OSPAR COMMISSION

Protecting and conserving the North-East Atlantic and its resources

Background Document for Loggerhead turtle *Caretta caretta* – Update

Biodiversity and Ecosystems Series

2015

OSPAR Convention

The Convention for the Protection of the Marine Environment of the North-East Atlantic (the "OSPAR Convention") was opened for signature at the Ministerial Meeting of the former Oslo and Paris Commissions in Paris on 22 September 1992. The Convention entered into force on 25 March 1998. The Contracting Parties are Belgium, Denmark, the European Union, Finland, France, Germany, Iceland, Ireland, Luxembourg, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom

Convention OSPAR

La Convention pour la protection du milieu marin de l'Atlantique du Nord-Est, dite Convention OSPAR, a été ouverte à la signature à la réunion ministérielle des anciennes Commissions d'Oslo et de Paris, à Paris le 22 septembre 1992. La Convention est entrée en vigueur le 25 mars 1998. Les Parties contractantes sont l'Allemagne, la Belgique, le Danemark, l'Espagne, la Finlande, la France, l'Irlande, l'Islande, le Luxembourg, la Norvège, les Pays-Bas, le Portugal, le Royaume-Uni de Grande Bretagne et d'Irlande du Nord, la Suède, la Suisse et l'Union européenne.

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Cover page: Loggerhead turtle ©Ricardo Sagarminaga/ALNITAK Photo Library

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Backgound Document for Loggerhead Turtle *Caretta caretta*

Executive Summary

This background document on the Loggerhead turtle (*Caretta caretta*) has been developed by OSPAR following the inclusion of this species on the OSPAR List of threatened and/or declining species and habitats (OSPAR Agreement 2008-6). The document provides a compilation of the reviews and assessments that have been prepared concerning this species since the agreement to include it in the OSPAR List in 2003. The original evaluation used to justify the inclusion of *C.caretta* in the OSPAR List is followed by an assessment of the most recent information on its status (distribution, population, condition) and key threats prepared during 2008-2009 and updated in 2013-2014. Chapter 7 provides proposals for the actions and measures that could be taken to improve the conservation status of the species. In agreeing to the publication of this document, Contracting Parties have indicated the need to further review these proposals. Publication of this background document does not, therefore, imply any formal endorsement of these proposals by the OSPAR Commission. On the basis of the further review of these proposals, OSPAR will continue its work to ensure the protection of *C.caretta*, where necessary in cooperation with other competent organizations. This background document may be updated to reflect further developments or further information on the status of the species which becomes available.

Récapitulatif

Le présent document de fond sur la caouanne a été élaboré par OSPAR à la suite de l'inclusion de cette espèce dans la liste OSPAR des espèces et habitats menacés et/ou en déclin (Accord OSPAR 2008-6). Ce document comporte une compilation des revues et des évaluations concernant cette espèce qui ont été préparées depuis qu'il a été convenu de l'inclure dans la Liste OSPAR en 2003. L'évaluation d'origine permettant de justifier l'inclusion de la caouanne dans la Liste OSPAR est suivie d'une évaluation des informations les plus récentes sur son statut (distribution, population, condition) et des menaces clés, préparée en 2008-2009 et mise à jour en 2013/2014. Le chapitre 7 fournit des propositions d'actions et de mesures qui pourraient être prises afin d'améliorer l'état de conservation de l'espèce. En se mettant d'accord sur la publication de ce document, les Parties contractantes ont indiqué la nécessité de réviser de nouveau ces propositions. La publication de ce document ne signifie pas, par conséquent que la Commission OSPAR entérine ces propositions de manière formelle. A partir de la nouvelle révision de ces propositions, OSPAR poursuivra ses travaux afin de s'assurer de la protection de la caouanne, le cas échéant avec la coopération d'autres organisations compétentes. Ce document de fond pourra être actualisé pour tenir compte de nouvelles avancées ou de nouvelles informations qui deviendront disponibles sur l'état de l'espèce

1. Background Information

Name of species

Caretta caretta Loggerhead Turtle

2. Original Evaluation against the Texel-Faial selection criteria

List of OSPAR Regions and Dinter biogeographic zones where the feature is under threat and/or in decline

OSPAR Regions IV & V Dinter biogeographic zones: Warm-temperate waters, Warm-temperate pelagic waters, Azores shelf, Lusitanian (Cold/Warm)

Original evaluation against the Texel-Faial criteria for which the feature was included on the Initial OSPAR List

C.caretta was selected for inclusion on the OSPAR list on the basis of an evaluation of their status according to the Criteria for the Identification of Species and Habitats in need of Protection and their Method of Application (the Texel-Faial Criteria) (OSPAR 2003). The nomination for inclusion on the list cited the criteria decline and sensitivity, with information also provided on threat. It has been nominated for OSPAR Regions IV & V. Table 1 provides an update on this evaluation. The main threats to this species in the OSPAR regions are linked to ingestion of anthropogenic debris and fishing by-catch.

Table 1: Summary assessment of *C.caretta* against the Texel-Faial criteria.

Criterion	Comments	Evaluation
Global importance	Loggerheads breed on NW Atlantic, Gulf of Mexico and Caribbean coasts. Apparently, the limit of distribution is waters of about 10°C; if they encounter colder waters, they may become stunned, drift helplessly and strand on nearby shores. Records are quoted from New England and eastern Canada, Labrador and Nova Scotia, especially between July and October of warm years. The northern limit of distribution is a summer capture of a live young turtle entangled in a fishing line off Murmansk, Barents Sea (68º 55'N). They are also the most common Mediterranean species with most nesting at sites in Libya, Greece, Turkey and Tunisia. The majority of loggerhead turtles found in the OSPAR maritime area are thought to originate from NW Atlantic and Cape Verdean populations (Monzon-Arguello *et al*., 2012). After hatching, young turtles of about 5 cm carapace length swim offshore where the Gulf Stream/Azores current carries them to the eastern Atlantic, including the areas around the Azores, Madeira, and Canary Islands (Carr, 1986; Bolten *et al.*, 1998 in Santos, 2007)	Considering the relevance of the Gulf Stream and a great portion of the east and southern waters of the OSPAR range for loggerhead turtle hatchlings and juveniles in their oceanic stage, and especially areas of aggregation induced by physiographic and oceanographic features, there is certainly a clear justification for the species to qualify at a global level. Strandings of cold stunned turtles or turtles with restricted ability to move due to entanglement in debris or tar, or subsequent mutilation of flippers, is common throughout the range of the species in the OSPAR region (see map of overlap OSPAR – Caretta caretta)

Regional importance	This species is known to occur in large numbers around the Azores and in the seas north of these islands, as well as along the Atlantic coast of the Iberian Peninsula especially southern Portugal in spring and summer and Spain (Andalousia – Bellido *et al*., 2009, 2010; Camiñas & Valeiras, 2003) year round (Lídia Nicol*au pers. Comm.)*; Brongersma, 1995). It is occasionally observed along the Spanish Galician coast (López *et al*., 2014). Its occurrence in Irish, British and French waters is considered a result of winter storms, when winds and currents overwhelm the swimming abilities of post-hatchling cold-stunned or mutilated loggerhead turtles, transporting them to habitats which cannot sustain them (Hays, 1997 in Bolten *et al*., 2004, Monzon-Arguello *et al*., 2012). Spatially, there is an inverse relationship between increasing number of records and decreasing latitude. Migratory fluxes of loggerhead turtles near and through the strait of Gibraltar has been reported in both directions. Thanks to this connection, the Atlantic and Mediterranean loggerhead populations share developmental habitats in the western Mediterranean and in the northeastern Atlantic. There are no loggerhead nesting beaches in the OSPAR maritime area.	Not likely to qualify
Rarity	A highly mobile species, with an unknown total population size	Qualifies
Sensitivity	The loggerhead turtle is a long-lived, late-maturing (mean at 30 years) animal with growth rates dependant on temperature, food quantity and quality. A summary of its life history made during the latest global population assessments of 2009 is posted at: http://www.nmfs.noaa.gov/pr/species/turtles/loggerhead_lifehistory.xls http://www.nmfs.noaa.gov/pr/pdfs/statusreviews/loggerheadturtle2009.pdf	Qualifies – rated as Very Sensitive
Keystone species	Has no controlling influences on communities within the OSPAR region	Not applicable within OSPAR area
Decline	Detailed information on population sizes and trends is difficult to obtain and interpret, especially as loggerhead turtle can spend several years adrift in the North Atlantic. The most suitable index of marine turtle population stability remains the number of females nesting at a given rookery from year-to-year. Loggerhead turtle nesting populations are subject to important natural inter-annual variations which make it difficult to assess trends in population size, unless studies are carried out over several decades. Analyses in 2009, showed that data from the past 10-23 years from different sites within the Northwest Atlantic Distinct Population Segment (DPS) did show a severe decline overall – however, with the addition of new data (2008-2010) the trend line (1989-2010) was slightly negative	Potentially threatened

	but not significantly different from zero – large increase in nesting in 2008 compared to 2007 and highest nesting ever in 2010 (http://www.nmfs.noaa.gov/pr/pdfs/fr/fr76-58868.pdf). The most recent trend analysis is posted at: http://myfwc.com/research/wildlife/sea-turtles/nesting/loggerhead-trends/ and http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0081097 - PLOS one paper by Arendt *et al*	

Worldwide, this species is particularly susceptible to bycatch; ingestion of marine debris, and predation on eggs. Bycatch and debris ingestion are considered to be the most important anthropogenic mortality factors known within the OSPAR maritime area (Angel *et al.,* 2013; Bellido *et al*., 2010; Lídia Nicolau *pers. comm*.).

The risk of bycatch varies according to age class, region and season (water temperature). For turtles in the neritic stage, fixed nets and bottom trawling are a major risk. For turtles in their oceanic stage, pelagic gear such as driftnets or longlines constitute a risk (Angel *et al.,* 2013, Ricardo Sagarminag*a pers. comm.*). Ingestion of plastics and tar by sea turtles is common and is believed to contribute to their mortality.

Loggerhead hatchlings and juveniles are frequently associated with sea fronts (oceanic current convergences), downwellings and eddies, where floating epipelagic animals and flotsam are gathered (Eckert *et al.,* 2008). The elapsed time, usually more than a year - during which the small turtles remain in those places feeding and growing - is called the “lost year”. The duration of this oceanic phase is thought to be highly variable. Bjorndal *et al*., 2000 growth models suggest the oceanic phase from hatching to recruitment to neritic habitats may range between 6.5 and 11.5 years, with individuals attaining curved carapace lengths of 46 – 64 cm. A general life history review compiled during the species status review of 2009 is available at http://www.nmfs.noaa.gov/pr/species/turtles/loggerhead_lifehistory.xls

During this first period of life there is evidence that these turtles lead a pelagic-nectonic existence, feeding on organisms usually associated with sargassum mats (Marquez, 1990).Young pelagic loggerheads seem to be especially susceptible to anthropogenic-debris ingestion, perhaps because loggerheads forage on novel items that stand out most against the backdrop of sargassum and because floating plastics and tar concentrate within the downwellings inhabited by turtles (Barstow 1983 in Witherington 2002). This pelagic life-stage makes the loggerhead the species of hard-shelled turtle that is most susceptible to surface longline bycatch.

3. Current status of the species or habitat

Distribution in OSPAR maritime area

During their first years of life, North Atlantic loggerhead sea turtles inhabit extremely stochastic environments. The duration and path of the journey undertaken by loggerhead hatchlings from western Atlantic nesting beaches (principally eastern Florida) to eastern Atlantic foraging areas are determined largely by chance (Witherington, 2002). Hatchling loggerheads swim actively for the first 24h after entering the ocean and maintain a straight-line course that will carry them away from shore. This “swimming frenzy” helps the hatchlings traverse the inshore waters, reach offshore currents, and become incorporated into the North Atlantic Gyre (Bjorndal, 2003). Younger age classes then spend several years associated with Sargassum drift lines, convergences, eddies and rings in the North Atlantic gyre (Pierpoint, 2000). Consequently, juvenile loggerheads are commonly observed in OSPAR Region V (reported from around Madeira, the Canary Islands and especially the Azores).These turtles apparently originate in the Western Atlantic rookeries, from where hatchlings enter the Gulf Stream and are carried to these islands. These oceanic gyres and eddies are considered as feeding grounds and developing habitat, where the loggerheads reach the last juvenile stages (Marquez, 1990). Region IV is also of relevance as range for the species being the eastern edge of the passive migration flow of hatchlings and juveniles with the Gulf Stream and its meanders, which take them to the feeding grounds of OSPAR Region V, the adjacent region south from here (Macaronesia) and the Western Mediterranean (Alboran sea and Algero-Balearic basin).

C. caretta strandings are more abundant in the winter along Portuguese western, Galicia, France, Ireland and England coastline. Proximity to coast during periods of cold water temperatures is a factor of risk for turtles given the effects of the cold on their metabolism and hence their capacity to stay offshore in deep waters (cold stunning). The coastal bias probably reflects also the ‘distribution of observers ’. The vast majority of loggerhead turtles observed in these waters are cold-stunned juveniles recorded during the winter and spring, during or following periods of stormy weather. Both French and English researchers have noted that, when loggerhead turtles over 30 cm carapace width are stranded, the majority had their swimming ability impaired due to lesions and amputations resulting from either predation or entanglement with different types of fishing gears. This impeded movement also would explain what causes them to be more affected by the currents (Penrose, pers.comm), and their presence in low water temperatures supports the North Atlantic Gyre-mediated dispersal mechanism theory, where individuals are shunted off towards Europe's coast after heavy storms.

For the continental coast of Portugal, the Algarve region, is the most important area for *C. caretta*, especially during the spring and summer months. The presence of the species in this area is associated with described oceanic pathways that clearly include continental Portugal in the areas frequently used by loggerheads, from Western Atlantic rookeries, in their movements into the Mediterranean waters (Lídia Nicolau *pers. comm*.). Also, the southern area of the Portuguese coast has already been mentioned as the area with higher incidence of strandings for loggerheads in the country (Brongersma, 1972). Further, data from satellite tagged loggerheads gives insights that continental Portuguese waters are important foraging and passage grounds. For *C. caretta*, the Southern Portuguese coast (Algarve) is the most important area during Spring and Summer months,

with the seamounts of Goringe, Ormond and Ampere off the Cape Saint Vicent indicated as significant areas.

The Atlantic Andalusian waters also have a high incidence of strandings of loggerheads, especially in the province of Huelva, suggesting that the waters next to Huelva and Cádiz coasts could be an important area for this species concentration (Bellido *et al.*, 2009). This correlates with this area being favored by the high productivity near the coast due to the incidence of the Guadiana and Guadalquivir Rivers (Camiñas & Valeiras 2003; Bellido *et al.,* 2009, 2010).

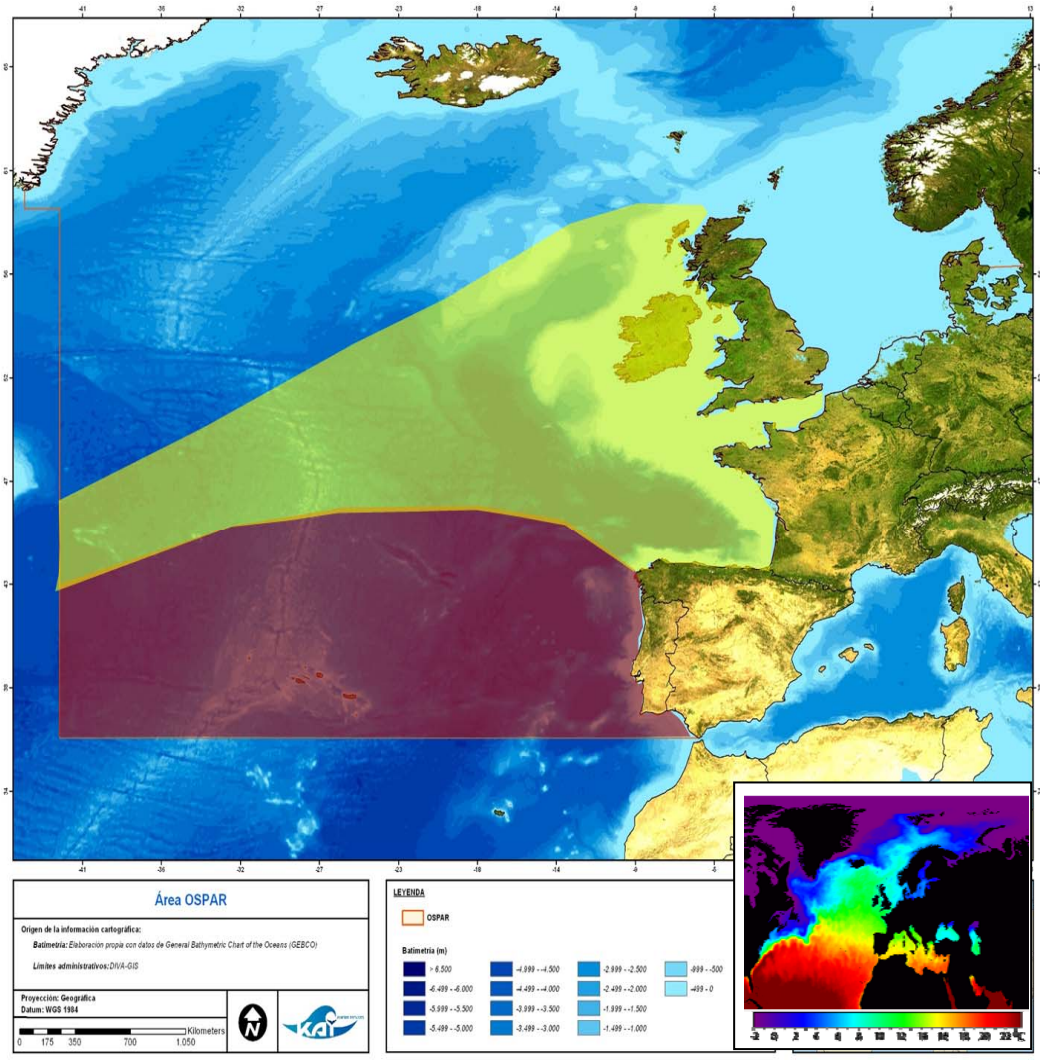

***Figure 1** : Map of OSPAR area overlapping with the loggerhead turtle range and sea surface temperature map of North Atlantic highlighting the relevance of the preferential temperature of the species (18 ºC).*

Evidence from the pelagic longline swordfish fishery in the Azorean Exclusive Economic Zone (EEZ) and from satellite telemetry suggests that seamounts may affect loggerhead turtle distribution. Seamounts appear to be important habitats for juvenile oceanic loggerhead turtles (Santos *et al.*, 2007). More information on the ecological role of this habitat can be found in the parallel OSPAR background document on Seamounts (in press).

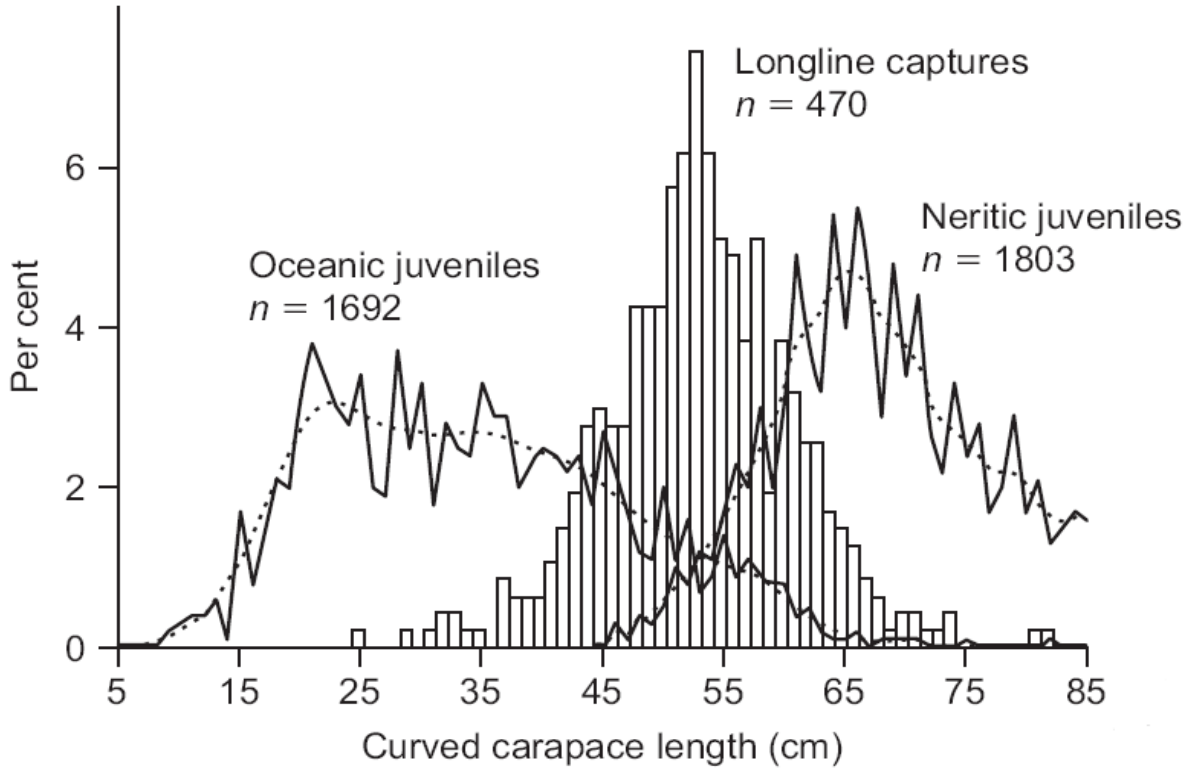

***Figure 2**: Size distributions of loggerhead turtles: left curves are oceanic loggerheads in Azorean waters; histogram shows loggerheads caught in long-line fisheries in Azorean waters; right curves are neritic loggerheads in western Atlantic along east coast of USA (Source: Santos et al., 2007 - modified from Bolten et al., 2004)*

Population (current/trends/future prospects)

A study by Bowen *et al.* (2005) concludes that the complex life history of loggerhead turtles may include two homing migrations. Loggerhead turtles have two distinct juvenile stages, the first being an oceanic stage after hatching and the second being a neritic stage. For post-hatchling turtles departing the nesting beaches of the western Atlantic, this oceanic habitat includes waters around the Azores and Madeira, and the Grand Banks (Newfoundland, Canada), as well as the Mediterranean Sea. Subsequent to the oceanic stage, which may span a decade, most older juveniles enter a neritic (benthic feeding) stage, in which they consume hard-shelled invertebrates in shallow habitats of the western Atlantic (Bolten 2003a). Whereas the journey from nesting beaches to oceanic juvenile habitat is largely mediated by passive transport, the return trip may include active orientation and swimming (Bolten 2003b).

All lines of evidence support the hypothesis of juvenile homing in loggerhead turtles. Whilst not as precise as the homing of breeding adults, this behaviour nonetheless places juvenile turtles in the vicinity of their natal nesting colonies. Therefore the coastal hazards that affect nesting populations may also affect the cohort of benthic-feeding turtles in nearby habitats. A study by Bowen *et al*. (2005) clearly illustrates how at each life history stage loggerhead turtles, due to their complex population structure, encounter different threats, different responsibilities, and different prospects.

Condition (current/trends/future prospects)

The future prospects of highly-migratory species such as *C.caretta* are a function of a number of pressures worldwide. Population numbers in the OSPAR maritime area depend on nesting populations on both sides of the Atlantic Ocean and Mediterranean, each with their share of anthropogenic impacts (*e.g*. egg harvesting, shrimp trawlers, gill nets).

Sea surface temperature is likely to be the factor determining the incidence of hard-shell turtles in the British Isles and France (Witt *et al.*, 2007). For the majority, sightings and strandings of loggerhead turtles in the North-east Atlantic increase during seasonally inclement water temperature (winter to spring). During this period sea surface temperatures around the British Isles are within the range reported to induce floatation (Schwartz 1978). Possible alterations in sea surface temperatures and storm surges as a result of climate change, may lead to increased accidental presence of juvenile and maimed sub-adult loggerhead turtles along the Atlantic coast of the OSPAR Region.

Bycatch in fisheries is considered to be one of the main risks for sea turtles in the open seas, yet the lack of data constitutes an obstacle for its assessment and management, as has recently been highlighted by the Environmental Risk Analysis attempt conducted by ICCAT. One major concern is the bycatch of oceanic stage juvenile and sub adult loggerhead turtles in fisheries in the southwest Mediterranean. Data on bycatch is at present still very heterogeneous. Some fisheries, as the Spanish Mediterranean longlining fleet have been providing data since 1980, and this data has been used to obtain estimates from global data compilation as those of Lewison (PNAS – 2013), Wallace (2010 – Conservation Letters) and Finkbeiner (2011 – Biological Conservation).

However, in many areas with similar fisheries and a similar risk of sea turtle interactions, there is a lack of bycatch reporting. In coastal Portuguese continental waters, most bycatch risks seem to be associated with entanglement in fixed nets (gill or trammel nets; *Lídia Nicolau pers. comm.*). Bycatch risk mitigation is feasible in fisheries such as that of the SW Mediterranean where operational modifications have resulted in a reduction of bycatch by over 95% (Ricardo Sagarminaga *pers. comm.*). With the thirty year generation time of loggerhead turtles, the impact of the bycatch on the nesting beaches, which are currently the only means of assessing population size, are difficult to gauge.

Limitations in knowledge

Research on nesting populations of loggerhead sea turtles has focused on the beaches of the western Atlantic. Apart from nesting at the Cape Verde Islands, little is known about the African nesting populations the hatchlings of which are thought to also make their way into the North Atlantic Gyre.

Annual marine turtle sightings reported each year vary considerably. This is due in part to the efficiency of reporting networks, but the influence of biological factors (*e.g*. prey density) on their abundance is not yet well understood (Pierpoint, 2000). The majority of both turtle sightings and strandings records are reported haphazardly via a number of informal networks. In this sense, it is important to recognise the limitations of the data available on bycatch in OSPAR waters and the opportunities to improve this situation for example through new requirements of parties to monitor fisheries and in particular, protected species bycatch. As an example, the UK, France, Portugal, Spain and Italy bycatch monitoring programmes, whilst focussed on cetaceans and meeting requirements

of Regulation 812/2004, is a protected species monitoring program and therefore records all species listed under Annex IV of the Habitats Directive (includes loggerhead & leatherback).

4. Evaluation of threats and impacts

A summary of the key activities which can cause impacts to *C. caretta* within the OSPAR Regions is given in Table 2. Worldwide, anthropogenic threats to which nesting populations are subjected also include: beach development/nesting habitat destruction; disorientation or misorientation of hatchlings by beachfront lighting; directed take; nest destruction by beach vehicles; nest destruction by feral dogs, hogs and natural predators; dredging.

Along the Portuguese continental coast efforts supported by SAFESEA-EEAgrants (2008-2010) and Life^{+}MarPro (2011-2015) projects for the last 5 years have been to upgrade stranding networks, assess stranded sea turtles and for the first time treat data that has been completely overlooked. Dead sea turtles were necropsied and live animals taken to rehabilitation centres for recovery and release. Stranding data using a 33 year database has been studied, providing results on sea turtle species, maturity stages and cause of death. Juvenile-subadult loggerheads comprised the majority of the records and interaction with coastal entangling nets (gill or trammel nets) was determined as the main cause of dead (Lídia Nicolau *pers. comm.*).

The Andalusian coast in southern Spain presents a high rate of dead loggerhead strandings, especially in the Atlantic side and less frequently on the Mediterranean coast, which is not only representative of the loggerhead presence in these waters, but also of the negative interactions between sea turtles and human activities in the area (Bellido *et al*., 2009). According to Báez *et al*., 2006, the trammel net fishery and tuna poundnets are the most dangerous for sea turtles next to the coast, and it is practiced with particular intensity in front of the coast of Huelva and the western part of Cádiz. Around the Strait Gibraltar and in the Alborán Sea the trammel net fishery is replaced by bottom longlines mainly targeting *Pagellus bogaraveo*, which are not dangerous for marine turtles (Báez *et al*., 2006).

In the waters beyond national jurisdiction in OSPAR Region V, approximately 150 active Japanese pelagic longline vessels operating over the wider Atlantic Ocean targeting species such as bluefin tuna Thunnus thynnus and bigeye tuna Thunnus obesus (ICES 2008a). The gear used has not changed recently and the longline systems used by these vessels are still labour intensive. Up to 50 km of 2500 hooks is shot and hauled per day. ICCAT resolution, requires fleets to report their data.
http://iccat.int/Documents/Recs/compendiopdf-e/2010-10-e.pdf
http://www.iccat.int/Documents/Recs/compendiopdf-e/2013-11-e.pdf
http://www.iccat.es/Documents%5CRecs%5Ccompendiopdf-e%5C2010-09-e.pdf

Beyond the OSPAR maritime area, in the South of the Atlantic, the Portuguese longline fleet targeting swordfish reports incidental captures of majorly loggerheads at a seasonal basis. Mitigation trials have been performed using circle hooks and changes in bait in order to reduce captures. Results showed that significant reduction of sea turtle accidental catches on the swordfish longline fisheries can be achieved by changing the J hooks to circle hooks, especially if baited with mackerel. However, such gain is species-specific and area dependent. (Santos *et al*. 2013)

In Azorean waters, most loggerheads are between 10 and 65 cm curved carapace length (Fig. 3) and are primarily epipelagic, spending 75% of their time in the top 5 m of the water column, but occasionally diving to over 200 m (Bolten *et al*., 2004). The fishery that targets swordfish, present around the Azores, sets hooks at depths of 5 - 50 m primarily baited with squid and mackerel. Both loggerheads and leatherbacks are captured on the baited hooks as well as entangled in lines. The largest size classes of loggerheads present in the eastern Atlantic are impacted by this fishery. Turtles are usually released alive by the longline fishermen, but in general the hook is left in the turtle. The fate of released turtles is not known, but studies in adjacent waters on survival of turtles released after being caught on longlines show a wide range of survival rates between 90% (Ricardo Sagarminaga *pers. comm*) and less than 50% (Clusa *et al*., 2014). A key factor of increased mortality identified is that of the turtle being released by cutting the line far from the turtle, which results in entanglement or death of the animal from ingestion of the line (FAO Guidelines to reduce sea turtle mortality in fishing operations).

Table 2. Summary of key threats and impacts to *C. caretta*

Cause of threat	Comment	Scale of threat
Bycatch	The pelagic life-stage of the loggerhead turtle results in it being the most susceptible of all shard-shelled species to surface long-line bycatch. Aguilar *et al.* (1995), based on observations in captivity of turtles with internal hooks, estimated that 20 to 30% of sea turtles might die after being captured by the Spanish longline fishery. These mortality rates are difficult to extrapolate to turtles released back into the sea by the longline fishery. Data on the survival of sea turtles after being caught by a hook and released are needed for the estimate of the impact of the swordfish longline fishery (Ferreira *et al*., 2001). Bycatch in other types of fishing gear such as fixed engine nets, gillnets, trawlers, baited lines, and entanglement in pot and creel ropes can also occur. Many fisheries do not individually have much impact, but collectively contribute to a significant overall challenge to recovery.	High
Waste: litter and debris	Witherington (2002) revealed that 20% of post-hatchling turtles had ingested tar, and 15% plastic debris, with consequences on their growth and agility. Loggerheads are unable to distinguish between plastic flotsam from their natural prey, and as a result often ingest them. Such elements frequently block the digestive tract of turtles. Impacts from micro plastics in the smaller turtle class size are still to be determined, but are likely to be of high relevance.	High
Pollution: oil/tar/chemicals	In their juvenile and sub-adult pelagic phases, loggerhead turtles are particularly sensitive to oil pollution, which has been observed in the mouth and stomachs of both size classes. The relationship between pollutants and alteration in *C. caretta* reproductive process as well as their hormonal system activity have been linked *inter alia* to the presence of industrial waste and pesticides. Heavy metals and PCBs have also been detected in turtles and eggs, but the effects on them are unknown (OSPAR, 2006).	High
Shipping Boating/yachting/water sports	In areas where recreational boating and ship traffic is intense, propeller and collision injuries are not uncommon. Marina and	Low

Cause of threat	Comment	Scale of threat
	dock development leads to increased boat traffic, increasing the risk of turtle/vessel collisions.	
Climate change: Increase in sea temperature and storm surges	Oceanographic conditions added to some environmental factors often cause strandings, sometimes on a massive scale. Due to the fall of body temperature and diseases caused by bacteria and fungi infections the species loses its mobility (OSPAR, 2006). The possible effects on sex ratio should also be considered.	Low

The sizes of the loggerheads captured in the longline fishery are significantly larger than those of the general population in the waters around the Azores. The conservation implications of these results are serious as Crouse *et al.* (1987) reported these size classes as being the most important for the recovery of the North Atlantic loggerhead populations.

5. Existing Management measures

In OSPAR Regions III and IV a major development within the static net fisheries was the development and subsequent banning of a driftnet fishery for albacore tuna *Thunnus alalunga*. This fishery straddled the wider Atlantic region. This fishery developed in the early 1990s and at its peak involved around 120 Irish and French vessels working 5 – 10 km of gear in line with the UN Resolution 44/225 of 22 December 1989, which called for a moratorium on the use of large-scale driftnets to protect cetacean species. Following protracted negotiations this fishery was closed in 2002 on the basis of reported marine mammal by-catches. Following these measures, Irish and French fishers converted to other forms of fishing, including the use of pair pelagic trawls. Research trials with this method showed that by-catch of marine mammals and turtles was as high as in the driftnet fisheries, although in later years this by-catch has reduced considerably. Anecdotally, this is likely due to the fact that fishers have tended to drop the headline of these trawls to well below the surface to target bigger tuna (ICES 2008a).

Surface longline fisheries for tunas, swordfish, and others often have a by-catch of sea turtle, pelagic sharks, and seabirds. After assessing bycatch of seabirds, ICCAT has in 2013 – 2014 engaged in assessing all of the fisheries that it manages to determine the scale and significance of marine turtle bycatch. Management measures for loggerhead turtles could, where appropriate be linked with those for seabirds and pelagic sharks, notably the Porbeagle (*Lamna nasus*), featuring on the OSPAR list. Results from Báez (2007) imply that retrieving longline fishing gear before the morning, or at least reducing daylight soak time, could help diminish substantially loggerhead turtle bycatch, whilst not significantly affecting fish captures. This management measure has been highlighted by several studies worldwide which also highlight the utility of deep sets and change from squid bait to mackerel bait, which can reduce bycatch rates by over 85%. (Ricardo Sagarminaga *pers. Comm*, Watson *et al.,* 2005, Gilman *et al.,* 2006. In certain fisheries the use of circle hooks has also proven to be an effective measure (Santos *et al*., 2013).

It should be noted that *Caretta caretta* is listed in Annex II of the Habitats Directive as a priority species for which conservation requires the establishment of Special Areas of Conservation. The CMS report (Fretey, 2001) on the biogeography and conservation of marine turtles of the Atlantic Coast of Africa advises that the regional priority for conservation should essentially focus on the immature

individuals in northern Macronesia, *i.e.* the Azores, Madeira and the Canary Islands. A programme to monitor demersal longline fisheries around the Azores placed three observers on-board vessels in 2005–2007 over periods between 6 and 9 months. Surface longline fisheries for tunas, swordfish, and others often have a bycatch of sea turtle, pelagic sharks, and seabirds. ICCAT is currently engaged in assessing all of the fisheries that it manages to determine the scale and significance of and sea turtle bycatch (ICES, 2008a, Coelho *et al*. 2012a, 2012b, 2012c).

A number of programmes and workshops are underway or have taken place in the Azores over the last 10 years:

- A workshop to design an experiment to determine the effects of longline gear modification on Sea Turtle Bycatch Rates was held in Horta, Azores 2 – 4 September 1998. Funded by the National Marine Fisheries Service, USA (Bolten *et al.* 2000). The experiment was initiated in 2000 and terminated in 2004, the results from Phase 1 and 2 were published in NOAA Technical Memorandum (Bolten *et al*., 2004), while the *Final Project Report* is available for download at the SEFSC/NOAA website. During these experiments fishermen were informed of how to handle hooked turtles and made aware of turtle conservation in general;

- The POPA (Programme for Observation of the Fisheries in the Azores), which until now only observed the tuna fleet (www.horta.uac.pt/projectos/popa) started recently a programme directed at the surface longline fishery operating in the Azorean EEZ. The objective of this programme is to monitor catches, by-catches and discards, including turtles. Observers also have a role in the education of the crew, showing best practices and offering tools for safe handling of hooked turtles;

- Project MADE (Mitigating Adverse Ecological Impacts of Open Ocean Fisheries) (FP7), started May 2008, and aimed to devise mitigation strategies for open-ocean fisheries, focusing on by-catch of protected species. Surface longline is one of the targeted fisheries, and spatial measures emerge as the main tool to be proposed. It is anticipated that marine turtles will be the subject of some of this research;

- Collaborative projects are currently underway in the Azores region between DOP/IMAR (Department of Oceanography and Fisheries at the University of the Azores, Horta and the Instituto do Mar, University of the Azores) and NOAA (past and present) using satellite telemetry to evaluate the post-release lethal and sub-lethal effects of deep-hooking on turtles.

In Andalousia, where collaboration between longliners and scientists to address sea turtle bycatch management has been constant since 1986, a programme was launched in 2003 involving monitoring, experimental trials of mitigation measures and capacity building to improve sea turtle handling and release.

6. Conclusion on overall status

The complex population structure of loggerhead turtles mandates a different management strategy at each life stage (Bowen *et al*., 2005). Disturbance to pelagic juveniles will have a diffuse impact on Atlantic nesting colonies, mortality of sub-adults will have a more focused impact on nearby breeding

populations, and disturbance to adults will have pinpoint impact on corresponding breeding populations. These findings demonstrate that surveys of multiple life stages are desirable to resolve management units in migratory marine species (Bowen *et al*., 2005).

Conservation efforts, necessarily need to focus both on eggs and nesting beaches, as well as on the reduction of bycatch and other risks. In a declining population, adult and large immature turtles make the greatest contribution to the survival of the population (Crouse *et al.,* 1987). Laurent *et al.* (1992) showed that the main factor affecting population growth rate for the Mediterranean loggerhead population is adult survival and considered fecundity to be less important. Thus, the reduction of natural or anthropogenic mortality of eggs is not sufficient as a conservation measure alone to assure the survival of the species. It is of high priority to concentrate efforts on the protection of large sub-adults and adults also (Panout *et al.* 1995 in Ferreira *et al*., 2001).

One of the most promising advances in marine conservation is the development of marine protected areas (MPAs) on an ecosystem scale. Studies have confirmed the efficacy of MPAs for these ecological goals, but do not fully address the needs of migratory species. The genetic surveys of juvenile loggerhead turtles confirm suspected links between nesting colonies in the North-west Atlantic and distant feeding populations in the North-east Atlantic and Mediterranean Sea (Carr 1987; Bolten *et al*., 2000 Laurent *et al*., 1993. These ocean-wide connections raise doubts about protecting specific ecosystems as a comprehensive management option for loggerhead turtles and other migratory species (Bowen *et al.*, 2005).In the case of migratory species, the solution is not ecosystem protection alone, but taxon-specific protection of vulnerable life stages (Bowen & Roman 2005). The specific management strategy will depend on the idiosyncratic life histories of the target species. In sea turtles this clearly includes nesting beaches and juvenile-feeding habitats, which in OSPAR Region V should focus on seamounts as likely foraging areas.

The discovery of the importance of seamounts for sea turtles raises the possibility of protecting these animals by establishing marine protected areas around seamounts, which combined with other fishery management options (*e.g*., gear modifications, line retrieval times, time/area closures) in these critical areas would reduce incidental capture of turtles (Santos *et al.*, 2007).

7. Action to be taken by OSPAR

Action/measures that OSPAR could take, subject to OSPAR agreement

As set out in Article 4 of Annex V of the Convention, OSPAR has agreed that no programme or measure concerning a question relating to the management of fisheries shall be adopted under this Annex. However where the Commission considers that action is desirable in relation to such a question, it shall draw that question to the attention of the authority or international body competent for that question. Where action within the competence of the Commission is desirable to

complement or support action by those authorities or bodies, the Commission shall endeavour to cooperate with them.

In order to facilitate the implementation of international conservation measures, a greater understanding of the relative importance of the OSPAR maritime zone to marine turtles is needed. The establishment of a common, regularly updated and accessible database is a first step towards achieving this.

It is proposed that OSPAR should recommend that relevant Contracting Parties take into account the need for the protection of *Caretta caretta* in the development and application of fisheries policies and plans with a view to:

a. incorporating loggerhead turtles into existing/future monitoring programmes for protected species and/or fisheries;

b. routinely recording the information provided by fishermen on fisheries inspection visits in Central Databases;

c. encouraging voluntary reporting of turtle bycatch to the relevant authorities;

d. encouraging localised scientific efforts to pool their findings.

OSPAR should request that Contracting Parties report back to the OSPAR Commission on the implementation of the above recommendations so that the development of the necessary measures can be evaluated. As a first step Contracting Parties should make an assessment of the effectiveness of the regulations they already have in place for the protection of *Caretta caretta*, consider how those regulations might be made more effective through improved monitoring, control and surveillance and report the results to the OSPAR Commission.

To complement these actions, the OSPAR Commission should:

a. communicate to the EC and other relevant fishing authorities the need for increased transparency in bycatch statistics (vessel tracking, electronic logs, observer data);

b. work with the EC to clarify conservation objectives in relation to fishing regulations;

c. emphasise to relevant scientific funding bodies the following research needs with respect to *Caretta caretta:*

   (i) Further tracking of individuals using satellite telemetry will help address key questions regarding migrations, foraging behaviour, residence times, surface behaviour, and behavioural plasticity of the species;

   (ii) Further evaluation of fisheries impacts, as information on sea turtles and fisheries related mortality must be urgently collected;

   (iii) Implement reliable data collection on fisheries/sea turtle interactions and other sources of mortality in order to enable quantitative risk assessments to be carried out; and where data collection exists, ensure its quality, reliability and above all accessibility.

Table 3 Summary of the key priority actions and measures which could be taken for Loggerhead turtle (*Caretta caretta*)

Key threats	Interactions with fisheries, especially bycatch on oceanic pelagic longliners and coastal entangling nets. Marine Pollution – debris and oil spills in particular Loss of habitat Sea temperature/climate change Boat collisions
Other responsible authorities	UNCLOS, EU, FAO, NEAFC, NASCO, ICCAT, fishery authorities of non-EU countries
Already protected?	EU Habitats Directive Annex II & IV Bern Convention Annex II CMS Appendices I & II CITES Appendix I IUCN Red List EN (Endangered) A1abd
Measures adequate?	No
Recommended OSPAR Actions and measures	**By the OSPAR Commission** • Ensure policy coordination across agencies/authorities • Encourage Contracting Parties that are also EU Member States to place observers aboard fishing vessels as required by EC Regulation 812/2004 for the purposes of monitoring cetacean bycatch, to include loggerhead turtles in their reporting • Work in partnership with Regional Fisheries Management Organisations • Work with Contracting Parties and the European Commission to clarify conservation objectives and the links to management actions in MPAs particularly in relation to measures to regulate effects of fishing that compromise conservation objectives (ICES, 2008a) • Support a regional sightings database • Increase the number of MPAs focused on the conservation of loggerhead turtles, which could also provide protection and encompass a number of other OSPAR-listed species (sharks in particular) and the seamount habitat • Continue to work in partnership with NGOs striving to reduce marine litter **By the Contracting Parties** • Include loggerhead turtles in existing systems of stranding response for cetaceans • Increase the collaboration between national Sea Turtle Strandings Networks • Support efforts to decrease plastic marine debris • Support marine turtle satellite-tracking research programs • Strengthen port-state control to reduce oil pollution from ships **By the responsible authorities to whom the OSPAR Commission can make its concerns known** • Recommend mitigation measures (*i.e.* reduced daylight soak time for longline gear) to appropriate fishing authorities • Record information provided by fishermen on routine fisheries inspection visits • Encourage voluntary reporting of turtle bycatch • Encourage the public availability of fishing boat, gear type and

	VMS data in order to correctly evaluate and situate accidental Catch Per Unit Effort. • Encourage common standards of data recorded in order to facilitate wider-scale analysis

Where relevant, the OSPAR Commission should draw attention to the need for action in relation to questions of fisheries management to the competent authorities. Where action within the competence of the Commission is desirable to complement or support action by those authorities or bodies, the Commission shall endeavour to cooperate with them.

Brief Summary of monitoring system to be implemented (c.f. annex 2)

It is strongly recommended that observer programs be continued to monitor sea turtle bycatch rates, as capture rates may vary among years and among fishing boats.

Article 5(3) of the European Union Council Regulation EC n°812/2004, of 26.4.2004 laying down measures concerning incidental catches of cetaceans in fisheries and amending Regulation (EC) No 88/98, reads as follows:

> "Independent observations of fishing activities are essential to provide reliable estimates of the incidental catch of cetaceans. It is therefore necessary for monitoring schemes with independent on-board observers to be set up and for the designation of the fisheries where such monitoring should be given priority to be coordinated. In order to provide representative data on the fisheries concerned, the Member States should design and implement appropriate monitoring programmes for vessels flying their flag engaged in these fisheries. For small sized fishing vessels less than 15 m overall length, which sometimes are unable to allow an additional person permanently on board as an observer, data on incidental catches of cetaceans should be collected through scientific studies or pilot projects. Common monitoring and reporting tasks also need to be set.
>
> The task of observers is to monitor incidental catches of cetaceans and to collect the data necessary to extrapolate the by-catch observed to the whole fishery concerned. In particular, the observers shall:
>
> (a) monitor the fishing operations of the vessels concerned and record the appropriate data on fishing effort (gear characteristics, location and timing of beginning and end of effective fishing operation);
>
> (b) monitor incidental catches of cetaceans.
>
> **Observers may also carry out such other observations, as may be determined by Member States, for the purposes of contributing to the scientific understanding of the catch composition of the vessels concerned and the biological status of fishery stocks.**"

This article is a key piece of EU environmental legislation, which requires the presence of observers on board fishing vessels to officially monitor all bycatch of marine mammals, reptiles and birds. However, very few turtle records are reported in the 812/2004 reports which are reviewed annually by the ICES Working Group on Protected Species. This highlights the need for urging fishery monitoring programmes to focus on sea turtle bycatch reporting. In this sense, the emphasis needs

to be on supporting /encouraging ICCAT in its efforts in offshore fisheries. Additionally CPs that are EU Member States are required to monitor incidental bycatch of Annex IV species under Article 12(4) of the Habitats Directive to ensure that it does not have a negative impact.

Annex 1 Overview of data and information provided by Contracting Parties

Contracting Party	**Feature occurs in CP's Maritime Area**	**Contribution made to the assessment** (***e.g.*** **data/information provided)**	**National reports** **References or weblinks**
Belgium	N		
Denmark	N		
European Commission	Y		
France	Y	Y	http://www.aquarium-larochelle.com/index.php?id_page=63&id_site=1
Germany	N		
Iceland	N		
Ireland	Y	Y	www.strandings.com
Netherlands	N		
Norway	N		
Portugal	Y (Continent) Y (Azores)	Y	Lídia Nicolau *pers. comm*; http://socpvs.org/cramq.php http://www.arquipelago.info/
Spain	Y	Y	http://www.mapa.es/fr/pesca/pags/sostenibilidad_p/tortugasypesca/reduccmortandad/estudio2.htm http://www.tortugasmarinas.info/apoyo-al-pescador.html http://www.tortugasmarinas.info
Sweden	N		
UK	Y	Y	Pierpoint, C., 2000.Bycatch of marine turtles in UK and Irish waters. JNCC Report No 310. JNCC, Peterborough. http://www.jncc.gov.uk/page-2330 http://www.jncc.gov.uk/article17 www.strandings.com

The Loggerhead turtle was nominated for inclusion in the OSPAR List in 2001 in a joint submission from Iceland, Portugal, UK for OSPAR Area V and from Portugal for OSPAR Area IV. Contact persons for Portugal: Fátima Brito, Direcção Geral do Ambiente, Rua Murgueira-Zambujal, 2720-865 Amadora, Portugal and Ricardo Serrão Santos, DOP-Universidade dos Açores, Cais de Santa Cruz, 9901 862 Horta, Portugal.

Summaries of country-specific information provided

UK and Republic of Ireland: Data for these two countries are grouped together as they share a common database: Rod Penrose of Marine Environmental Monitoring, and Gabriel King in Ireland have painstakingly gathered records of turtle sightings and strandings from around Ireland and the UK that date back over 100 years

In addition to European and international agreements, legislative coverage for loggerhead turtles in the UK is provided by the Conservation Regulations 1994 (Schedule II) and the Wildlife and Countryside Act 1981, as amended (Schedule 5). It is the oceanic stage of life that results in the greatest proportion of animals being recorded in UK and Irish waters (Witt *et al.*, 2007). The average size for *C. caretta* recorded is approximately 30 cm (range 13.5 – 110 cm). By far, the majority are 'first-passage' turtles and their arrival is most likely mediated by North Atlantic current that flows adjacent to the continental shelf of Europe. While individuals have been reported every month of the year, the majority are found between November and March. At this time of the year, sea water temperatures are low and often below the threshold of 9.5 reported to induce floatation in this species (Schwartz 1978). Witt *et al.* (2007) found that the temperature distribution for *C. caretta* reported dead was significantly lower than the temperature distribution for those reported alive. Spatially, there is an inverse relationship between number of records and latitude and most sightings and strandings occur on west facing aspects. On the whole these results are taken as evidence that UK and Irish waters do not constitute a viable part of this species range.

France: Loggerhead turtles are mainly present in French atlantic waters as juveniles. The Centre d'Etudes et de Soins pour les Tortues Marines of La Rochelle Aquarium collects sea turtles stranding datas along the French Channel and Atlantic coasts (Morinière and Dell'Amico, 2011). It rehabilitates alive animals and makes necropsies on dead ones. 89 samples from juveniles loggerhead sea turtles stranded on the French atlantic coasts from 1995 to 2009 have been genetically analyzed. We were able to detect two major origins: South Florida (51%) and Cape Verde (26%) (Monzón-Argüello etal., 2012). On July 29th 2008, a juvenile (8 kg) loggerhead turtle, "Antioche", was tagged with a satellite-linked transmitter and released after receiving specialist rehabilitative cares for several months at La Rochelle Aquarium. This was the first juvenile loggerhead turtle equipped with an Argos tag on Europe's Atlantic coasts. Since 2008, 13 new trackings of 10 loggerheads, 2 Kemp's Ridley and 1 green sea turtles have been realized (http://www.aquarium-larochelle.com/suivi/tortues).

Portugal (Azores & Madeira): The Azores seem to be a regular transit area for young loggerhead turtles coming from SE United States and Mexico (Fretey, 2001). Between 1984 and 2004, the Department of Oceanography and Fisheries (DOP) of the Univerisity of Azores tagged 2672 turtles, 16 of which have been recaptured (Azores - 9, Nicaragua -1, North Carolina -2, Florida-2, Cuba-1, Morocco -1 Spain - 1, Sicily -1). A collaboration between the University of the Azores and the University of Florida equipped 6 turtles with a longline hook inside them and 12 without with satellite transmitters. The hooked turtles all followed the currents to the east, made shallower dives and stayed down longer

From 1994 to 1997 the University of Madeira marked and measured a large number of juvenile loggerhead turtles. A "LIFE" project has identified the turtle's favored zones within a radius of 200 nm with the goal of creating a marine reserve protecting this pelagic stage. The archipelago includes six protected coastal areas. Another project (Praxis) began at the end of 1998, and established the population's feeding habitats and composition (skeletochronology, hormonal analysis) (Fretey, 2001). Loggerhead sea turtles begin to leave oceanic habitats around the Azores

and recruit to neritic habitats at 7 years of age, at ~46 cm curved carapace length (Bjorndal *et al*., 2003). Mortality from incidental capture in longline fisheries in the Azores does increase with size, with the 2 to 6 year age classes experiencing very little mortality (Bjorndal *et al*., 2003). The loggerhead also used to be collected for human consumption/ sale to tourists in the Azores and Madeira during the late 1960s-70s (Brongersma, 1995).

Portugal (Continent): Recent projects provided evidence that the Portuguese continental coast is an important passage/transit area for loggerheads, especially the Southern coast of the country (Algarve). Satellite tagged rehabilitated loggerhead identify seamounts off the coast as important foraging areas. Incidental capture in coastal entanglement nets has been determined as the major threat. Goals include to obtain good estimates of bycatch rates for better management and risk assessment in the area for the species.

Spain: Loggerhead turtles are a common species year round in all Spanish waters, with juveniles and sub adults both in oceanic and neritic phases. There are no nesting beaches in Spain, both occasional nesting occurs along the Levantine and southern coast of the Iberian peninsula. Research and conservation on the species has mainly focused on the bycatch issue both in longlining, trammel nets, bottom trawls and poundnets. In relation to these bycatch risks, intensive studies on survival rate, habitat use and movements have been and are being developed.

Bycatch monitoring in diverse Spanish fisheries has been continuous since the early 80's when the problem was detected in the surface longline fisheries. The Spanish Oceanographic Institution (IEO) and Alnitak have in particular maintained long-term programmes of bycatch risk assessment and identification of technological measures for its mitigation. In 2005, IEO and Alnitak together with NOAA initiated a series of fishing trials to test identified mitigation measures.

After the success since 2008 of bycatch mitigation measures including deeper setting and using fish bait in the longline fishery targeting swordfish, monitoring and capacity development workshops have been extended from the Mediterranean based longlining fleet to other fleets operating out of northern Spain and fishing in OSPAR areas.

Since 2003, a training programme was set up to keep an open discussion with the fishing fleet with regards to bycatch mitigation and the optimization of sea turtle handling and release. In 2007, through the TECNO project conducted for the SG Fisheries by Alnitak and NOAA, the veterinarian approach was integrated in sea trials with the assistance of the CRAM Foundation recovery centre. This project allowed to study the comparative lesions of circle hooks and "J" hooks and establish a series of measures to regulate the handling of turtles and avoid uncontrolled programmes based on the transportation of turtles to recovery centres.

Spain has 11 marine wildlife recovery centres and a stranding network that covers most of its coast efficiently since 1995.

Annex 2 Description of the recommended monitoring and assessment strategy

Rationale for the proposed monitoring

Serious data deficiencies in sea turtle fisheries interactions exist and it is recommended that information on sea turtles and fisheries related mortality must be urgently collected.

Use of existing monitoring programmes

Union Council Regulation EC n°812/2004 is a proposed legislative tool with which to place observers onboard national fishing fleets.

Synergies with monitoring of other species or habitats.

Other OSPAR species and habitats with which synergies could be made during monitoring programmes are as follows:

Species: pelagic sharks, sea birds and marine mammals.

Habitats: seamounts, sargassum

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