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Manual on Turtle Conservation in the Mediterranean

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Manual on Turtle Conservation in the Mediterranean

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Manual on Turtle Conservation in the Mediterranean

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PREFACE TO THIS EDITION

This edition of the manual has been prepared for the meeting of the National Focal Points for Specially Protected Areas of the Mediterranean Action Plan (Athens, 26-30th October , 1992). This manual will appear in printed form with colour illustrations in the near future. The printed edition is being financed by the Mediterranean Action Plan (Specially Protected Areas Progamme) through the World Conservation Union (IUCN) within contract 9112-4/CWS/RAC-SPA.

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They would like to thank also all the participants in the training courses for their interest and their numerous questions which have helped shape this manual. The authors hope that it will answer the needs of future trainees and be of assistance to marine turtle conservation projects.

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CONTENTS

I. INTRODUCTION

II. ABOUT TURTLES

- Longevity
- Feeding
- Behaviour at sea
- Hearing
- Chemosensory behaviour
- Vision
- Maturity
- Fecundity
- Mating
- Nesting
- Intraseasonal Nesting
- Natal homing-philopatry
- Nesting cycles

III. ABOUT TURTLES IN THE MEDITERRANEAN.

- Origins
- Status of nesting in the Mediterranean
  - Green Turtle
  - Loggerhead
- Population size and dynamics.

IV. IDENTIFICATION OF TURTLES.

- (a) Adults.
  - Loggerhead
  - Green Turtle
- (b) Hatchlings
  - Loggerhead
  - Green Turtle
- (c) Juveniles and Sub-Adults
  - Loggerhead
  - Green Turtle
- Sexual dimorphism
- Deviations
- Other species
- Commensals and ectoparasites

V. NESTING AND NEST AND TRACK IDENTIFICATION.

- Track identification
- Nests and nesting
- Nesting periodicity and nesting season
- Eggs and clutch sizes

Incubation
Timing of nesting
Beach surveys

VI. PREDATION

Predation on turtles
Predation on eggs and hatchlings

VII. FISHERIES AND TURTLES.

1. Impact of fishing and relevant legislation
2. Dealing with apparently drowned turtles
3. Trauma-propeller injuries.

VIII. CONSERVATION TECHNIQUES

1. Observing and tagging turtles
   - Spotting and approaching nesting turtles
   - Tagging and measuring turtles
2. Hatchery techniques
   - Transplantation of nests
   - Location of eggs in nests
   - Protecting eggs in situ
   - Egg collection
   - Hatchery location.
   - Replanting of nests
   - Protective cages
   - Incubation temperature and sex determination.
   - Hatching and releasing of hatchlings
   - Tagging of hatchlings
3. Rearing turtles in captivity
   - Head starting.
   - Diseases and other problems.
4. Beach management.
   - Threats from human activities
     - (a) Nesting and prenesting stage.
     - (b) Incubation.
     - (c) Hatching.
5. Management measures - Legislation
6. Conventions
7. National Legislation

IX. RECOMMENDED READING AND REFERENCES.

I. INTRODUCTION

Three species of turtle are commonly found in the Mediterranean. These are:

Caretta caretta - Loggerhead Turtle

Chelonia mydas - Green Turtle

Dermochelys coriacea - Leatherback Turtle.

Only the Loggerhead and Green turtles breed in the Mediterranean. There are no records of Leatherbacks breeding in the Mediterranean but their pelagic nature often leads them into this sea where they are occasionally caught on floating long-lines. Occasional records of other species also exist.

Past exploitation is undoubtedly responsible for the decimation of turtle stocks in the Mediterranean. Though some exploitation still takes place, this concerns mainly incidental catches. At present the other main threat to turtles comes from putting nesting beaches to recreational use. Many beaches have already been completely lost to the turtles. Nowadays Loggerheads nest mainly in Greece, Turkey and Cyprus. They are also known to nest in Syria, Israel and Tunisia in very small numbers. Nesting in Libya and Egypt has been confirmed, though the number of turtles nesting there is still uncertain.

Green turtles nest in Cyprus and Turkey. There are past records of them nesting in other areas of the Mediterranean. The populations of both species are known to have been much larger in the past than they are now.

If turtles are to be effectively protected in the Mediterranean, conservation efforts should concentrate on protecting them from man's activities, by reducing losses due to fishing and by safeguarding their remaining nesting and feeding habitats. They should also aim at protecting turtles eggs and hatchlings from predation and other dangers.

A strategy of intervention in conserving turtles is necessary in certain areas because of the low population levels in the Mediterranean and because of the disturbing trends in the destruction of their nesting habitats. Such intervention should be carefully thought out and used where appropriate, using techniques that are as close to nature as possible. Without a doubt the protection of the remaining habitats merits top priority and nothing in this manual is intended to imply a different ranking of priorities.

The present manual attempts to give practical information that may be useful, under Mediterranean conditions, for such conservation work. It was originally conceived as an aid to the training courses held at the Lara Reserve in Cyprus for UNEP/MAP sponsored trainees from Mediterranean countries. This manual is still seen as a supplement to practical training

in turtle conservation techniques.

II. ABOUT TURTLES

Though it is not within the scope of this manual to summarise the biological data on turtles, some basic information is presented as this may be useful. A brief bibliography at the end of this manual gives the references to other documents whih are recommended reading. References are given only where mandatory or useful.

Marine turtles are an ancient group of reptiles which, like the marine mammals, have "reversed" their evolution and have returned to the sea. This "reversal" is however incomplete and although turtles have adapted well to life in the sea (e.g. they are excellent swimmers and can stay underwater for long periods of time), their ties to their land-adapted ancestors are unmistakable. For example, they still have to breathe air and they have to come up on land to lay their eggs.

There are eight species of marine turtles in the world (or seven if *Chelonia agassizi* is grouped as a subspecies of *Chelonia mydas*). These are:-

Lepidochelys kempi - Kemps Ridley
Lepidochelys olivacea - Olive Ridley.
Eretmochelys impricata - Hawksbill
Caretta caretta - Loggerhead.
Chelonia mydas - Green Turtle
Chelonia agassizi - Black Turtle
Chelonia depressa - Flatback
Dermochelys coriacea - Leatherback.

Longevity

It is not known how long turtles live. Without any human interference their life-span is estimated at over 60 years.

Feeding

Adult and sub-adult Loggerheads are primarily carnivorous, feeding on benthic invertebrates such as crabs, sea urchins, snails and other hard-shelled animals, which they crush with their hard palate. They also feed on jellyfish. Hatchlings and juveniles feed on macro-planktonic animals and plants. Hatchlings in particular are initially attracted to light-coloured or white objects as food. As a result they may also ingest plastic beads, polyethylene sheets etc.

Adult and sub-adult Green turtles are herbivorous. In the Mediterranean, there is little information on their food and it is assumed that they feed mainly on sea grasses such as *Cymodocea nodosa*, *Zostera* spp., *Posidonia oceanica* *Halophila stipulacea*, algae etc. In a 50 cm (15.5 kg) drowned Green turtle examined for gut content in Cyprus it was found that the turtle had fed exclusively on *Cymodocea nodosa*. Green turtle hatchlings and juveniles are primarily carnivorous and feed on a diet similar to that of the Loggerhead hatchlings.

Behaviour at sea

Turtles are solitary and do not form any concentrations except in the mating season in which they seem to congregate in specific areas. In the Mediterranean migrations (to and from the feeding grounds) probably occur but migration routes etc. are still largely unknown. There is ome evidence of Loggerhead turtles migrating to the gulf of Gabes in Tunisia, i.e. to their feeding grounds, from the nesting beaches in Zakynthos in Greece.

Hearing

Turtles have no inner ear structure and to all intents and purposes they are deaf. They can, however, detect vibrations of certain low frequencies probably through the skull and carapace. They are apparently sensitive to stimuli in the range of 0.25 to 0.50 kc/s (1). For the turtle this sensitivity to a low frequency spectrum of sounds may be relevant in the turtle locating and selecting the right spot on which to emerge onto the nesting beach (wave action ?).

Chemosensory behaviour

Little is known about chemosensory behaviour in turtles (2) though orientation by hatchlings to certain chemicals introduced in the nest has been experimentally demonstrated (3+4). There is also strong indirect evidence of chemosensory behaviour in the turtles locating nesting beaches. In Cyprus, the densest nesting activity of Loggerhead turtles is on a stretch of beach of about 100 metres which has been contaminated

for many decades by the tailings from the processing of copper pyrite for the extraction of copper.

Vision

Not much is known about vision in adult turtles though this is obviously an important sense at sea and on land. Hatchlings need their sight to locate the sea. (5). Turtle hatchlings are apparently more sensitive to the shorter wavelengths wavelengths of the light spectrum (i.e. blue colour). This however, may be related to the intensity of the light seen and not to colour (6-9). Their sensitivity to the very long has still to be ascertained and may have conservation implications e.g. in the use of infra-red lights, in monitoring nesting activity on beaches.

Maturity

The age at which turtles mature apparently varies from place to place, presumably, as a result, of growth rate which depends primarily on temperature and food availability.

Estimates of sexual maturity for Loggerheads vary from 7 to over 30 years. However, this information, which is obtained partly from captive turtles, is misleading, since captive turtles evidently mature more quickly than wild turtles. More recent estimates put sexual maturity in the 13-30 years bracket for wild turtles.

Published estimates put sexual maturity in Green

turtles at anywhere between 9-58 years (10) and put it at 27-33 years for Atlantic Green turtles (11).

In the Mediterranean, Loggerheads start nesting when they are about 60 cm long (CCL).These females are smaller than those in other areas of the world. The age at which they reach this size is uncertain.

Green turtles in the Mediterranean start nesting when they are about 70 cm long (CCL). The age at which they reach this size is not known.

Fecundity.

There is some evidence that not all females retain their reproductive capacity throughout their life-span. Estimates put this at about 32 years for Loggerhead turtles (12).

Mating

This takes place in shallow waters,usually within 1 km of the shore, often in areas not adjacent to the nesting beaches but a few kilometres away. In Cyprus mating starts in late April, when turtles congregate offshore prior to mating.

There is evidence that turtles are polyandrous i.e. that they mate with several males which vigorously compete for the female. Copulation is infrequent after the start of the

nesting-season. Fertilization is internal. The male clings onto the female with all four flippers with the large claws on the front flippers firmly holding on to the female's carapace. Copulation lasts several hours and mating pairs can often be seen on the surface of the sea. In the Green turtles the carapace of the older females is deeply and permanently scarred in the marginals where the claws of the male clasp the female.

Nesting

Nesting takes place at night. In the Mediterranean Loggerheads usually start nesting at the end of May and continue laying till the end of August, sometimes stretching the season into early September. Green turtles start about 2 weeks later. Variations in the nesting season have been observed in both species, as a result of weather conditions. The nesting process is discussed in detail in later chapters.

Intraseasonal nesting

In other areas of the world Loggerheads are known to lay from 1-6 times and Green turtles from 3-6 times in the same nesting season. In Cyprus Green turtles have been observed returning to nest 3-4 times. The observers, however, probably missed some nesting by the same turtles and the number of clutches laid in one season is, therefore, probably somewhat higher, judging from the length of the nesting season and the records of the nesting dates of tagged turtles. It is probable that 4-5 clutches of eggs are laid in a season, in some years at

least. Loggerheads have been noted to nest 1-3 times in the Mediterranean (13) though more observations are needed to confirm this. Indications from Cyprus are that on Lara beaches they nest at least 4 times in the season. There are also indications that the number of clutches laid in a season may vary depending on such factors as weather conditions (extended winter or early summer) though it is still unclear that the totl number of eggs laid in a season is smaller as a result. There are indications that the number of eggs per clutch may vary to compensate for such eventualities (Cyprus data).

Turtles and more particularly Green turtles will usually nest on the same beach in a season. Nesting by the same turtle on different beaches or on a different and distant part of a long beach, during the same season, is probably the result of disturbance by humans or predators. Loggerheads are said to be somewhat less specific, though much remains to be learnt on their habits. More intensive tagging and especially follow-up programmes (beach surveillance in the breeding season) will help in getting better information.

Natal homing

Tagging has demonstrated that female turtles faithfully return to the same beaches in successive nesting seasons. It was postulated that turtles return to their natal beaches.

Recent research involving mitochondrial DNA

fingerprinting in turtles has demonstrated that environmental cues i.e. imprinting behaviour, is responsible for the selection of their nesting beaches (14). Similar imprinting on their feeding grounds may take place (15). The environmental cues responsible for imprinting on natal beaches are still the subject of many hypotheses and research. Wave direction, the earth's magnetic field and variations in it and chemicals in the water are some of the factors that are being researched into as possible cues in "map reading" in turtles.

Nesting cycles

It is generally accepted that turtles usually nest in cycles of 2,3, or 4 years and even longer. Green turtles in Cyprus have been noted to nest on a predominantly 2 year and 4 year cycles though 3 year and 5 year cycles or even longer have been recorded. Where four, six or eight year cycles have been observed, the information may well be the result of insufficient beach surveillance (they are multiples of shorter year cycles). It may be that turtles nest in a wider area (i.e. nesting on beaches not under surveillance), though on present evidence this is unlikely. Nesting periodicity for the same turtle may change, this probably reflects changes in food availability and food (fat) stored by the turtle. Such changes in periodicity have been noted in the Cyprus turtle population. Many nesting turtles are, however, never seen again and the implications and reasons for this are of great interest.

III. ABOUT TURTLES IN THE MEDITERRANEAN

Origins

Although trtle evolution goes back to about 200 million years their present colonization of the Mediterranean is much more recent. In Tethyan times they probably colonised the Mediterranean several times from the Atlantic, during inter-glacial periods, and in previous eras from both the Indian and Atlantic oceans.

The current population probably colonised the Mediterranean after the regression of the last ice age which started about 40.000 years ago. Most likely this colonisation took place in the last 10.000 years when the area warmed up enough to sustain nesting on its shores. Recent mitochondria DNA fingerprinting of Green turtles from Cyprus (16) confirms that these turtles have formed a separate (and isolated) population from the Atlantic stock, for this period of time.

The degree of isolation of Loggerhead turtles is not so clear as yet. Loggerhead turtles nesting in Greece, Turkey, Cyprus and on the south-eastern Mediterranean coast would similarly be expected to show a degree of isolation from the Atlantic stock. This, nonetheless, is only a hypothesis at this stage and MtDNA fingerpinting is likely to provide more tangible clues on the situation.

Nesting in the Mediterranean

Green turtles

Mediterranean Green turtles nest only on the eastern shores; a few beaches in Cyprus and a few beaches on the eastern end of the Turkish Coast (17). There is no nesting in Greece and the Levant coast while the status of any nesting in Egypt and Libya, if such nesting takes place at all, is unknown, but likely to be sparse. There is no nesting of Green turtles in Tunisia and further west.

It is unlikely that any historical data will be reliable enough to distinguish with any certainty between Loggerhead and Green turtles and determine with any reliability the previous extent of Green Turtle nesting in other areas. Nonetheless statistical data, including data from FAO (18), show relatively large catches of turtles (without mentioning species). For example turtle catches of 75 tons are recorded in Turkey in 1965. This is equal to about 1,000 turtles. Records for Cyprus concern the export of turtles to Europe in the 1920's via Alexandria. Turtles from Palestine and Syria were also exported to the U.K. via Alexandria (19). Nesting has practically stopped since then on the Levant coast. "Historical" records of the species concerned are suspect and often conflicting. It is likely that both species of turtles were caught, both on the beaches during nesting and during fishing operations. Presumably the Green Turtle would have been targeted by preference.

Loggerhead turtles

Currently Loggerheads are known to nest in Greece, Turkey and Cyprus. They are also known to nest in very small numbers in Syria, Israel and Tunisia. It is likely that they also nest on the Eyptian and Libyan coasts, though the intensity of nesting has not yet been ascertained.

The largest single nesting site known in the Mediterranean for Loggerheads is in Zakynthos. These turtles also nest on several other beaches in Greece, mainly in Cephalonia and the Peloponese. They also nest on several beaches on the southern Turkish coast, from Dalyan in the west to Samandagi in the East (20).

Population size and dynamics

Many estimates of the numbers of turtles currently nesting in the Mediterranean are based on the number of nests counted on the beaches. In some cases this number is estimated as a percentage of the turtle emergences (i.e. turtle tracks) counted. This percentage needs to be verified as it can vary very significantly from beach to beach. To calculate the number of female turtles nesting the number of successful nests (as estimated) is divided by the number of clutches these turtles are thought to lay in a season. Obviously, this again can lead to significant variations. Until more information is collected on the number of clutches laid in a season, such calculations inevitably have to be treated with some caution.

In Green turtles in particular there are large fluctuations in nesting activity from year to year, sometimes of orders of magnitude and any estimates of density of nesting or population size, based on one year's data (or even two years' data) may be misleading.

On the basis of the information that is currently available it is obvious that any estimates can only give figures relating to orders of magnitude and not to true estimates of populations.

The number of Green turtles nesting on the west coast of Cyprus is tentatively estimated at about 100 (60 have already been tagged). Several new (untagged) turtles are found each year. This shows that it is possible that the population may be larger and (a) is nesting more infrequently (on average) than was thought until now - which tallies with the information so far collected at Lara or (b)that it nests over a wider area - which does not tally with the available information (the question of tag losses is discussed elsewhere in this manual).

It is assumed that the Green Turtle population nesting in Cyprus does not exceed 200, the north and east coast beaches included.

On the basis of 1988 data, the turtle population nesting in Turkey was estimated at about 300-350 females p.a. (20). More recent information (22) suggests that there has been a very significant decline in the Green Turtles nesting there. Whether this is a real decline or not is debatable as both estimates are based on observations made in oe year (or shorter) surveys and , as already mentioned, annual fluctuations on the number of females nesting are likely to disguise any trends. The estimate of 300-350 females nesting per year (for Turkey) assumes that the average number of clutches laid by a turtle in a year is 2+5. If more clutches are in fact laid in a season (say 4-5) then this reduces this estimate.

On the basis of the available information and keeping in mind the various assumptions, it is likely that the population level of female Green turtles nesting in the Mediterranean is in the range of 500 to 1000. More information is urgently needed.

The number of males is unknown but this is probably of little importance.

The size of the Loggerhead population is evidently somewhat larger. The numbers of females nesting each year in Greece, calculated again from the number of nests, is probably about 300-800 for Zakynthos and probably about 1000 for the whole of Greece with probably another 500 - 1000 for Turkey. Assuming nesting usually takes place every two years this would

put the total population at about 2000 - 4000 -say 5000 if all the remaining nesting areas(Cyprus, Libya, Egypt) are taken into consideration. Nesting in 3 or 4 year cycles or longer will change this estimate. Recent (1988) catches of turtles in Tunisia and elsewhere (excluding the Balearics and Spain) were in the range of 6000-8000 animals per year (21). If these data are correct then it is safe to assume that these catches do not consist solely of nesting age females, whose numbers are obviously very limited. These catches may for example be based on immature turtles or on a larger male population, or that the catches are dependant on entrants into the Mediterranean from the Atlantic -or indeed that the catch figures need to be verified.

Sex ratios in turtle populations in the Mediterranean are unknown, but it is tempting to speculate that since the Mediterranean is on the northern limit of the turtles' distribution the male to female ratios may be high.

The size composition of the turtle populations in the Mediterranean is also largely unknown. The sizes of nesting females, though not an indication of the population size composition, indicate, nonetheless, that the Mediterranean populations have a larger number of small mature females than practically any other population elsewhwere in the world. This, however, may be the result of several factors such as the considerable variations between populations in growth rates and size at sexual maturity.

The rates of recent decline in the Mediterranean nesing populations are still unclear as the information available is still not adequate. On the basis of 15 years of data on Green and Loggerhead (but especially Green) turtles nesting in Cyprus it is obvious that there are very wide fluctuations in the numbers of females nesting from year to year, though no overall decline has been noticed during this period in the turtles nesting on the beaches of west coast (Lara-Toxeftra). Nonetheless, several beaches have been lost to recreational use in other parts of the island in the last 15 or so years and the turtles that used to nest there are presumed to have been lost to the nesting population of turtles nesting in Cyprus.

IV. IDENTIFICATION OF TURTLES

This chapter deals primarily with the identification of Loggerhead and Green turtles and the differences between them.

(a) ADULTS

Loggerhead.

Loggerheads are smaller than Green turtles and do not usually exceed 90cm (curved carapace length)in the Mediterranean.

The carapace is somewhat flat, elongated, tapering towards the rear, dark brown to orange-brown. Its surface, though generally smooth, is not shiny and may be flaky. The throat and the soft parts of the flippers are whitish-yellow or yellow. The plastron is whitish-yellow to pale orange. There are 5 costal shields (scutes), the front one being smaller than the rest. The plastron has 3 inframarginal shields. The head is very large, compared to that of the Green turtle and it has a powerful jaw. The flippers have two claws.

Green turtle.

These are larger animals reaching 110 cms or so in length (curved carapace length) with a domed, oval and often smooth and shiny carapace which is generally black. There are four costal shields (scutes) of about equal size which are often mottled brown or copper in radiating patterns. The throat and soft parts of the neck and the flippers are white, occasionally off-white or yellowish. The plastron is white or off-white. The plastron has 4 inframarginal shields. The flippers have a single

claw.

(b) HATCHLINGS.

Loggerhead.

Both the carapace and the plastron are brownish -black, as is the rest of the body, with the marginals sometimes paler, from brownish-black to ochre. The extremities and the plastron are also occasionally ochre-brown. The carapace is rough with the costal and especially the median shields keeled. The average length (straight length) of the carapace of the hatchlings is about 41 mm. and on average they weigh 16 gms (Cyprus data). There are marked differences in the size of hatchlings from different clutches originating from different females. Hatchlings from a single clutch of eggs are very uniform in size. The average size of hatchling apparently varies very little between rookeries in the Mediterranean.

Green Turtle.

The carapace is black with a narrw white margin. The underside of the hatchlings is white. The shields on the carapace are smooth (not keeled). The hatchlings are usually larger than Loggerhead hatchlings, averaging 47 mm in carapace length (SCL) and 21 gms in weight (Cyprus data).

Measuring hatchling and eggs

These should be measured with caliper fitted with a micrometer, measuring straight length (SCL) in the case of hatchlings.

(c) JUVENILES - SUB ADULTS.

Loggerhead

The carapace starts turning orange-brown and the median plates remain keeled until the turtles are a few years old. The keels disappear before maturity. Within a few months the black plastron turns light brown to yellow-ochre.

Green turtle

Green turtle juveniles and sub-adults often retain their hatchling colours i.e. a smooth black carapace with a white or off - white plastron and throat etc. After the first year or so, however, the shields on the carapace often turn lighter in colour going light brown with off-centre radiating patterns of copper-brown and black.

SEXUAL DIMORPHISM

In both species, hatchlings, juvenile and sub-adult males and females are similar in external features. Before sexual maturity, the males of both species grow a much longer and fatter tail than the female. This extends well past (15 cm or more) the posterior end of the carapace. This is the main external means of identifying the sexes. There are also secondary characteristics such as the male's longer curved claw on the front flipper, the size (length) of the plastron and the shape of the carapace but it is more difficult to base identifications on these features.

DEVIATIONS

It should be noted that the above characteristics of the two species are subject to individual variations. The most common variation in the eastern Mediterranean population of the Green Turtle is the number of costal and central shields. There may be 5 - 7 costal shields and up to 8 central ones and their shape may be irregular. This seems to be a genetically controlled feature and it is apparent from the hatchling stage. In some nests a large number of hatchlings exhibit this feature.

Occasionally adult Green turtles have been found with a smooth carapace with no shields showing.

The identification should, therefore, not be based solely on shield counts but should also take other characteristics into consideration. Albino hatchlings are very rare and usually do not survive, even in captivity.

OTHER SPECIES

No other species are known to nest in the Mediterranean. Leatherbacks are occasionally caught on floating long lines. This is a much larger animal reaching 2 metres in carapace length with a soft, skin-covered carapace which has no shields but seven longitudinal ridges.

In the East Mediterranean the only other species that reaches a comparable size to a young Green or Loggerhead turtle is the freshwater species *Trionyx triunguis* which can easily be identified by its limbs which have 5 claws and lack the lipper-like shape of the marine turtles. It occasionally strays into the sea.

COMMENSALS AND ECTOPARASITES

It is highly unlikely that identification can be hindered by the presence of animals growing on the carapace of turtles. The commonest species encountered in the Mediterranean belong to the genus *Chelonibia*, which are large encrusting barnacles. They are more frequent on Loggerhead turtles and they are commensals. Several species of commensals and parasites have been identified on Mediterranean turtles (23).

V. NESTING AND NEST AND TRACK IDENTIFICATION

Track identification

The Loggerheads, being smaller and lighter animals can "walk " on land with their flippers moving alternately i.e. front-left and rear-right at the same time, followed by front-right and rear-left.

Green turtles are generally larger animals and lift their heavy bodies up on both their front flippers pushing their body forwards with all four flippers at the same time.

Because of their way of "walking" on land the tracks that the two species leave on their nesting beaches are different. Loggerheads leave tracks where the deep impressions of the front flippers are alternate while the Green turtles leave parallel impressions. The "footprints" of the Green Turtle are also closer together as shorter " steps " are taken by the turtle.

Checking for turtle tracks should be done early in the morning, if night surveillance is not possible. The wind will cover turtle tracks very quickly on some beaches making their location impossible later in the day while tides and waves will make the distinction between old and fresh tracks difficult. Footprints and car tracks may also confuse the situation on some beaches.

Keep in mind that not all tracks lead to nest as many "false crawls" are made, on some beaches in particular, before a nest is made and eggs are laid.

Nests and nesting

Typically, both the Loggerhead and the Green Turtle make an arc-shaped nest as the turtle faces away from the sea when she lays her eggs and then turns gradually towards the sea as she covers up the nest. This is, however, not always the case, particularly when she has made many attempts to find a suitable spot to lay. The shape of the nest also varies due to a number of other factors such as the nature of the beach (slope, grain size) and the habits (idiosyncrasies) of individual turtles.

Both species start digging with the front flippers moving together in powerful strokes throwing sand out behind them.

Loggerhead nests are shallow as these turtles do not dig much of a body pit but simply make a small depresion in the sand. The turtle then digs the egg chamber, with her rear flippers, with her body sloping down towards her tail and her head and carapace usually well above the surface of the beach. The depth of the chamber varies and depends on several factors, such as the size (age) of the turtle, the location of the nest on the beach, the distance from the sea, the nature of the beach (grain size) etc. The top eggs are usually 20-35 cm below the surface of the sand while the bottom of the egg -chamber is

about 35 - 50 cm deep. The diameter of the chamber is about 14-18 cm. on top widening by about 5 cm lower down. Usually the whole nest, including the cover-up operation, is relatively narrow and may reach about 2,5-4 metres in length, though this again varies according to the nature of the beach, the size of the turtle, etc.

Green turtle nests are deeper, as these turtles dig a sizable body-hole before digging the egg- chamber. Consequently the nest is wide and deep and the eggs are deposited deeper than those of the Loggerhead. The top layer of eggs in this case is usually about 45-60 cm. below the surface of the beach while the bottom of the egg-chamber may be 60-85cm deep. The diameter of the egg chamber is about 18-23 cm on top widening by about 5 cm lower down. Here again the nature of the beach (grain-size etc.) affect the depth at which the eggs are deposited. The complete nests (including the cover up operation) are often also longer than those of the Loggerhead turtles reaching 5-10m in length. Green turtles often leave a sizable depression at the end of the nest i.e. the end at which the turtle left the nest for the sea. The head and carapace are usually below the surface of the beach during laying.

In both species the point of entry at the nest can be distinguished from the point of departure from it because the tracks at the point of entry are covered up by the sand thrown up by the turtle in digging the nest and in covering the egg-chamber.

The turtle digs her egg-chamber carefully with her rear flippers used alternatively. The dimensions of the chamber vary somewhat with the species, the size of the individual female and the size of the clutch of eggs. (Double chambers i.e. one for each rear flipper, have occasionally been recorded in young inexperienced turtles).

The turtle deposits her eggs in the chamber and takes care that no sand falls onto the eggs while she is laying. While she is laying she guards the chamber with both her rear flippers, to prevent sand from falling onto the eggs. Green turtles keep their rear flippers close together, cupping the chamber while Loggerheads tend to keep them further apart.

After the eggs are deposited in the chamber the turtle uses her rear flippers again to cover the eggs with wet sand, forming a kind of lid to the chamber, making sure that sand does not fall between the eggs. (The mucus which covers the eggs when they are being laid helps to stop the sand from dropping between the eggs and to form the lid to the chamber). She then covers and camouflages the chamber by throwing back large quantities of sand with her front flippers. As she does this she moves forward in stages. The Green Turtle moves forward as the level of the sand reaches the level of the body pit. As she comes to the end of her digging the body pit gets shallower, although Green turtles always leave a sizeable depression.

Loggerheads do more shallow digging to cover up their

nest.

Loggerhead nesting is quick and may finish in about one hour. Green turtles take much longer because of the kind of nest they dig and may take 2-3 hours to finish - and sometimes more. Green turtles usually (but not always)nest higher up on the beach than Loggerheads and will usually only lay on high profile beaches. Green turtles seem to prefer surf-swept beaches, which often have such high profiles. They often select the part of the beach which has the highest profile.

Nesting periodicity and nesting season.

Nesting usually takes place every 14 days (half a lunar cycle) but variations are frequent and turtles may lay in periods varying from 10-18 days. Loggerheads start laying at the end of May or the beginning of June and usually finish laying by the end of August. Occasional nesting in early September has been noted. Green turtles usually start about 2 weeks later and finish in mid -August, though sparse nesting has been noted even in early September.

The beginning of the nesting season may be affected by weather conditions and it may vary widely from year to year. Prolonged winter conditions can delay nesting; for example, in Cyprus, in the summer months of 1992 the nesting season was delayed by about 2-3 weeks.

Timing of nesting

Nesting almost invariably takes place at night. Daylight nesting was witnessed only twice, (in Loggerheads), in 15 years of observation in Cyprus. It took place 1-2 hours before sunset.

Usually nesting starts after 10 pm. though the actual nesting time is largely influenced by the state of the moon. Turtles usually come up on the beach just before the moon rises, when the moon is "young" or just after it sets when the moon is "old". Therefore, during certain periods nesting-time can be predicted to a degree. However, turtles will nest during the full moon or when there is no moon at all. During the full moon they usually come up when the moon is at its highest, (i.e. about midnight), perhaps to avoid throwing long shadows (made by a low full moon) which are all too noticable by predators. In other parts of the world, where there are large tides, tidal cycles have been mentioned as an influence on nesting time, the turtles reportedly coming up on the beach at high tide 24.

It is unusual for nesting to start after 3 a.m. unless the turtle has been disturbed or has repeatedly been unsuccessful in finding a suitable nesting spot.

There is still insufficient information as to whether the beginning of the nesting season is related to moon and tidal cycles.

Eggs and clutch sizes

The eggs are white, spherical and leathery i.e. they are soft-shelled. Loggerheads lay 85 eggs per clutch, on average, while the Green Turtle lays 120 eggs per clutch, on average (figures refer to Cyprus data). Loggerhead clutch sizes in Greece and Turkey are reported to be in the range of 90-100 eggs. In Cyprus, Green turtles have been noted to lay up to 21 eggs and Loggerheads up to 165 eggs. At the beginning and at the end of the season, the size of the clutch may be very small (20 -30 eggs) or very large. There is some indication that this may be connected to the timing of the beginning of the nesting season. Delayed nesting (as in 1992 in Cyprus) may result in very large egg clutches at the beginning of the season.

Loggerhead eggs average 38.4 mm in diameter and 30 gms in weight while Green Turtle eggs average 41.5 mm and 38 gms respectively (Cyprus data). These data may vary considerably from turtle to turtle. Small, non-spherical, yolkless or deformed eggs are found regularly in small numbers.

Freshly-laid eggs have a " translucent ", soft shell and are not dented. The eggshell of the fertilised egg starts turning white (opaque) on top, over the embryo. The white patch grows and its size is often a good indicator of the age of the egg during the first few days. One or two days after laying a white spot appears on the uppermost part of the egg over the embryo, where the extra-embryonic membranes attach it to

the top of the shell. In about five to seven days half of the egg has turned white. In about ten to twelve days, the whole egg is white. Infertile eggs remain translucent.

Denting of the eggs often occurs, even in undisturbed nests and is the result of water losses due to evaporation. The nature of the beach, (particle size etc.) is usually a factor in the degree of denting, as is the depth of the egg chamber. Usually it is the top eggs that get dented, especially in shallow Loggerhead nests. Such denting is apparently normal and usually it has little effect on the hatchability of the eggs.

Incubation

Incubation takes about 7 weeks but may vary from 44 days to 60 or more. This is discussed in more detail in the chapter on " Incubation temperature and sex determination " while hatching is discussed in the chapter on " Hatching and releasing of hatchlings".

A few days before hatching the eggshell starts flaking and it becomes somewhat brittle. This is the result of calcium uptake by the embryo. The hatchling breaks through the shell with a protuberance on its snout, which is lost soon after hatching.

Beach Surveys

Though most nesting beaches on the northern shores of the Mediterranean are largely known there are extensive areas on the southern shores that need to be checked in order to identify nesting beaches. The intensity of nesting activity on these beaches also needs to be assessed. The most cost-effective way of identifying nesting beaches on extnsive coastlines is by aerial survey. This is best done by using helicopters, though this is more expensive than using small planes. Helicopters can fly at low speed and are more versatile in such work. Surveys should be done from a height of about 80 - 100m. Turtle tracks, especially fresh ones, are easily detectable early in the morning when the low sun enhances shadows. Flights should aim at finishing by about 08.00 as information collected after that may be misleading. Once-off surveys during July, when nesting activity is at its highest, will give a first inventory of nesting beaches and some indication of relative nesting intensity. Regular flights are needed if more information is to be collected i.e. on the actual intensity of nesting etc. This, inevitably, is a more elaborate operation. Turtle tracks don't always lead to nests and on some beaches very few do. Results of aerial surveys therefore need to be verified on the ground.

It should be kept in mind that there are very significant fluctuations in nesting activity from year to year and the results of such surveys (or indeed of any surveys) need to be qualified.

VI. PREDATION

Predation is natural and an equilibrium between prey and predator is achieved in many cases. In the case of turtle eggs and hatchlings predation is seasonal and hence opportunistic as far as the predator is concerned.

Predation has become an important problem since the turtles have become endangered. Increasing recruitment of new entrants into the populations can be achieved by reducing the incidence of predation.

Turtles face different predators during their life cycle:

Predation on adult and sub-adult turtles

The main "predator" on adult turtles is undoubtedly man. The capture of turtles on the nesting beaches of the Mediterranean and elsewhere in the world in the past has been the main cause of the turtles' decimation. Currently their capture is limits as turtles are protected in many, but still not all, countries of the region.

Incidental catches of turtles in trawl nets, bottom set nets (trammel nets) and floating longlines for swordfish are having a serious impact and several thousand adult turtles are killed each year (see also chapter on Fisheries and Turtles).

Sharks are the only other predator on adult turtles. The impact of predation by sharks is, however, not considered to be significant on these turtles. It is likely that it is more significant on younger turtles though little information is available on this. Occasionally turtles missing flippers or parts of fippers are encountered on nesting beaches. Bites on the carapace are even less frequent.

Predation of eggs and hatchlings

In areas where there is no human interference predation on turtle eggs and hatchlings is usually the main factor that limiting the number of hatchlings that reach the sea from any successful nesting. The main predator in many countries in the Mediterranean is the fox. The level of predation depends on a number of factors such as the number of predators, the proximity to habitation and the nature of the beach, which to some degree determines the depth of the nests-and the accessibility of the eggs. Shallow nests are more easily detected by animals with a keen sense of smell. On some beaches in Cyprus over 80% of the nests are destroyed by foxes, which eat the eggs and hatchlings. The main danger periods are soon after laying, when smells are fresh, and when the hatchlings emerge from the nest. Nests, however, can be dug up at any time during incubation. Foxes can easily locate nests which are hatching when the first batch of hatchlings emerges, carrying with it the very characteristic smell of a hatched nest. The fox will eat or kill most of the emerging hatchlings and will dig up the nest and usually eat most of the rest; otherwise it will kill and bury nearby the

hatchlings it cannot eat. Foxes frequently patrol nesting beaches during the nesting and hatching season and will follow the tracks of hatchling back to the nest. Even a single experienced fox can devastate an area. Foxes are territorial and one fox can be expected to cover about 1 km of beach. Other predators on eggs and hatchlings include feral dogs, jackals and other mammals. The spectrum of land predators obviously varies with the country and its mammalian fauna mainly.

As the hatchlings usually emerge at night only nocturnal animals will normally be a danger to them. Ghost crabs (*Ocypode cursor*) usually take a small percentage of the hatchlings. Ghost crabs do not live on all beaches but only on those which have the right grain size and structure for them to make their burrows. They can catch hatchlings both on the beach and in the surf zone. Occasionally ghost crabs will burrow into a nest causing damage to the eggs.

Crows and other day diurnal birds are only attracted to nests which have already been disturbed by foxes or other animals.

Hatchlings and juveniles at sea are also undoubtedly subject to predation by large pelagic fish such as *Coryphaena hippurus* but little information is available on such predation and on any predation by sea birds in the Mediterranean.

VII. FISHERIES AND TURTLES

1) Impact of fishing - rlevant legislation.

Fishing activities invariably result in turtle catches. These are mainly incidental catches which, however, are collectively damaging to turtle populations. Past exploitation of turtles (by catching them on their nesting beaches and during fishing operations) is seen as the main reason for their decimation. Current fishing activities and the resulting incidental catches keep populations at low levels or even reduce them further. This kind of slaughter can be curbed by adopting and enforcing legislation concerning the landing, sale and possession of turtle and turtle meat or products.

Turtles in the Mediterranean are caught mainly on surface long lines, bottom-set trammel nets and by trawlers. The turtles are often caught alive. They are then killed. Trawler hauls are often short. As a result the turtles caught in the nets don't drown, as proved by catches of turtles by Cypriot trawlers in the Nile Delta area, in Libya and occasionally in Cyprus. Though "Turtle Exclusion Devices" (TEDs) appear to work in other seas (mainly on shrimp nets) their effectiveness on the Mediterranean trawl nets needs to be verified. The feasibility and means of their introduction for certain areas also needs to be assessed, if they prove effective on Mediterranean trawl nets. TED's are essentially devices with a trap door which are installed on the top rear part of the trawl net. The trap door opens when pressed against by a heavy object e.g. a turtle, releasing the turtle from the

net.

Bottom-set nets, in some cases at least, also result in catches of live turtles as the period of leaving the nets on the seabed is often restricted by practical considerations. Such nets are usually left on the bottom only for a few hours to avoid the spoiling of fish or to reduce the chance of predators getting at the fish. This can be regulated by law in order to safeguard resources. This is the case in Cyprus. Turtles and especially Loggerheads will locate nets left down for any undue length of time and will systematically raid such nets for fish, damaging the nets in the process. This makes turtles unpopular with fishermen who will often kill them to protect their nets. **Legislation restricting the period during which nets may remain on the sea bed does not only protect fishery resources but it also helps in eluding turtles.**

Prohibiting the setting of nets in shallow waters, in particular near nesting beaches during the nesting season, will also reduce incidental catches and conflicts with fishermen. Banning trawling in shallow waters (less than 50 metres) will have a very beneficial effect, though this may not be feasible in all areas. Such legislation has already been introduced in Cyprus and it provides for the periods of the day during which bottom-set nets can be used (See Annex II for details). This legislation also bans trawling in waters shallower than 55 metres, mainly for the protection of young fish and *Posidonia* meadows. The enforcement of this is, hoever, not simple.

Floating long lines used for catching swordfish also result in turtle catches. The large hooks used often cause injuries to the mouth and throat but with some care the hooks can be removed without any serious long term effects. Should they be swallowed their removal may not be feasible.

The intensity of fishing (and the rate of incidental catches) has a bearing on the longevity (and average size) of the animals in the population.

2) Dealing with apparently drowned turtles

Turtles caught in nets may be brought up in a comatose state. They do not move and appear dead. Some of them may be revived if kept out of the water for some time. They should be kept cool on their "belly" with the head down and the tail end much higher (at about 45°) This helps any water in the lungs drain out. Such comatose turtles should be kept out of the water for about one day to ascertain if they are dead or whether they can be revived. If put back into the sea in a comatose state they will die.

Artificial resuscitation, by repeatedly pushing on the plastron with the turtle on its carapace and the head lower than the tail may also work in clearing the lungs. Try this for a short time and then turn the turtle and place it as described above. Some of the turtles will come out of such comatose states. A supply of pure oxygen has also been found very useful in reviving comatose turtles. This is of course not often available on boats. Oxygen

may be allowed to free flow near the nostils. Alternatively the head of the turtle may be put in a large polythene bag (held by an elastic band around the neck) while free-flowing oxygen into the bag. Do not exceed 2 hours of such treatment.

3)Trauma - propeller injuries

Turtles are occasionally found with injuries caused by boats and propellers, or by fishermen. Some of the injuries are superficial and the turtles are best left to themselves to heal. In more severe injuries such as damage to the skull it may be necessary to keep the turtle and attempt treatment. It is beyond the scope of this manual to provide information on such a specialized subject. It is worthwhile to encourage a local vet (or doctor) to specialise in the treatment of such turtles. Such experience has proved invaluable, especially if facilities for turtle recuperation (sea cages - spare bathrooms (!)) are available. A manual by Stuart Mc Arthur "Veterinary Manual for Tortoises" is now in preparation and though this is not aimed at marine turtles it provides much valuable information that may also be relevant to marine turtles .

V III CONSERVATION TECHNIQUES

1.OBSERVING AND TAGGING TURTLES

Although observing, tagging or measuring turtles are not strictly speaking conservation techniques, they are included in this chapter as they provide valuable information for conservation purposes and projects. Tagging turtles can provide information on populations, nesting frequency, migrations, behaviour etc. Any tagging programme will inevitably require a follow-up. Monitoring of beaches, in particular during the nesting season, over many years, is necessary if the programme is to give results. Tag losses should be expected and it is not certain whether scars from lost tags are permanent. Caution should therefore be employed in the interpretation of results from tagging programmes.

Double tagging, as recommended in this manual, can provide information on tag losses. If tags are expected to be returned by people other than those who are undertaking the tagging and the beach monitoring, the tags should be marked clearly on one side with a return address. Rewards for returned tags are a debatable issue, as they obviously have their pros and cons.

In spite of any shortcomings, tagging is a useful technique in providing information for turtle conservation work especially in the Mediterranean where little is known about turtles and turtle populations. It should, however, not become an end in itself as obviously no amount of tagging will conserve turtles.

All it can do is provide information on which to base conservation

measures. Therefore, any tagging programme, its follow-up and the interpretation of the results, should have clear aims and be well-planned.

Spotting and approaching nesting turtles

If turtles are disturbed before they start nesting they will be frightened easily and will quickly return to the sea. Movements on the beach will also easily disturb turtles enough to disrupt nesting during the early stages and turtles will often go back to the sea or, at best, look for another place to nest. The more advanced the digging, the less likely the turtle is to be disturbed, especially if the digging of the egg-chamber has started. If the actual laying has started the turtle will not usually stop laying but may, if unduly disturbed, finish laying and cover the chamber and the eggs more quickly. **Green turtles are more easily frightened than Loggerheads .**

It is preferable to walk on the beaches either singly or in twos communicating with the main group (if there is one) through portable VHF units (walkie-talkies). Tagging-guns and an adequate number of tags (in quadruplicate) should be carried by anyone checking a beach. This is best done with a large waist wallet in which a tape measure, a pen and a notebook are also carried. A small adjustable narrow-beam torch is also indispensable. It should preferably have a red filter. Large torches are not recommended but may be used if one narrows the beam with the fingers. Holding the torch near the ground enhances the shadows so that tracks can easily be spotted at a distance.

When looking for nesting females, it is recommended to walk along the beaches carefully, preferably without using a torch. Torches should be used only when necessary. On many beaches it is possible to see well enough to spot turtle tracks with starlight alone. Torch-beams should not be waved about on the beach or out to sea. **It is recommended to follow the surfline while looking for tracks. Emerging turtles leave tracks that start from the surf-swept strip of that night.** Tracks from previous nights do not usually start from this strip but higher up, as tides and waves usually cover up the lower tracks. They may also be overlaid with footprints. It is good practice to draw a line in the sand across old tracks at 3-4 metres from the water-line to help identify new tracks. A single fresh track means that the turtle is on the beach, two tracks may mean that the turtle has left, or that there are two turtles on the beach and so on. The novice may find it difficult to assess the direction of the movement of the turtle from its tracks.

If the turtle is disturbed and returns to the sea, it will probably return to the beach one hour or so later, probably at another place on the same beach or on a neighbouring beach. Otherwise she may return the next night.

Image intensifiers (night-sights) can be very useful to scan or monitor the beaches from a safe place without disturbing the turtles at the wrong moment. Such devices can however be expensive and are not always easily available to the public (check local legislation). Cheaper models are becoming available for a

variety of purposes (hunting, yachting etc.). These do not usually require any source of supplementary light and will work very well with a little moonlight. Starlight alone only allows their use at short distances for turtle track spotting. Their effectiveness can be improved dramatically by the use of a narrow beam torch with a red filter. Though the beam is hardly visible (it may not be visible)to the naked eye (turtle eye?) its effect through an image intensifier is spectacular. A small torch (e.g. a mini Mag-lite) with a red filter is effective to over 200m. Infra-red light sources are similarly useful and some of the intensifiers have built-in infra-red emmitters for map-reading etc. These built-in sources are, however of little use for scanning beaches. Holding the torch at a low level will enhance shadows and highlight tracks etc.

Once a turtle has been located it is recommended to watch her for some time to ascertain what stage of the nesting process she is at. Following the tracks to find the turtle will not necessarily place you behind her and care should be taken to find out in which direction the turtle is looking. Approach her carefully from behind once this has been ascertained. Keep in mind that Green turtles may not be visible above the level of the sand. Loggerheads usually are. Crawling on all fours is safer, to avoid disturbing the turtle.

Clothes which do not provide a visual contrast with the beach should be worn on night patrols. White or black clothes should be avoided as they can more easily be detected by the nesting turtles which are on the lookout for any moving objects.

Tagging and measuring turtles

Tagging should be undertaken after the turtle has finished laying and has covered the eggs. Turtles which are found obviously returning to the sea should be checked for tags, and tagged if necessary. **Double tagging is strongly recommended** (i.e. one tag on each flipper) **with the same number.** Plastic Jumbo Tags have been found by the authors to be reliable, practical to use and easy to read. (These are large mammal ear-tags manufactured by Dalton Supplies Ltd., in the U.K.). They have been found, still in place, by the authors a decade after tagging. Some researchers prefer alloy tags and several kinds are available. These are closed-end tags that firmly clench the turtles flipper. The authors have observed that such tags tend to constrict the flipper as it grows and they have discontinued their use. Moreover these tags are not easy to read.

Tags should be attached to the soft part of the fore-flippers (see photograph for location of tag on the flipper). Other researchers prefer to tag at the proximal end of the flipper. It should be expected that some tags will be wasted and spares with the same number should be available. Tags are put into place by special plier-like applicators. A strong hole punch or chisel, though not essential, will help in making a hole before inserting the tag. The tag should be put into place with the number uppermost. This will help in later observations. At this stage, i.e. during tagging, carapace length (and if possible the width) of the turtle can be measured.

Though there is still no agreed standard method of measuring turtles, experience has shown that it is more practical to measure turtles with a tape (metal or cloth), measuring "curved carapace length" (CCL) than it is to measure "straight length" with cumbersome instruments (calipers etc.) which may, as a consequence, result in fewer counts. **The method used should be clearly stated in any records or publications.**

During tagging the following should be recorded :species, tag number and carapace length (and width if possible) and any other identifying marks. These should be entered with all the other information either in a notebook or directly on the Log Sheets (Annex I) during tagging. The same holds for already tagged turtles which are observed to nest.

Good photographs showing details of the carapace with the tag number showing could be invaluable. Photographs should be taken preferably after the turtle has finished laying.
Photographs should not be taken before the turtle has started laying. **It should also be ascertained that there are no other nesting females in the vicinity at the time of taking photographs.**

Whilst being tagged the turtle will wince, as she is obviously in pain. Loggerheads may snap. **During tagging it is strongly recommended to:**

- **Keep out of reach of her head and beak.** The beak is very strong and accidents can happen.

- **Tag standing behind the fore - flipper with an assistant(s) holding the flipper.** A single person can relatively easily tag the left flipper by standing outside the reach of the turtle flippers by holding its tip with the left hand and the tagging gun in his right. It is difficult for a single person to tag the right flipper and usually an assistant has to hold the flipper. **Do not turn turtles over to tag them.**
- **Watch out for flapping flippers as they can cause injuries, mind your shins.**
- **Beware of sand thrown up by the flippers, mind your eyes.**

2. HATCHERY TECHNIQUES AND NEST PROTECTION

Transplantation of nests

If eggs can be protected *in situ* i.e. where they were laid they should not be moved. Intervention (i.e. transplantation) is necessary and justified when it is not possible to protect the eggs *in situ* and where there is heavy predation, likely inundation by the sea or other obvious dangers to the eggs or to the hatchlings.

Location of eggs in nest

Locating the eggs in the nest is done with a short thin stick (a cane will do) about 1cm in diameter and 70-90cm in length which is pushed gently into the sand at various places in the nest. The sand " gives " easily where the egg chamber is. For the Green Turtle the egg-chamber is usually about 1-2 metres from the beginning of the nest i.e. where the turtle started digging. For the Loggerhead this distance is shorter-usually about 0.5 to 1 m. At the end of the nest there is a depression caused by the turtle as she digs up sand to cover the chamber. The direction of the "footprints" in the tracks and the point of departure of the tracks from the nest are indicators of the beginning and the end of a nest. Tracks going to the nest are covered by sand thrown up by the turtle in digging and covering up the nest. The tracks leading away from a successful nest go straight back to the sea. "Tries" i.e. unsuccessful nesting, result in tracks which usually lead to another "try", or to a completed nest or, of course, back to the sea if the turtle has been unsuccessful in nesting. Tracks which do not lead to a nest are known as "false-crawls".

On most beaches it is not usually possible to locate the egg chamber in Green Turtle nests with a stick, as the chamber is fairly deep, unless a layer of sand, (about 30 cm.) is first removed. Loggerhead nests do not usually present such a problem. **Caution: The stick should be used gently to avoid damage to the eggs.**

Where the turtle is seen to lay, it is good practice to mark with a stick the location of the chamber. This will prevent unnecessary risks to the eggs on the following day. Two sets of sticks on eiter side of the nest, out of reach of the nesting turtle, can also be used to get a "fix" on the chamber.

Protecting eggs *in situ.*

Protecting nests in situ can be achieved by placing a protective cage on top of the egg chamber. This needs to have a substantial part of its base (about 30 cm) buried in the sand to stop foxes or other predators digging under the cage or up-ending the cage. Such cages are intended for the protection of the eggs during incubation and should not aim at restraining the emerging hatchlings from going out to sea. The cages to be used are therefore of a different design to hatchery cages. The cages used for this purpose have a gap at the level of the sand which allows hatchlings to escape from the cage but prevents large predators (foxes etc.) from getting at the eggs. The reason for this different approach is that it is not usually practical to continuously monitor for emergences many cages scattered around a

beach or on several beaches for emergencies. Undoubtedly this practice does not protect the hatchlings from predators during their dash down to the sea but it does protect the nest during incubation. It also prevents a predator from digging up the nest if the predator follows the trail of hatchlings back to the nest. **Where such cages are used it should be ensured that the escape slit in the cage is on the surface of the sand and that it remains on that level during the expected period of hatching.** Wind and other disturbance of the sand can block the slit and the nests should be regularly and carefully monitored especially during the period of the expected hatching.

Handling of eggs

The eggs can be collected while the turtle is laying by scooping them out of the chamber while they are being dropped. This may be practical when the turtles are seen laying. This may disturb the turtle however. For other nests the following are recommended:-

After the location of the egg chamber has been ascertained, a layer of sand should be carefully removed using a sand-removing shovel. Lower down it is preferable to work with the hands. Fresh eggs (up to 6 hours after they are laid) are said to be unaffected by turning. It is preferable not to turn the eggs whatever their age. **The eggs should not be turned if they have been laid more than 6 hours before transplantation.** Turning the eggs will brake the extra embryonic membranes and blood vessels and kill the embryo. It is preferable (and more practical) to remove the eggs early in the morning or late in the afternoon and

not at midday to avoid marked temperature changes. They should be placed on a layer of moist (but not wet) sand (2-3 cm thick) in a narrow vertical cooling box, preferably square or cylindrical, and then stacked in layers. Cooling boxes should have a single handle and be about 30 cm in height and 25 cm in diameter or width (internal dimensions). These have been found to be very practical. Larger ones are not recommended, as sand easily collapses between the eggs while temperature changes are likely to be greater in such boxes. Smaller ones may not accomodate large clutches of eggs. Eggs should be counted as they are placed in the box. They should then be covered by a layer (3 -4 cm) of moist sand, taken from around the egg chamber of the nest. This stops the eggs from moving during transportation and keeps them moist. It also reduces temperature changes. Moist sand ensures that the humidity remains high. Also, it forms a layer above the eggs and does not fall in the air spaces between them. It is also recommended to place a cloth on top of the eggs to stop the sand from trickling between them. This cloth should have a wide enough mesh to allow for ventilation but not wide enough for sand to fall through it. The cloth should be preferebly synthetic as it will be less likely to host bacteria and fungi. The whole process from removing the eggs from the nest, to covering them up with sand in the cooling box, should be quick to avoid evaporation, temperature changes etc.

Do not handle eggs with your hands if you have been using suntan oils, insect repellants etc. Wash you hands before handling eggs.

Information on each nest should be recorded in detail in the Log Sheets (see Annex I) after the eggs have been transfered to the cooling box. The cooling boxes should be numbered and cross-referenced with the Log Sheet so as to keep track of the nests upon transplantation.

Eggs should be transported with the minimum of vibration. Long trips especially on bumpy dirt-track roads should be avoided as they cause significantly lower hatchability rates. During transportation the cooling boxes with the eggs should be cushioned on a layer of rubber foam or be placed on the car seats and secured there or, better, carried on the passengers laps.

Hatchery location.

The hatchery patch should be high up on the beach to avoid any likely inundation by sea-water even during periods of rough weather. The patch should be fenced off with rope or better still, wire meshed to keep visitors and the occasional predators out. Wire mesh is a must if predation is likely.

Selecting a beach for the hatchery, if there is such a choice to be made, depends on many factors. It is prudent to choose a beach or a location on a beach from which there is no visual contact with habitation, lights etc. For practical reasons it is better to choose a beach in which the nature of the sand is such that it facilitates digging. Coarse sand beaches require the removal of considerable quantities of sand before a chamber can be dug.

The hatchery patch should be placed, if possible, on a part of the beach which is not often used by turtles for nesting e.g. behind a patch of rocks on the waterline etc.

Summer storms with very heavy rains can destroy a whole years egg production by innundation and though this is a rare event in this part of the world it may be prudent to have available at the hatchery large polythene sheets to cover the hatchery in the event of heavy downpours.

Replanting of Nests

Egg-chambers should be dug in the moist sand after the top layer of dry sand has been removed and the first 5cm. or so of moist sand has also been removed. The depth of the chamber is best estimated by measuring the depth of the chamber of "natural" nests of the species concerned from the hatchery beach. If there is no nesting on that beach the depth of chambers on a beach with similar grain size sand can be measured and used as a guideline.

The size of the chamber should be according to the size of the clutch to be reburied. The diameter of the new egg chamber for a loggerhead nest should be about 14-18cm on top and widening by about 5cm lower down. Green turtle chambers are a little wider i.e. 18-23 cm in diameter on top and widening by about 5cm lower down. Large nests with more than 120 large turtle eggs can be split and reburried as two nests, with an equal number of eggs in each, with better results than in a single large nest. Wide

chambers should be avoided as the sand covering the eggs will collapse on top of them compressing them or filling the air spaces between them.

The eggs should be recounted as they are placed in the egg chamber. Care should be taken not to turn the eggs while transfering them to the new chamber. When the eggs have been put into place they should be covered carefully with the moist sand removed in making the egg chamber, making sure that as little sand as possible falls between the eggs. Fresh eggs are covered in mucus and during their removal they are likely to end up covered in sand. Older eggs dry up and pose no such problem. Washing sand off fresh eggs prior to their reburial by dipping them quickly into a bucket of fresh water was practiced at the Lara hatchery for a while. A control reburial of unwashed eggs, however, proved that there were no significant differences in hatchability rates and washing was discontinued. It should be noted that the mucus layer which covers freshly laid eggs, in addition to its other purposes, helps in the formation of a "lid" to the original chamber. This prevents sand from trickling between the eggs. The eggs and chamber should be covered with moist sand and the remaining depression filled in with dry sand. The sand should then be levelled off and a protective cage placed over the nest, making sure the nest is in the centre of the cage and that no gaps are left between the wire mesh of the cage and the sand. All relevant data should be recorded in the Log-Sheet. Nests should be planted about 1.5m apart, to ensure adequate working space. They should then be numbered.

Upon hatching, egg shells, unfertilised eggs, etc. should not be left in the chamber. They are not easily biodegradable and they will be found there in subsequent seasons.

Protective cages

The best protective cage so far designed for the hatchery is a circular conical cage, 40 cm in diameter at the top and 60 cm at the bottom and about 30 cm in height. Such cages fit into each other. They are ideal for stacking and storing purposes. The 3 supporting " pillars " are about 45 cm in length of which 15 cm. or so act as pegs for anchoring the cage into the sand. Too small a mesh size will shade the nest, reducing sand temperature and too wide a mesh size will allow hatchlings to escape. The size of hatchlings within the same species varies considerably. Loggerhead hatchlings can be quite small. Mesh sizes that will trap the heads of the hatchlings should not be used. For the frame, an aluminium strip about 3mm thick and 2-4cm wide is rigid enough, the legs being of angled aluminium. Galvanized or plastic-covered wire mesh 1 cm X 1 cm or 1cm X 2 cm (used vertically) is best for the sides of the cages and for the top, if necessary.

Protective cages for nests to be protected *in situ* differ from hatchery cages as they are intended to prevent predators such as foxes from getting at the eggs. They are similar in specification to the above but they are cylindrical with an extra 30 to 40 cm in height. They have a 2-3cm slit for half the circumference at about 30 cm below the top of this case. This

allows hatchlings to escape. The cage is buried to the level of the slit. These cages invariably have a wire mesh on top to them.

Incubation-temperature and sex determination

Incubation takes about 7 weeks but may vary from 44 to 60 days or more, varying with the temperature (latitude, date of laying and incubation period etc.).

Incubation temperature is very important as this determines the sex of the embryo. This is apparently determined within the first 3 weeks of incubation. High temperatures of about 30°-32° C or more result in the production of females while low temperatures of less than 29°C result in the production of males. The pivotal temperature apparently varies somewhat on a global scale and has still to be determined for the Mediterranean. For Green turtles this is between 28.75°C and 29.75°C and for Loggerheads 30°C. (25,26,27).

In Cyprus the range of egg-chamber temperatures varies from 28°-30°C, warming up around August. These temperatures produce a spectrum of male/female ratios in the nests. Factors such as the date of laying (and the period of incubation) and the depth of each nest determine chamber temperatures. Hence it is important, when transplanting nests, to place the eggs at the right depth. In the early years of a hatchery programme it is advisable to monitor temperature in the nests and in the sand at various depths, as characteristics of the sand itself on the hatchery beach (grain size, chemical make-up etc.) will determine the optimum depth for

the right incubation temperatures. A starting guide to this has been given in the chapter on " Hatchery Location" and "Replanting of Nests ". Beaches with different grain size or other characteristics of the sand may produce the same (optimum) temperature at different depths.

It should be noted that the temperature in the nest itself may be higher than that of the surrounding sand as a result of metabolic heat. The temperature of the eggs gets even higher just prior to hatching and may be 2^{o}-3^{o} C or more above the temperature of the sand at this stage.

The temperature in the egg chamber can be monitored with a thermistor probe, (or several probes buried at different depths) . Such work requires an accuracy of at least 0.1^{o}C

Eggs will hatch at temperatures as low as 22^{o}C (albeit resulting in males) and as high as 32^{o}C or even higher resulting in all females, but a low hatchability rate is likely.

Hatching and releasing of hatchlings

The hatchlings success rate varies significantly with the handling of the eggs and incubation techniques. With good care and following the techniques described in this manual, hatching rates can be very high. Some of the eggs are almost always unfertilised or are in any case infertile. In undisturbed Green turtle nests, protected in situ on Lara beach, about 10% of the eggs were found

to be infertile. The hatching success rate in transplanted Green turtle nests at Lara station is about 80% while the rate for Loggerhead nests is a little over 70% . The number of infertile eggs in undisturbed Loggerhead nests is higher than in Green Turtle nests. (28).

Hatchlings emerge from the nest usually 2 - 4 days after hatching. It needs time for the carapace to straighten and for the hatchlings to be ready to surface. Not all the eggs hatch at exactly the same time and hatching time can vary from one to two days. It takes the hatchling about one day to get out of the egg from the moment of breaking the eggshell (pipping).

The hatchlings usually emerge in batches (often one batch per day) over 2-3 days but it is not infrequent for all the hatchlings in a nest to emerge together. The hatchlings rise from the chamber in a batch forming a cone, with their bodies nearly vertical and helping each other as they rise towards the surface. Single hatchlings will sometimes emerge though this is often a sign of disturbance or something unusual happening in the nest. If, on the second night after the first emergence, there is no sizeable batch of hatchlings emerging, the nest should be dug up. Stragglers or hatchlings trapped in egg shells are frequent. Nests should be dug up anyway after the 3rd day of hatching to rescue the odd hatchling.

Hatchlings emerge usually at night after 10 pm (and more often after 12 pm.) though earlier night emergences have been

recorded. However, hatchlings may sometimes emerge during the day, though this is probably a sign of human disturbance. **Hatchlings emerging during the night should be released as soon as possible.** Emergence takes place during a period of mass "frenzy" (triggered by a drop in sand temperature) that affects first the top hatchlings which activate the whole batch by their movement.

This "frenzied" state helps the hatchlings to scramble to the sea very quickly and to swim to "safer" deeper waters.

This frenzied stage continues for several hours and hatchlings keep on swimming straight out to the open sea. During the following day, hatchlings kept behind show several periods of such frenzied activity. Low evening and night temperatures can make hatchlings lethargic and slow in making their way to the sea, if they are kept at such temperatures for any length of time. Hatchlings that emerge too late to be collected and released during the night should be collected in the morning and released early in the evening. They should be kept warm, but not hot, in semi-closed cooling boxes. Such hatchlings should not be kept in water.

Hatchlings should be released high on the beach at the level of the nest, or from the hatchery cages directly if possible, and allowed to crawl down to the water by themselves. This is done to safeguard possible imprinting mechanisms. It may be a futile exercise but it should be undertaken as a precautionary measure.

Hatchlings will not feed during their first 1-2 days. They have an adequate supply of yolk to keep them going.

Nests which are hatching under cages should be checked frequently and regularly for day emergences. Nests known to be hatching under cages should be shaded for the hottest part of the day. **If the hatchlings remain in the sun in the cage even for a few minutes after emerging they will die very quickly.** Hatchlings collected during the day should also be kept and released early in the evening under the same conditions as above.

Hatchlings will normally go towards the sea as soon as they emerge. They are drawn to the brightest part of the horizon -which is normally the sea. However, lights will easily attract them especially on moonless nights and they can be disorientated and led (even by a small torch) away from the sea. Lights should be out when releases are made - and should remain so for at least half an hour after the last hatchling has gone to the sea.

Hatchlings originating from nests laid on beaches other than that of the hatchery should normally be released on their original beach unless these beaches are very close by or there are adequate reasons to avoid them.

When releasing hatchlings, make sure that predators such as ghost crabs do not catch them. The largest of the crabs should be chased away before the hatchlings reach the lower part of the beach and the surf zone. Ghost crabs are not easy to detect in the

surf. Ghost crab burrows in the pat of the hatchlings should be obstructed just before releasing the hatchlings.

Tagging of hatchlings

There is as yet no practical and reliable way of tagging hatchlings. Experiments have been carried out with a variety of techniques, none of which are satisfactory. Notching of the marginal scutes appears to give permanent results though it can easily result in a deformed carapace in adults. Whether this is acceptable or not is debatable. In any case this is not a foolproof method of marking hatchlings as natural injuries may result in similar scars or deformities in adults. Transplantation of white plastron tissue to the carapace of Green turtles also seems to work but this is not practical when dealing with thousands of hatchlings. Other methods have also been suggested (e.g. implanting skull tags as in salmon) but none have proved practical or advisable so far. Keep in mind that any tags that may interfere with the ability of turtles to detect geomagnetic forces should be avoided until more conclusive information is available on the turtles' ability to navigate on such environmental cues. In the absence of reliable tagging techniques for hatchlings the results of hatchery programmes can only be assessed at present by studying populations.

(3) REARING TURTLES IN CAPTIVITY

"Head-starting"

The present chapter is not intended for turtle farming in any way and is included only as a starting guide for experimental "head-starting" work or for rearing individuals in captivity for other scientific reasons.

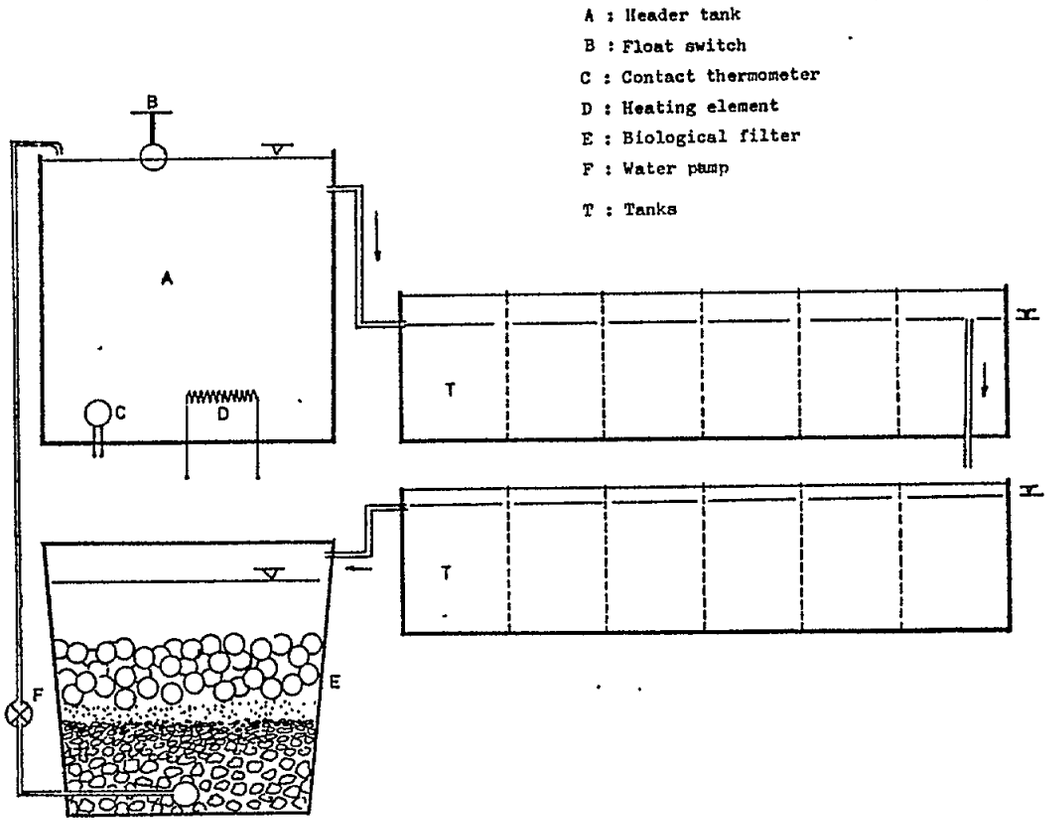
"Head-starting" means rearing hatchlings to a certain size or age and releasing them.

"Head-starting" is a somewhat controversial practice and its effectiveness has yet to be proved. Nonetheless it has some merits which need to be further explored, the main one being that predation on turtles that have been "head-started" is likely to be much lower than on hatchlings. Moreover, these head-started turtles can be tagged.

Rearing hatchlings of Green and Loggerhead turtles is relatively simple once they have started feeding. Initially they will feed or try to feed on anything white in the water. Small pieces of squid provide a start. These should be phased out or at least supplemented by a dry diet of fresh floating (or well bound sinking) pelleted food. Green turtles will also feed on sea grasses or lucern and other vegetables though this is best undertaken after the turtle is a few years old. Hatchlings from both species are normally opportunistic feeders (mainly carnivorous) during their first year or so and will thrive on high

protein dry diets -supplemented with the occasional fish and squid. Trout food with protein levels of about 40-50% has been shown to be suited to rearing young turtles which can assimilate high levels of protein. Feeding by Green turtles on sea grasses, which have a protein level of about 13% is evidently not because of physiologial limitations but probably because of ecological considerations (29,30,31). Deformities etc. and sometimes death will follow inadequate diets.

Temperature over the first winter is critical and should not be allowed to drop below about 16°C. This usually requires either a heated recirculating system or a through system from a suitable source of sea water. The optimum water temperature for rearing hatchlings seems to be 25°C. Under Mediterranean conditions it is recommended to rear hatchlings until they are about one year old in closed systems equipped with a suitable biological filter and with an adequate replenishment of fresh sea water. The diagram below gives a schematic view of the layout of such a closed system. This diagram is not to scale and dimensions can be adjusted according to the number of hatchlings to be reared. As a guide keep in mind that hatchlings will require an initial surface area of about 1000 cm^2. This should be increased as the hatchlings grow. Crowding hatchlings - or older turtles will lead to biting and to the development of necrotic lesions or of lesions from a type of Herpesvirus (see chapter on "Diseases and other problems"). Such symptoms must be taken as signs of crowding and space should be adjusted accordingly.



The hatchlings should be fed 2-3 times a day while juveniles can be fed 1-2 times a day. Feeding rates are dependent on temperature. At 25°C typical feeding rates with pelleted food of 500 gr to about 10kgs are 1.5.% of the body weight/day. Keep the depth of the water shallow until hatchling learn to dive and feed, if they are to be fed on food that sinks. Hatchlings should be fed to demand.

After their first year young turtles can easily be reared in floating cages, or in ponds with an adequate water supply. Cages are preferable for a number of reasons - such as better water exchange etc. Avoid polluted areas when deciding on the location of sea cages. Part of the keeping tanks or cages should be shaded, at least in summer. These cages and tanks should have adequate space. As a guideline yearlings will require about $0.3m^3$ of water each (See also the chapter on "Diseases and other problems").

Hatchlings to be "head-started" should be allowed to walk down the beach and preferably swim for a while before being picked up to be reared. This is to safeguard imprinting mechanisms for locating natal beaches as much as possible. These hatchlings should originate from different nests if possible.

Experimental work in Cyprus and elsewhere with released "head-started" turtles has proved that these turtles can survive in te wild. The best age, for releasing these turtles - if there is an optimum age, is not known. It has also yet (and perhaps more significantly) to be proved that "head-started" turtles retain their imprinting in locating their natal beaches. Until more information becomes available on the merits, if any, of head-starting use only a very small percentage (2% -3%)of the hatchlings for head-starting programmes.

Diseases and other problems

A variety of diseases and other problems may be encountered. Only the commonest problems have been included here.

The hatchlings may bite each other especially in the rear flippers and the neck - and can cause each other severe injuries. Crowding aggravates this. If it can be arranged, the hatchlings should be kept in individual compartments or in compartments containing a few individuals each. As already mentioned at least 20-30 litters of water should be provided for each hatchling. It should have a surface area of about $1000cm^2$. This should be

increased as the hatchlings grow.

White patches of skin (necrotic lesions) often appear on the neck and head but also on the flippers, when the turtles are not kept in separate compartments and especially when the turtles are crowded. Keep in mind that Loggerheads are more aggressive. Do not keep Green and Loggerhead turtles together. These lesions are probably wounds from bites which subsequently become infected. These can be effectively treated with Gentian Violet. Regular treatment (every day) for a few days with 1% Gentian Violet (3N) in water is effective. The turtles should be treated locally with Gentian Violet applied with a brush. Turtles should be treated out of the water. They should be dried with paper tissues prior to treatment and kept out of the water for about half an hour after treatment. If left untreated the infections can cause severe damage, (blindness, loss of limbs) and can lead to death. A Herpesvirus type lesion has also been described which manifests itself when turtles are crowded (32). Several other diseases such as mycotic pneumonia, parasitic gastritis and a coccidia infection have been described. Most can be prevented by providing the turtles with good food, adequate space and a supply of clean fresh seawater. **Do not release sick turtles-whatever they may suffer from.** Make sure of a good diagnosis. Keep in mind that diseases from head-started turtles may be transmitted to turtles in the wild.

4. BEACH MANAGEMENT

Beach management for turtle consrvation purposes aims at protecting nesting females and pre-nesting females, their eggs and the resulting hatchlings. Inevitably, beach management relates to the control of human activity on the beach and in the surrounding area, including the sea.

Threats from human activities

The main threats to the various stages of the nesting and hatching processes are listed below for each stage of this process:-

(a) Nesting and pre-nesting stage.

Water skiing, surfing, paragliding, power boats, fishing (with nets in particular), in shallow waters etc. are dangers and are likely to disturb female turtles approaching nesting beaches. Boats and speed boats in particular can also cause injuries to turtles. At night human activity on the beaches or in the surrounding area is likely to disturb turtles. People moving on the beaches, lights, torches, flashguns, moving shadows etc. will scare the turtles away from the beach when they come up to nest. Car-lights visible from the beach will also disturb turtles. Obstacles on the beaches such as umbrella-stands and sunbeds can hinder nesting or make it impossible under certain circumstances.

The use of the beach by vehicles or its intensive use by people compacts the sand and can make nesting impossible.

b) Incubation

After nesting, the use of vehicles on the beach may lead to a compaction of sand which may make it impossible for the hatchlings to emerge from the nest. It may also cause nests to collapse.

The intense use of the beach by bathers may also result in similar problems. The shade made by umbrellas and sunbeds can cause temperature changes in the nest, and may change the male to female ratio. Umbrella-spikes stuck in the sand may also damage the nests.

c) Reaching the sea

Lights anywhere near the beach are a considerable danger to hatchlings as they lure the hatchlings away from the sea. Apart from predation this is the main danger to hatchlings. It extends the period the hatchlings stay on land. Hatchlings will die from high temperatures if they stay on the beach during daylight hours. Staying on the beach for any length of time will also greatly increase the risk of predation. There is also the possibility of erroneous imprinting.

Obstacles on the surface of the sand such as deep car-tyre grooves etc. can also extend the hatchlings' stay on the beaches with similar results.

5. MANAGEMENT MEASURES - LEGISLATION

It is highly desirable to implement beach management measures restricting or controlling public access to the nesting areas during the nesting period and the incubating period. This includes the sea area adjacent to the beaches. The following recommendations are based on the management measures implemented at the Lara Reserve in Cyprus. This is an area in which there is no development (See Annex II for the legislative text):

For the period starting on the 1st June and ending on September 30th, the following measures are recommended:-

(1) The public should not be allowed on or near the beaches at night i.e. for the period starting one hour before sunset and ending at sunrise. The extent of the land area to be covered obviously depends on local circumstances but this should be a zone large enough to ensure the least disturbance to nesting turtles and emerging hatchlings.

(2) Driving on the beaches should be forbidden.

(3) The use of sunbeds, umbrellas etc. should be forbidden on the beaches.

(4) The use of boats and fishing (except with a rod and line should be banned from the sea area adjoining the beaches to a specified depth (20 m isobath) or to

a set distance from the shore (1-1.5 kms or more depending on the area).

The public should be suitably warned with appropriate notices on the periphery of the protected area and in the vicinity of the beaches.

These recommendations are made on the assumption that the beaches and the hinterland to be protected are not "developed". In areas which are partly developed mitigating measures such as the controlling of lights (public and private) may help, especially in the case of Loggerheads. Shading of lights or the use of lights which are not directly visible from the beach is recommended. Fences and hedges on the seaward side of existing roads etc. could minimize interference from car lights or other low-level lights.

Important nesting beaches in "undeveloped" areas should be protected from any "development", which might lead to future problems and conflicts, by declaring them and their environs as specially protected areas (nature reserves, etc.). These protected areas should include a wide enough zone in the hinterland to prevent the kind of development that will lead to more intensive use of these beaches.

Public awareness is extreemly important in any conservation project and in addition to notices etc. it is very worthwhile to set up, where appropriate, information centres, with leaflets, stickers, posters, etc., helping the public understand what is going on and why the management measures are essential.

6.CONVENTIONS

Turtles in the Mediterranean are protected by several Conventons. A brief summary of the provisions relevant to turtles is given here.

(a) Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) (1973).

All marine turtles are listed in Appendix I of this convention. The species in this Appendix are subject to very strict trade regulation.

(b) Convention on the protection of European Wildlife and Habitats (Berne Convention).

Both *Caretta caretta* and *Chelonia mydas* are listed in Appendix II of this Convention. The species in this Appendix are to be strictly protected by the Contracting Parties and so are their habitats (especially nesting habitats).

(c) Barcelona Convention-Mediterranean Action Plan Protocol on Specially Protected Areas.

Turtles are singled out for protection in the Genoa Declaration and a Plan of Action for their conservation has been adopted by the Contracting Parties under the Specially Protected Areas Protocol.

7. NATIONAL LEGISLATION

In several chapters of this Manual, mention is made of legislation (Fisheries and Turtles, Beach Management Measures etc.). Suggestions for detailed legislative texts for the conservation of turtles which could be applicable to all countries of the region cannot be given here.

The detailed legislative text for Lara Reserve in Cyprus is given in Annex II. This deals with nesting habitat protection. Another regulation, in the same legislation, provides for the protection of turtles and their eggs. National legislation should aim at protecting turtles not only during the nesting period, albeit the most crucial period, but throughout their lifetime. Such legislation should therefore aim at regulating the capture of turtles at sea the possession and the use of turtles or turtle parts (including sale) or any attempt at the above. The legislation should have adequate penalties for violations in order to be effective.

Nicosia, 23rd October, 1992.
AD.AH
A:A203 D23 D24 (DCWS-12-)

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(W58N10)

Year..... ANNEX I

Nest number.....Number of eggs burried.....

Species.....

1. Nest Collection Data: Location ..... Date.....

Nest distance from sea..... Collection time .....

Age of eggs..... Small/deformed eggs.....

Eggs broken or discarded ..... No.Eggs collected..... Total eggs.....

Observations.....

Arrival time at Lara..... Burial time.....

Collected by..... Burried by.....

2. Tagging/Female turtle data: Date..... Location.....

Tag Number.....New/Old. Type.....Flipper-Left/Right

Laying/Tagging time ..... Marks/Barnacles.....

Carapace dimensions (cm):..... Tracks (cm).....

Observations.....

Moon (time of setting/rising).....

Sea state..... Tide level.....

Person tagging or observing.....

3. Hatching data

Time te	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Hatchl. No/day

Nest Opening Date Time No of hatchlings

Observations :

Hatchling total	
Unfertilised eggs	
Non viable E / L	
Dead in eggs	
Dead in nest	
TOTAL	

A:468 D17
AD/AH

E: Early ebryonic stage L: Late ebryonic stage

273/90

Free Translation

THE FISHERIES LAW
(CAP. 135 AND LAWS 1961 UPTO 1990)

Regulations Made Under Section 6

The Council of Ministers in exercise of the powers vested to it by section 6 of the Fisheries Law does hereby make the following Regulations.

1. These regulations may be cited as the Fisheries Regulations 1990.

2. -(1) In these regulations:-

"Director Fisheries Service" means the Director of the Fisheries Service of the Ministry of Agriculture and Natural Resources and includes any officer duly authorised by him for the purpose of these regulations.

"inland waters" means river, natural stream, canal, dam, lake or salt lake.

"sea corridor" .....

"I.C.E.S." means the international organisation which is bearing the name "International Commission for the Exploration of the Sea".

"Fish Farm" means any place or any installations where rearing or breeding of fish is carried out for the purpose of selling them or fish ova are produced for the purpose of selling them.

"Mesh" means the in between space or the holes of the net.

Provided that the employment of such nets will be prohibited after the 31st December 1991.

Provided also that the master or the owner of a vessel to which a fishing licence was issued under section 3 of the Law, can employ or carry on his vessel monofilament nets only if:-

(a) they are gillnets (vopodikta)

(b) they have mesh size between 34 and 40 millimetres; and

(c) their total length is not greater than 1200 metres.

(5) It is prohibited to intervene in any way on the Cod-end of a trawler's net in such a way that the meshes of the sack can retain fish smaller than those for the retainment of which this sack had initially been constructed.

(6) Fishing by the method of surrounding the fish. with . nets (gyrovolia) is prohibited, unless the Director Fisheries Service issues a special licence in writing for this purpose in the form set out in Annex II and provided that any provisions written on such a licence are observed.

(7) It is prohibited, for any vessel, to carry any nets or part of nets which are not made according to the provisions of these regulations unless the Director Fisheries Service grants such authorization in writing.

8.- (1) The setting, on the sea bottom, of any nets the mesh size of which is greater than fifty millimetres is prohibited between 11 am and one hour before sunset.

(2) The setting on the sea bottom, of any net the mesh size of which is between thirty two (32) and fifty (50)

millimetres is prohibited:-

(a) Between 10 am and one hour before sunset; and

(b) during the period starting two hours after sunset and ending at midnight.

(3) Not withstanding the provisions of the above paragraphs (1) and (2), between 15 February and 15 May every year, the setting of nets on the bottom of the sea at any time of the day is allowed, if:-

(a) The mesh size of these nets is not greater than forty millimetres, and

(b) the person setting the nets does not move away from them after their setting on the sea bottom.

(4) The setting of any nets in the sea at a place where the depth is smaller than 10 metres is prohibited during the period starting on the 1st June and ending on the 31st October every year.

9.- (1) The measurement of the mesh size of any net is carried out only with a special mechanical gauge approved by I.C.E.S and when this net has already been used and while it is wet.

(2) The above mentioned measurement is achieved provided that:-

(a) The gauge is regulated in order to exert pressure of four (4) kilograms and placed diagonally within the stretched mesh of the net.

(b) The average is taken, of any series of measurements of twenty meshes in line which are, in the case of a trawler's Cod-end, on the upper part of the sack along a line parallel to its oblong axis; the

shall prescribe the dam or the dams for which it is granted; the fees to be paid for the issue of such a licence are the following:

(a) for one dam : £3

(b) for two dams : £6

(c) for three dams : £9

(d) for four or more dams : £10

(5) The Director Fisheries Service may grant to organised groups a licence for fishing in dams after the submission of an application by any authorised representative of the interested group; on this licence, the validity of which it is not allowed to be greater than fourteen days, the names of the members of the group and the conditions under which this is issued, are written.

(6) For every licence granted under paragraph (5) the fee to be paid is as many pounds as is the number of persons written on the licence.

13.(1) Without a special permit in writing from the Director of Fisheries Service, it is prohibited:-

(a) to kill, purse, take, buy, sell or possess any aquatic turtle, seal, dolphin, freshwater crab or sand crab of the species Ocypode cursor;

(b) any attempt to kill, purse, take, buy or sell the above species; or

(c) to buy, sell or possess turtle eggs or any part of a turtle, seal or dolphin.

(2) It is prohibited to collect from any salt lake or to possess or sell adults or cysts of the species Artemia salina without the prior permission, for this purpose,

of the Director Fisheries Service.

14.(1) No person shall, between the 1st of June and the 30th of September of every year, in the sea area of Lara, the boundaries of which are set on the east at the line of the upper tide level from the point of interception with latitude 34 54'30" North until the point of interception with latitude 34 59' North, in other words from the location known as "Aspros" upto the location "Argaki tou Yiousoufi", and which is extended at right angles towards the sea upto a depth of not less than 20 metres:-

(a) sail or anchor or tolerate any other person to sail or anchor any vessel for any reason; or

(b) fish with any method (except fishing with a rod and line),

unless he has secured, prior to this, a written permit from the Director Fisheries Service and provided that he fully observes any conditions that may be prescribed on it.

(2) As from the 1st June until the 30th of September of every year and within the coastal zone the boundaries of which are set on the west at the line of the upper tide level from the point of interception with latitude 34 54'30" North until the point of interception with latitude 34 59' North (in other words from the location known as "Aspros" upto the location "Argaki tou Yiousoufi") and which as extended at right angles towards the land at a distance of 90 metres from this line, no person shall:-

(a) Enter or stay in this area during the period of the day which begins one hour before sunset and ends with

the rising of the sun, unless he has secured, prior to this, a written permit from the Director Fisheries Service;

(b) drive or tolerate other person to drive any vehicle along any sand beach of this area;

(c) place on any part of this area any camp bed, umbrella, a wheel-house, a tent or any other relative construction, unless this is done on the basis of the provisions of the Foreshore Protection Legislation.

Provided that the persons using the main road of Ayios Georgios Peyias towards the area of "Joni" are exempted of the provisions of sub paragraph (a).

(3) For the purposes of this regulation, the term "vessel" includes any ship, yacht, boat, raft, cargo-vessel, floating raft, as well as every other floating object, independently of its method of propulsion or movement or of the purpose for which it is used.

15.-(1) The discharge or disposal of any substances or objects in the waters of any sea area of the Republic or in the waters of any dam, river, lake or other natural or artificial reservoir in which fish live, which results in the creation of any direct or indirect harmful impact on the reproduction, growth, survival or utilization of fish, is prohibited.

(2) Without prejudice to the generality of the previous paragraph direct or indirect harmful impact, in respect of any marine area, is assumed to be caused:-

(a) By the discharge or addition to the sea, of water of which:-

(2) Any conditions that the Director Fisheries Service, necessary to impose in relation with the establishme operation of the fish farm may be written on any lice granted under paragraph (1).

(3) Every licence granted under paragraph (1) is valid for a period of five years and after that it can be renewed every year unless the Director of the Fisheries Service considers that there is serious reason for which this licence must not be renewed.

21.-(1) Fishing with a trawler in the territorial waters of the Republic is prohibited:-

(a) Between the 1st June and the 7th of November in any year;

(b) at any point of the sea where the depth of water is less than thirty fathoms; and

(c) at any time of the day or period which is not stated clearly on the relevant fishing licence issued under regulation 4.

(2) Notwithstanding the provisions of any other of the present regulations, swordfish fishing with any vessel in the territorial waters of the Republic during the period starting on the 1st October in any year and ending on the last day of February of the next year, is prohibited.

22. Independently of the provisions of these regulations any trawler can, after securing the written permission by the Director of the Fisheries Service and provided that any conditions that may be written on such a licence are observed:-

(a) move at any time from the harbour in which it is anchored to any other place in the Republic, and