A Cooperative Mediterranean Monitoring Programme on Sea Turtle Interaction with Fisheries and Relative Abundance

A proposal by

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1. Introduction

The work of several teams for many years has produced a good deal of information about the distribution of sea turtles in marine habitats of the Mediterranean and threats at-sea. However, some information necessary for focusing the efforts in conservation of these animals is still missing. This is basically due to the great difficulty in obtaining data and the limited efforts that research groups can carry out individually. In particular, turtle catch estimations are available only for some areas and fishing gears, and in most cases they were obtained through short-term studies. In order to provide an overall estimation and to have a wider geographical definition of this problem in the Mediterranean, data on turtle catch by different fishing gears from more areas and more fishing seasons are highly desirable. Another important issue is the trend of populations at sea. Although in the Mediterranean data exist from long-term studies in some nesting beaches, there are no long-term data sets useful for detecting trends of abundance at sea. But only at-sea trends may indicate the contemporary status of the populations (mostly juveniles), in contrast to nest trends, which reflect past populations trends, due to the long maturation time of these animals.

Furthermore, although some important marine areas for turtles have been identified, others may be not yet recognized as such, and so they may not receive the necessary attention for conservation.

Recognizing the above, in the Second Reunion of Mediterranean Sea Turtle Specialists (17 March 2003) a working group was assembled to elaborate a possible Mediterranean research programme aimed to obtain this information.

To reach these goals studies at sea are required. However, they are very difficult to carry out, so a long-term project on several Mediterranean areas is unlikely to be possible if it included expensive activities, like specific surveys. Thus, the working group investigated the possibility of taking advantage of the 'sampling' effort normally carried out by fishing vessels. Naturally, this approach should be intended as one of several possible, and the contemporary carrying out of studies addressing the same issues through different methods is highly desirable.

The results are summarized in the present document, to be distributed among Mediterranean researchers working on sea turtles, in order to get feedback and hopefully to set up a cooperative Mediterranean programme of this kind.

2. Objectives

a) A more comprehensive and realistic figure of the number of turtles caught by different fishing gears in the Mediterranean
b) Trends of turtle occurrence in different marine areas
c) Relative abundance of turtles in different marine areas

3. Characteristics and methods

3.1. Geographical coverage
Objectives (a) and (c) require a large geographical coverage.

3.2 Temporal coverage
Objective (b) requires a medium/long-term temporal coverage.
Although objectives (a) and (c) could be ideally accomplished in one sampling season, their reliability would greatly benefit from a medium-term temporal coverage, which could balance and smooth possible exceptional events, such as large seawater temperature fluctuations, that may occur in some areas in one year.

3.3 Data source

Objective (a) requires collecting data from fishing vessels. Certainly, fishing gears like drifting longline and bottom trawl, known to catch a high number of specimens or to induce a high mortality, should be included. But the inclusion of other, more 'elusive' fishing gears, like set nets and bottom longline, is highly desirable.

Objectives (b) and (c) can be reached by collecting data from fishing vessels too, if the following assumption is met: spatial or temporal differences in the results can be ascribed only or mainly to corresponding differences in turtle abundance.
Taking into account that different fishing gears may catch turtles in different ecological phases, and that different life stages may not all have the same importance when investigating a specific topic, the fishing gear more likely to meet the assumption above should be chosen.

3.4 Participants and general organization

Because of 3.1 and 3.2, it is unlikely that such a programme can be funded as a whole, so it is not possible to hire fishing vessels and/or place observers on board. However, objectives may be reached alternatively, by the collaboration of fishing vessels (captains) providing all the data needed on a voluntary basis.

Because of 3.1, a large number of teams participating in this programme will produce better results and a more accurate picture of the region. A broad involvement of Mediterranean turtle working groups is therefore desirable.

Because of 3.2., the longer the programme, the better the results. Participation of permanent working groups, which can guarantee continuity, is therefore desirable.

Although desirable, co-ordination of research teams in the collection and analysis phases is not strictly necessary. A co-operative approach may be sufficient: teams involved in the programme should share the interest to achieve the goals, adopt the same methods, and periodically publish their results. Certainly, periodical discussions about possible improvement of methods or refining of goals are desirable.

3.5 Data needed and assumptions

-    Objective (a): *Catch estimations in different fishing gears.*
For each fishing gear, the fundamental data to be collected are (i) number of Turtles Caught (TC) in the sampled period, (ii) Fishing Effort (FE) in the sampled period, and (iii) the Total Fishing Effort (TFE) in the sampled area and period, which is usually available as published fishery statistics or other sources. In this way a Catch Rate (CR) could be calculated from (i) and (ii) (TC/FE). Then CR*TFE will give the Total Turtles Caught (TTC). In order to do this, the sampled fishing effort should be measured with the same unit of the TFE available in fishery statistics (e.g. number of vessels, number of fishing days). Whenever it is possible, a second set of data would be very important to be collected: (iv) turtle condition and (v) turtle size. The former is needed to estimate a Direct Mortality Rate and then Total Direct Mortality, the latter to identify the targeted size class. Finally, additional data can improve the estimation of the fishing effort (see 3.6). The main assumptions here are that the collaborating vessels are representative of those belonging to the sampled fishery/area for which TTC is estimated, both as fishing gear characteristics and fishing effort distribution.

-    Objective (b): *Trends.*
In order to compare results from different years, a standardized CR (see above) is needed, to be used as an index of turtle abundance comparable between different years. The main assumption here is that CR differences between years can be ascribed only or mainly to corresponding differences in turtle abundance. The standardization of CRs from the same fishery (in which variability is probably low) and comparison of CRs of different years but from the same fishery, area and season, reduce at minimum the number of possible technical and biological sources of variability affecting CR. Moreover, possible exceptional events which may influence results of a single year study are expected to be smoothed down by medium-long term monitoring projects. This further decreases the probability that a detected trend is due to factors other than trend in turtle abundance, making the assumption likely to be met.

-    Objective (c): *Relative abundance.*
In order to compare results from different areas, a standardized CR (see above) is needed, to be used as an index of turtle abundance. The main assumption here is that CR differences between areas can be ascribed only or mainly to corresponding differences in turtle abundance. A careful evaluation of technical and biological sources of variability possibly affecting a standardized CR (so other than the technical characteristic of the gear already considered in the standardization) should be carried out before considering the assumption met and results reliable. However, in certain cases fishing gears used in different areas may be so different as to make it impossible to standardize CRs, so preventing any comparisons.

3.6 Data collection and standardization

As introduced in 3.5, possible data to be collected from the captains can be divided into three data sets in order of priority: fundamental data (turtles caught and fishing effort), important data (condition and size of turtles), and additional data (fishing parameters). Fundamental data are the

minimum data set needed to reach the objectives of the programme. The following approach is suggested: first ask the captain for the fundamental data; then if he provides these data easily and shows interest in providing other data too, he can be asked to record the status of the turtle (healthy, injured, comatose, dead) [NOTE: although an easy datum to record, this has implications for the impact of the fishing activity on turtles, *an endangered species*, and this issue should be treated carefully when consulting with the captain]; the next step, requiring a specific action by the captain, is to ask him to measure the turtle (CCLnt) (a flexible meter should be given to him in this case); finally, the additional data: detailed fishing effort (e.g. for Trawl: number of hauls, duration of each haul, haul speed) and any other data (position, target species, sea bottom depth, water temperature, etc.) which might achieve an even better investigation.

As far as the fundamental data are concerned, while the number of turtles caught is relatively simple to record, the fishing effort represents the real difficulty of the study. Since data are to be collected by captains on a voluntary basis (see 3.4) they should be asked for very simple tasks. This limits the quantity and quality of data that is possible to collect. Fishing effort can be measured in different units with different levels of difficulty. Units of fishing effort can be reduced to two types: standardized (taking into consideration technical/operational factors) and not standardized. Fishing efforts proposed to be used in this programme are presented below for each fishing gear.

-   **Trawl** (bottom and midwater)
    -   Fishing days (useful for Objective (a))
    -   Headrope Length x Duration (useful for Objectives (b) and (c))

    This is the most common standardization adopted by studies in different areas of the world:

    $$SFE \;=\; \sum_{i=1}^{n} sh_i * sd_i$$

    where SFE is the standardized sampled fishing effort, i is the single haul, sh is the Standardized Headrope Length (m/30.5) and sd is the Standardized haul Duration (min/60). [the length and time units of 30.5m and 60 min are arbitrary and any other can be adopted]

    To calculate this fishing effort the following data are needed:
    a)   number of hauls
    b)   duration of each haul
    c)   headrope length

    In this project actual data on (a) and (b) cannot be obtained easily (headrope length (c) can be considered the same for hauls using the same net, so it does not represent a problem), because in many cases this would require too much work for captains.

    However, a possible approach is to approximate SFE to a standardized *average* sampled fishing effort, calculated as:

    $$SFE \; \tilde{} \; \overline{SFE} = d * se$$

    Where d is the number of sampled fishing days and se the *average* standardized fishing effort per day:

    $$s\overline{e} = sh * s\overline{d} * \overline{n}$$

    where

sh   is the standardized headrope length ,

$s\bar{d}$ is the standardized *average* haul duration (min/60),

$\bar{n}$ is the *average* number of hauls per day.

In contrast to obtain total number of hauls and haul duration of each haul, obtaining from the captains the *average* number of hauls per fishing day and the *average* haul duration they adopt for an arbitrary period of time (a week, 2 weeks, one month) could be a feasible task. Certainly, standardized fishing efforts obtained in this way should not be considered of the same quality of those obtained through direct collection of data by observers on board.

In this way, the trawl captains should provide the following data:

-        on a routine basis:
    -        number of fishing days
    -        number of turtles caught

-        periodically:
    -        average haul duration
    -        average number of hauls per day
    -        headrope length

- **Longline** (drifting and bottom)
  - Fishing days (useful for Objective (a))
  - Number of hooks (useful for Objectives (b) and (c))

Longline is a complex fishing gear, as far as the number of parameters is concerned. For instance: hook number, hook type (size and shape), bait, float line length, branch line length, distance between two branchlines, distance between two float lines, etc. This makes standardization difficult and in some cases impossible, preventing comparison to be made. The only standardization possible is on the number of hooks, if all the other parameters are constant or their difference is assumed to have little effect on difference in CRs. In this case, the common unit of fishing effort is 1000 hooks.

An average number of hooks used can be easily obtained by the captain. Alternatively, periodical counts can be carried out by the research team.

In this way, the longline captains should provide the following data:

-        on a routine basis:
    -        number of fishing days
    -        number of turtles caught

-        periodically:
    -        average number of hooks per set
    -        average number of sets per day

However, all fishing gear parameters should be assessed at least once, in order to decide whether or not comparison with other fisheries is possible.

- **Other fishing gears** (e.g. gill nets)

  In the case of other fishing gear with a presumed low catch rate per vessel, another approach could be used to gain a preliminary assessment of the total catch. This approach is based on questionnaires rather than monitoring (see 3.7).

The routine data should be collected choosing an arbitrary but appropriate time interval. This interval should be a right compromise between annoying the captains and avoiding loss of notes or memory of the data. Since many fishermen stop fishing at least once a week (usually at the weekend), a possibility could be to ask them once a week, as in this case one week would be an objective working period.

3.7 Data sheets and questionnaires

- *Trawl and Longline*. The data sheet the captains could use to record data on a routine basis is fundamentally a calendar, with days in rows and number of turtles and fishing day (Y/N) in columns (see the specimen enclosed below). Normal calendars or logbooks could work as well. Specific and more complex data sheets are required in case the captains are willing to record additional data (see 3.6) and the local research team will prepare the sheets accordingly.

- Other fishing gear. For other fishing gear the local research team could find that questionnaires are the most effective approach due to the suspected low CR. The unit of study is the vessel and only one fisherman from each boat should be interviewed. The questionnaire should concern a standard period of time, corresponding to the frequency of the interview. Interviews should be carried out at least once a year and during a period when different types of fishing gear are used, so optimizing the work by having a complete survey of all fishing gears. The basic questions that should be included are: number of turtles caught by the boat in this period of time, and the effort made by the boat in the same period (months that the vessel fished). In order to increase the chances of getting reliable answers, particular attention should be paid on the way fishermen are approached and interviewed. Some suggestions are: friendly approach; casual dress; no questionnaires in the hand; just chat, and firstly on other topics; present the project as a scientific one, not an official inspection; never disagree, whatever the matter; do not suggest the answers; about turtles, firstly questions on the general fishery/fisheries, then specific questions on the fisherman's experience with turtles; "when/where/which/who" questions on interaction are preferable to "Yes/No" questions (reducing the possibility that the fisherman can answer that he does not catch or kill turtles). Although thoughtful interviewing techniques can increase the chances of getting reliable answers and validate their truthfulness, a comparison of the results with other sources of data is desirable. A specimen of questionnaire with basic questions is enclosed below. Certainly, more detailed interviews are desirable whenever possible. For instance, the project "Protección de Praderas de Posidonia en LICs de Baleares" (LIFE00NAT/E/7303) prepared a detailed questionnaire, available from Carlos Carreras (cchuergo@bio.ub.es).

Data sheet for routine data

Boat			
Month/Year			
Date	**Turtles**	**Fishing Days**	**Notes**
1			
2			
3			
4			
5			
6			
7			
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Questionnaire for other fishing gears

1. Boat name:

2. Boat length:

3. Crew (nº):

4. What kind of fishing gears did you use in the last year? (multiple answer)

5. In which months and area did you use each fishing gear in the last year?

6. In which months is possible to see sea turtles and how many in each month (few/some/many)?

7. In your opinion, what is the trend of the sighting frequency (decreasing/stable/increasing)?

8. In which months is possible to catch turtles and how many in each month (few/some/many)?

9. In your opinion, what is the trend of the catch frequency (decreasing/stable/increasing)?

10. Do you think that the involuntary catches are related to some fishing gear in particular? Which one?

11. In which fishing gear is more common that turtles are found dead?

12. How many turtles did you catch incidentally in the last year?

13. How many for each fishing gear?

14. In which months did you catch more?