind and the necessity to consider all options available. Dr Mrosovsky has represented these admirable qualities for as long as I have known him.

The programme proposed in this volume deserves support.

Dr George R. Hughes
Chief Executive
Kwazulu-Natal Nature Conservation Service

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Abbreviations

CCP	Cuban CITES proposal at the 10th Conference of the Parties
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CSG	Crocodile Specialist Group of the IUCN/SSC
IUCN	International Union for Conservation of Nature and Natural Resources (World Conservation Union)
IWC	International Whaling Commission
MTSG	Marine Turtle Specialist Group of the IUCN/SSC
NGO	Non-Government Organization
SSC	Species Survival Commission
WCMC	World Conservation Monitoring Centre
WMI	Wildlife Management International

1

Introduction and chronology of main events

The hawksbill turtle, *Eretmochelys imbricata*, has a beautiful shell which has long been valued for combs and ornaments, especially in Japan, but also in Europe for inlays on furniture. Hawksbills frequent reefs and are remarkable for being able to feed off sponges full of sharp spicules of silica. For nesting, they often choose small dispersed beaches, especially on islands, rather than aggregating on mainland beaches. Scattered nesting at low densities makes it harder to study this species than some other sea turtles. However, there have been a number of valuable long-term studies (Section 4 below).

Since 1976 the hawksbill turtle has been listed on Appendix I of the Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES). That means that international trade is prohibited, except for countries that entered a reservation which makes them equivalent to not being party to CITES for that species. Japan, in the past a major importer of shell, banned importation of hawksbill products at the end of 1992, and withdrew its reservation on hawksbill turtles in 1994. In 1997, Cuba submitted a proposal to CITES to downlist its population of hawksbill turtles to Appendix II, subject to an annual quota for the harvest of 500 individuals whose shells were to be exported only to Japan, with only one shipment a year. With no agreement of this kind, if everything continues as it is, then Cuba like any other country has a legal right to harvest at whatever level it chooses within its territorial waters. But if it were granted an export quota under CITES, then in effect it makes an international agreement to restrict its hawksbill harvest to a set level.

In Committee I of the 1997 Conference of the Parties to CITES in Zimbabwe, 53 parties voted in favour of Cuba's proposal, 39 against, and 18 abstained. Because this type of proposal requires a 2/3 majority to pass, it was not accepted. A modified proposal, put forward at the plenary session of CITES, also was not accepted (55 in favour, 49 against, 7 abstentions). This decision can be portrayed (Anon 1997a) as a defeat for Cuba, as it is technically. But it is also true that more countries voted in favour of the proposal than against it. In fact, opinion was fairly evenly split.

This essay attempts to place the issue of trade in hawksbill shell in a wider context of biology and conservation of sea turtles, and of some other species. It argues that limited and regulated trade of hawksbills from Cuba would be likely to be beneficial both to turtles and people. The main reason for this view is that increasing the value of a resource can, if done properly, promote the conservation of a species and its habitat. This point has been officially recognized by CITES in 1992 in an important resolution on the Benefits of Trade in Wildlife (Box 1). It is a matter of providing incentives for conservation for the countries, societies and people that actually possess such resources.

Box 1

Kyoto CITES Resolution Conf 8.3

Recognition of the Benefits of Trade in Wildlife.

NOTING that the majority of species of wild fauna and flora that CITES seeks to protect and enhance occur in the developing countries of the world;

RECOGNIZING that the sustainable use of wild fauna and flora, whether consumptive or non-consumptive, provides an economically competitive land-use option;

BEING AWARE that, unless conservation programmes take into account the needs of local people and provide incentives for sustainable use of wild fauna and flora, conversion to alternative forms of land use may occur;

RECOGNIZING that over-utilization is detrimental to the conservation of wild fauna and flora;

RECOGNIZING further that legal trade in a species should not lead to increases in illegal trade anywhere in its range;

RECOGNIZING also that the returns from legal use may provide funds and incentives to support the management of wild fauna and flora to contain the illegal trade;

ACKNOWLEDGING that the aesthetic, scientific, cultural, recreational and other largely non-consumptive uses of wild fauna and flora are also of enormous importance;

RECOGNIZING that there are many species for which trade would be detrimental to their survival;

THE CONFERENCE OF THE PARTIES TO THE CONVENTION

RECOGNIZES that commercial trade may be beneficial to the conservation of species and ecosystems and/or to the development of local people when carried out at levels that are not detrimental to the survival of the species in question.

2

Experiments in turtle conservation

Behler (1997) described some of the problems in conservation of reptiles and then urged conservationists to be creative and daring. In the case of sea turtles, however, there has been little reluctance to intervene and experiment, starting with Archie Carr's pioneering programme with green turtles, *Chelonia mydas*, at Tortuguero, Costa Rica. In Operation Green Turtle, thousands of hatchlings from Costa Rica were flown around the Caribbean for release on beaches thought to have been former nesting grounds for this species, or to be potential nesting grounds (Eliazar et al 1998). This experiment was eventually discontinued, without apparently having re-established any turtle populations. But suppose it had worked, how instructive and useful that would have been!

So re-establishing green turtle populations in former nesting areas was tried, and was then discontinued for lack of obvious success. Operation Green Turtle may have been little more than an expensive way of feeding fishes, but — and this is the point — it was not the end of the green turtle population at Tortuguero. Indeed green turtles at Tortuguero appear to be doing relatively well, not merely holding their own but actually increasing (Bjorndal et al 1999).

There are many other interventions that have been used in turtle conservation and research, sometimes perhaps more out of thoughtlessness and ignorance than daring, but certainly with good intentions. Some of these are now being questioned. For instance, the use of plastic Rototags (Dalton, UK) to mark turtles seems to make them more liable to become entangled in fishing nets; one group of

researchers, in Baja, California, have stopped using these tags on the basis of preliminary evidence (Nichols et al 1998). Remnants of nets have sometimes been found wrapped around tags (Suggett and Houghton 1998).

When a turtle is tagged, the skin must be pierced, either by the tag itself or first by another instrument. Some investigators are sufficiently concerned about the possibility of tagging providing sites of infection that they use sterile tags and antibiotic ointments (Fontaine et al 1989). It has been hinted that infections starting at tag sites could even result in death (see Witzell 1998; Caillouet 1998). This does seem rather unlikely; numerous investigators have tagged turtles in the field without noticing any signs of infections, and this lack of obvious problems has sometimes been specifically noted (e.g. van Dam and Diez 1997). But I cannot point to any study that provides reassurance that tagging cannot ever cause serious problems; there is no proof at present that tagging is totally harmless. For photographs of tag scars, see Schmid (1998).

There are additional concerns about tagging now that fibropapilloma, a debilitating and sometimes lethal disease in turtles, is so widespread. Green turtles have been tagged as yearlings at the Cayman Island Turtle Farm and released. In those seen later it was found that although "both tagged and untagged turtles had fibropapillomas, there was a tendency for fibropapillomas to be associated with the titanium tags. Turtles that had fibropapillomas and a titanium tag, consistently had fibropapillomas enveloping the tag" (Wood and Wood 1993). In research on green turtles in Hawaiian waters, "examination of some tagged and recaptured turtles suggested that tumour growth had been enhanced at the piercing site of the tag" (Balazs et al in press). Interpretation of such observations cannot be definitive, because the axillary area of the flipper is a common site for tumours anyway, and because tumours often start round the mouth and eyes, not on the flipper (Balazs pers. comm.). Nevertheless, the chance that tagging might enhance fibropapilloma was one of a number of reasons why this project has now switched to using internal PIT tags.

Protecting nests with wire mesh is another simple procedure that seems harmless. It is conceivable, however, that such objects on the beach

provide cues for predators. If predators persist for several nights, they may sometimes be able to pull the wire away and obtain their meal. At Boca Raton, Florida, wire protectors were not used in 1997. The percent of nests destroyed did not increase (Rusenko 1998). Additional, preferably within-season, studies are needed, especially since in another part of Florida, the Canaveral National Seashore, screening of nests did reduce predation by raccoons (Ratnaswamy et al 1997). The paper just cited stresses the need for evaluation. A variety of management approaches may be appropriate because the combinations of ecological factors influencing loss of nests on turtle beaches may differ. "Costly screening programs should not be implemented before evaluating the primary source of nest mortality." To assist such evaluations estimates were provided of the relative costs of different techniques to reduce predation.

Satellite telemetry is frequently used to track the movements of animals at sea. However, the attached transmitters increase the drag on a turtle (Watson and Granger 1998). If the turtle is to maintain normal speed, it must expend additional energy.

For many years at Tortuguero, turtles were routinely turned on their backs after nesting, and left there until the morning for measurements and release. The desirability of this practice was later questioned (Pritchard 1982). Subsequently, a comparison was made of the tendency to remigrate between turtles that had been turned and those that had been left the right way; this suggested that reproductive performance was not affected by turning (Bjorndal 1982). But this study was less than ideal because the data for the turned turtles were obtained in a different year from those for the unturned animals, and because the number of eggs laid was not compared. Turning turtles has been discontinued at Tortuguero. I am unaware whether it was stopped because it was shown to be detrimental, or because it offended the sensibilities of volunteers doing the tagging. Whatever the case, turning turtles is an example of a potentially stressful procedure that was used for many years without being properly evaluated.

The use of styrofoam boxes for incubation of turtle eggs is another practice that has been abandoned or much reduced. This followed

demonstrations that hatchlings from styrofoam boxes were mostly males (Mrosovsky 1982; Morreale et al 1982; Dutton et al 1985). In sea turtles, as in many reptiles, whether an embryo develops into a male or female depends on the temperature prevailing during incubation. Presumably the cool night air affects the eggs more if they are above ground in boxes than if buried deep in the sand, and this results in more males.

Of course when these boxes were first introduced as a convenient way of protecting eggs, the influence of temperature on sexual differentiation was not common knowledge within the turtle conservation community. Now that this is known, it is necessary to consider implications for other procedures not involving styrofoam boxes. For instance, central hatcheries may or may not be thermally equivalent to the places on the beach where the eggs are actually laid (Mrosovsky and Yntema 1980). With the availability of cheap dataloggers the necessary research has become easier.

Head-starting turtles is the practice of raising hatchlings in captivity for awhile and then releasing them in the hope they will then be larger and less vulnerable to predators. Imprinting is the practice of exposing hatchlings and/or eggs to sand of a particular beach in the hope that when adult, the turtles will be attracted back to that beach on account of its particular olfactory and chemical characteristics. Head-starting and imprinting, combined with moving eggs or hatchlings away from the beach on which they were laid, have been tried with Kemp's ridley (*Lepidochelys kempi*). Eggs have been translocated from the natal beaches in Rancho Nuevo, Tamaulipas, Mexico, to Padre Island, Texas, and been exposed to the beach and surf there, and then raised in captivity before release the next year or later. This is a prime example of the willingness to gamble because the numbers of Kemp's ridley nesting each year have been down to only a few hundred or a few thousand.

My main criticism of head-starting has not been that it is experimental, but that too often the experiment has been launched with insufficient thought about how it is to be evaluated (Mrosovsky 1980, 1983; Taubes 1992; Eckert et al 1992). It may be an encouraging sign that 5 head-started Kemp's ridleys have nested at Padre Island (Kaiser 1996; Shaver

and Caillouet 1998). But the significance of this is moot without more information on the frequency of beach patrols before and after head-starting on Padre Island. Also, nest-site fidelity might not be very strong in this species: there are 2 instances of females which had previously nested near or at Rancho Nuevo, the main nesting area for Kemp's ridley, being found on the beach at Padre Island (Shaver and Caillouet 1998). So whether the head-started turtles were imprinted on Padre Island or reached it by wandering is unclear. Kemp's ridleys have recently nested in Florida, outside their historical range (Bowen et al 1994). In Mexico also there are increasing reports of nesting outside the Rancho Nuevo area (Márquez et al 1996b). Moreover, to assess head-starting, one needs to know not simply whether a head-started turtle can survive to breeding, but also whether this approach is quantitatively superior to others (Mrosovsky 1983).

So turtle biologists have hardly been reluctant to institute procedures about which they lack complete knowledge: turning turtles upside down, piercing them with tags that might increase liability to entanglement or infection, marking their nests with wire cages that are obvious to racoons and foxes, keeping hatchlings in tanks for months or more prior to releasing them at places they might not inhabit at that stage of their life cycle, incubating their eggs in styrofoam boxes in unnatural conditions, or even on occasions deliberately manipulating their sex ratio (Chan and Liew 1996a; Leh 1985), and "removing approximately 2000 hatchlings per year for the past 15 years from the wild population of the most endangered sea turtle in the world", Kemp's ridley (Byles 1993). The apparent boldness, some might even say recklessness, in these instances contrasts with the extreme caution, some might even say hostility, which often greets the idea of trying utilization-based approaches to turtle conservation.

But trying something is not the same as sanctioning it forever, as is evident from some of the backtracking mentioned above. Likewise, decisions at CITES are not irrevocable, as shown by the recent changes in the regulations concerning the export of ivory from certain African countries. Indeed the Cuban proposal to CITES (1997) spelt out some criteria for stopping the harvest if monitoring indicated decreased numbers (Box 2).

Box 2
Safeguards in Cuban CITES proposal

8.5.1. In the event that annual monitoring over 3 years indicates a decline of 20% in the total population (or the reproductively active segment of the population), that cannot be attributed to survey biases, the traditional wild harvest will be reduced by 50% as a first stage response.

8.5.2. In the event that the annual monitoring indicates a decline of 20% in the subadult population over 3 years or more that cannot be attributed to survey biases, the harvest of hatchlings/eggs will be reduced by 50% as a first stage response.

8.5.3. In the event that monitoring indicates a drastic short-term decline in the total population (50% in one year) that is not explicable by survey biases, all harvesting will cease.

(CCP 1997)

3

Complete knowledge: population models or adaptive management

At a meeting convened by IUCN in 1988 in Costa Rica, to devise guidelines for CITES proposals on turtle ranching, some participants argued for the need for more information on population levels and life history — so much more information that this approach was dubbed the complete knowledge scenario.

To attain that state would involve decades of research, maybe longer. Population models need to replace assumptions about life history with facts about average age and size at maturity, age-specific survival rates, sex ratio, and life-time reproductive output. But growth rates vary considerably between different feeding grounds. For instance, a 30-40 cm hawksbill at Mona Island, Puerto Rico, grows an average of 3 cm/year. Separated from Mona Island by a channel of water a mere 5 km wide lies a still smaller island, Monito. Here the growth rate for such a turtle is 7 cm/year, more than double that at Mona Island (Diez and van Dam 1997). With such differences between places so near to each other, it would not be surprising to find important differences among hawksbill populations in different parts of the world. Population models worked out for one place may not be applicable to another area without many years of research to specify the relevant parameters.

Of course it would be nice if complete knowledge were available, but, since it is not, to insist on this in any debate on trade is essentially to oppose present day trade altogether. Meanwhile, there are places in the world where nesting turtles, in particular olive ridleys, are so dense

that they dig up each other's eggs. There are also places where thousands of eggs are being washed away by tides, or where other causes of mortality at early stages strongly suggest that some kind of use is possible before complete knowledge is attained (Mrosovsky 1997a).

But the demand for complete knowledge still thrives. In a keynote address to the Annual Symposium on Sea Turtle Biology and Conservation, Mast (1999) warned:

> Management is risky unless you have a complete, and I mean complete, knowledge of how Nature works and you can predict and control all the impacts of your management interventions....

For Mast, management encompasses sustainable use initiatives. But when it comes to other things, he sidestepped the need for complete knowledge.

> Conservation is an experimental science.... The best way to learn is to just do it, make mistakes, but be honest about them, and use the lessons you learn to improve your techniques.

The 1997 Cuban CITES proposal (CCP).

To satisfy the requirements of CITES Resolution Conf 9.20 and 9.24, Cuba did come up with some estimates of total population size, but also discussed the limitations of this exercise. Its proposal was not based on a population model. It was based on adaptive management strategy. Essentially adaptive management involves adjusting the take in response to changes in catch or availability. Therefore criticism aimed at the downplayed and much qualified population modelling in the Cuban proposal misses its essence, that management decisions are not based on a model (Box 3) — unless it be argued that this kind of adaptive management depends on an implicit model (Frazer 1989) that altering the take will have some effect on the rate of population change. But it is not a model in the sense of including information on rates of recruitment, reproductive output, and maturation times, etc. This may seem shocking to people who specialize in such modelling, although most would probably admit that understanding of sea turtle demography is still in a

primitive and tentative state, and that present day models are not definitive.

The essence of the adaptive management strategy in the case of the Cuban hawksbill lies in the numbers graphed in Fig 1 which shows the estimated catch of hawksbills since 1968. The Cuban CITES proposal (1997) was for a quota of 500 hawksbills. And, in the hope of success, or to show good intentions to increase their chances of success, or because they were short of gas following the collapse of the Soviet Union, or for a combination of reasons, starting in 1990/1991 the annual catch was phased down in the years before 1997 from around 5000 to the 500 level (Carrillo et al 1999).

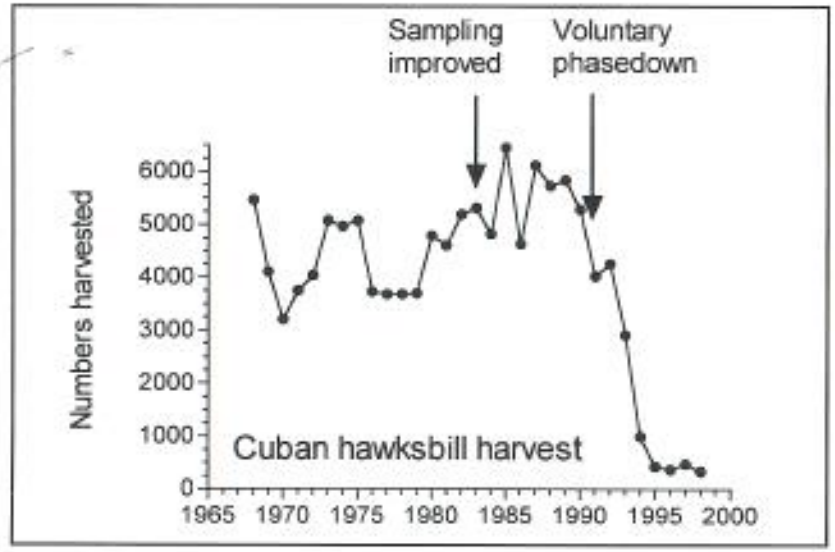

Fig 1. *Harvest of hawksbills in Cuba (from the Cuban CITES proposal 1997 and the Ministenio de la Industria Pesquera). Because some values were derived from weights of hawksbill shell, and for other reasons, the numbers given should be considered approximate estimates rather than exact figures.*

Of course, the quality of data collected by many people over many different years can be questioned. That is true also of data going into sea turtle population models. Documented cases of inconsistencies of measurements of turtles on successive occasions are not uncommon; sometimes negative growth rates are reported (Mrosovsky 1983; Shoop and Ruckdeschel 1986), making one wonder about extrapolations of growth curves to determine the age of turtles at breeding size. And should one extrapolate growth to minimum size of nesting females or to average size (Frazer and Ehrhart 1985)? People even make considerable errors simply in counting the number of eggs in a clutch (Cruz and Frazier 1998). Such errors, combined with uncertainties deriving from tag loss, could affect estimates of total reproductive output. So there is no monopoly on error proneness.

Staying then with order of magnitude rounded figures, from the Cuban Ministry of Fisheries numbers in Fig 1, it does seem fairly reasonable to accept that around 5000 hawksbills have been taken in the Cuban fishery each year from 1968 onwards — and perhaps from earlier when information was less reliable (CCP 1997). This harvest has taken place without signs of major difficulties or diminished catch. There is some argument about whether size of turtles has declined or is declining (IUCN 1997 analysis; Cuban CITES Management Authority 1997; Wildlife Management International 1997). Some declines in size were reported and would be expected if one harvests adults over a number of years. Are any such declines continuing or levelling off? One complexity is that the data appear different for different seasons and zones within Cuban waters (Carrillo et al 1999). One must also wonder about the margin of error in size measurements.

Another possibly instructive indicator of the size of nesting females might be clutch size. In the Doce Leguas region of Cuba, hawksbills lay a mean of 136 eggs/clutch (CCP 1997). This is fewer than occurs in some other areas in the Caribbean. For instance in Antigua mean clutch sizes of 157 (Hoyle and Richardson 1993) and 155 (Richardson et al 1999) have been reported. A number of studies of sea turtles have found correlations, even if sometimes rather weak, between the number of eggs in a clutch and the size of the mother (Witzell 1983; Garduño 1998). More attention might be given to clutch size and mass in the

Box 3

Examples of misinformation and misconceptions about the Cuban turtle program

Misconception	*Actual Situation*
"In response to the demand for hawksbill shell, the government of Cuba announced in 1992 an intention to resume the commercial harvest of hawksbill turtles on the reefs within the Cuban territorial waters[77]."	In 1992 the Cuban hawksbill harvest was being reduced. By 1995 it was less than 1/10th the pre-scaling down level. The cited reference[77] is to an extended abstract by Ottenwalder, J.A. and Ross, J.P., 1992, p. 90-92. In Salmon, M. and Wyneken, J., compilers, Proc. 11th Annual Workshop on Sea Turtle Biology & Conservation, NOAA Tech Memo NMFS-SEFC-302. This does not mention an intended resumption of harvest. Even if the spoken version had mentioned an intent to resume commercial harvest, this would not accord with the facts. It does not make sense to talk of resuming something that was never totally stopped, but in 1992 the harvest was being *scaled down* (data in Cuban CITES proposal), not "resumed".
Bowen, B.W. and Karl, S.A., 1997 p. 44 In: The Biology of Sea Turtles, Lutz, P.L. and Musick, J.A., Eds. CRC Press, Florida.	
Referring to the DOIRAP model: "Proposals to CITES undergo careful scientific scrutiny, particularly those that recommend reevaluation of a species' trade status. The model we evaluated was insufficient to justify reinstating the hawksbill harvest" Heppel, S.S. and Crowder, L.B., 1995 Biol. Conserv. 10, p. 880.	This passage implies that the DOIRAP model is the basis of the Cuban CITES proposal. But the Cuban proposal is not based on the DOIRAP model. It also implies that the proposal is to reinstate the hawksbill harvest. In fact, the proposal is for a harvest level approximately 1/10th of what has been taken in the past and, as indicated above, the harvest has already been phased down to this level.

future. Nevertheless, given the likelihood that the previous catch was in the order of 5000, the proposed quota of 500 hawksbills, combined with the contingencies specified for reducing or stopping even this catch (Box 2), add up to a conservative application of adaptive management.

But it may still be argued that any kind of adaptive management is unacceptable with species such as sea turtles. Their slowness to mature may make it hard to detect a drop in recruitment when that occurs. If

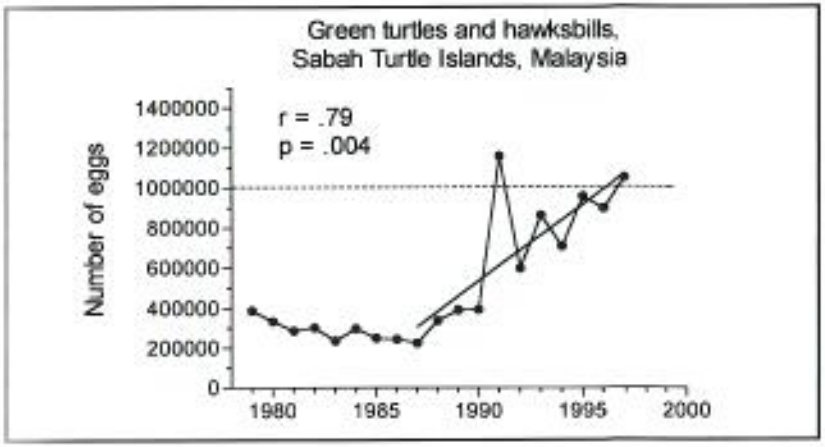

Fig 2. Number of green turtle and hawksbill eggs laid on the Sabah Turtle Islands of Selingan, Bakkungan Kecil and Gulisaan (data from Basintal and Lakim 1994; Chan pers. comm.; Basintal pers. comm.). Clutch size of green turtles in Sabah is 93.57 (Table 4-5, Chan and Liew 1996b), that of hawksbills 120.43 (Chan pers. comm.). Close to 10% of the total egg production comes from hawksbill turtles, as inferred from the following information. About 7.3% of the clutches laid on the Sabah Turtle Islands are hawksbills (Table 3-4 Chan and Liew 1996b for 1990-1994 data). Therefore, for every hundred clutches laid, there are 7.3 x 120.43 = 879.1 hawksbill eggs and 92.7 x 93.57 = 8673.9 green turtle eggs, giving 9.9% of the total eggs as hawksbills. A graph showing the number of hawksbill clutches for 1982-1992 is given in Limpus (1995); there is a clear upward trend in recent years. For information on numbers of eggs in earlier years, see de Silva (1982) and Mrosovsky (1983); procedures in earlier years may not have been the same in all respects.

eventually there is a crash, it may be too late for recovery, even in the absence of further harvesting. These concerns need to be taken seriously; systematic monitoring of numbers of turtles at life history stages before they show up at the nesting beaches would be desirable. But it should also be noted that there are examples of recovery in sea turtle populations having occurred, or appearing to be in the course of occurring, after large setbacks.

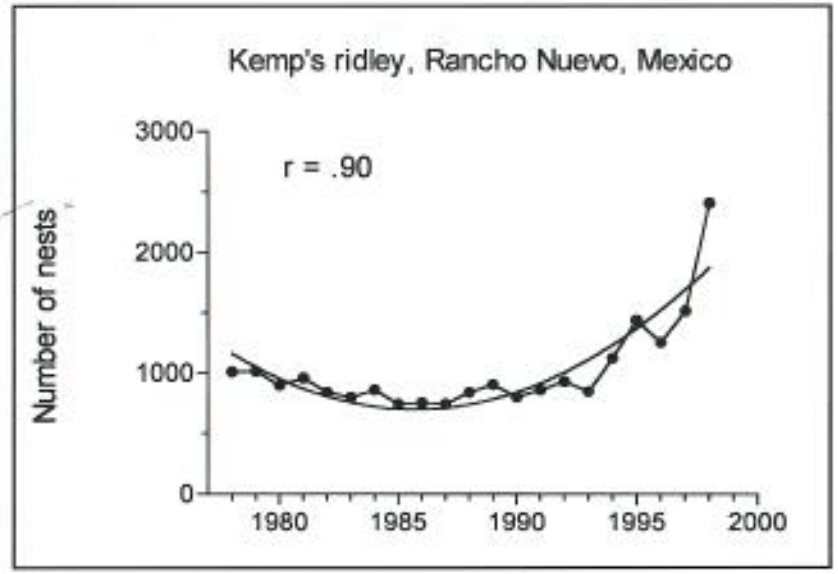

Fig 3. *Number of nests of Kemp's ridleys laid at Rancho Nuevo, Tamaulipas, Mexico. The data are for Rancho Nuevo itself and do not include the nearby beaches of Barra del Tordo and Ostionales-Tepehuajes, where some nesting in lesser numbers has been recorded in recent years (see Márquez et al 1996b). The data graphed do not agree in every respect with those given in the preliminary report of Márquez et al (1996b). The present data were provided by Márquez (pers. comm.), courtesy of the Instituto Nacional de la Pesca, Mexico; see also Márquez et al (1999). In the present data set, the 1998 figure is also considered preliminary; there may be some small changes (Márquez pers. comm.). Some data for the years before 1978 are available (Márquez et al 1999) but are not included here because beach coverage was different then.*

Population crashes and recoveries.

Green and hawksbill turtles nest on the islands of Selingan, Bakkungan Kecil and Gulisaan in Sabah, Malaysia. In former times, under the combined pressures of licensed egg collection, poaching and piracy, egg production declined from highs of about 1/2 to 3/4 million in good years in the 1960s to lows of about 1/4 million in the 1980s (De Silva 1982; Basintal and Lakim 1994). Hatcheries were started in 1966, with additional protective measures in 1972, culminating in the gazetting of the Sabah Turtle Islands Park in 1977 (Chan and Liew 1996b). The downward trend was reversed in 1988, and a few years later there were dramatic increases in nesting. In the 1990s, about 3/4 million eggs/year were produced; in 1991, and again in 1997, there were more than a million eggs (Fig 2).

Kemp's ridleys at Rancho Nuevo, Mexico, have declined drastically from 1947 when it was estimated from a film that 40,000 females nested during an arribada (Carr 1963). In the early 1970s there were fewer than 500 clutches per year laid there (Márquez et al 1996b). But for the 8 years from 1988-1995 there was a gradual but significant trend up, with 1429 nests in 1995 (see also Pritchard 1997; Godfrey 1997). Since then the upward trend has continued, with >2000 nests in 1998 (Fig 3).

Olive ridleys (*Lepidochelys olivacea*) at Escobilla, Oaxaca, Mexico, have staged a more spectacular recovery (Márquez et al 1996a). In 1990 a ban on taking turtles was declared in Mexico. In the 18 years before then, 1973-1990, the maximum number of nests in any season at Escobilla was 295,000. Within four years of the ban, numbers had more than doubled: in 1994 there were more than 700,000 nests. These increases have occurred rapidly despite the huge numbers of ridleys that have been killed at Escobilla. Cahill (1978) gives a figure of about 40,000 for 1997. Márquez et al (1996a) think that the harvest may sometimes have exceeded 100,000/year. Presumably the rapid increases have resulted from neophyte breeders, many of which would have formerly been killed, being able to enter the nesting population. Rather little, however, is known about arribada formation, and it is perhaps conceivable that for some reason olive ridleys previously nesting elsewhere joined the aggregations at Escobilla.

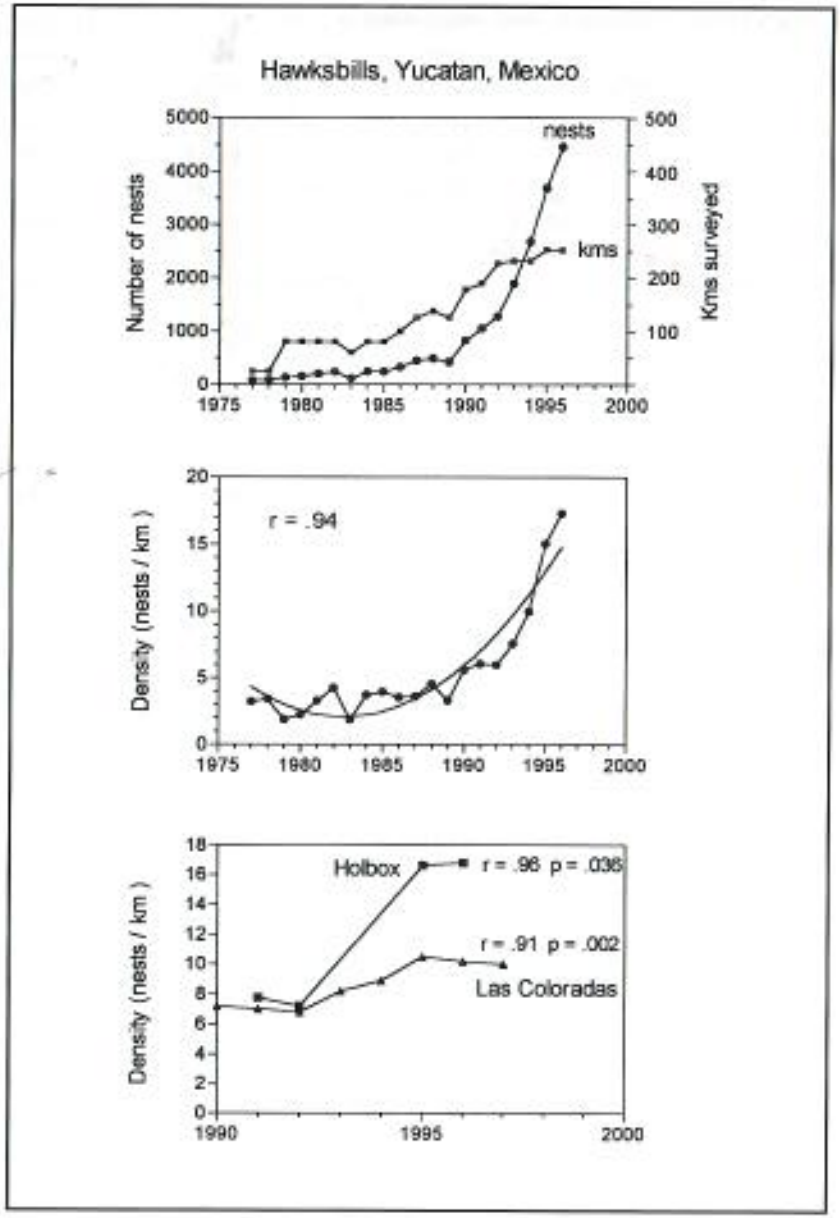

Fig 4. ***(opposite page)*** *Increased nesting of hawksbills in the Yucatán Peninsula, Mexico. Because the area of beach surveyed increased over the years (top), the best indication of increased nesting is the density of nests (middle) which shows a highly significant upward trend. Also, in recent years, the number of nests increases more steeply than the area surveyed (top). The bottom graph shows nesting density and associated r values for linear regressions, for some individual beaches where "efficiency and coverage were constant and intense at least from 1991 onwards." Data from Garduño-Andrade et al (1999), Garduño-Andrade (1999) and pers. comm. Slopes for increases of nesting density for two other well-studied beaches, graphed in Garduño-Andrade et al (1999), are similar to that for Holbox.*

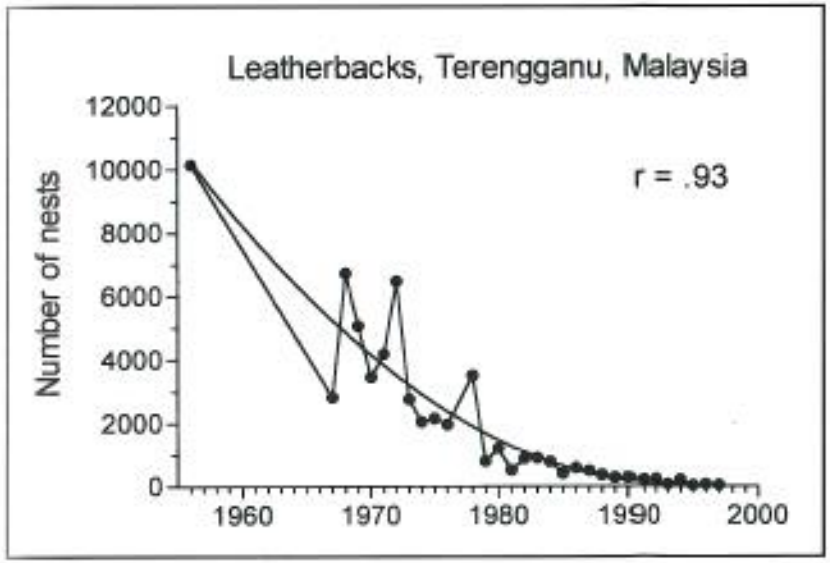

Fig 5. Decline of leatherback nesting at Terengganu, Malaysia (data from Chan and Liew 1996a and Chan pers. comm.).

Hawksbill nesting on the east coast of Mexico is also increasing. Because patrols have been expanded to more and more areas, density of nests is a better index than number of nests found. Nesting density has more than doubled on the beaches with the most consistent monitoring, and has clearly increased in the Yucatán Peninsula as a whole (Fig 4).

Leatherbacks in KwaZulu-Natal, South Africa, have gone from a low of 5 nesting females in 1966/67 to 124 animals 28 years later, "one of the most dramatic recoveries of sea turtle populations in the world" (Hughes 1996).

Against these instances must be set examples of populations that do not appear to have responded to protection, i.e., where the protection was inadequate or too late. For example, olive ridleys in Suriname have declined despite conservation measures. Erratic protection over the years of political and economic upheavals have made the situation worse (Hoekert and Schouten 1996).

Nests of leatherback turtles (*Dermochelys coriacea*) at Terengganu, Malaysia, have fallen from about 10,000 in 1956 to around 5000 in the early 1970s, and then to fewer than 100 in the mid 1990s (Chan and Liew 1996a; Fig 5). Whether this population can recover remains in the balance. Leatherbacks on the west coast of Mexico have also suffered major declines. At Playa Mexiquillo numbers of nests have declined from about 5000 in the mid-1980s to about 500 in the mid-1990s (Sarti et al 1996).

The point being made is that turtle populations can sometimes recover from considerable setbacks, not that they always do. Adaptive management strategy with a slow maturing species does pose some risk. Even with the conservative Cuban harvesting proposals, no one should claim that there are no uncertainties, absolutely no risk. But any such risks in a harvesting programme should be balanced by consideration of possible benefits (Section 6 below). Risks should also be compared to those in situations where there is official protection but inadequate enforcement. That is the reality in many national parks (Section 5 below).

According to the IUCN (1997) analysis of the Cuban CITES proposal, illegal fishing removes 1000 hawksbills a year from Puerto Rico and the Virgin Islands. The analysis does not make clear whether 1000 are removed from each of these areas or from both together. Either way, it appears that from just one part of the Caribbean, an area far less extensive than Cuban waters, at least twice as many hawksbills are being taken as in the Cuban harvest. The same source mentions illegal takes in other places in the Caribbean. One does not know how dependable these figures are because some of the sources of information for these analyses have not been made public (Wildlife Management International 1997; Mrosovsky 1997b). Still, probably most would accept the general point that the taking of hawksbills continues to be widespread in the Caribbean.

So let us not throw up our hands in horror against the proposed attempts to set up a controlled harvest and export in Cuba without considering the situation in other parts of the Caribbean where preservationist sentiment does not always translate into effective action.

4

Are hawksbills Critically Endangered?

Perceptions of the public; whaling.

Perceptions of the prospects for survival of a species play an important role in public attitudes, which in turn influence politicians and governments. This is exemplified for whales through surveys of what people know about these species (Freeman and Kellert 1994). When

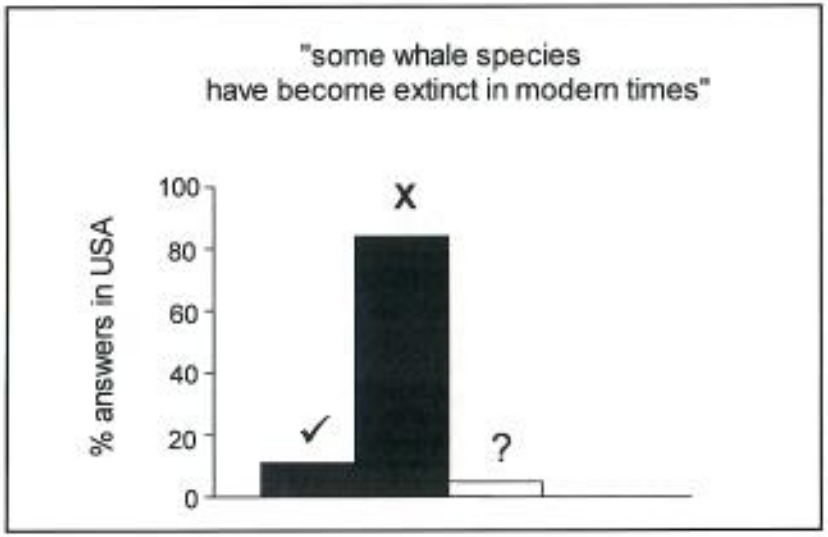

Fig 6. *Percentage of a sample of people in the USA responding correctly (tick), incorrectly (cross) or with "don't know" (?) to a question about the extinction of whale species (data from Freeman and Kellert 1994).*

the statement "some whale species have become extinct in modern times" was put to a sample of the public at large in the USA and they were asked if this was correct or not, 84% answered that it was true (Fig 6). This is the wrong answer — the only species known to have gone extinct in historical times is the Atlantic gray whale which disappeared in the 17th century, well before factory ships and intensive whaling (Francis 1990).

When asked about the population size of minke whales, nearly one third of respondents in the USA thought that there were fewer than 1000 left. More than 60% thought there were fewer than 10,000 (Fig 7). These estimates are orders of magnitude lower than the number estimated by biologists, which is about 935,000 (IWC 1998). This figure is based on surveys done in various years between 1982 and 1995.

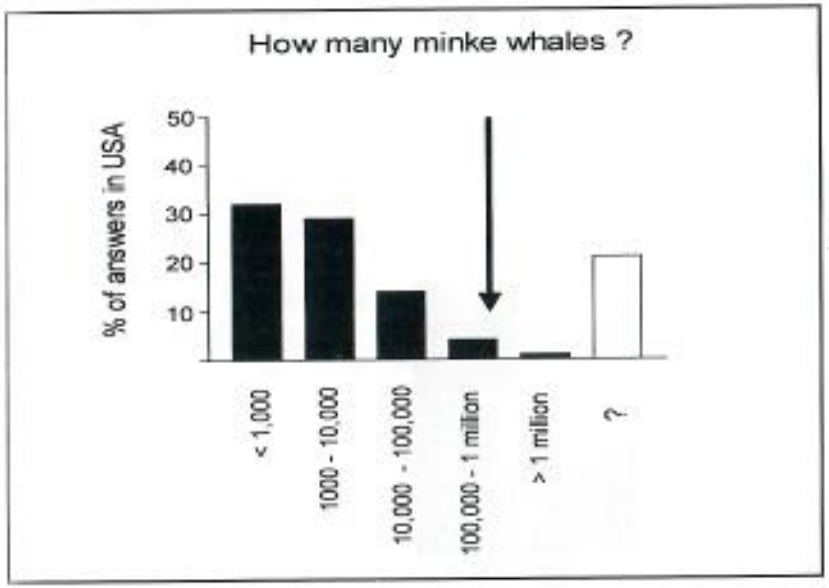

Fig 7. Responses of people in the USA asked how many minke whales they thought existed in the world today (data from Freeman and Kellert 1994). Arrow indicates the estimate of close to a million from International Whaling Commission (IWC) reports (IWC 1998).

With annual population growth, it is most likely that there are more than a million minke whales in the world today. In Norway, a whaling nation, the public also underestimated the number of minke whales, but not as much as in the USA.

This level of public ignorance suits groups promoting a moratorium on whaling, and raising money on this basis, because if people are given the facts, their attitudes toward whaling are rather different. In 1997 the following question was put to a representative sample of adult citizens in the USA:

> The minke whale is not endangered and the International Whaling Commission (IWC) estimates there to be 1 million minke whales worldwide. Please tell me if you would support or oppose the harvest of minke whales if you knew that harvested minke whales would be used for food; the harvest of minke whales is an aspect of the culture for some nations and for some groups of people; and the harvest of minke whales would be regulated by the IWC which would set a worldwide limit on the number of whales to be harvested each year to ensure there would be no impact to overall minke whale population numbers. Would you support or oppose the harvest of minke under these conditions?

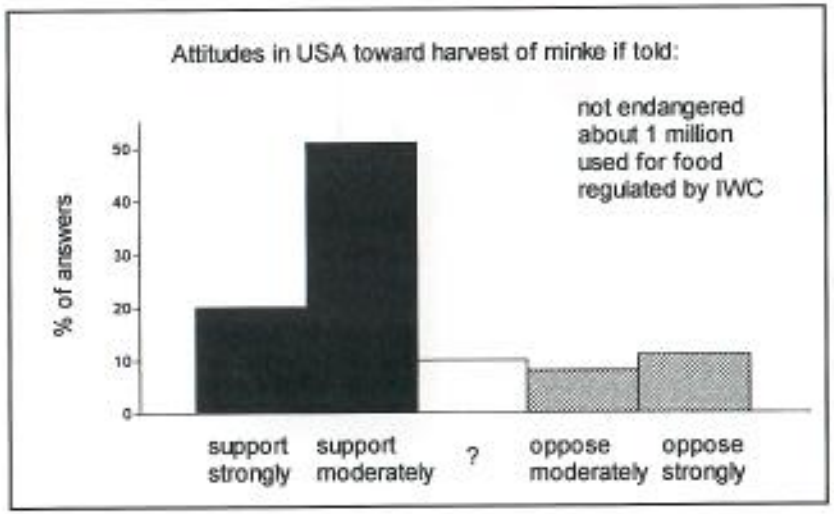

Fig 8. *Attitudes of people in the USA toward harvesting minke whales if certain conditions were present (data and details in Responsive Management 1997).*

In answer to this question, 71% expressed moderate or strong support for a harvest (Fig 8). This suggests that many people are not against harvesting of whales *per se*. But if they think that whale numbers are very low, and that they are in danger of extinction, it is not surprising that they support a moratorium and contribute money to organizations that promote such measures.

IUCN categories of threat.

One factor that influences the public's perception of survival prospects of a species, or, to put it more cynically, one factor that can be used to influence their perceptions, is the category of threat assigned to a species by the IUCN in their Red Lists.

Many years ago, when I was visiting Florida after turtle work in Costa Rica, I asked Archie Carr whether he thought that green turtles in the Caribbean were really in danger of extinction. No, not really, he said, but we need that idea so they receive wise stewardship. I do not recall his exact words, but I do recall the phrase wise stewardship, and the general argument, which at the time struck me as entirely reasonable, and good conservation. Since then I have come to change my mind about this. For most people, raising the cry of endangered with extinction implies that complete protection is the only course open. This is because large sections of the public do not appreciate what CITES has now officially recognized in its Kyoto resolution (Box 1): that trade can sometimes be beneficial to endangered species. So "the alarmist strategy" (Mrosovsky 1983) starts with the goal of total preservation and then portrays the situation in a way that promotes that strategy. I now think it better to start with an open factual assessment of the situation, and then from that basis consider what options there are for wise stewardship.

If things are not done in this order, it is not only decisions about particular species that may be ill founded: deeper problems may arise. When facts are denied, or decisions are made on the basis of claimed facts

that are not openly substantiated, it corrupts the process of science, its credibility, and the organizations involved. An analogy from Ibsen (1882): suppose the water supply of a town is polluted and this fact is repressed to avoid putting off tourists, then this denial not only obstructs corrective action, but it also infects the spiritual life of the community with lies.

Trends in monitored hawksbill populations; distribution.

What then are the facts about hawksbills? In some places nesting is decreasing, in other places increasing, and for many places there are inadequate data to tell. Numbers of nests are an index — though not a measure — of the number of adults in the population. However, monitoring of hawksbill numbers presents some challenges, because this species often selects scattered small isolated beaches and cays

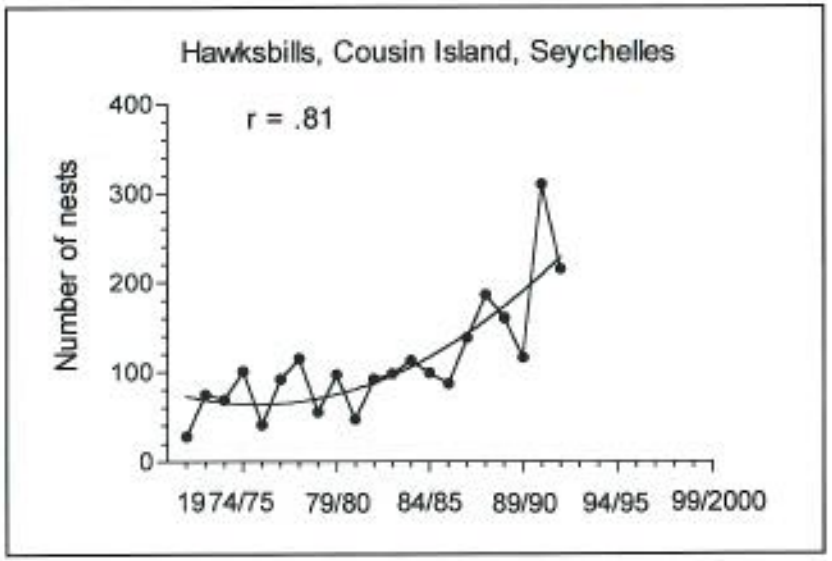

Fig 9. *Number of hawksbill nests on Cousin Island, Seychelles. The upward trend is still statistically significant ($p < 0.001$) after exclusion of the 1971/72 and 1975/76 seasons when patrolling of the beach may have been less thorough (data from Mortimer and Bresson 1994; Mortimer pers. comm.).*

for laying its eggs; systematic surveys of such areas over long periods are not generally feasible. Nevertheless, a number of hawksbill nesting areas have been patrolled sufficiently often for some long-term trends to be evident.

On Cousin Island in the Seychelles, over the 20 years from 1971/72 - 1991/92 there has been a significant upward trend, with an approximate doubling of nesting (Fig 9; Mortimer and Bresson 1994). Apparently, this trend has continued in the 1990s, giving an approximate tripling of nesting (Mortimer and Bresson 1999).

The spectacular resurgence of sea turtle nesting in the Sabah Turtle Islands has already been mentioned (Fig 2). About 7.3% of the nests on these islands are laid by hawksbills (Chan and Liew 1996b), and there is an upward trend in recent years (Limpus 1995). Hawksbills also nest in Peninsular Malaysia. There has been no significant trend up or down for 1984-1993 at Terengganu (Fig 10); only data collected at this location were considered reliable by Ibrahim (1994).

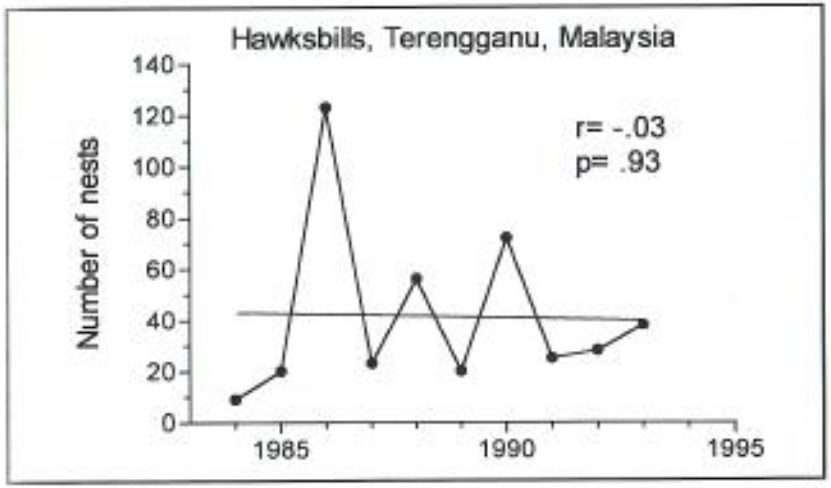

Fig 10. *Number of hawksbill nests at Terengganu, Malaysia (data from Ibrahim 1994).*

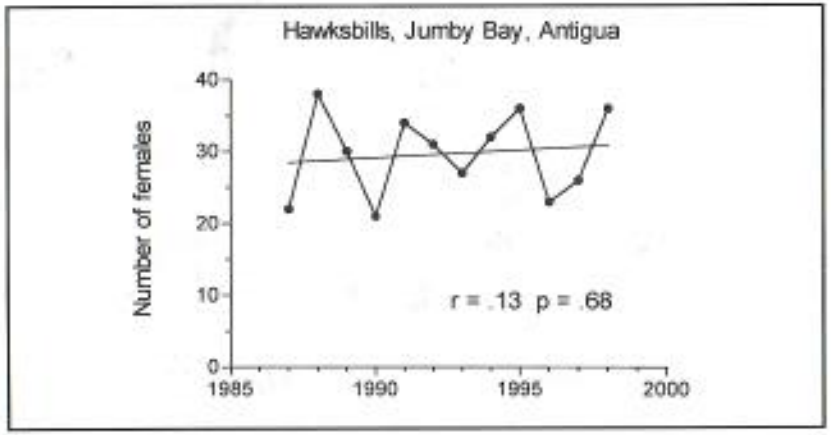

Fig 11. Maintenance of numbers of hawksbills nesting at Jumby Bay, Antigua. Linear regression is not significantly different from zero slope (data from Richardson et al 1999).

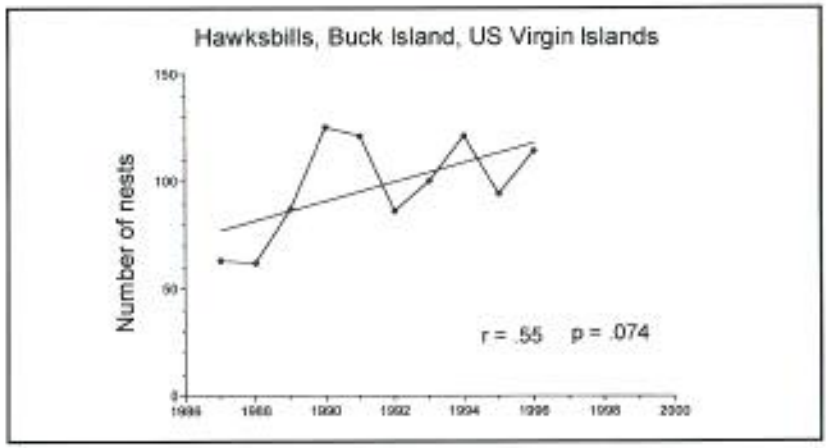

Fig 12. Number of individual hawksbills nesting on Buck Island, US Virgin Islands, as determined by nighttime beach patrols. In 1991, the coverage was extended from July to early October; it had previously been June-September. In 1995, some turtles were probably missed because hurricanes prevented patrols from 4 September - 13 October (data from Buck Island Sea Turtle Research Programme Annual Report 1998; Hillis-Starr pers. comm.).

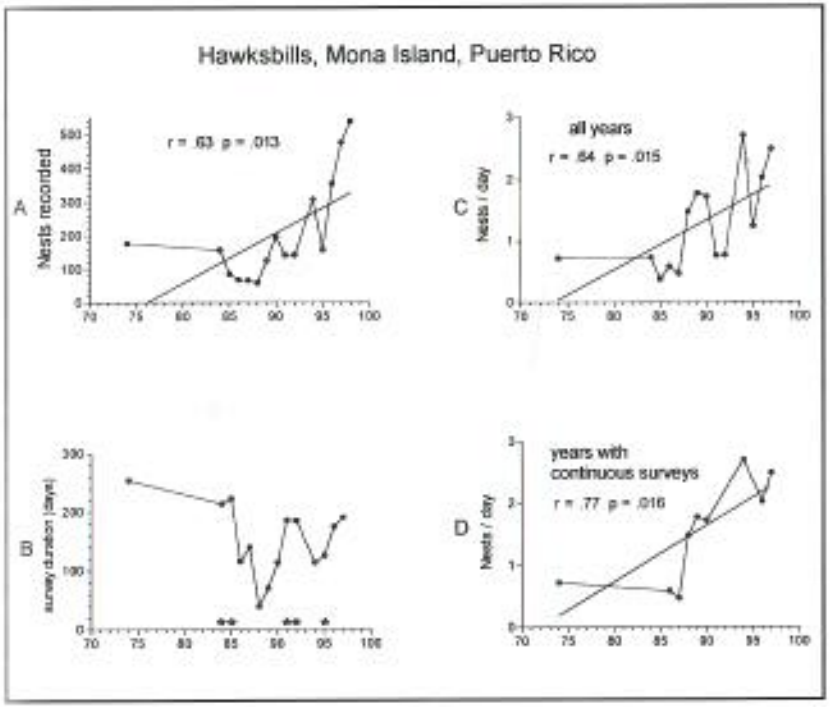

*Fig 13. Numbers of hawksbill nests (A) recorded on Mona Island, Puerto Rico, in different years. Because the duration of surveys (B) was not standard, the data for the numbers of nests in different years are not strictly comparable. To make some allowance for this, the number of nests per day of survey duration was calculated (C). However, in some years the surveys were discontinuous (years marked by * in B) and therefore the total number of days surveyed was fewer than indicated by the duration of the survey. Because of this, the number of nests per day of survey duration is also shown for only those years in which the survey was continuous over its duration (D). Number of nests for 1998 in A obtained from Meylan and Donnelly (1999), all other data from Diez et al (1998) who cautioned that further study is desirable. Nevertheless, the upward trends are statistically significant in all the ways of plotting the data shown above.*

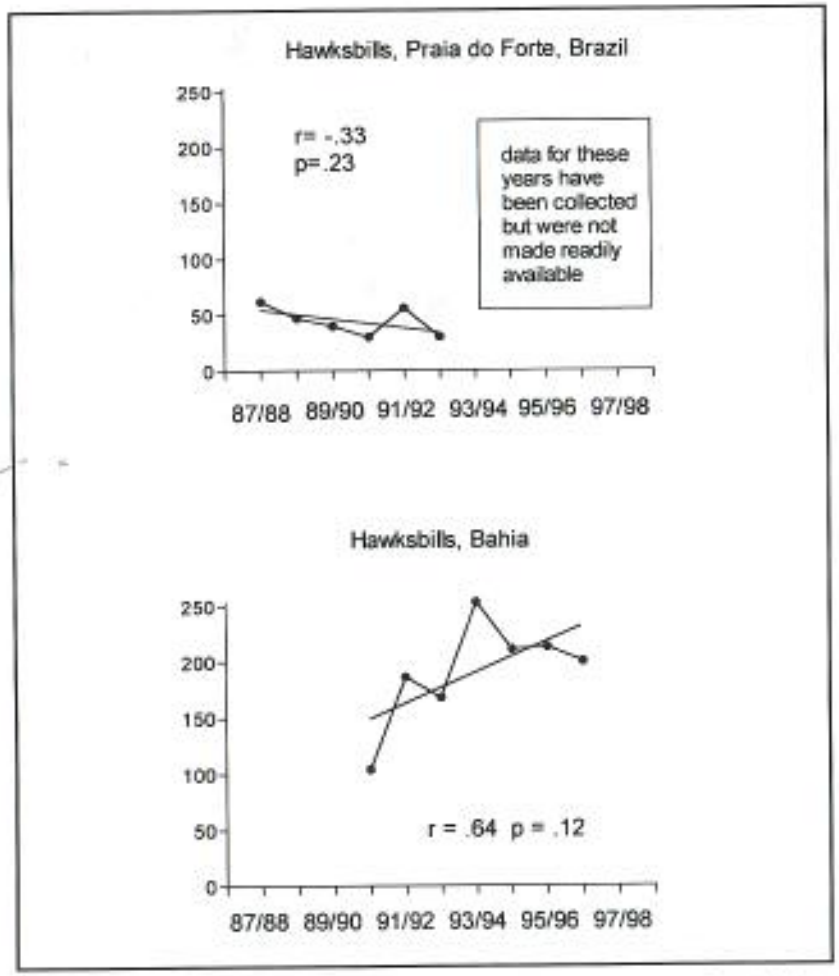

Fig 14. *A. Number of hawksbill nests at Praia do Forte, Bahia, Brazil (data from Marcovaldi and Laurent 1996). B. Number of hawksbill nests in Bahia. These figures include nests at Praia do Forte (data from Marcovaldi et al 1999). The number of nests are those for which egg counts were made. Attempts are made to do this for all nests, but this is not always possible. Therefore, the numbers given for Bahia are approximate. Marcovaldi et al (1999) suggest that the number of nests in Bahia "are not currently decreasing."*

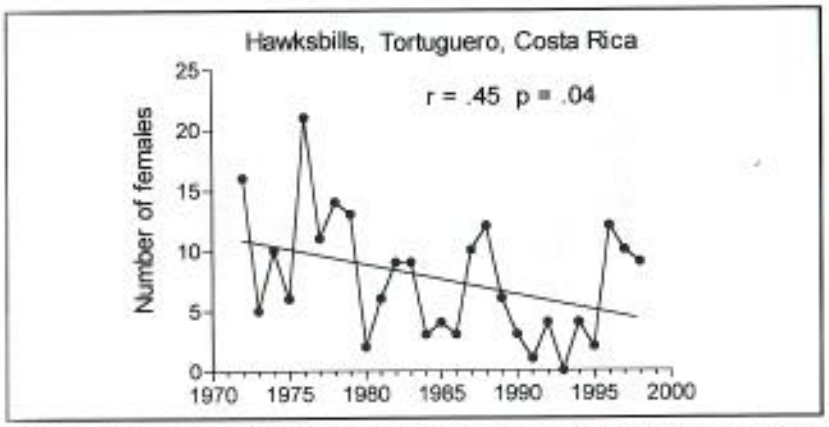

Fig 15. Significant downward trend in numbers of hawksbills nesting at Tortuguero, Costa Rica (data from Meylan 1999).

Turning to the Caribbean, in the Yucatán Peninsula, Mexico, there has been a substantial increase in the density of hawksbill nesting in recent years (Fig 4). At Jumby Bay, Antigua, nesting has held more or less level, with the usual year to year variability (Fig 11). Not so far away, on Buck Island in the US Virgin Islands, the situation is similar; certainly there is no downward trend there (Fig 12). On Mona Island, Puerto Rico, hawksbill nesting is increasing, with a statistically significant upward trend for 1986-1997 (Fig 13).

Hawksbills have been monitored for over a decade on some beaches in Brazil. The data suggest that nesting is not currently decreasing (Fig 14).

At Tortuguero, Costa Rica, there has been a significant decline in hawksbill nesting (Fig 15). In Suriname, for the whole of its coast, there was something of an upward trend from 1967-1985 followed by a downward trend from 1985-1998 (Fig 16), but the monitoring of these beaches was probably uneven.

To my knowledge, this covers the main places where there has been long-term monitoring of hawksbill nesting. Data also exist for Milman Island, Australia, for 1991 and for 1993-1997 (Miller et al 1998). The

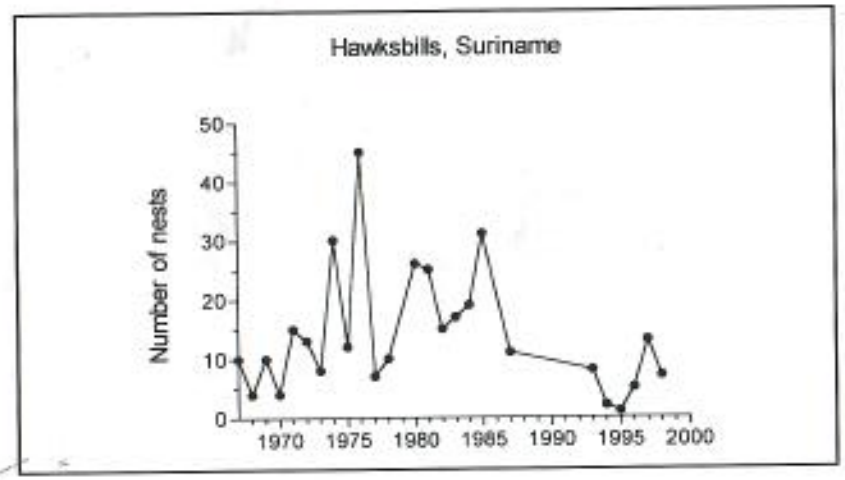

Fig 16. *Number of hawksbill nests in Suriname. Data for 1967-1983 from Suriname's (1985) CITES proposal; some of the same data are also in Schulz (1980). Data for 1984-1998 from K. Mohadin (pers. comm.). These numbers for Suriname should not be overinterpreted. Coverage of the extensive beaches in Suriname has not been standard over all these years (see also Hoekert et al 1996). In addition to variability in patrol efficiency, cycles of erosion and deposition move the beaches along the coast of Suriname. It is not known if hawksbills can make use of small patches of sand that may be left as the main beaches move. A line fitted through all the data is not significant, but this is not shown because the data do not appear linear. Downward trends are present in the more recent data, their extent depending on the years chosen for analysis. The data do suggest great variability in hawksbills in this area, and that nesting in low density has persisted over many years.*

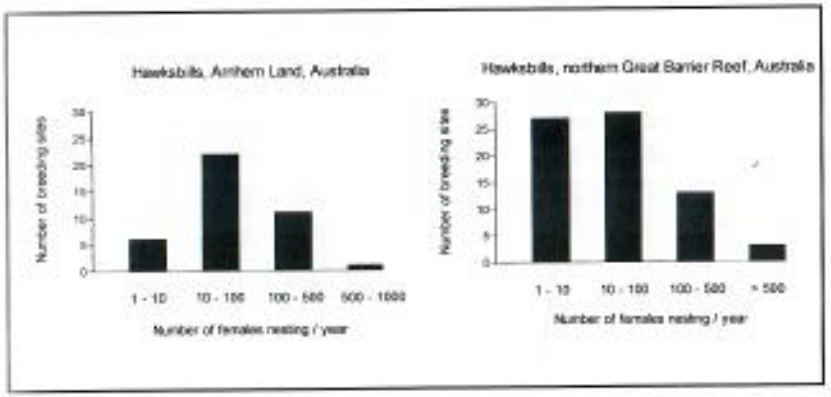

Fig 17. Left: Estimates of numbers of females per year nesting in 40 different breeding sites in Arnhem Land, Australia (Limpus and Chatto 1998). These estimates are based on track counts made from aerial surveys and should be regarded as "an acceptable first approximation." For instance, flights over some islands were made on days when no turtles nested there, even though it was known from ground surveys that this did sometimes occur. The authors give >2500 as a preliminary estimate for hawksbills nesting annually in the whole area of east Arnhem Land. It may be noted that if mid-points of the various ranges given on the figure are taken, the number would exceed 4500.

Right: Estimates of the numbers of females per year nesting on 71 different islands in the northern Great Barrier Reef, Australia (Limpus 1997a). These estimates were also made from aerial surveys and are considered by Limpus (1997a) to be "a first approximation to the size of the northeastern Australian Eretmochelys imbricata nesting population." This author gives an overall estimate of several thousand nesting annually on the islands in the Torres Strait and northern Great Barrier Reef. It may be noted that if the mid-points of the various ranges on the figure are taken, and if > 500 is taken as 750 to match up with the range given for Arnhem Land for larger nesting aggregations, the number would exceed 7000.

numbers of females (more or less level) and the numbers of nests (decreasing) are not in close agreement. With different impressions from different indices, and the year to year fluctuations common at turtle beaches, this does seem to be a case requiring further information and additional years of monitoring (see also Dobbs et al 1999).

Unfortunately, biologists working on turtles do not always publish detailed accounts of their methods alongside reports on numbers of nests, making it hard to assess the potential for biases in surveys. Also, the exact dates when surveys were done can be important. For instance, although Jumby Bay in Antigua has been patrolled with exceptional thoroughness, this took place in the autumn months, the main nesting season, but there is some nesting outside this time. An extended nesting season might also affect the interpretation of the Tortuguero data for hawksbills, if the main surveying there was geared to the green turtle nesting which peaks in the summer months. Nevertheless, assuming the surveying was done in a similar way from year to year, the various studies outlined above can be used to provide indicators of trends. With the exception of Tortuguero, and probably Suriname, these indicators are level or pointing up. Of course upward trends may not be maintained in the future (and downward trends in other areas may not persist) but assessments of species status should be more forthright in providing the good as well as the bad news (see also Pritchard 1997; Godfrey 1997). There is definitely some good news in the present trends for hawksbills.

Trends in adult females are not the only point to consider when assessing survival outlook for a species. Distribution, numbers and possible threats are also important. The hawksbill is not a species with remnants restricted to just a few areas. According to information available on the World Conservation Monitoring Centre (WCMC) website in 1996, the distribution of hawksbills includes 122 areas. It has a pantropical distribution. In some places fairly high numbers of hawksbills remain. In Australia, it is estimated (Fig 17) that > 2500 females nest annually along the east coast of Arnhem Land (Limpus and Chatto 1998) and another several thousand in the northern Great Barrier Reef (Limpus 1997a). When the estimates for the individual nesting sites are plotted as a frequency distribution, and an overall number calculated from these,

as is done in Fig 17 here, then Arnhem Land hosts > 4500 and the northern Great Barrier Reef > 7000, combining to give 11,500 hawksbills annually for these two regions. Since the data for these regions are based on aerial surveys, one should not get too precise about the numbers, but a figure of 10,000/year would seem conservative. Since the females do not nest every year — in Arnhem Land the most common interseasonal nesting interval is 4 years — the total number of breeding females in these populations must be several times the number nesting annually. Again, to be conservative, let us only double the number nesting per year, to give some 20,000 mature females. This is for Arnhem Land and the northern Great Barrier Reef. These are probably the main breeding areas for hawksbills in Australia, but other areas there could well make some additional contributions; in Western Australia 1354 nesting hawksbills have been tagged (Prince 1998). Another way that gives a figure of about 20,000 breeding females for Australia is to start with the > 5000 estimated by Limpus (1997b), or the 6000-10,000 estimate by the same author (quoted in Meylan and Donnelly 1999), and multiply by 3.4 for the mean interseasonal nesting interval (Dobbs et al 1999).

Of course, it may always be objected that because of the long maturation periods, a crash could be round the corner; there may not be enough juveniles in the pipeline to adulthood. Without complete knowledge, this cannot be refuted. But, while admitting absence of omniscience, it should be noted that there are areas in Australia where juveniles are common. In Fog Bay, Northern Territory, Australia, juvenile hawksbills can be relatively easily studied because they are found in shallow water over an area of reef on which it is possible to walk at low tide The density of hawksbills here is estimated at an amazing 81 per sq km (Whiting and Guinea 1998). There are plenty of juveniles in this particular pipeline.

In the Caribbean, around Mona Island it has not been difficult to find juveniles for the research and monitoring taking place there (van Dam 1997). In the Dominican Republic, densities of immature hawksbills in a foraging area range from 6 to 97 per sq km (León and Diez 1999). In the Yucatán Peninsula, increasing numbers of juveniles have been noted in foraging sites (unpublished reports cited in Garduño-Andrade et al

1999). Finally, back to Cuba: there must have been many hawksbills somewhere to sustain a catch of 5000/year over more than 2 decades. Juveniles are reported as common in the shallow reefs of the Doce Leguas area (Carrillo et al 1999).

Circumglobal distribution in 122 areas, some trends in nestis laid level or going up, juveniles still commonly seen in a number of feeding grounds — dear reader, be honest, with yourself at least, does this add up to being on the brink of annihilation? But according to IUCN/SSC 1996 red listing (see WCMC 1996; Baillie and Groombridge 1996), the hawksbill is Critically Endangered. This category means "it is facing an extremely high risk of extinction in the wild in the immediate future" (IUCN 1994). How does IUCN reach this conclusion?

The Critically Endangered listing for hawksbills.

For the purposes of IUCN Red Lists, endangered and critically endangered are technical terms with defined meanings which may or may not correspond with how most people would use these words in ordinary language. We need then to look into the criteria IUCN uses to categorize species as Endangered or Critically Endangered. However, these criteria change from time to time. They were defined in 1968-70 (for reptiles see Honegger 1968) and revised in 1975 (see Honegger 1979); new criteria came in during 1994 (under which the hawksbill was listed in 1996), and currently there is discussion of further revisions.

Some of the past history about these definitions and the red listing of sea turtles has been covered elsewhere (Mrosovsky 1983). Here we stick with the present day criterion for Critically Endangered — with the reminder that IUCN is attempting to improve and refine its system for categorizing degrees of threat and that its definitions may change again.

As of today, there are various ways in which species can qualify as Critically Endangered (see Box 4). The ones that have been invoked for hawksbills are a decline of at least 80% in 10 years or 3 generations whichever is longer, and an expected decline of at least 80% in the next 10 years or 3 generations whichever is longer (WCMC 1996; Box

Box 4

from IUCN (1994) Red List categories

Critically Endangered (CR)

A taxon is Critically Endangered when it is facing an extremely high risk of extinction in the wild in the immediate future, as defined by any of the following criteria (A to E):

A. Population reduction in the form of either of the following:

1. An observed, estimated, inferred or suspected reduction of at least 80% over the last 10 years or three generations, whichever is the longer, based on (and specifying) any of the following:
   - (a) direct observation
   - (b) an index of abundance appropriate for the taxon
   - (c) a decline in area of occupancy, extent of occurrence and/or quality of habitat
   - (d) actual or potential levels of exploitation
   - (e) the effects of introduced taxa, hybridisation, pathogens, pollutants, competitors or parasites
2. A reduction of a least 80%, projected or suspected to be met within the next ten years or three generations, whichever is the longer, based on (and specifying) any of (b), (c), (d) or (e) above.

(Other criteria for Critically Endangered concern area of occurrence being less than 100 km², or total populations being estimated at less than 250 mature individuals. These have not been invoked for hawksbills and are not reproduced here).

Documentation.

The factors responsible for triggering the criteria, especially where inference and projection are used, should at least be logged by the evaluator, even if they cannot be included in published lists.

4). To make such listings objective and transparent, the IUCN 1994 categorization procedure also says that background information should be made available, especially when inference and projection are used (Box 4). But this background information was not supplied for hawksbills, and was not made available on request. It took well over 2 years before the justification of the listing became available (Meylan and Donnelly 1999). Use of the Critically Endangered category at CITES in 1997 without having promptly supplied the supporting documentation was strongly criticized (see Mrosovsky 1996, 1997b, 1998; see also Brackett 1997, Meylan 1998).

This long delay, plus the use in the justification of numerous papers published after the initial listing in 1996, as well as some others still in press when the justification finally appeared in 1999, make one wonder if the listing followed on from a careful consideration of a well marshalled and studied body of evidence, or whether the evidence was assembled as an afterthought to try to justify a decision already taken. Of course some of the recent papers contain information that might have been available in some other form previously.

Be that as it may, now that reasons for the listing have finally been given, it is appropriate to examine them. The review of information and opinions on different geographical regions leaves little doubt that in some areas hawksbills are gravely depleted and in urgent need of better stewardship. I doubt this has ever been disputed. But the question is whether as a species the hawksbill is critically endangered with extinction. The section on status justification in Meylan and Donnelly (1999) introduced the idea that because there is variation in the survival status among different populations of hawksbills, it is appropriate that "the status of the regional (= significant) population with the most imperiled survival outlook be applied to the entire species." There must be many species with some of their regional populations in a perilous state or being wiped out. If that is how the Red List categories are meant to be applied, huge numbers of species would be listed as Critically Endangered, probably mosquitoes even! The idea of taking the most imperiled population to determine the global status of the species comes from Bjorndal, a former chairperson of the IUCN Marine Turtle Specialist Group (MTSG). In a paper in 1999 she says that:

> By adopting this approach, we affirm that it is not acceptable to have any sea turtle species survive in only a limited area of its natural range. Sea turtles must occur throughout their natural ranges to ensure that they fulfill their ecological roles.

The phrase, "we affirm that it is not acceptable," is telling. It shows that what starts with an attempt to answer a question — is the hawksbill as a species Critically Endangered (i.e., in imminent danger of extinction, etc.) — is being turned into assertion about what is acceptable. The Red Lists are meant to provide a scientific assessment of survival status, not what is acceptable or not. I do not think that many who worked on the red listing process see these lists as implying particular actions, or as statements about what is acceptable, but rather as supplying objective summaries, and alerting people to best guesses as to the survival status of a species.

In contrast, the MTSG justification (Meylan and Donnelly 1999), although not entirely explicit on this point, appears to adopt Bjorndal's approach of taking the most imperiled population as a benchmark. It quotes this view with approval, and appears to accept it when it says it is difficult to tell which region has the poorest survival outlook for the hawksbill.

When the MTSG does address the question of the survival prospects of hawksbills as a species, this is what it says: "the species is not expected to become extinct in the foreseeable future." This is an extraordinary statement to find in a justification of the Critically Endangered listing because IUCN (1994) has defined this category as "facing an extremely high risk of extinction in the wild in the immediate future."

Reduce all this to its essentials and ponder:

1) The IUCN says Critically Endangered means facing an extremely high risk of extinction in the immediate future.
2) The hawksbill is listed as Critically Endangered.
3) The justification of that listing says the species is not expected to become extinct in the foreseeable future.

No wonder IUCN is losing credibility as a source of scientifically based assessment.

Given these evasions and inconsistencies, it is hard to take the MTSG justification of the hawksbill listing seriously. Nevertheless, as well as implying that the hawksbill is Critically Endangered because some of its populations may be in this state, it does also address the matter of 80% declines in the last 3 generations, or projected declines in the next 3 generations. These could perhaps constitute grounds for a Critically Endangered listing (Box 4).

Given that the importation of hawksbill shell into Japan has been drastically reduced (Section 1 above), and that nesting in a number of places is level or even increasing, the case for a projected 80% decline from the present situation seems tenuous. Habitat destruction is perhaps a way in which this could come about.

For past declines, those in the last 3 generations, the problem with species maturing slowly and living a long time is that adequate data simply are not there. As the justification recognizes, "few nest-monitoring projects have ever been carried out (Meylan 1999). This leads to weak population estimates and poor tracking of population changes throughout most of the range of the hawksbill." It is not surprising that the justification produces no figures supporting an 80% decline on a worldwide basis, that is, no estimate of the hawksbill population for 3 generations ago, compared to an estimate for 1999.

In certain regions, it does indeed appear likely that an 80% decline has occurred over the last 105 years (the value that is taken as 3 generations — a figure that is not very hard scientifically, and could be debated). But overall it remains impossible to know that in the species as a whole there have been such declines. For example, we have no adequate quantitative information about what size the Australian hawksbill populations may have been a hundred years ago. This is needed for assessing whether the species as a whole has declined by 80%, because the Australian population of hawksbills is currently one of the largest. Maybe hawksbills in Australia have hardly declined at all, thereby making it harder to reach a decline of 80% for the species as a whole. Maybe they have actually increased: it cannot be disproven.

There are also problems for other areas in demonstrating declines of 80%. For example, the MTSG justification says that "declines in hawksbill populations of 80% or even greater have been recorded during the last three generations of hawksbills (105 years) throughout the global range of the hawksbill." Malaysia is included in "areas in which declines of this magnitude in hawksbill populations have been recorded." But in the section on Malaysia, no numbers on % declines are given. The increases that have been occurring in the Sabah Turtle Islands are barely acknowledged: "This hawksbill population is also considered to be the only one in Southeast Asia that may be increasing in size, although Mortimer urged caution in interpreting the data because of incomplete record-keeping in early years of the program there...." It seems rather clear that hawksbills nesting on the Sabah Turtle Islands are increasing (Fig 2 here and legend; Limpus 1995). If incomplete record-keeping is to be used as an argument for downgrading the significance of the situation in Sabah, then that should apply equally to the even less adequate records we have for interpreting the data for many of the places where decreases are reported.

Madagascar is another of the areas in which, according to the MTSG justification, declines of 80% have been recorded during the past 105 years. But in the section on Madagascar, again one fails to find figures demonstrating such a decline. This is not surprising because, as Groombridge and Luxmoore (1989) have pointed out in their compilation of information on hawksbills, "no quantitative nesting data are available" for Madagascar. They also note that decreased figures for export of raw shell do not necessarily imply decreased availability of hawksbills. More shell might have been exported in the form of worked items. It is also possible that demand may have slackened at times.

Inadequate information on population trends should not be taken to imply complacency about the situation for turtles in Madagascar. Recent accounts indicate major problems with enforcement of legislation. Hawksbills are said to be becoming scarce, especially large ones (Rakotonirina and Cooke 1994). Madagascar is not an auspicious place for hawksbills, but the records are simply not there to show an 80% decline over the last 100 years.

The same is true of Indonesia. "The status of hawksbill populations in Indonesia is particularly difficult to evaluate because few census data exist and the extent of the habitat is vast (Meylan and Donnelly 1999)." Nesting of hawksbills in small numbers in widely dispersed areas makes estimates of their numbers less reliable than for green turtles (Schulz 1987; Groombridge and Luxmoore 1989). With these cautions in mind, Schulz (1987) estimated that 21,000 - 28,000 clutches a year were laid in Indonesia, but information on historical trends in numbers was not provided. Even if, as it appears, Schulz (1995 letter, cited in Meylan and Donnelly 1999) thought that declines of hawksbills in Indonesia may have been as great as 80% over the last 100 years, conjecture made in an unpublished unreviewed letter is not a basis on which to accept an 80% decline. In his letter Schulz says, "Since no long-term data are available, it is with great hesistance that I try to answer the question" — about an 80% decline. So everyone agrees that adequate information simply is not there. There are more than 13,000 islands in Indonesia, many of which have not felt the foot of a turtle biologist on their beaches. The scope of Schulz's (1987) study did not permit systematic counts of nests on turtle beaches; the information he compiled came mostly from interviews and records of licenced egg collecting. One difficulty was that different species of turtle were not always distinguished in such records. Therefore, guesses had to be made about the percentage of the eggs collected that came from hawksbills. Schulz (1987) repeatedly used terms such as "hazardous", "precarious" and "*very* rough approximations" to qualify the numbers he presented. For some areas that he was not able to visit at all, he relied on a 1984 report by Salm to the Government of Indonesia. I have not been able to obtain this report but have ascertained from Salm (pers. comm.) that he also did not have an opportunity to visit all the sites discussed, and sometimes had to fall back on collecting information from different sources of varying reliability.

For a few parts of Indonesia there is some information from more recent surveys. Although doubtless the best possible in the circumstances, such surveys have been inadequate for quantifying trends. For example, Suganuma et al (1999) produced estimates of hawksbill nesting for 15 beaches in the Java Sea. Eleven out of these were visited once only, in

one season. Large fluctuations in nesting numbers from year to year is a well-known fact of sea turtle biology. Did the surveys take place in a good or a bad year? Also, many of these estimates were based on counts of body pits made by turtles during nesting, not of tracks or turtles themselves. Despite attempts to check on this method, this paper does not adequately address the matter of distinguishing a partly filled green turtle pit from that of a hawksbill, the variable persistence of such pits, or the possibility of missing them altogether in the underbrush. Because of such difficulties, and the lack of adequate monitoring in previous years, the estimated 72% decline of nests from the 1980s to 1995-97 is not a figure solid enough to argue about. It might easily have been 80%, or less than 72%.

For some regions covered in the MTSG justification the link between the numbers given and the actual facts is even more tenuous than rounded up counts of body pits. The figures for Chiriquí beach, Panama, are based on unpublished interviews with fishermen, made in the 1980s about the situation in the 1950s. Of course, local knowledge can be valuable. In this instance, unfortunately, how the questions were structured, how many people were asked, and how the sample was chosen are not described. Perhaps memory encodes particular kinds of events better. As noted by Bury and Corn (1995) in an account of exaggerations about the former abundance of another reptile, the desert tortoise: "population sizes based on personal interviews can be easily biased toward reporting large populations or rare events, because people recollect outstanding events." That as many as 900 hawksbills may have nested on a single night in Panama is possible, but it is far from observed fact.

It is not disputed that large and worrying declines have occurred in Panama and elsewhere (see Regional red listing, below). It is argued that we should not try to squeeze numbers out of inadequate data sets in an attempt to meet the 80% decline figure in the IUCN listing criteria for Critically Endangered.

In summary then, the attempt to show that the species has declined by 80% in 3 generations fails for two reasons. First, even in particular regions, often such information as there is for the last 100 years does

not come from long-term monitoring, a limitation repeatedly mentioned in the MTSG justification. Second, even if one were to accept 80% declines for a number of regions or particular beaches, it would still not be possible to say the species as a whole has declined by this amount because of the scant information about other regions, especially for some of the larger populations. So making a scientifically sound case for an 80% decline in the last 3 generations becomes an impossible task. But the MTSG found a way to avoid this problem.

The criteria for an 80% decline do not require this decline to be *observed*. It is sufficient if there is an *estimated, inferred* or even *suspected* reduction of this amount. If then someone suspects such a decline to have occurred, even if that suspicion is based in part on shaky evidence,

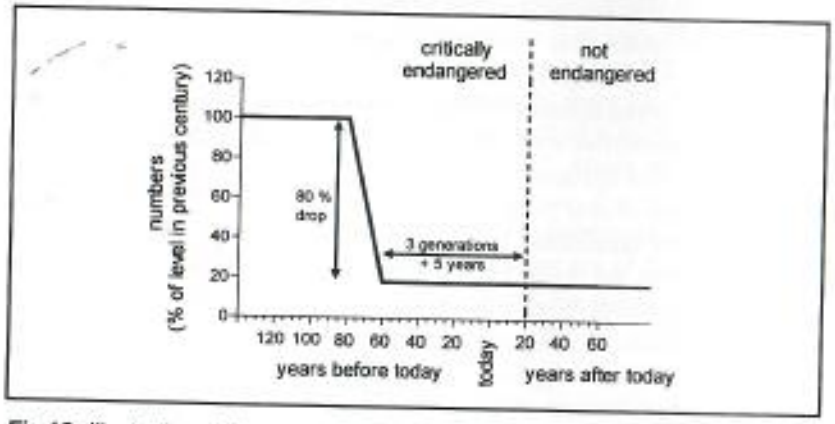

Fig 18. *Illustration of the problems with the IUCN Critically Endangered criterion part A when applied to species with long maturation times. In this hypothetical example, the time between generations is 25 years. It is assumed that no factors other than an 80% drop in numbers within 3 generations of today qualifies the species for any category of threat. For the sake of simplicity, the end of the 80% drop is taken as the starting point for the 3 generations (+ 5 years) wait that is needed before the species no longer qualifies as Critically Endangered. The vertical dotted line marks the time when the species changes from being Critically Endangered to not being Endangered at all. This can happen without there being any change in the numbers of the species, or changes in trends in those numbers at that time!*

then that qualifies, technically, as meeting the criteria, because just as the data are not there to prove a decline of 80% in a scientifically reputable way, so there are not data there to disprove such a decline. This means that with a long-lived species, when we are dealing with periods of 100 years or so, the whole matter of declines can move out of the realm of solid science into that of suspicion, inference. With respect to possible 80% declines, it would be more scientific, a better reflection of the facts, to place such species in the Data Deficient category (see IUCN 1994).

Instead, the justification opts for Critically Endangered on the basis of inferences and suspicions about such declines, not on the basis of adequate data which are not available. Inferences and suspicions allow the IUCN to say that, in terms of its definitions, a species is Critically Endangered, even though that designation is at variance with what a less technical and common sense assessment would be. Such contradictions raise some basic questions about the use of endangered labels.

Consider a species with a long time between generations. For the purposes of illustration, let's take an example with 25 years. Three generations then adds up to 75 years. Suppose there had been a properly documented 80% decline in the numbers of that species just over 60 years ago. As this is within 3 generations, this would qualify the species as Critically Endangered. Even if after the 80% decline there had been no further appreciable changes, or even perhaps some increases in some areas, this species would still qualify as Critically Endangered. But suppose then that nothing happens over the next 15 years, and the numbers remain at the level they reached after the 80% decline. At that time, the decline which today took place 60 years ago, would become more than 3 generations (75 years) in the past, and therefore would no longer be sufficient to meet the Critically Endangered criterion (Fig 18). A further 5 years is required before the transfer to the lower category of threat can actually be made (IUCN 1994). Presumably this is built into the system to avoid frequent changes back and forth when numbers fluctuate around a level permitting change in categories.

The actual situation for the species might be very similar today and 20 (15 + 5) years hence, but if the original listing had been made solely on the basis of declines in numbers, then the species could go from being Critically Endangered to not being Endangered at all! Theoretically, this could happen within a year, without anything having changed at that time (Fig 18)! In this example, from a common sense perspective, there has been a drop in numbers, and then stabilization. But with the IUCN criteria the way they are at present, despite this stabilization, or even if there were some increase, the species can still be considered to be Critically Endangered, "facing an extremely high risk of extinction in the wild in the immediate future". So the common sense use of the words critically endangered, and the use made of these terms by IUCN diverge.

Perhaps, a case could be made for thinking that IUCN usage of Critically Endangered, defined according to specified criteria (Box 4), and applied by experts to particular cases, is preferable to what ordinary people might understand by these words. But it is not so simple as that, because labels such as Critically Endangered can then get used, in mobilizing public opinion, fund raising, and debates such as those at CITES. In such cases the public will be misled by the words Critically Endangered about the actual situation of the species — as they have by the publicity about whales.

The labelling of the survival prospects of species is in a primitive state compared to the labelling of foods. In the case of foods, the ingredients should be on the packet in small print, so that if it is claimed that the product is low fat, one can see what is meant by low. Often with labels put on the survival prospects of species, there is no small print for the reader given in pamphlets. Even when requested, in the case of the hawksbill, this information was not forthcoming (Mrosovsky 1996, 1998). And when it did finally become available (Meylan and Donnelly 1999) it turned out that a species can be classified as Critically Endangered ("facing an extremely high risk of extinction in the wild in the immediate future") when it is widely distributed around the world, with nesting increasing in some areas.

If the technical usage of a term diverges too much from how ordinary people would understand it, then use of that term in debates and

education and fund raising, and at international conferences, becomes a questionable procedure. If definitions are set up right, a patch of sand can make a verdant field into a desert, a few clouds an overcast sky. To say the hawksbill is in immediate danger of extinction is hardly more ridiculous. In short, even if it could be shown that hawksbills meet the present day IUCN criteria for classification as Critically Endangered, the actual situation of this species must call into doubt the use of those criteria. The same conclusion has been reached by comparing the actual situation of 6 long-lived reptile species with their IUCN Red List categorizations. The latter fail to reflect the risk of extinction in a reasonably consistent way. The simple question of whether there are any populations of a species that can be considered secure is not even included in the IUCN listing process (Webb and Carrillo, in press).

The problem of discrepancies between the IUCN Red List category of threat and the actual situation of a species has been recognized in a forthright manner by those responsible for collating information on the red listing of birds. In 1994, 168 avian species were listed as Critically Endangered (Collar et al 1994). It was also made explicit what was meant by being in "immediate" danger of extinction: a 50% chance of extinction in 5 years. Even then in 1994 it was obvious to Collar et al that it was unlikely that 84 species would go extinct in 5 years. Now, in 1999, it is even more evident. Two points emerge from this. First, immediate means something in the general order of what an ordinary person might understand by this word. It does not refer to hundreds of years which might be considered immediate in terms of some vast geological and evolutionary time scale of millions of years. Second, with respect to Critically Endangered, "there is a condition which satisfies a criterion for this category which does not truly reflect a 50% chance of extinction in five years" (Collar et al 1994). Therefore, putting these points together, the use of the Critically Endangered listing with birds has ended up, undeliberately, in a situation that could confuse the public. More species were listed as Critically Endangered than could be expected to go extinct in 5 years. That subsequent to the Collar et al (1994) book on threatened birds the definition of immediate was set at 10 rather than 5 years (IUCN 1994) is unlikely to eliminate this problem.

The IUCN Crocodile Specialist Group (CSG) have made the same point, and produced a vivid analogy to illustrate the problem, the use of dichotomous keys to identify an unknown specimen to a particular species:

> If after following the key you conclude that you are holding a green tree frog, but the organism in your hand is brown, warty, and has the definitive characteristics of a toad, it is obvious[ly] it is not the organism (category) reached via the key (criteria). This is important information and it happens commonly when developing keys. Either the key is wrong or it has ambiguities in it that need correcting. In the final analysis, you do need a description or illustration of the frog to make sure you reach the right answer, and to ensure the key is steadily improved. We found that thoughtless application of the IUCN criteria, without any consideration of whether the final "risk of extinction" is consistent with some narrative description, can lead to evaluations of extinction risk that are simply not justifiable. (Messel 1998).

The CSG also pointed to the inadequacy of the present red listing criteria for species with long generation times. More emphasis should be placed on current trends than on what happened 100 years ago. But there are some nostalgic individuals who look much further back than that in their assessments of listing.

Shifting baseline syndrome.

People tend to use conditions with which they are familiar in their own lifetimes as baselines against which to assess change. As a result baselines are continually being reset. This "shifting baseline syndrome" (Pauly 1995) can lead to a failure to notice how very great have been the long-term changes in habitats or abundance of animals. It has been suggested that with hawksbills the number of turtles that can still be seen today in certain places may lead to a failure to appreciate the extent to which this species is diminished (Bjorndal 1999; Meylan and Donnelly 1999).

Incontestably, it is valid to think about ecological change over spans of more than individual human lifetimes, and to consider what densities a particular species could attain. It would also seem incontestable that hawksbill turtles could in other circumstances be far more abundant than they are today. But to leave consideration of the predicament of the hawksbill, or any other species that may be subject to shifting baseline syndrome, at that would be a partial and inadequate characterization of the situation, because there is another baseline that has shifted, that of the number of people on this planet. The shift in this case has been up, from Adam and Eve in the garden of Eden to 6 billion people on the earth today. It has been said that baselines for measuring change have "drifted further and further away from a 'true' pre-man condition" (Sheppard 1995). The words "true" and "pre-man" here are revealing. They imply that the appropriate baseline is that of an era before the evolution of man. It depends though on what kind of truth one thinks appropriate for conservationists, truth about some golden era for nature in the past or truth about the conditions of the world today, the world in which remedial actions must actually take place. It will take time, if it can be done at all before major disasters, for population and poverty to fall to levels permitting more room for animals and nature. It is not evident that harking back to what may have been in the distant past, before people swarmed over this planet, or invoking the shifting baseline syndrome, is valuable in assessing the survival prospects of species today, especially of species inhabiting the coasts where so many people live. Contemporary trends may be more relevant to predicting the future of a species. That is what the Red Lists are about, assessing prospects, not former state (cf Webb and Carrillo, in press).

Comparison of Kemp's ridley and hawksbill.

A comparison of the survival prospects of the hawksbill with that of Kemp's ridley may be instructive. Kemp's ridleys nest only along a limited stretch of the Mexican coast, with a handful of females nesting in the adjacent USA. It is widely acknowledged as the most endangered of the sea turtles. It is listed as Critically Endangered by IUCN and as

Endangered by the USA (any nation can have its own classification system and legislation; in the USA Endangered is the highest category of threat). Intensive efforts on behalf of Kemp's ridley appear to be meeting with some success (Fig 3), although the relative contributions of beach protection, head-starting, turtle excluder devices, or other factors remain unclear.

In the USA there is a Recovery Plan for Kemp's ridley (US Fish and Wildlife Service and National Marine Fisheries Service 1992). One excellent feature of recovery plans in the USA is that explicit goals are given. In the case of Kemp's ridley, for instance, the plan states that when the population reaches 10,000 nesting females in a year, the species can be downgraded from Endangered to Threatened. It is not quite clear whether the 10,000 applies to the main nesting beach at Rancho Nuevo, or includes nesting further north along this coast. Such details will have to be resolved. Also some other conditions have to be in place, for instance, the use of turtle excluder devices on shrimping nets, for the change in status to be made. Nevertheless, what is notable is that for a species of sea turtle, a specific population size has been set; above this level downlisting it from the highest category of threat can be contemplated.

Now consider hawksbills in the light of this 10,000 recovery goal. It appears that there are already some 10,000 nesting annually in Australia alone (Fig 17). But while Kemp's ridleys nest only in one area, hawksbills nest in numerous places around the world, 122 areas by some counts (WCMC 1996). Even though the largest aggregations of hawksbills occur in Australia, their pantropical distribution places them in a *far* more favourable position than Kemp's ridley, which puts all its eggs into one regional basket. It is also notable that while the IUCN has placed the hawksbill in its highest category of threat for prospects of surviving anywhere in the world, in Australia it is considered only Vulnerable rather than Endangered in their Endangered Species Protection Act 1992 (Armstrong et al 1998).

Some may argue that the 10,000 nesters/year target for Kemp's ridley is inappropriate, too low. It would not be surprising if there were attempts to keep the public thinking that Kemp's is Endangered as long as

possible. Nevertheless, the majority opinion of the team responsible for the Kemp's Ridley Recovery Plan was that a 10,000 figure was reasonable. If there are already more than that number of hawksbills, is it for rational or for emotional reasons that they are placed by IUCN in their highest category of threat?

Regional red listing.

In southern parts of Africa, especially Botswana and Zimbabwe, elephants have become so numerous that they are destroying their own habitat. Within national parks and reserves, trees are uprooted and vegetation trampled, making such areas unsuitable for both elephants and other species. Outside the parks, crops are raided and people terrorized and sometimes killed — it is not so uncommon to read of people being killed by elephants. In other parts of Africa, Kenya and Tanzania in particular, the situation is quite different: elephant numbers are much reduced, so that illegal take can become a serious problem.

These regional differences are well known and are the root cause of the tremendous controversy over the moratorium on the international sale of ivory, and its subsequent relaxation (Bonner 1993; Sugg and Kreuter 1994). At the 1989 meeting of CITES in Lausanne, when the moratorium was voted in, IUCN proposed that a split listing be tried: no trade be allowed in products from elephants in east Africa, but some trade be allowed from southern parts of Africa. Such were the emotions and the political pressures prevailing in 1989 that this idea did not get far at the time. Eventually, at the 1997 meeting of CITES in Harare, it was officially recognized in the votes of the parties that the same rules should not be applied across the board to all regions with elephants. Trade, with limited quotas, and with various safeguards and checks, was to be allowed for some of the countries with healthy elephant populations.

The main support for the original ban came from nations without elephants (Sugg and Kreuter 1994). But a number of countries with people actually in contact with the elephants in their daily lives made the case that incentives for keeping elephants would be removed if

they did not have value; trading ivory and trophy hunting were major ways of giving value to elephants in countries whose citizens otherwise considered them unwanted and dangerous, economically and physically.

The compromise reached at CITES in 1997 is not a perfect solution. There still remains a possibility that some illegal products from East Africa will be laundered as legal exports, but the numerous regulations and limited quotas are also far from ideal for the southern nations. However, given the regional differences, it seems reasonable to search for a solution somewhere between a total ban and unrestricted trade. The middle ground reached is a recognition of the reality that the situation for elephants is different in different parts of their range.

The same is true for sea turtles, not just hawksbills, but sea turtles in general. On some beaches in Costa Rica and India, olive ridleys are so numerous that they dig up and destroy huge numbers of eggs from turtles that nested before. In contrast, in Suriname, olive ridleys are remnants of their former numbers. It would be pointless to stop the promising community-based managed harvest of eggs at Ostional, Costa Rica (see Campbell 1998) because of events in Suriname.

The abundance of hawksbill turtles also varies widely. Rather than either permitting unlimited trade or prohibiting all trade, thereby diminishing incentives for conservation in cash-starved countries, the appropriate course is to devise ways of incorporating the reality of the situation, the regional differences in status, into some overall compromise agreement.

Some of the pressure for a Critically Endangered listing for hawksbills comes from a genuine wish to afford protection to the most endangered populations. Just as Carr wished to have Caribbean green turtles considered endangered with extinction when he knew this was not really the case, so there are those who think the effect of saying a species is Critically Endangered is more important than whether that is true or not. There is also a darker side to the pressures for having animals considered as endangered as possible, the boost that this can give to fund raising by preservationist organizations (Bonner 1993).

Once the public believes that a species is close to extinction, it becomes harder to try anything other than complete protection, even in areas

where it may be holding its own. People assume that the only course of action is non-consumptive use. Brundtland's (1997) plea for decisions to be based on the best available scientific evidence is swept aside. People who question whether declines have occurred, as have Bury and Corn (1995) with desert tortoises, are advised not to publish their conclusions. Young people become intimidated and dare not speak up, as has happened within the turtle community. Open debate is stifled, emotion drives out the facts.

There is, however, another way of going about it. The IUCN red listing system can be applied on a regional basis. Particular populations of a species may be Critically Endangered but the species as a whole may not qualify for this category of threat. With hawksbill turtles, in Indonesia for example, eggs are taken from nearly every nest that can be found; also traders say that the size of hawksbill scutes has declined (Schulz 1987). Sea turtles in Indonesia are unmanaged, unmonitored, and overexploited; a case for an 80% projected decline in hawksbills might well be justified. Whatever the appropriate regional red listing category for this species might be, it is almost surely worse than for the species as a whole.

To ameliorate this situation, there is much that could be tried without bringing in the worldwide status of hawksbills at all:

1) Stress how valuable resources are being destroyed. For Asia the example of Terengganu (Fig 5) can be held up again and again. Compare the number of leatherbacks there now to 30 years ago. Calculate how many meals of turtle eggs have been lost as a result of the decline. Appeal to people's self interest.

2) Explain the biology of sea turtles with simple diagrams (e.g., Mortimer 1995) showing that if recruitment stops, it may take many years before adults disappear; explain nest site fixity, how turtles moving in from other places is too rare an event to compensate for overharvesting.

3) Point to other countries that have thriving wildlife resources and are able to profit by them. Calculate how many people have benefitted from egg harvest over the years in Suriname, or at Ostional in Costa

Rica. Contrast the controlled harvests from some of the monitored populations of crocodiles and alligators with the overharvested and uncontrolled take of turtles in Indonesia.

4) Work toward situations where local communities have a stake in preservation of resources in their areas. Rather than trying to impose a top-down solution from without, on the basis that some international body has said that hawksbills are Critically Endangered, work with facts that everyone can agree on, and with the people who are actually in contact with the turtles, and may have good reasons for taking them to feed their families.

There are several advantages of not taking a procrustean approach to red listing. First, a strong preservationist strategy can be pursued in some areas and sustainable utilization tried in others without creating clashes between the biological and cultural differences in different regions with turtles. Second, people within the sea turtle community can cooperate more on conservation initiatives where the hawksbill is worse off, or where there is agreement about the situation, rather than expending energy and time on battles over the status of the species as a whole. Third, with species such as the African elephant and the hawksbill turtle, regional differences in survival outlook, without those species as a whole being in immediate danger of extinction, is closest to the truth — as is recognized for the hawksbill by the MTSG when they say that it is not expected to become extinct in the foreseeable future (Meylan and Donnelly 1999). Decisions about conservation of such species should be based on the most accurate and scientific characterizations possible of their survival status. Those in the upper echelons of IUCN must decide what they want to promote in their Red List descriptions of sea turtles: particular conservation strategies and fund-raising fantasies or scientific truth.

5

100% safeguards and parks

Illegal take of turtles.

Few conservation measures, if any, are likely to be 100% certain or effective. Setting up of parks and reserves is a case in point. If it were required that these sprung into being in a perfect protected state, few would exist. The designation of a park may be the start of a process that takes a long time to become effective.

There are currently, or have been, problems with enforcement in many parts of the world where sea turtles are meant to be protected: Venezuela, Peru, Greece, Puerto Rico, Sri Lanka, Indonesia, Nicaragua, Suriname, Costa Rica, Malaysia, Madagascar, the Seychelles, and Mexico to name a few. In Puerto Rico, "despite local and federal laws protecting these sea turtles, they are actually heavily hunted by means of either nets or spearguns" (Matos 1986). Also in Puerto Rico, few officials are willing to endure life on Mona Island, a remote nesting ground for hawksbills. Those that do undertake the job of warden tend to become dependent on fisherman for water, gas and companionship, and turn a blind eye to poaching (Olson 1985). The annual illegal take of 1000 hawksbills in Puerto Rico and the US Virgin Islands (IUCN 1997) has already been mentioned in Section 3. In Suriname, in the Galibi Nature Reserve, 40% of olive ridley nests were collected at the peak of the 1995 season; lack of staff and of field stations to house them were compounded by disagreements between local inhabitants and government authorities (Hoekert et al 1996). In Venezuela, there is poaching at the National Park of Laguna de la Restinga (Trujillo et al 1998). In Peru, such laws as there are protecting sea turtles have rarely

been observed by fishermen or enforced by the authorities (Aranda 1989). In Nicaragua, closed seasons are disregarded (Lagueux 1998). In Madagascar, enforcement of laws is inadequate; turtles below the legal size appear in the markets (Rakotonirina and Cooke 1994). In the Seychelles, "hawksbills are still being killed in large numbers in the Marine Parks" (Mortimer 1998). In the Yala National Park, Sri Lanka, the laws protecting turtles are simply not effective because they are not being properly enforced (Hewavisenthi 1990). In Greece, in 1989 it was said that "legislation remains on paper alone and so far has not been implemented" (Veniselos 1989); adequate enforcement is still not in place (Margaritoulis in press). In Costa Rica, in the Gandoca National Wildlife Reserve, 15% of the leatherback nests are taken illegally (Chacon et al 1996). In Malaysia, within the leatherback sanctuary at Rantau Abang, "turtle watching rules are more frequently flouted than followed" because of large crowds and lack of enforcement personnel (Chan and Liew 1996a). In the Marine National Park of the Seribu Islands, Indonesia, locals collect many of the turtle eggs laid (Suganuma et al 1999). In the eastern Caribbean, most islands have legislation protecting female turtles on their beaches. Unfortunately, even where this legislation exists, it is rarely enforced (Meylan 1984). In Mexico, armed marines are often employed to protect turtle beaches. But in the latter part of 1996, the insurrection of the Popular Revolutionary Army resulted in withdrawal of marines from beaches in Oaxaca. Word of this spread rapidly; within hours, according to some accounts, many people from nearby villages descended onto the beaches to take eggs. The event was widely reported in the North American press (e.g. Moore 1996). But it is not clear whether any lessons have been learnt. This kind of event was to be expected (Mrosovsky 1979): armed guards with automatic weapons is not robust conservation, it is fragile conservation. As Alvarado and Figueroa (1989) have written, based on their experiences further north in Mexico with the green turtle, "sea turtle poaching will continue as long as regional socio-economic conditions are not included in the formulation of conservation strategies". Symbolic legislative acts are inadequate. Or, more generally, as Murphree (1998) has said, "any regulatory system which relies primarily on negative incentives is — in the long run — in trouble. Enforcement

costs are high and the legitimacy of the system in the eyes of the enforced is called into question. History shows that such systems are unstable...."

Since these various reports of illegal take of turtles were made, some of these situations of course may have changed for the better — or for the worse. Even in national parks that have been established for a number of years there can be problems with enforcement. Tortuguero National Park in Costa Rica includes the beach where Archie Carr did his classic work. It might be hoped that this would be a model programme, but there have been reccurring problems with illegal harvests. More than 150 green turtles were taken on two nights alone in 1997 (Opay 1998). For the whole 1997 season more than 1600 green turtles are thought to have been taken illegally (Troëng 1998). The same author gives an estimate of >1700 in another place (Troëng 1997), adding that this is conservative because traces of turtles and people near low tide often get washed away before being seen.

Illegal harvest has also affected leatherbacks at Tortuguero: it was estimated that in 1990, 25% of the leatherback eggs there were taken, and in 1991, 11.3% (Campbell et al 1996). In 1977, poaching of green turtle eggs was not considered to be a major problem; nevertheless, estimates of 2.1-6.6% of clutches being lost in this way were given (Fowler 1979). The newsletter of the Caribbean Conservation Corporation (Anon 1997b) thought poaching had escalated at Tortuguero in 1996; insufficient money to hire park rangers was the problem.

Paying for enforcement; rhinos.

It is not surprising that money and enforcement are related. This relationship has been documented quantitatively for rhinos and elephants in Africa (Fig 19; Leader-Williams and Albon 1988). For black rhinos, in the 1980s, $US230/km/year for enforcement was needed simply to hold numbers level. Most countries in Africa spent below the maintenance level. The figure must surely be higher than $230 now, but presumably the same general relationship holds.

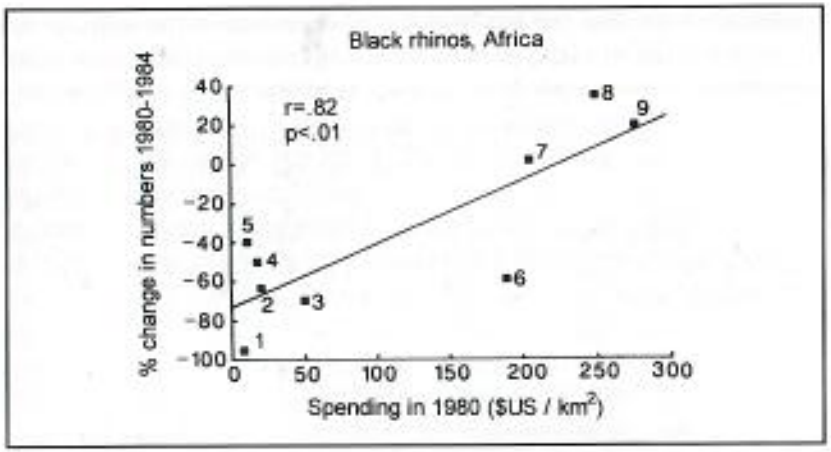

Fig 19. Relationship between change in black rhino numbers and spending on conservation areas in nine African countries. 1 = Central African Republic, 2 = Tanzania, 3 = Somalia, 4 = Mozambique, 5 = Zambia, 6 = Kenya, 7 = South Africa, 8 = Namibia, 9 = Zimbabwe (from Leader-Williams and Albon 1988).

Despite defects and difficulties, parks are generally considered to make important contributions to conservation. But when it comes to conservation-through-use projects for sea turtles, some of those debating the issue demand instant perfection and 100% safeguards. One might have thought, if lack of money is an important constraint in enforcement, that people concerned with turtle conservation would be more open-minded about schemes that propose to pay for protection through revenues derived from the regulated use of the animals in question.

Again the example of rhinos is telling. In South Africa, between 1962 and 1996, 3874 white rhinos had been distributed by the national parks (Hughes 1997). Initially many were given away or sold at subsidized prices, but now they are sold at as high a price as possible, by auction. Some go to commercial game reserves. Clients then pay to hunt rhinos in these areas. Currently the fee is in the order of $US30,000 ; additional money enters the economy for preparation of trophies and other services.

However unenthusiastic one may be about the idea of putting a bullet through a rhino, it should be recognized that this system creates a flow of money from the hunters to the commercial reserves and then through the auctions to the national parks (Fig 20). Some of that income to the national parks is used in these hard financial times to pay for enforcement, to keep the money spent per km per year above the level needed to maintain rhino numbers. Does this system achieve the desired results? How is South Africa doing in conservation of rhinos compared to other countries?

Fig 20. Essentials of conservation through use of white rhinos in South Africa.

More than 90% of all white rhinos in Africa are now in South Africa (Fig 21). This is not because they started with more animals. A hundred years ago, there were just 14 white rhinos remaining in this country according to a ranger's report in 1898 (Hughes 1997). Moreover, with the present system, rhinos in South Africa are not just confined to national parks but are being re-introduced to other areas in the country. Is it simply irrelevant to this state of affairs that South Africa has given its rhinos an economic value? CITES recognizes this system as valid, and issues permits, with certain conditions and safeguards applying.

Of course risks in any course of action should be considered. A powerful green lobby will ensure that these are not neglected in the case of hawksbills, and this is as it should be. Dialectic and challenges are good. Governments without effective opposition can become sloppy and corrupt. If, as I believe will be the case, sustainable use of wildlife becomes increasingly effective and important in conservation, groups with different views would still have an extremely important role to play.

Not all sustainable use approaches promote conservation and biodiversity. It is a matter of understanding the conditions under which such approaches are valuable and effective (Freese 1997). But request for 100% certainty is ridiculous, an unrealistic debating tactic. It is more important to consider whether particular conservation measures have a chance of improving the situation and are likely to lead to benefits.

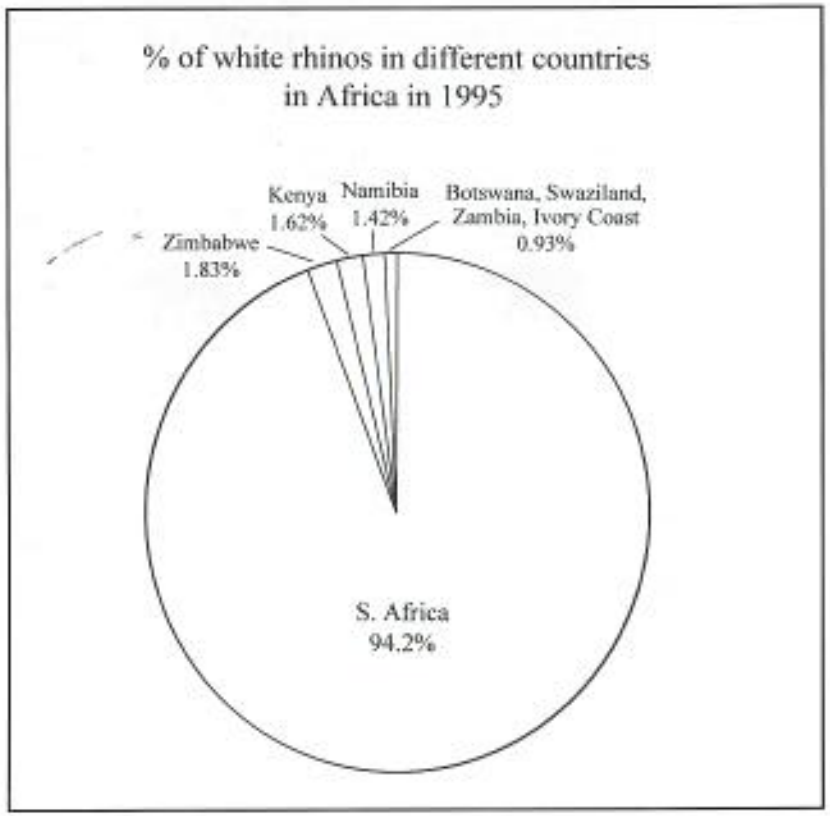

Fig 21. *Percentage of white rhinos in different countries in Africa, based on a total of 7532. The higher number in South Africa cannot be attributed to there being more there to start with, because a century ago, in 1896, there were only 14 white rhinos in South Africa (Hughes 1997).*

6

Possible benefits of accepting Cuban proposals

People stress the possible negative consequences of regulated trade, such as creating a conduit for laundered shells. They raise the spectre of opening floodgates of international trade (Meylan 1998). They should also consider the possible benefits.

Other species; hutias.

When an area receives protection and attention because it contains a special "flagship" species, other less well advertised species in that habitat may also benefit. Consider the case of hutias (family Capromyidae). These are mammals, about the size of cat, and they occur only in the West Indies; they have a long gestation, and no obvious mammalian predators, other than man — they are highly palatable. Some species are only found on small islands and so are especially vulnerable to being taken by passing fishermen (Nowak 1991), it being difficult and expensive to organize effective enforcement on remote islands. Legal protection has not been a guarantee in the past in Cuba (Oliver 1977). It may well be that as endemic island species, with slow rates of reproduction, and a distribution restricted to the West Indies, the hutias are more likely to become extinct than are the pantropical hawksbill sea turtles.

However, on some islands in Doce Leguas, Cuba, hutias appear to be still abundant at present, although they have not received adequate study. If reserves to protect sea turtles were set up with some

infrastructure and money for enforcement, the presence of wardens could provide some protection for the hutias. It would, of course, not be 100% protection, the protectors might lapse into putting some hutias into the cooking pot, but at least it should bring more biologists to the area, and some monitoring would be possible.

Moreover, if keeping this area in a more or less natural state, as a nesting area for hawksbills, were to generate income and foreign currency, it would put the Ministry of Fisheries in a stronger position to ward off development. In the Doce Leguas islands, in the Archipelago de los Jardines de la Reina (the Archipelago of the Gardens of the Queen) — an attractive name for a brochure — one can easily imagine how exclusive resorts for fishing and diving, with their own airstrips, could spring up. One could imagine too that the vegetation would be changed, with more acceptable flowering shrubs planted where there was wilderness, with the sweeping of twigs, leaves and seaweed off the beaches so that the tender tootsies of tourists are not inconvenienced, and the spraying of chemicals to keep down insects, and all the kinds of interventions that one can see elsewhere in the Caribbean. This applies of course to nesting areas elsewhere in Cuba. The alternatives to the Cuban turtle proposal need to be considered. A chelonocentric preservationist approach may be fiscally inadequate to resist the pressures to use such habitat for other, higher income generating activities, or to prevent neglect of these areas and the turtles in them.

Incidental catch.

Around Cuba, in fisheries for other species, stingrays for example, there is some incidental catch of hawksbill turtles. Studies are being initiated (CCP 1997), but no hard data are yet available. Numbers in the order of 100-200 hawksbills during the nesting season have been mentioned (Moncada 1998). For a country with so many islands, and so much territorial water, these figures seem low. Whatever the case is now, it is likely that, as human populations expand, fishing around Cuba will also expand. Incidental catch of 500 turtles is easily imaginable. That would be the same as the present harvest. Given the extensive areas of shallow

water around Cuba and the importance of fishing for its economy, incidental catch may well in the long run prove to be a larger source of mortality in this area than a small harvest. If hawksbills have a recognized value to the Cuban economy, incidental catch will receive more attention, initially leading to better monitoring, and then to remedial measures. If turtles have only modest commercial value, mainly stemming from their meat for local consumption, less attention will be paid to incidental catch. Beyond that, resources will be much harder to obtain for monitoring turtle populations, for research on migratory patterns, habitat preferences and diet, surveys of nesting beaches (some in isolated areas), record keeping, and the whole turtle programme.

Enforcement.

The decisions at CITES in 1997 did not automatically result in any fewer hawksbills being taken in Cuba. If anything, it seems likely that the reverse will occur. This is because the Cubans are already taking hawksbills for the meat, to eat themselves. In addition to the official quota, it would seem inconceivable that an illegal harvest is absent. I am not aware of any estimates of the numbers of hawksbills taken illegally by Cubans, but it could be considerable — as it is elsewhere in the Caribbean. In an impoverished country there is little reason to expect this to stop, especially if resources for enforcement become scarcer.

What the CITES decision means is that the shells of the quota of 500 turtles that are already being killed for their meat will go largely to waste. If this shell could be sold, some of the proceeds could go towards enforcement, improved monitoring, reduction of incidental catch, and all the ingredients of an active management programme.

But if Cuba cannot earn money, and if its biologists believe on the basis of past catch records, and other information, that a catch of 5000 is sustainable, what incentive remains to keep the quota at 500? In the long run, whether the quota is officially raised or not will probably be immaterial. The number of turtles taken will go up because they are a source of food, and funds for enforcing low catches will not seem to be pressing to the government — and CITES will not be able to do anything about it.

On the other hand, with quotas sanctioned under CITES there comes the obligation to permit site visits and to provide reports. International scrutiny is facilitated and there is an incentive to stay within the proposed (500) quota, because CITES has the option to reverse the decisions and take other actions if there are significant or repeated irregularities. With quotas being set by the parties to CITES, other countries have far more leverage than they do in the present situation, in which Cuba can pretty well do what it likes with turtles in its waters.

The example of crocodiles.

Among the more common crocodilian species are: the Nile crocodile (*Crocodylus niloticus*), the saltwater crocodile (*C. porosus*), the New Guinea crocodile (*C. novaeguineae*), the American alligator (*Alligator mississippiensis*), and the spectacled caiman (*Caiman crocodilus*). These are the main commercial species with harvests from wildstock occurring. Other less common species can be traded from captive breeding operations registered with CITES: the Philippine crocodile (*C. mindorensis*), the Chinese alligator (*A. sinensis)*, the Siamese crocodile (*C. siamensis*), and the American crocodile (*C. acutus*). No trade is permitted in some other species: the Orinoco crocodile (*C. intermedius*), and the false gharial *(Tomistoma schlegelii*), for example. Nevertheless, some of the rare species benefit from trade in the common species. Here are some recent examples, based mostly on information provided by the Executive Officer of the IUCN Crocodile Specialist Group (CSG) (Ross pers. comm.).

Commercial farms in Cambodia and in Thailand have supported surveys of Siamese crocodiles. A registered crocodile farm in Mexico has contributed funds to help graduate students with studies of American crocodiles.

The Japanese government has provided considerable funds, with some matching funds from the Japanese Leather Tanners and the Philippines Government, for the operation of a crocodile farming institute in the Philippines. The greatly depleted Philippine crocodile is likely to benefit.

Farms in Papua New Guinea have made donations to the National Environment Ministry for computers, and for training of personnel abroad. The Singapore Reptile Skin Industries are supporting CITES involvement with a programme for the Chinese alligator, a species that is truly on the brink of extinction.

The Japanese Leather Industries Association has given $US10,000 for surveys of false gharials in Indonesia. In Thailand, farms are raising this species in captivity with the goal of releasing them into the wild. A consortium of these farms have funded related field work. This work should provide guidance in picking suitable release sites. In Colombia also, crocodilians are being raised by commercial enterprises for eventual release into the wild; the government has the rights to acquire the offspring of Orinoco crocodiles and of black caimans (*Melanosuchus niger*) from farms, and then release them.

Attention is by no means confined to the rarer species; efforts have also been made to learn more about the distribution and numbers of species such as the saltwater and New Guinea crocodile that are not in danger of extinction on a worldwide basis, but may be depleted in some places. The Japanese leather industry has supported work on these species in the Solomon Islands, Vanuatu and Papua New Guinea.

These are recent examples only. Over a number of years much of the funding for the operation of the CSG, about $US65,000/year, has come from industry (Brazaitis et al 1998). In all, hundreds of thousands of dollars have been provided by the crocodile industry for conservation (Ross pers. comm.). This flow of money from industry to conservation has come with the minimum of overheads; there has been no need to hire special fundraisers, or take out full page advertisements in newspapers.

Of course, some of these activities benefit commercial enterprises. Doubtless they have this in mind, but that does not negate the benefits to the species in question. For example, in order to manage crocodiles in places such as Vanuatu and Papua New Guinea, it is necessary to have surveys telling one how many there are and where they are. In the long run the interests of businessmen and conservationists are congruent: both want there to be plenty of crocodiles.

If the parties to CITES had insisted on 100% safeguards, perfect knowledge, and absolute guarantees for crocodile farms and ranches, much of this would have been impossible. Some of the early proposals to CITES for quotas for crocodile products were pathetically thin scientifically, and deficient in many other respects. But they were judged to be pointed in the right direction, an improvement on what went before. Treating crocodiles as a valuable resource, to be managed, was thought preferable to treating them as vermin. It was implicitly realized that "the good cannot be held hostage to the perfect" (Bailey 1995).

Even now, conservation through utilization of crocodilians has much room for improvement. For example, in Venezuela, more caiman are sometimes killed than the number specified in quotas because hunters throw out skins from smaller animals when larger more valuable indiyiduals become available. And the methods of setting quotas and providing incentives to landowners to protect caiman need adjusting (Thorbjarnarson and Velasco 1999). Some relatively constructive criticism can be found in the newsletter of the CSG. In a recent issue of the Scientific American, however, there is a strongly worded attack on trade in caimans under CITES (Brazaitis et al 1998). This article covers points typically touched on in such debates. It invokes the former abundance of crocodiles encountered by travellers in Brazil in the last century, who wrote of black caimans "carpeting the banks of the Amazon," but it does not mention the number of people in Brazil at present, or their economic circumstances. The main concern raised is that of enforcement:

> Many conservationists see commercial farming and ranching of crocodilians as providing cash that will somehow be redirected into conservation. But they seem to believe countries with poor histories of enforcing wildlife laws will become completely law-abiding overnight. (Brazaitis et al 1998).

Criticizing crocodile utilization because enforcement cannot be *completely* effective, *overnight*, is reminiscent of the types of demand for 100% safeguards and instant perfection made by some preservationists about trade in sea turtle products. In fact, I assert, few conservationists have illusions about the likelihood of citizenry suddenly

respecting laws, be those laws about trade or about reserves. But some conservationists do think that there may be advantages of having utilization, which is probably unstoppable in remote places with impoverished rural communities, take place in a regulated way as much as possible and under CITES. Imperfect as that is, it permits some external influence on the situation. International standards and obligations can help government agencies within a country compete for resources.

Another concern about trade in wildlife, common to crocodiles and turtles, is that of market stimulation versus market saturation. Brazaitis et al (1998) say that "once a prohibited species is put into trade, it instantly generates a new market." This also has been one of the main fears about permitting any trade in sea turtle products. But both for sea turtles and for crocodilians, there is, and long has been, a market for these species, whether legal or illegal. The question is whether any expansion of markets, if this occurs, can be safely supplied. With crocodiles and alligators it would be hard to make the case that legal trade has nourished illegal trade. According to Thorbjarnarson (1999), "all evidence points to a significant decline in illegal Caiman trade over the last 10 years."

Ironically, one of the problems with conservation of crocodilians through farming and ranching is the current depression in prices, arising from the combination of abundant supplies and economic downturns (Thorbjarnarson 1999). At the moment the fear of some of those knowledgeable about the situation is not that an explosion of new markets for leather goods will result in a *poaching* orgy. It is more that a lack of adequate markets for crocodile products will diminish the demand for these species and their *habitat* (Box 1). Culling of crocodiles and alligators is far from the only way to use wetlands. However, these animals can provide a welcome additional source of income, as do the caimans for the cattle ranchers in Venezuela. If regulated harvests of other species such as capybaras, anacondas and tegu lizards were added, the combination of these activities and the people involved might add up to a significant constituency for habitat protection (Thorbjarnarson and Velasco 1999). More generally, maintaining the

value of crocodilians is important if the pressure to turn their habitat into rice paddies or use it in some other way is to be resisted. As with so many species, loss of habitat, not poaching, is the ultimate threat. This is exemplified in extreme form by the predicament of the Chinese alligator. Captive stocks exist but there are few natural places left to which they can be re-introduced.

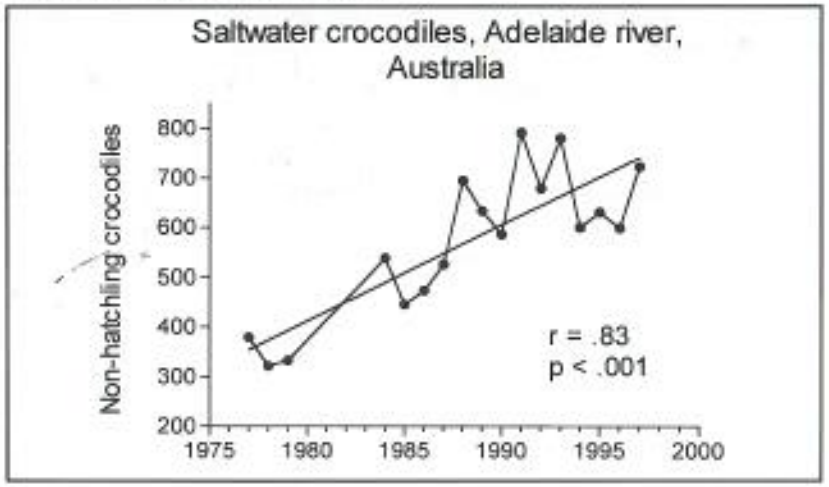

Fig 22. *Numbers of non-hatchling saltwater crocodiles sighted during dry season spotlight surveys of the Adelaide River, Northern Territory, Australia. With increasing population size, the proportion of large animals has increased (Webb and Manolis 1991). As larger, more wary crocodiles are more likely to be missed (Webb and Messel 1979), the population increase may be underestimated. Numbers of crocodiles have increased despite the harvest of eggs. From 1983/84 to 1996/97, 24,714 eggs were taken from 528 (77%) of 683 nests located. The total number of eggs laid in the river system is unknown, as some nests were not located during nest surveys, and some were too dangerous to collect or examine. Nonetheless, the harvest represents a high proportion of the eggs laid each season, with egg collections coinciding with the peak of the laying season. In addition, 30 adult animals were removed as part of a trial harvest in 1994 (Manolis pers. comm.), and some crocodiles are known to drown in fishing nets. Data from Webb et al (unpublished). Data up to 1993/94 have been presented at meetings of the CSG.*

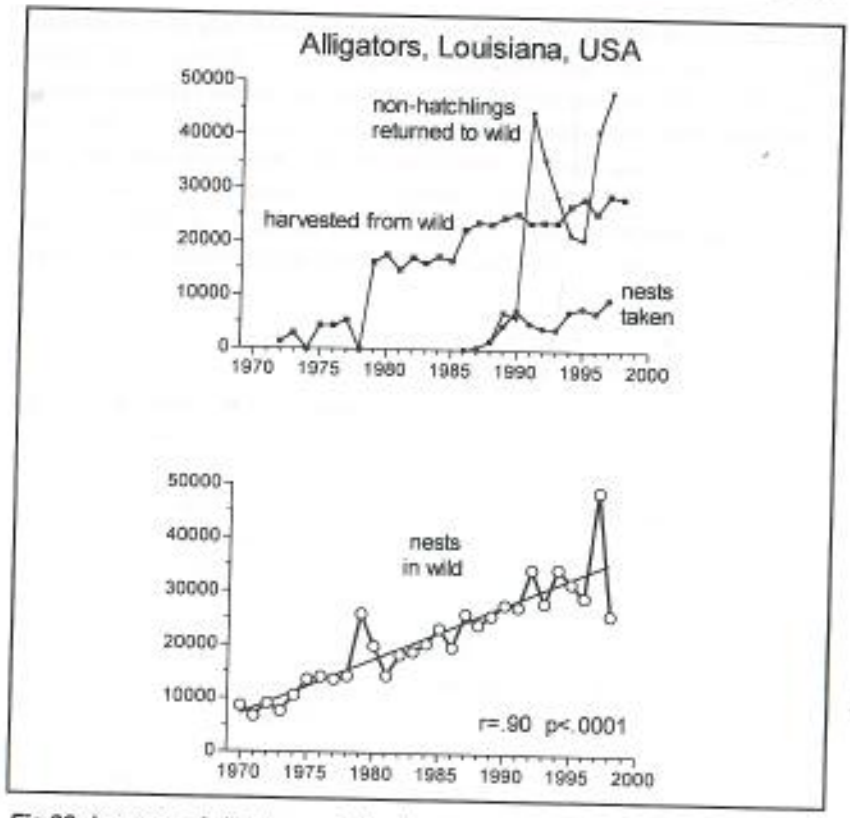

Fig 23. *Increase of alligator nests despite considerable harvest of large alligators and eggs. Top: harvest from the whole state of Louisiana of alligators from the wild and collection of eggs for ranching. In addition, a total of 9846 nuisance alligators were killed 1979-1996. Bottom: number of nests seen on aerial surveys of the coastal marshes in Louisiana; these areas constitute about 80-90% of the alligator habitat in this state (Elsey pers. comm.) Drop in nests in 1998 probably related to severe drought that year. Data from Louisiana Department of Wildlife and Fisheries and Elsey (pers. comm.). Some of the data are also available in Joanen et al (1997) and Elsey et al (in press). Clutch size of 38.9 (Joanen 1969) has been taken to convert eggs to nests; this value is for the Rockefeller Refuge and may not apply to all of Louisiana. Values for 1997 and 1998 for harvested alligators are subject to minor adjustments. Note that nests in the wild were increasing before the start of returning non-hatchling juveniles to the wild; moreover, these would not have laid eggs for a few years.*

It should also be asked, what better feasible realistic way of conserving crocodilians is there than the present emphasis on utilization. Brazaitis et al (1998) offer no alternative vision as to how these reptiles, which are actually disliked and feared by many, and their habitats are going to be saved. Notwithstanding imperfections and problems with international trade, in some places numbers of crocodiles and alligators are increasing dramatically despite considerable harvests (Figs 22 & 23); there seems little inherent reason why the same could not apply to caimans — and to turtles.

But of course it will be objected that turtles are unique, that compared to crocodiles they are more migratory, crossing international boundaries, and that a longer maturation period increases risks. However, recovery of turtle populations can occur despite continued take. This has happened with green turtles at Tortuguero, Costa Rica. Some people think of green turtles in this area of Costa Rica as being protected. This makes it easy to attribute the recovery of this population to the protection afforded them on the nesting beaches and leave it at that.

But there is an illegal take estimated conservatively at 1600/year (Section 5 above), and there has also been — it is now to be stopped (Taft 1999) — a legal take of 1800/year by the fishery at Puerto Limon. There is also an unquantified harvest of adults when they move away from the nesting beaches. After nesting at Tortuguero, one of the major destinations for green turtles is the pasture of sea grass off Nicaragua. Studies of DNA markers suggest that about 90% of the green turtles foraging off northeastern Nicaragua originate in Tortuguero (Bass et al 1998). From 1991-1996, 6000-10,000 green turtles per year, mostly large juveniles and adults, have been taken from Nicaraguan waters (Lagueux 1998). These are minimum estimates, because data from some communities could not be obtained. It is not known whether the present harvests are sustainable or not. During the 1980s and the civil war in Nicaragua, it is thought that turtling slackened, but it did not stop altogether; Lagueux (1998) cites figures of 1600-3000 per year for 1985-1988. In the early 1970s when turtle processing plants were operating, in the order of 10,000 animals/year were taken for export; there would presumably also have been local consumption of turtles. These figures are all estimates, approximations. But they are sufficient to say that the

harvesting of green turtles in Nicaragua, which has been going on for centuries, certainly continued from the 1960s to the present. Yet, from 1971 to 1996, estimated annual nesting emergences of green turtles on the northern 18 km of Tortuguero have gone from about 20,000 to 60,000 (Bjorndal et al 1999). Protection on the beaches, even if not complete, has surely been an important factor in this increase. That is not disputed. It is equally clear that use of this resource has not been postponed until these turtles are back at some garden of Eden abundance, or until there is complete understanding of their population dynamics and biology. As with crocodiles, and many other species, use of a resource is not necessarily incompatible with recovery.

So the example of crocodiles, with their similar high output of eggs and high mortality at early stages of the life cycle, is not simply irrelevant to sea turtle conservation. And if there are problems, there is also reason for optimism about the conservation of crocodilians. Marking systems are evolving and improving; surveys and some research are being funded. The CSG wields considerable influence; it scrutinizes proposals to CITES which are often modified before the meeting of the parties. The atmosphere is less adversarial and more constructive than has been the case with proposals concerning turtles. Representatives from industry and people of different persuasions meet, compromises are worked out. The idea that crocodiles are worth having is spreading. Conservation initiatives are receiving tangible financial support. Few would dispute that the survival prospects of crocodilians in general have brightened over the past 20 years — the period over which legal international trade has developed.

Psychological.

Since at least 1935 there has been a harvest of hawksbills in Cuba. From 1968-1990 this has been documented by their Fisheries personnel at about 5000 adults or subadults per year (Fig 1; CCP 1997). Crouse et al (1987) and others have warned that turtles at this stage of their life cycle have high reproductive potential compared to hatchlings, most of which will not survive to breed. In that context, the Cubans deserve some credit for having, for whatever reasons, reduced their harvest by

some 90% over the last few years to about 500/year. They are also experimenting with ranching, and paying more attention to the nesting beaches. For the first time in decades there are signs of flexibility and change in the Cuban turtle programme.

How has this flexibility been greeted by the international turtle community, especially by the IUCN/SSC? Mostly with hostility and spreading of misconceptions (see Box 3 for examples; see also IUCN 1997; Cuban CITES Management Authority 1997). That may not be the best way of improving the situation for turtles in Cuba. There are plenty of deficiencies in the Cuban turtle programme. Despite the considerable efforts and the large amounts of information made available, there are numerous things that could be improved — as there are in many national parks, and in many other conservation and management systems. Perhaps these improvements would be more likely to come about through help, cooperation and constructive criticism, provided those are given in the general context that the Cubans wish to use their turtles.

In my own brief visit to Cuba I encountered openness, desire for information and opinions, and a remarkable lack of defensiveness about their procedures. Moreover, the Cubans have made available information, both in their proposal and subsequently, that could be seen by some as damaging to their proposal, for instance information on satellite tracking of hawksbills (see Section 7 below). What a contrast to the prevarications of the MTSG in providing the information supporting their categorization of the hawksbill as Critically Endangered (Brackett 1997; Meylan 1998; Mrosovsky 1998)!

Education centre.

A casualty of lack of CITES approval to trade a limited quota of hawksbill shells has been the proposed education centre dedicated to sea turtles (CCP 1997). This would have been near enough to Havana to attract not only paying tourists but also to bring in school children from the city, and show them displays of live animals, provide them with information and history, and sensitize them to their biological heritage. Selling hawksbill scutes to Japan is not the only aspect of the turtle programme.

When conservation and commerce join forces, much is possible — as with the crocodiles.

An opportunity for a well-financed sea turtle centre of this kind has already been missed once. On the Cayman Islands, land was already bought and set aside, there would have been access to turtles of all ages from embryos to adults, with modern laboratory facilities and a library. Dr Judith and Dr Heinz Mittag, owners of the farm at that time, had many excellent ideas and a feel for science. Even before then, when people such as Irvin Naylor and the Fisher family were involved, the Cayman Turtle Farm was exemplary in providing assistance to many scientific investigators, as well as pursuing its own researches (Fosdick and Fosdick 1994). In the end, the continuing opposition to the Cayman Turtle Farm led the Mittags to sell it, and the idea of the sea turtle research centre withered.

A sea turtle education and research centre, with a computerized data base, near Havana might be a rather suitable place for Caribbean nations and for Spanish-speaking nations in general.

7

Whose turtles?

Sea turtles are migratory species; feeding grounds and nesting beaches are often far apart. Do hawksbill turtles from the populations harvested in Cuban waters move outside these boundaries? If so, can those turtles be considered to belong to the other countries visited? If so, are the Cubans killing turtles belonging to others? At CITES in 1997, questions along these lines rapidly hardened into the cry that the Cubans were taking other people's resources.

Finding turtles that have been tagged in one place appearing in another place, or tracking them by satellite, are ways to learn about their movements. There have been very few tag returns from international waters of hawksbill turtles tagged in Cuba compared to the number from green turtles (CCP 1997; Manolis et al in press); this suggests some hawksbills may reside in Cuban waters for long periods, but it is not conclusive because tag loss or sampling effort could be responsible for the observed differences between species.

Satellite tracking is expensive and is usually only carried out with small numbers of animals, but it can tell us what is possible, even if it is less informative about what the average turtle does. Of 5 hawksbills equipped with transmitters at the Isle of Pines (not the main nesting area for hawksbills in Cuba), 3 travelled for considerable distances, to Colombia, the Yucatán, and to the eastern Caribbean (Antigua), one stayed near the Isle of Pines for 75 days when transmissions ceased, and another swam to the Cayman Islands but then returned to Cuba (Manolis et al in press).

Another way of assessing movements is to use information from mitochondrial DNA (mtDNA): this provides a genetic tag that does not fall off, and can be read from a very small sample of tissue obtained without harming the animal. Comparison of mtDNA from hawksbills at a feeding area off Mona Island, Puerto Rico, with that of mtDNA from females on nesting beaches in various parts of the Caribbean, has indicated that some turtles at the Mona Island feeding ground originate from and nest in distant places, while others nest fairly close by (Bowen et al 1996; Díaz-Fernández et al 1999). If the same applies to waters off Cuba where harvesting occurs, one might expect that some of those turtles come from relatively near, and others from far away.

There are some different ways of looking at the same data from the Mona Island study (Bowen et al 1996; Mrosovsky 1997c; Bowen and Bass 1997; Díaz-Fernández et al 1999). Differences of opinion concern quantitative considerations: what proportion of hawksbills are resident, what proportion are migratory, and how far do they go? Most would agree, however, that with many nesting areas in the Caribbean, and many feeding grounds, much more extensive work on mtDNA will be needed to provide definitive answers on hawksbill movements. Further information on this topic will doubtless have some relevance to any future regional management of Caribbean stocks of hawksbills, but in my opinion the question of how many hawksbills move in and out of Cuban waters has been given far too much prominence by both sides on this issue.

The Cuban proposal, while careful not to claim that hawksbills in its waters were a closed population, did argue that the data were consistent with some of these turtles being relatively resident. *Suppose* this argument is wrong, utterly. Suppose that *all* hawksbills in Cuban waters at some time or another move into the waters of another nation. Would this mean that no harvest should be permitted?

There are numerous cases of resources that cross international boundaries. That does not mean one country has no legal right to use the resource. The important question is whether that utilization is done responsibly. If the Cubans were harvesting in a responsible way, then other countries should be happy: if the Cubans were driving the resource

into the ground, then other countries would have cause to be unhappy, but could probably do rather little legally.

What is the case? Cuba has actually reduced its harvest by 90% from the level that has been sustained in the past (Fig 1) — a level that might well have been sustainable into the future. That cannot be ruled out, but now it will never be known whether the unreduced annual harvest at the 5000 level was sustainable or not, since it has been voluntarily phased down, and circumstances will never be exactly the same. So there is little point in arguing about that. But if other countries want to assume, for whatever reasons, that a significant number of turtles harvested over the last years were their turtles, they should be pretty happy with the 90% reduction. Perhaps they would be wise to try to have this institutionalized by international agreements that would prevent this quota going up, or drifting up through lack of interest in the future.

But perhaps even a take of 500 is too much? One of the points made in the debate before CITES 1997 was that the upward trends in hawksbill nesting in Mexico, and perhaps some other places, coincided with the reduction of the Cuban catch (compare Figs 1 and 4 here). This was taken as suggesting that the Cubans had been, and by implication still were taking Mexican turtles and those of other nations (Frazier 1997). It will never be possible to know whether the rise in Mexican hawksbill nesting is attributable, even in part, to the decline in the Cuban harvest, because there are other factors involved. In 1990 a moratorium on taking of turtles in Mexico was declared. This and other conservation measures within Mexico are likely to have made substantial contributions to boosting hawksbill nesting there (Garduño-Andrade et al 1999). Unknown variables in weather and food may also have played a part. But suppose one accepts the proposition that the improving situation of hawksbills in Mexico is the result of reduced harvesting in Cuba. If that were the case, the 500 harvest level would appear compatible with increasing nesting outside of Cuba.

These upward trends are an embarrassment to those who want to say that the hawksbill is Critically Endangered and then stop all trade. It seems extraordinary that the roughly concomitant changes in the Mexican nesting and the Cuban harvest are used to discredit the Cuban

proposal by stirring up the idea that Cubans are taking resources from other nations. If the positive events in other countries are related in any way to the altered harvests in Cuba — something that is by no means clear — then surely the Cubans should be given credit for having made these positive trends possible.

More generally, the whole proposition that some Cuban turtles migrate to waters of other nations is one that cuts both ways. If people in country A complain that turtles in Cuba are also their turtles, then Cuba has the right to claim that turtles in country A are also Cuban turtles. What has country A done toward conserving and managing those turtles? Where is country A's long-term monitoring data? Has it provided information comparable to that collected in Cuba and presented in its massive CITES proposal? How much is A's government spending on its turtle programme? In many cases, probably not nearly as much as the Cuban programme; some of the turtle work in the Caribbean receives little financial support from governments, but is mostly funded privately, as for instance is the Jumby Bay project in Antigua.

What is country A doing about protecting hawksbills that may just as well be considered to be Cuban turtles? According to the IUCN (1997), 1000 hawksbills/year are illegally taken in Puerto Rico and the US Virgin Islands. That is double the present Cuban harvest of 500, and Cuba has a far greater coastline. If there is migration of turtles between Cuba and those areas, as well there may be, then the Cubans have an equal or greater right to protest.

The movement of hawksbills is a debating point, and should be de-emphasized. Abundance, trends, better monitoring at nesting grounds, and whether management is conservative and sound are more important questions.

8

Why conserve?

Large sums of money have been spent on turtle research, surveys, symposia, pamphlets, public awareness and beach patrols. Much thought has been given to *how* to conserve sea turtles. Less thought has been given to *why* we conserve turtles — certainly less has been made explicit. I used to think (Mrosovsky 1983), or at least hope, that the difficult question of why conserve could be kept separate from the disagreements and honest debate on the means of doing this, just as people travelling from one place to another may all have different reasons for wanting to get there, but can still argue about whether bicycle, aeroplane, car, foot or train is the best way to get there, without going into motives for the journey. I now think that this was naive. For some people the use of aeroplanes may be morally repugnant, or too frightening, even if in all other respects it is the most appropriate transport. For some people utilization may be a repugnant conservation method. But if that is so, then let the argument be honest. Instead of debating about the population numbers and trends and the science, be open about the real reasons.

Cultural values.

The real reasons tend to emerge when one side makes headway in the debate on the science. For instance, with whales, as the evidence mounts that there are enough of certain species to harvest, the arguments against whaling switch in emphasis from the numbers and danger of extinction to appeals about the unique attributes of whales (Kalland 1994), their large brains relative to body weight (not in fact strictly true for all whale species, Hurlburt 1996), and their supposed

human characteristics. The clash about whaling is really more one about values than about scientific facts. In certain cultures the whale has become a taboo animal. But there is more to it than that. These cultures are trying to impose their values on others. Lynge (1997) compares the way some western cultures feel about eating whales to the way Hindus feel about eating cows, but then points out a difference:

> ...no European or American politician would ever dream of suggesting that his/her voters should stop eating beef out of respect for the feelings of Hindus of India.... Nevertheless, the British public, the Australian government and Greenpeace supporters around the world expect the Japanese to give up their tradition of eating whale meat out of respect for the feelings of the English and Australians, and Greenpeace's symbolic world. Japan should bow to the new taboo, if for no other reason than because so many in the West have.

With sea turtles, there is a similar clash of values and of attempts to impose values on others. Again we see a situation starting to arise where the word unique is being used. The particular aim is to show that turtles are not like crocodiles, for which utilization approaches appear to be successful, or at least highly promising (Section 6).

What happens when reasons for conserving, the why of conservation, informs the how of conservation? According to Webb and Vardon (1996) we conserve things that we value, but they add:

> Value is a somewhat intangible concept because what is highly valued by one individual may have only a negative value to another. For example, elephants may have high value to the average person in Washington, but a purely negative value to a rural farmer in Africa. In the end, people in Washington can be expected to fight for elephant conservation. But what are the prospects for conservation if those who live with the elephants attribute only a negative value to them?

Value is also important in the conservation of turtles. Many of those actually in contact with the animals value them primarily as a resource, for food or to obtain money. Valuing wildlife as a resource should not be

taken as derogatory or implying a limitation of sensibility. Consuming wildlife is not incompatible with appreciating its beauty or mystery. There may be some truth in the idea that, paradoxically, it is "chiefly through the instinct to kill that man achieves intimacy with the life of nature" (Clark 1956). The "two roles as hunter and as lover of nature complement one another" (Lynge 1997). One has only to look at some of the cave paintings to see this. Animals can be food but they can also be gods. The use that the aborigines of Australia or North America make of wildlife does not prevent it from fulfilling a spiritual role. Still, for many people at the margins of existence, with large families but lacking good health services or security for old age, economic value is of major importance; in some places the prime reason for conserving wildlife is that such people can benefit from it.

In the case of Cuba, this is even enshrined in Article 27 of their constitution, the first sentence of which addresses the why question:

> Para asegurar el bienestar de los ciudadanos, el Estado y la sociedad protegen la naturaleza. Incumbe a los órganos competentes y además a cada cuidadano velar porque sean mantenidas limpias las aguas y la atmósfera, y que se proteja el suelo, la flora y la fauna.

It is not surprising that a country that has gone through considerable economic hardship would take this approach. Is it right for preservationist NGOs, a number of which are based in the USA, to try to impose a different attitude toward turtles on the Cubans? Of course, some organizations will claim that they are not against utilization *per se*, but argue the need for more safeguards, and precautionary principles, and better understanding of population dynamics, and more research and information. Sometimes such arguments are stalling tactics, because the real argument is not about science but about values. Some organizations and their supporters are against any consumptive use, as is evident from the case of minke whales. There are about 1 million minke whales in the world, but some NGOs and governments still oppose any consumptive use of this species. That is their prerogative, but should they try to impose their attitudes on others? In the case of

Cuba the long history of American interference — from the Platt amendment (a resolution of the US Congress, attached to the 1901 Cuban constitution, giving the USA considerable rights to intervene in Cuban affairs) to the invasion of the Bay of Pigs — makes any hint of cultural imperialism particularly resented.

Progress through compromise.

The Good Friday agreement in Northern Ireland, the end of apartheid in South Africa — these extraordinarily difficult compromises were made because the majority of people recognized that, however much they had suffered, however wronged they felt, the way forward to a better future was through compromise. The possibility of one side winning by outright force seemed remote, and the continuation of debilitating struggles too appalling. These are not altogether farfetched analogies, because differences about conservation can be as deeply felt and passionately held as religious convictions and racial prejudices.

But perhaps real progress could be made if the why of conservation were not allowed to obtrude so much into the how of conservation. This does not mean renouncing one's beliefs. It means working with others with different viewpoints to achieve some progress, the kind of approach advocated by a former head of Greenpeace International (Wilkinson 1998). In this particular case, it may mean trying to influence the course of utilization that is taking place anyway, in the interests of achieving some of one's objectives.

Those who oppose use of turtles and their consumption, and fear for their extinction, might achieve more — more in terms of conservation of sea turtles — by working with the Cubans rather than against them. A nation that has withstood invasion and embargo from the most powerful country in the world is not especially likely to give in to outside pressure — unless perhaps as a bargaining chip in some more general political and economic rapprochement.

There are a number of benefits for turtles that could be linked to permission for some international trade under CITES in hawksbill shell. First and foremost, the reduced harvest levels of 500 or quotas for

ranching could be locked into place. They could not then be changed without approval by the parties to CITES. Routine CITES inspections could and should be arranged. Maybe something equivalent to the international observers on tuna fishing vessels in the eastern tropical Pacific could be arranged; observers could be present during harvests, and during labelling and shipping. Cuba is a large country; there are probably plenty of problems with enforcement, as there are in other places (Section 5). There is much else that could be improved in the Cuban turtle programme which falls far short of perfection. Additional pressures for enforcement and monitoring might be beneficial, especially if coupled with explanations and education. Some NGOs have special skills and resources in such matters. They could be constructively involved in the education centre (Section 6). If there was some goodwill, it might facilitate the introduction of turtle excluder devices. This might save more turtles than are taken for consumption and trade. Perhaps the Japanese government and Japanese Bekko Association would sponsor research on excluder devices appropriate to the regions from which their imports would come, or on new technologies for reducing incidental catch.

Insistence on better monitoring of nesting beaches in Cuba, despite the logistic difficulties in remote places, might also be part of a compromise agreement. It might be possible to arrange that additional areas be gazetted for total protection and as control areas for beaches or marine habitats from which there was harvesting. If there were a ranching component in any future Cuban proposal, improvements in animal welfare might result because the CITES ranching criteria require humane treatment of animals. This could provide an entry point for considerations of animal welfare to become more widespread. It has to be recognized that some communities, especially impoverished ones, do not have the attitudes towards animal suffering that are prevalent in wealthy western nations. It has also to be recognized that inhumane treatment of animals is deeply offensive to some people.

Meeting international CITES standards for quotas and enforcement would involve considerable concessions on the part of the Cubans. But if trade is to be internationally sanctioned, then it is reasonable that

those sanctioning the trade can assure themselves that agreed procedures are being followed and that progress is being made in management and conservation. The world is becoming more international. Pollution, the environment, conservation, the ozone layer, global warming, the economy, the euro, medicine and the spread of disease, legal treaties, extradition, the fight against crime and terrorism, control of nuclear weapons, sharing of communication channels — these problems are too big and too transnational to be solved by countries on their own. Countries lose some of their ability to control events and make all their own decisions in exchange for the benefits that a global and international approach to problems can bring. CITES puts trade in wildlife into this growing tapestry of international cooperation.

One great advantage of CITES is that it focusses attention on a species. Even attempts to change CITES trade regulations for a species can stimulate action. In the case of the hawksbill, funds from US government agencies have recently become available for more extensive satellite tracking of this species in the Caribbean; several countries are involved. The Japanese Bekko Association has also supported research on hawksbills; studies lasting several years are in progress in Australia, Puerto Rico and Cuba. A special issue of the journal Chelonian Conservation and Biology has been devoted to hawksbills in 1999. In this issue, the MTSG finally produced its justification of the 1996 hawksbill listing as Critically Endangered. That is not yet in sight for other species of sea turtle. The Cubans have collated and published large amounts of data, initially in their CITES proposal (1997), and subsequently with a few additions in Revista Cubana de Investigaciones Pesquera (1998), in both Spanish and English. They also take digital photographs of each scute of shell in their stockpile (Carrillo et al 1999). This does not solve every problem (it is not perfection), but it is a definite contribution toward enforcement. The day-to-day running of the Cuban turtle programme is also improving, with more rigorous data collection and analysis, better data sheets, renewed attempts to monitor nesting beaches systematically (Moncada et al 1999), and to learn more about the species (Carrillo et al 1999, pers. comm.). As a result of potential trade in hawksbills under CITES more is known about this species,

and much more of this information is out in the open, than was the case a few years ago.

However, if improvements and openness are not rewarded at some stage, if the good — or even merely the better-than-before — is held hostage to the perfect (Bailey 1995), then the idea of getting CITES approval for trade in that species will become less attractive. CITES will lose its power to influence events, and interest in the conservation of the species, at least from those who want to trade it, will fade. Governments and others may choose to direct their efforts and resources elsewhere. And the turtles themselves may be no better off.

A vision of the future.

To point out that hawksbills are recovering in some places, and to argue that on a world-wide basis this species is not in immediate danger of extinction (Section 4), does not imply satisfaction with the present state of affairs, far from it. Even if this species could not reach the Serengeti-like profusion of marine herbivores envisaged for green turtles (Jackson 1997), hawksbills could surely be far more numerous than they are today. They may have numbered in the tens of millions in the past according to some speculations (Jackson 1997).

In my vision of the future this kind of profusion would occur again, at least in some areas. In my vision of the future, all sea turtles would be abundant. A mutualistic combination of protection and sustainable use would have enabled turtle populations to increase by orders of magnitude.

In my imagined hoped-for future, ethical attitudes would also change, evolve. It would become widely recognized that allowing animals to spend most of their lives in natural conditions and then killing them for food and other products is preferable to intensive farming in unnatural conditions and the attendant welfare problems. Animals and people and plants are all part of a web of life, of eaters and eaten intertwined; their welfare is interdependent. But acceptance of culling wildlife should not prevent tolerance of any sects intent on teaching tigers to be vegetarian.

Along with these attitudes, there would come a shift in the preferred methods for use of animals. Initially, in the latter part of the 20th century, it was thought that permission for trade in endangered wildlife should only be granted for captive breeding operations not relying on continuously taking stock from the wild. Farming, in the technical sense of being a closed cycle operation, was considered by CITES earlier than ranching, in which the animal spends only part of its life cycle in captivity. By the end of the 20th century, however, ranching was seen as better for conservation. The continuation of a ranch depends on maintaining the health of the ecosystems and populations supplying the ranched animals. In the case of crocodiles and turtles, ranches rely on eggs or hatchlings, most of which will die in the wild anyhow. With numbers of animals in the wild still depressed, taking the animals at a stage when they are less likely to survive, and so have less reproductive potential, was thought safer.

But, in the future, where numbers increase, culling of adults from wild populations will be introduced because culling will be considered ethically preferable and more natural. Harvest quotas would be small initially, but could gradually be raised in healthy monitored populations, especially in those in which an appreciable number of eggs are destroyed by turtles themselves nesting later on the same beach. Also, except in cases where standardization and quality control is critical, keeping reptiles in tanks and feeding them in captivity is probably more expensive than culling them from the wild. In some populations this stage of culling may not yet be reached for a long time; in some areas the collection of doomed eggs, some of which are raised in ranches, could still be practised.

In the future, the silly exaggerations of the 20th century will have gone. Debates over the meaning of subsistence hunting or subsistence use will be abandoned. Whether people eat the meat themselves, or exchange it locally for goods for their families, or sell it to foreigners to buy food or TVs or computers, or whatever gadgets there are then, will be seen as irrelevant in a globalized economy.

The idea that sea turtles are unique will also have gone, except in the sense that all species are unique. Much more will be known about the

biology of these reptiles. The mechanisms for natal homing will be determined, the reasons for skewed sex ratios understood, the turtle genome project will have been long completed and % homologies with other species worked out at the molecular level. All this knowledge will enable people to focus on the ways in which turtles are similar and the ways in which they are different from other species. Comparisons between species will depend on specification of the presence or absence of particular genes and their functions.

None of this will diminish an appreciation of the beauty of these animals, or of their value as resources. And there will still be people who believe — or pretend to believe — that turtle eggs are aphrodisiacs. This will be fortunate because it increases the value of this resource. Auctions would be held for the right to harvest a certain number of clutches each year, enabling those who pay to have the fun of the egg hunt and the pleasures of consummation. Some of the income derived from such auctions would go into better patrolled and expanded parks and into totally protected areas.

The public will be better informed. Unsubstantiated exaggeration will become less effective. IUCN will be reorganized so that the tail no longer wags the dog. Its membership may be reduced somewhat, but it will become more scientific and open, enabling it to have more credibility with governments and more secure funding from international organizations. Building on the earlier work of Mace and others (see IUCN 1994), more objectivity will be introduced into the Red Lists; greater flexibility and readiness to change categorizations in the light of evidence will further enhance IUCN's reputation. Alternatively, it will have been marginalized or replaced by a new organization, Sci-UCN (Scientists United for the Conservation of Nature).

Along with an increased emphasis on science, in the future, I hope that proposals for limited utilization combined with conservation will be treated more as experiments in adaptive management, to be tried in the spirit of Behler's (1997) call for creative initiatives.

The Cubans have put more into their turtle programme than nearly any other nation in the area. It may in the end turn out that their approach requires considerable modification or is a failure, but at least they will

have been given a chance, along with other experiments in controlled utilization. So many other experiments with turtles have been given a chance, such as Kemp's ridley head-starting, and Operation Green Turtle (Section 2). One way or another, given the biology of turtles, and its similarity to that of crocodilians in having a huge natural wastage of eggs and low survival to adulthood, some form of consumptive utilization of sea turtles is surely possible (Hendrickson 1958; Mrosovsky 1983, 1997a; Campbell 1998). One hopes the day will come when conservation policies are based on what is learned from giving them a fair trial.

Will this vision of the future be realized? Will the peace agreements in Ireland, the Middle East, and the Balkans be a way forward? It would be rash to predict. But if some of the energy dissipated in battles within the community of turtle conservationists were devoted to cooperation and pragmatic compromise, who knows what might be possible.

9

Summary

1) The willingness of turtle biologists to embark on unproven procedures and risky experiments contrasts with their reluctance to allow conservation through utilization a fair trial.

2) The Cuban proposal is based on adaptive management: that the catch in the order of 5000 hawksbills has been sustained in the past suggests that the proposed harvest of only 500 would be sustainable in the future. If it is not, the harvest would be further reduced. None of this is based on a model of population dynamics.

3) On a world-wide basis, hawksbills are not in "immediate danger of extinction", as evidenced by a pantropical distribution, and by nesting on some beaches actually increasing.

4) Sustainable use approaches to conservation should not be expected to spring into being in a perfect form, based on complete knowledge of the species and zero risk. Enforcement in many national parks and reserves is far from adequate. Sustainable use of turtles is not seen as an alternative to parks. Indeed some of the revenues from the use of turtles might go towards protection of sanctuaries.

5) Consideration of potential risks should be balanced by consideration of potential benefits. For the Cuban proposal, these include protection of other species found in hawksbill habitats, international scrutiny under CITES, additional resources for enforcement, management, research, and education. The striking developments in conservation of crocodiles should not be brushed aside with assertions that sea turtles are unique.

6) That some sea turtles migrate across international boundaries is a less important question than whether management or conservation practices are effective and responsible. To the extent that turtles from populations harvested in Cuban waters spend time in the territorial waters of other countries, those countries should applaud the reduced harvest in Cuba.

7) Debate about the facts and science of conservation often masks disagreements about values. These disagreements sometimes take on a quasi-religious intensity, and hinder compromise through which so much could be achieved, both for turtles and people, in the future.

10

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Summary

- The willingness of turtle biologists to embark on unproven procedures and risky experiments contrasts with their reluctance to allow conservation through utilization a fair trial.
- The Cuban proposal is based on adaptive management: that the catch in the order of 5000 hawksbills has been sustained in the past suggests that the proposed harvest of only 500 would be sustainable in the future. If it is not, the harvest would be further reduced. None of this is based on a model of population dynamics.
- On a world-wide basis, hawksbills are not in "immediate danger of extinction", as evidenced by a pantropical distribution, and by nesting on some beaches actually increasing.
- Sustainable use approaches to conservation should not be expected to spring into being in a perfect form, based on complete knowledge of the species and zero risk. Enforcement in many national parks and reserves is far from adequate. Sustainable use of turtles is not seen as an alternative to parks. Indeed some of the revenues from the use of turtles might go towards protection of sanctuaries.
- Consideration of potential risks should be balanced by consideration of potential benefits. For the Cuban proposal, these include protection of other species found in hawksbill habitats, international scrutiny under CITES, additional resources for enforcement, management, research, and education. The striking developments in conservation of crocodiles should not be brushed aside with assertions that sea turtles are unique.
- That some sea turtles migrate across international boundaries is a less important question than whether management or conservation practices are effective and responsible. To the extent that turtles from populations harvested in Cuban waters spend time in the territorial waters of other countries, those countries should applaud the reduced harvest in Cuba.
- Debate about the facts and science of conservation often masks disagreements about values. These disagreements sometimes take on a quasi-religious intensity, and hinder compromise through which so much could be achieved, both for turtles and people, in the future.