

# Report of the Joint IWC-SPAW Workshop to Address Collisions Between Marine Mammals and Ships with a Focus on the Wider Caribbean

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The Workshop was held from 18-20 June 2014 at the Gamboa Rainforest Resort at the Panama Canal. A list of participants is provided at Annex A.

## **1 INTRODUCTORY ITEMS**

### **1.1 Welcome from the Republic of Panama**

Yasmin Brea (IWC Commissioner for the Republic of Panama) opened the Workshop. She welcomed participants to Panama and thanked ARAP (Autoridad de los Recursos Acuáticos de Panamá), the Smithsonian Research Institute and the Panama Canal Authority for their assistance and support in planning the Workshop.

She noted that Panama has a strong commitment to the protection and conservation of whales and has declared its national waters as a sanctuary for all species of cetaceans. Recently Panama proposed and had accepted a Traffic Separation Scheme (TSS) to the International Maritime Organization (IMO), to reduce the risk of cetacean collisions in the approaches to the Panama Canal. In addition, Panama had recently conducted technical training on responding to entangled whales.

Ms Brea repeated Panama's support for cetacean conservation and hoped that all participants would find that the Workshop provided a valuable opportunity to further develop policy and cooperation.

### **1.2 Welcome from the IWC**

Frederic Chemay (Chair of the IWC's Ship Strike Working Group and IWC vice-Chair) reminded participants that a proposal for a joint workshop between the IWC and UNEP-CEP-SPAW was submitted to the IWC's 64<sup>th</sup> meeting in Panama in July 2012 by the Governments of Panama, Dominican Republic, France, Mexico, Netherlands and the USA. He recalled that an important component of the workshop's objectives was to assess the extent of ship strikes within the Caribbean Region and evaluate the potential for mitigation while recognising that there is no universal solution to the problem.

He highlighted the opportunity to identify data gaps at global and regional levels. This would require better communications with shipping companies and increased reporting of events via regional initiatives and especially to the IWC's global Ship Strikes Database. He made a call for increased efforts in this regard within the Caribbean area.

He noted that the Workshop, and two previous recent collaborations on entanglement response training, indicated an increased working relationship between IWC and UNEP-CEP-SPAW. This work had the common theme of reducing human impacts on cetacean populations, and he noted that the recommendations from the Workshop would be reported to the IWC's next Plenary meeting in September 2014.

Chemay thanked the Government of the Republic of Panama for hosting the Workshop and acknowledged the organisational support provided by the IWC Secretariat, the UNEP-SPAW team and the members of the Steering Committee. He particularly thanked the Governments of the USA, the Netherlands, and UNEP-SPAW who had made voluntary contributions to the cost of the Workshop.

### **1.3 Welcome from the Caribbean Environment Program's Protocol on Specially Protected Areas and Wildlife (SPAW)**

Sandra Jean (SPAW Programme Officer) welcomed participants on behalf of UNEP-CEP and of the SPAW-RAC. She thanked the hosts of the Workshop and the participants and noted that collisions between ships and cetaceans are an issue all around the world and also in the wider Caribbean region, and that this is an important issue to discuss. She described the SPAW Protocol and noted that the 16 Contracting Parties had established a marine mammal action plan in 2008 (UNEP, 2008). The recent collaborative work with the IWC to reduce human impacts on cetaceans in the Caribbean Region contributed to the objectives of the plan by providing technical training and policy development. She thanked the organisers and co-sponsors of the Workshop and wished everyone a productive meeting.

## **2 CHAIR AND RAPPORTEUR(S)**

### **2.1 Appointment of Chair**

Lorenzo Rojas-Bracho was elected Chair of the Workshop.

### **2.2 Appointment of Rapporteurs**

Andrea Cooke, Simon Brockington and David Mattila were appointed as rapporteurs, with assistance from Greg Donovan and others as appropriate.

## **3 REVIEW AND ADOPT AGENDA**

The adopted Agenda is given as Annex B.

## 4 BACKGROUND AND CONTEXT

Chemay noted that although management of whaling was the traditional role of the IWC, a number of new or emerging risks had developed which were relevant to whale conservation, one of which was ship strikes.

Ship strikes are a complex issue because:

- they involve multiple species;
- they involve a wide variety of shipping industries;
- it is a worldwide issue with wide political/financial considerations;
- there may be conflicting priorities across responsible organisations; and
- the issue needs both international and national regulation.

The complexity of the issue is further increased because ship strikes are generally under-reported. In addition, there are different perspectives for prioritising action on ship strikes, and these include *inter alia*: (1) a conservation perspective, in regions where ship strikes may reduce species or population recovery; (2) a welfare concern which arises because of the injuries caused by collisions; (3) a human safety concern arising especially where smaller vessels traveling at high speed are involved; (4) a necessity arising out of public perception to take all measures to reduce strikes; and (5) an economic need to prevent damage to vessels.

Within the IWC, ship strike issues are addressed through the Conservation Committee's Ship Strike Working Group (SSWG), whose membership comprises Argentina, Australia, Belgium (Chair), Brazil, Denmark, France, Germany, Italy, Republic of Korea, Luxemburg, New Zealand, Portugal, South Africa, Spain, UK, USA and UNEP/CMS. The SSWG delivers regular progress reports to the Commission covering key items including work plans, updates on collaboration with other organisations and progress with the IWC's global ship strikes database.

An important milestone for the SSWG was a joint Workshop held by IWC and ACCOBAMS in Beaulieu-sur-Mer (France) in September 2010 (IWC, 2011). This Workshop made several recommendations (see Item 5.1 below, and Annex E) and particularly requested IWC Contracting Governments and relevant maritime sector bodies to continue reporting ship strikes to the IWC Secretariat on a regular basis to allow further development of the IWC ship strikes database.

At the present time, the SSWG is developing a five-year strategic plan to guide its future work, which is being undertaken in close association with IWC Scientific Committee's work on human-induced mortality. Since 2012, the Scientific Committee has provided support to two ship strike co-ordinators who have continued work on the global ship strike database and are assisting with the drafting of the five-year plan.

## 5 SUMMARY OF CURRENT INFORMATION AND DATA GAPS

### 5.1 Global

#### 5.1.1 *Lessons from the 2010 Joint IWC/ACCOBAMS workshop (IWC, 2011)*

Donovan briefly summarised the generic lessons that arose from the 2010 joint IWC/ACCOBAMS Workshop in Beaulieu-Sur-Mer, France (referred to hereafter as the Beaulieu Workshop) and how these were related to recommendations. In addition, a full summary of the detailed recommendations can be found in Government of Belgium (2011), which was presented to the IWC Commission meeting in Jersey, IWC/63.

The Workshop had recognised the variety of reasons that the IWC and ACCOBAMS (Agreement on the Conservation of Cetaceans in the Black Sea, Mediterranean Sea and Contiguous Atlantic Area) were interested in this issue ranging from animal welfare and human safety through to population level threats. These different perspectives can lead to different approaches to the issue and assignment of priorities. There are an increasing number of reports of ship strikes although as the Workshop noted it was not clear whether this related to a true increased incidence, an increase in reporting effort or a combination of both. The focus of the Beaulieu Workshop was on information needs to assess whether ship strikes represented population level threats with a focus on the ACCOBAMS area, and an initial consideration of mitigation measures. In looking at population level threats it was recognised that ship strike mortality was one component of examining cumulative effects upon populations.

The issue of ship strikes is complex both from a scientific and a management context. It often involves multispecies consideration from a cetacean perspective and a wide variety of vessel types and categories including industrial, artisanal, whalewatching, transport, leisure and military. This variety and the various political and economic interests involved also presents difficulties with respect to appropriate management bodies and international and national regulatory responsibilities. The Workshop recognised that this was an issue that could not be addressed by the IWC alone.

An important component of the Workshop focussed on what types of data were necessary to determine the extent of ship strikes, in order to assess its significance as a population level problem. With respect to data on ship strikes themselves, there was a great need for good quantitative and even qualitative information. There is often considerable uncertainty in obtaining this information which sometimes comes as a result of direct visual information, but often

comes from systematic and *ad hoc* post-mortems. Recommendations from the Workshop focussed on the need for developing agreed protocols for post-mortems (subsequently reviewed and agreed to at IWC SC/65a; see IWC, 2014a), the importance of training/capacity building with respect to stranding networks and development of a tiered and pragmatic approach by region that recognises available expertise and resources. A major focus was on how to expand and publicise the newly developed IWC global ship strikes database.

The Workshop noted that the data required for both cetaceans and ships were similar in many ways. They included information on: abundance and trends; temporal and spatial distribution at appropriate scales and an understanding of predictability; susceptibility by species or vessel type; the behaviour of animals and vessels (night, speed etc.). In all of this, appropriate handling of the often inevitable uncertainty is essential. Recommendations from the Workshop focussed on obtaining the necessary baseline and monitoring cetacean data at the appropriate spatial and temporal scales, and collaboration with the various shipping sectors and authorities to obtain the necessary shipping information.

Once such data are available, then modelling/GIS approaches are necessary to produce integrated analyses which are important *inter alia* to evaluate and prioritise threats, as well as to assist in the development and evaluation of mitigation measures. Given the uncertainties, the process is likely to be complex and iterative, even for relatively data rich areas.

The questions surrounding determination of priorities was discussed at the Workshop, where it was recognised that a number of criteria are possible, depending on stakeholder perspectives and data available. These include: cetacean population status in light of quantified threats, qualitative evaluation based on an overview of available data; the feasibility of effective mitigation actions; economics; animal welfare, etc. Once priority species/regions/populations are agreed, then this may lead to further research to better quantify the problem or develop mitigation actions or implement mitigation actions themselves. The Beaulieu Workshop highlighted a number of potential priority areas within the ACCOBAMS region.

In examining questions of mitigation methods, the Workshop stressed the need to involve all stakeholders (e.g. industry, IMO, ports, national and international authorities, technologists, cetacean scientists etc.) at all stages and the importance of collaboration. The Workshop emphasised that local conditions and resources must be taken into account. Where there are economic or legal implications for mitigation, then the need for mitigation and the likely effectiveness of the methods themselves require a strong scientific basis and evaluation. Monitoring effectiveness of proposed 'solutions' is essential. The Workshop considered a number of approaches (annex E of the Beaulieu Workshop report summarises these) that can broadly be classified as those that 'keep apart' cetaceans and ships (e.g. shipping lanes, MPAs), those that aim to 'minimise' encounters (e.g. observers, technology) or their effects (e.g. speed restrictions).

A summary of the Beaulieu recommendations and proposed actions is provided as Annex E.

**5.1.2 The IWC Global Ship Strikes Database and the need for improved identification and reporting of ship strikes**  
Ritter introduced the IWC's global ship strikes database<sup>1</sup> detailing its development, structure, the layout of the online reporting tool and the categories of information that can be reported. Details can be entered into the database of incidents/collisions, the cetacean species involved, the impact upon or fate of the animal as well as the vessel's identity, type and speed, etc. He gave an overview of the current records contained in the database (over 1,100 individual reports) and summarised their geographical distribution especially relating to the North Atlantic including the Caribbean Sea. Data gaps were acknowledged, and these included an absence of data on vessel type and speed for many strikes. Ritter emphasised that the information held in the database related to reporting effort rather than representing an accurate reflection of the global situation. He also drew attention to the ongoing work of the IWC's Data Review Group in verifying records.

In discussion, the Workshop noted that the relative abundance of records in the database was as much a result of differential effort and reporting as to true relative occurrence. For example, the large number of North Atlantic right whale records reflected the substantial effort along the US east coast and the efficiency of the reporting systems in that area.

Given the patchy reporting and effort thus far (although this is improving), the Workshop **agrees** that at present it is not appropriate to use the database records to make initial estimates of the global extent of the ship strike issue. In general, the Workshop **agrees** that ship strikes are more likely to be an important factor at a population level for species and populations where abundance is low (e.g. western North Atlantic right whales, eastern North Pacific right whales, southeastern Pacific right whales, Arabian Sea humpback whales, western gray whales, blue whales off Sri Lanka, sperm whales in the Canary Islands and fin whales in the Mediterranean Sea). Once populated more fully, the database will also be valuable in highlighting areas where concentrations of strikes occur that may be important for more abundant populations, as well as highlighting important general areas on which to focus mitigation efforts.

The Workshop briefly discussed alternate approaches to estimating the extent of ship strikes including examination of scarring from non-fatal collisions and the use of photo-id records to estimate extent of non-age related mortality. It

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<sup>1</sup> Accessible through <http://iwc.int/ship-strikes>.

noted the inherent difficulties in such approaches and noted that this issue remains on the agenda of the Scientific Committee.

In summary, the Workshop **recognises** ongoing effort to populate the database and the work of the IWC ship strikes database co-ordinators. Here (and elsewhere in the report), the Workshop **stressed** that improved efforts to encourage reporting was of highest priority.

The Workshop noted the great importance of improved reporting. With respect to the IWC, the Workshop **strongly recommends** that:

- (1) IWC member countries place greater emphasis on publicising the database and the need to report ship strike data directly into it within their countries, including within their relevant government departments (including the navy and coast guard) and to local maritime users in general;
- (2) IWC member countries submit relevant information to the Scientific Committee, e.g. in national Progress Reports;
- (3) the IWC continues to fund the ship strikes database co-ordinators and that the co-ordinators continue to *inter alia* publicise the database; and
- (4) the IWC increase efforts to publicise the database to other intergovernmental and regional organisations, as well as all parts of the maritime sector.

#### 5.1.3 Identifying data gaps

The Workshop noted in addition to the need to encourage reporting (see Item 5.1.2 above) that ship strikes were likely to be greatly under-reported in most parts of the world for a variety of reasons including effort and resources available to stranding networks, difficulties in detection at the time (especially for large vessels where impact might not be noticed) and difficulties associated with either lost carcasses or determining cause of death even if the carcass is discovered. With respect to mitigation measures in particular, the Workshop **stresses** that obtaining information on ship strikes where vessel type and speed can be identified is extremely valuable; as part of the increased efforts to publicise the database to the marine sector (see Item 5.1.2 above), this should be emphasised. In this regard it is also important that mariners are informed that reporting a ship strike is a positive action aimed at enabling future mitigation, rather than something that will have negative implications for them or their company.

The Workshop also **noted** that there is a lack of information on the behaviour of whales around vessels; such information is of great value to the development of mitigation measures and the Workshop **recommends** increased studies of data on how whales respond to ships (and see the recommendation relating to the use of telemetry under Item 8).

#### 5.1.4 Shipping and other stakeholder perspective

##### 5.1.4.1 CRUISE INDUSTRY PERSPECTIVE

Griffiths summarised the state of the global cruise industry, including the organisation of the Cruise Lines International Association (CLIA) global secretariat and CLIA advisory committees. CLIA is comprised of more than 60 member cruise line companies, of which more than 40 are oceangoing members who operate more than 200 ships and representing approximately 98% of the global cruise capacity. While average growth of the global cruise industry in terms of gross tonnage (GT) has increased over time, it was noted that this trend is expected to level off in the coming years based on new ship orders up to a maximum of approximately 150,000 GT. Similarly, the maximum number of passengers and crew will also level off in the years to come. Finally, while Asia is the fastest growing market for the cruise industry, it was noted that the Caribbean region remains the highest global market share at 37.3% in terms of cruise ship itineraries and capacity.

CLIA is the world's largest cruise industry trade association with representation in North and South America, Europe, Asia and Australasia. It represents the interests of cruise lines, travel agents, port authorities and various industry business partners before regulatory and legislative policy makers. It is also engaged in travel agent training, research and marketing communications to promote the value and desirability of cruise holiday vacations with thousands of travel agency and travel agent members. CLIA's Associate Member and Executive Partner programme includes the industry's leading providers of supplies and services that help cruise lines provide a safe, environmentally friendly and enjoyable holiday vacation experience for millions of passengers every year.

Within the Caribbean region there are around 8,500 port calls per year and this figure is indicative of the number of passages made within the region, with transits often being made at night. Use of AIS tracking, and data obtained through [www.marinetraffic.com](http://www.marinetraffic.com) indicate the types of routes being used for transit (see Annex D). However the Workshop noted the paucity of empirical data on cetacean distribution in the region, which would be necessary for quantifying risk of ship strike (see Item 5.2.4).

The Workshop discussed the level of awareness amongst cruise line operators for reporting ship strikes and noted that it was low. Previously a CD-ROM had been developed by Holland-America Line which gives training on how to report ship strikes. CLIA offered to facilitate engagement with operators and noted that the International Chamber of Shipping

would also help facilitate awareness raising. This is also relevant to efforts to improve reporting discussed under Item 5.1.2.

#### 5.1.5 *High risk areas and species*

##### 5.1.5.1 MODELLING APPROACHES INCLUDING SHIPPING AND WHALE DATA WITH GLOBAL IMPLICATIONS OR APPLICABILITY

The methodology used by Redfern *et al.* (2013) to assess the risk of ships striking large whales contains three components: developing habitat models to predict whale densities, identifying management options using shipping data, and assessing risk in the identified options. Previous estimates of marine mammal abundance (e.g., stratified density estimates) were available at spatial scales that were typically much larger than the scale of human activities. To provide finer-scale estimates of species densities, researchers at NOAA Fisheries' Southwest Fisheries Science Center developed habitat models for 22 species or species groups using 15 cetacean and ecosystem assessment surveys conducted in the eastern Pacific Ocean between 1986 and 2006 (Barlow *et al.*, 2009; Forney *et al.*, 2012). During the development of these models, many methodological aspects of habitat modeling were investigated: modeling frameworks, data sources, error structures, model selection, spatial and temporal resolutions of input variables, and spatial interpolation techniques. Generalised additive models were used to relate species encounter rate and group size to bathymetry, distance to shore or selected isobaths, sea surface temperature, variance in sea surface temperature, salinity, chlorophyll, and mixed-layer depth. Model selection was performed using cross-validation on novel data. Smoothed maps of species density were created from the final models and are available with associated standard errors and 90% confidence intervals for the California Current ecosystem and eastern tropical Pacific. Redfern noted that current work is being conducted to further refine these models for large whale species.

Redfern *et al.* (2013) used fine-scale, systematic survey data to develop habitat models for humpback, blue and fin whales in the Southern California Bight, off the US west coast. Automatic Identification System (AIS) data collected between 15 September and 30 November in 2008 and 2009 was used to analyse traffic patterns for large commercial ships. From these traffic patterns, they derived four alternative shipping lanes. Ship-strike risk for the alternative shipping lanes was assumed to be proportional to the number of whales predicted by the models to occur within each lane. The proportion of whales within a shipping lane that will be struck is a function of whale densities, volume of shipping traffic, ship speed, and whale behaviour. Information is lacking on the functional form of these relations and other factors that may affect ship-strike risk. Consequently, they quantified the co-occurrence of whales and shipping traffic as has been done in recent ship-strike studies (Vanderlaan *et al.*, 2009). They found that the lane with the lowest risk for humpback whales had the highest risk for fin whales and *vice versa*. Risk to both species may be ameliorated by creating a new lane south of the northern Channel Islands and spreading traffic between this new lane and the existing lane in the Santa Barbara Channel.

Redfern reported that she and her colleagues are expanding the application of this methodology to assess ship-strike risk in numerous regions. For example, systematic survey data collected by NOAA fisheries' Southwest Fisheries Science Center and non-systematic survey data contributed by numerous individuals are being used to improve whale-habitat models and assess risk off the entire US west coast and throughout the Eastern Tropical Pacific. Blue whale habitat models developed for the US west coast are being used to predict blue whale distributions in data poor regions, including Sri Lanka and Chile. Predictions will be validated using all available systematic and non-systematic data from these regions. The predictions will be used to assess ship-strike risk and prioritise future data collection efforts in these regions.

The Workshop welcomed this paper, noting that it was based on an extremely good long-term dataset, probably the best in the world. It also noted that in an ideal case, a full risk assessment involves consideration of additional issues including whale behaviour (e.g. time at surface), and changes in seasons and changing environmental factors (e.g. El Niño). Lessons and conclusions about the value of modelling and the strengths and weaknesses of different approaches are discussed under Item 7.2.4.

The Workshop considered Priyadarshana *et al.* (2014) that reported on risk assessment work undertaken in Sri Lanka (Sri Lanka is not an IWC member). Surveys were conducted from February to April 2014 to investigate the distribution patterns of blue whales in relation to existing shipping lanes and further offshore. The highest densities of blue whales were observed in the current shipping lanes. These high densities of whales combined with one of the busiest shipping routes in the world suggest a severe risk of ship strikes. The authors concluded that the results suggested that blue whale distribution in the area is related to bathymetry and thus that the observed distribution patterns may be consistent over time. Hence moving the current Traffic Separation Scheme (TSS) further offshore would likely substantially reduce risk of collisions with blue whales. However, doing so may increase the risk of collisions with sperm whales. Two were struck last year, one of which stranded while the other did not. The IWC Scientific Committee reviewed this paper in May 2014 and had agreed that further surveys of blue whale distribution in the area at different times of year would provide important data to inform recommendations on mitigation measures including moving shipping lanes. Noting that there has been a dialogue between the IWC and the Government of Sri Lanka on the issue, the Committee had recommended that the IWC should begin to discuss possible mitigation measures with the relevant authorities and stakeholders in the area. The Committee had requested that the Secretariat send a letter to the Sri Lankan Government, with an update on the information from its discussion of this topic and ways in which the Committee or the IWC Ship Strikes Working Group may assist. In addition, it had recommended that a representative from Sri Lanka be invited to

relevant IWC meetings and workshops. A representative from Sri Lanka was invited to the present Workshop but the representative was unfortunately unable to attend. The Workshop **endorses** the Scientific Committee's recommendations.

The Workshop also considered Frantzis *et al.* (2014) concerning the situation for the Hellenic Trench southwest of Greece, an area that had been identified as potentially high risk during the Beaulieu workshop (IWC, 2011). An analysis of twelve seasons of visual and acoustic observations of sperm whales identified high risk areas where whales were exposed to very high shipping densities. There is evidence of high numbers of ship strikes from strandings data. The potential for small changes in shipping routes to greatly reduce risk in these high risk areas suggested considerable scope for effective mitigation. However, it is important to investigate whether moving the routes offshore might affect other species, especially fin whales, before recommending any changes. The Workshop **endorses** the Scientific Committee's recommendation that the IWC should encourage dialogue with shipping regulators and interests in the area, perhaps in conjunction with ACCOBAMS.

The Workshop then considered Vaes and Druon (2013) which modelled the seasonal ship strike risk of fin whales in the western Mediterranean Sea by making use of data on vessel traffic from AIS data (for May, July and October) and hypothesised 'potential fin whale habitat' modelled using fin whale sightings and satellite-derived data sea surface temperature and chlorophyll-*a* content. This 'potential habitat' was then extrapolated to the entire western Mediterranean Sea. The authors estimated mean risk per month from daily risk estimates. AIS data were available for May, July and October. Two high risk areas were identified to have an especially high collision risk for fin whales: (a) the Liguro-Provencal Basin north of Corsica (including the Pelagos Cetacean Sanctuary); and (b) the Alboran Sea with an even higher potential risk. The first area was already known as a potential high risk area whereas fin whales are rarely observed in the latter area. Near-realtime maps of 'potential fin whale habitat' have been computed on a daily basis since 2010 and provided to partner research groups. The Scientific Committee had expressed a number of reservations about this approach in 2013 (IWC, 2014a) including over-interpretation of limited data and extrapolation. The Workshop **echoed** these concerns and refers to its general conclusions and recommendations below.

#### 5.1.5.2 CONCLUSIONS AND RECOMMENDATIONS

Risk assessments require *inter alia* quantitative representations of species distributions/relative density at appropriate temporal and spatial scales. Species distribution modelling and predictions from these models can be a powerful tool for meeting this requirement, but several issues require careful consideration. Of primary importance is the nature and quantity of data available and the area in which data were collected. Marine mammal distributions are highly dynamic and variable. Consequently, the likelihood that predicted distributions capture areas of consistently high density and the uncertainty inherent in the species distribution will generally increase with the number of seasons and years of data available for model building. In particular, longer data time series will capture a greater range of temporal habitat variability (e.g. the El Niño Southern Oscillation, ENSO). The spatial extent of the available data has a similar effect. If sampling is limited by logistical constraints to only a small or atypical portion of the range of the animals (e.g., to areas close to the coast, major cities, etc.) and/or only one or two seasons, predictions from the model may well be misleading and inappropriate as a basis for identifying potential or actual important areas for cetaceans and/or high risk areas when combined with information on threats (e.g. AIS data). This potential bias can be a particularly important consideration when using presence-only data alone (e.g. sightings from whalewatching operations).

In addition, when developing appropriate statistical models, many decisions must be made, including selecting the modelling framework, data sources for the habitat variables (e.g., *in situ*, remotely sensed, or modelled) and their spatial and temporal resolutions, error structure, variable selection techniques, and spatial interpolation (and in certain cases extrapolation) techniques. Each of these decisions affects the predicted species distributions to a greater or lesser extent. In particular, these decisions can greatly influence the uncertainty in the predictions in addition to the uncertainty associated with the available data. It is, of course, also important to explicitly consider stock structure within the area.

The Workshop **stresses** that it is **essential** that the limitations and uncertainties surrounding density maps obtained from species distribution modelling are explained properly to managers along with the uses to which they can be put. Effectively communicating the uncertainty in the predictions is critical for correctly interpreting estimates of risk. This is particularly important because maps can be produced from poor datasets as simply as they can be produced from adequate datasets; such maps can be extremely misleading and imply a spurious level of reliability.

Notwithstanding the general difficulties associated with extrapolation (*versus* interpolation), the Workshop **recognises** that there are circumstances where extrapolation of spatial/habitat models from data rich areas to data poor areas can be of value in identifying areas of potential importance that warrant further investigation (e.g. by systematic surveys). In this regard, it noted the work on beaked whales undertaken by Cañadas *et al.* (ACCOBAMS document SC7-Doc 15) within the Mediterranean region and the ongoing work of Redfern and colleagues on blue whales found off South America and Sri Lanka reported above. Both studies correctly identified the limitations and the appropriate interpretations of this work.

The Workshop **commends** the work undertaken thus far on one of the best long-term datasets in the world for habitat modelling, i.e. the Eastern Tropical Pacific. It noted the potential of using this dataset to explore certain generic questions including the relationship between reliable predictions and, for example, length of datasets and/or



geographical extent of datasets. It **recommends** investigation of these issues by ‘censoring’ or filtering the datasets in various ways and comparing the reliability of the predictions against those from the full dataset. Similarly, it **recommends** exploration of the relationship between use of presence/absence data and presence-only data.

#### 5.1.5.3 MMPAS AND IUCN-IMMAS

Hoyt reported that in October 2013 at the third international MPA (Marine Protected Areas) conference in France (IMPAC3), the IUCN Marine Mammal Protected Areas Task Force (MMPATF) was launched. This was an initiative of the International Committee on Marine Mammal Protected Areas (ICMMPA) which has focused on MPA and habitat issues with marine mammals. The new task force sits within both the IUCN Species Survival Commission (the cetacean, pinniped and sirenian specialist groups) and the IUCN World Commission on Protected Areas.

The first Task Force action was to convene a workshop at IMPAC3 to look at creating a new category of ‘Important Marine Mammal Areas’, or IMMAs, to focus more attention on ‘important habitats’ for whales and other marine mammals. The workshop determined that the starting point criteria for IMMAs in terms of testing should fit within: (1) Convention on Biological Diversity (CBD) Ecologically or Biologically Significant Areas (EBSAs); and (2) IUCN Marine Key Biodiversity Areas (KBAs) (Hoyt and Notarbartolo di Sciara, 2013). But the fine-tuning and possible thresholds need to be determined after testing.

The impetus for creating the IMMAs category was: (1) the widely successful ‘Important Bird Areas’ (IBAs) concept which has proved an asset in global conservation planning (with some 12,000 IBAs named to date); and (2) the fact that whales and other marine mammals were largely being left out of the CBD EBSA planning process for the high seas. Looking at 168 EBSAs declared before Oct. 2013, only 11% listed marine mammals as a primary feature (EBSA Criteria I, II and III). Only 26 marine mammal species (out of 120) were named within EBSA submissions as either primary or secondary (Criteria VI) features. Only one species, humpback whales, was commonly named; then walrus, beluga, polar bear and bowhead whale were named in a few areas. The other 20 species were named in only 1-5 areas.

Besides marine mammals being left out of the EBSA process, there is no standardised method for presenting evidence of marine mammal occurrence or importance. A standardised IMMA protocol to categorise, collate and advocate evidence is essential for global strategic conservation planning for EBSAs, national and regional MPA networks, and might be helpful in terms of identifying areas to avoid or where guidance is needed in terms of averting ship strikes and addressing noise issues.

To help strengthen the EBSA process and support the incorporation of marine mammal conservation concerns into these processes, the Task Force is organising a series of workshops to map and test draft IMMAs in selected regions of the world’s oceans to provide the opportunity for developing and refining subcriteria and thresholds for IMMAs, and to start to put IMMAs on the map, so that ultimately the aim is to start to arrive at a World Directory of IMMAs.

This ‘directory’, which in time could become a global mapping project for the IMMAs, similar to IBAs and EBSAs, would incorporate information from all the existing spatial resources available, including:

- EBSAs with annotations for primary and secondary features related to large whales;
- OBIS-Seamaps and other databases as starting point indicators;
- marine IBAs, as mapped by BirdLife International in 2013, as well as national programs such as the Biologically Important Areas (BIAs) in the US;
- oceanographic data including SST, seasonal chlorophyll presence, bathymetry to show, e.g. whale feeding areas; and
- MPAs for whales and dolphins.

Out of more than 7,000 MPAs worldwide, some 575 have recognised cetacean habitat (Hoyt, 2011). At [www.cetaceanhabitat.org](http://www.cetaceanhabitat.org), it is possible to query the database separately for sperm, humpback, blue, fin and right whales. Users should note that these are political designations not necessarily equivalent to the initial ‘scientific’ proposals. Also, there are 176 proposed MPAs with cetaceans, as of 2011, and these tend to be closer to the scientific proposal for protection. The Task Force, and Whale and Dolphin Conservation (WDC), have assembled the point data to create polygons for most of these areas.

The Task Force is organising a workshop to test the process and to start populating a map of the data rich eastern Australia/New Zealand region, extending into the less data rich South Pacific. The workshop will be held at the Third International Conference on Marine Mammal Protected Areas (ICMMPA3) in Adelaide, Australia in November 2014. The goal is to devise a set of common currencies to qualify each species’ spatial distribution, as well as to devise a methodology for the considerable work to come. The goal of IMMAs should be to identify non-political, scientifically based important areas for marine mammals supported by data plus modeling and expert input.

The IMMA identification process has drawn upon its participation in the last 4 EBSA regional workshops for the North Pacific, Arctic, northwest Atlantic and the Mediterranean, and has worked with marine mammal data to create EBSAs with a strong cetacean rationale in each area. As a result, there are several new cetacean draft EBSAs (in which cetaceans are primary features) on the map that are to be approved by the Convention on Biological Diversity’s

Subsidiary Body on Scientific, Technical and Technological Advice (CBD SBSTTA) this month (June, 2014). The maps should be released shortly. This next set of EBSAs should increase the marine mammal coverage.

Hoyt concluded by noting that for the ship strike issue, it is important look at ship strike criteria, or in effect 'filters', for the EBSAs and IMMAs that will show known areas of the ocean and the large whales resident there including humpback, right, blue and fin whales as well as sperm whales, i.e. the animals most susceptible to being hit by ships.

The nature of the specific advice to the shipping industry that could come out of this approach was discussed. Examples ranged from advising companies that they should avoid MMPAs altogether to advisory notice that extra care should be taken (e.g. reduced speed) in areas where whales are more likely to occur. It was suggested that rather than a 'blanket' approach it would be better to start to work at the regional level (e.g. Australia and the South Pacific where the initial trial approach will be considered at ICMMPA3 in Adelaide in November 2014) and within this region address local areas and work with local stakeholders. Given the known variation in whale distributions from year-to-year in accordance with a range of environmental and ecological factors and the difficulties in precise predictability, the strengths and limitations of the spatial modelling approaches given above (see Item 5.1.5.1), also apply here. It was also recognised that the rationale for MPA boundaries often reflect logistical and political decisions rather than the distribution of animals and so simply suggesting or legislating for measures within MPAs is unlikely to be sufficient to ameliorate ship strikes at a population level.

Recommendations regarding this topic are given under Item 7.1.3.

#### 5.1.6 Other

Ritter presented Ritter (2012) which dealt with collisions of sailing vessels with cetaceans worldwide, representing the first quantification of this kind on a global basis. To receive reports about collisions and near miss events, web searches were carried out and a dedicated online survey ([www.noonsite.com](http://www.noonsite.com)) was set up. The survey included questions about features of a collision or near miss event, which were selected in accordance with the existing IWC ship strike database. A total of 111 collisions and 57 near misses were identified, spanning from 1966 until 2010. 75% of incidents occurred in the period from 2003-10, indicating a substantial increase during recent years (although the extent to which this is a true rate of increase, or a result of increased reporting or greater difficulty in finding earlier data is unknown). Collisions and near misses occurred on all oceans, often during ocean races and regattas, and were most frequent in the North Atlantic, probably reflecting the relatively large amount of sailing traffic here. Vessel type and speed as well as circumstances of the incident varied widely, but most often monohulls of 10-15m size were involved, predominantly sailing at speeds between 5 and 10 knots (range 2-25 knots). Multihull vessels appeared to have an especially high rate of collision reports. The findings also suggest that elevated vessel speed contributes to a higher risk of collisions, because 26% of collisions happened at speeds faster than 10 knots despite very few boats sailing at these speeds. Most reports referred to 'large whales' ( $n=51$ ) as opposed to 'small whales' ( $n=12$ ) or 'dolphins' ( $n=4$ ). The species could be identified in 54 cases. The most recognised animals were humpback or sperm whales. Injuries to the whales varied strongly from 'not visible' to 'dead after collision'. During 20 incidents, blood was seen in the water and two cases reportedly resulted in the death of the whale. Sailing crew members were hurt several times, even during collisions occurring at low speeds. Vessels were damaged regularly, including major impairment and seven cases of vessel loss. Conversely, the outcome of a collision (e.g. injury to whale or crew, damage to vessel) was not a direct function of vessel speed. It seems that many whales were not aware of the approaching vessels. Several measures are proposed which can contribute to mitigating the problem, including placing lookouts, speed reduction, avoiding important cetacean habitats, careful planning of regattas and ocean races, thorough reporting as well as educational initiatives to raise awareness.

Further examples of collaboration with vessel operators were discussed. Five years ago it was negotiated that the Volvo Ocean Race, planned to come into Boston through a densely-populated humpback whale marine sanctuary area, could race through the existing shipping lane. Once the organisers were persuaded to collaborate on the issue (which was not in itself an easy task and took considerable time) this became a good example of management and working together with other organisations. Another example referred to was a cooperation between the Global Ocean Race and the Environmental Investigation Agency (EIA) NGO in 2010 as well as the recent World Jet Ski Race held in Guadeloupe in March 2014, which is the peak humpback whale breeding season in the area. The organisers of this race collaborated with local agencies by using helicopter sighting teams to search for whales to try to ensure there were no whales in the area before the race could begin. However, even with this precaution, a mother-calf pair appeared in the middle of the race area. This illustrates that even with collaborative efforts it is not always possible for mitigation measures aimed at separating whales from vessels to be completely successful.

The Workshop noted the importance of this topic from the perspective of human as well as animal safety. It **encourages** increased efforts from the IWC ship strike co-ordinators and others to inform and collaborate with all maritime users and especially the organisers of sailing races and competitions, of the potential risks of collisions with cetaceans and the need to avoid or take extra precautions in areas likely to contain higher numbers of whales.

## 5.2 Wider Caribbean Region

### 5.2.1 *Existing information on ship strikes*

There are few (around 10) reports from the Wider Caribbean area listed in the IWC Ship Strikes Database from 1961-present.

It was reported that there are some additional reports from Guadeloupe (five strikes), with two documented – Bédél (Agoa MM Sanctuary/French MPA Agency) undertook to send these reports to the database coordinators. There are also potentially two further reports to add to the database from the Dominican Republic. It was also noted that last April there was a ‘near miss’ documented by a survey vessel where a near collision of a humpback whale with a high-speed fishing vessel which did not slow down. The Workshop noted that small cetaceans are probably involved in collisions with smaller fishing boats, too, as many of the photographs of small cetaceans taken for photo-identification purposes within the region have propeller scars.

In discussion, it was noted that similar data (photo-id and reports from various vessel captains) are being collected in the Canary Islands. From that experience there is a need to work with the owners of high-speed fishing vessels and fishermen. It was suggested that one approach for the wider Caribbean was to introduce the issue and increase awareness of cetacean ship strikes through the current manatee reintroduction programme, which involves the coastguards.

In conclusion, the Workshop noted that the general awareness of the issue of ship strikes and the IWC database in the Caribbean area is low. Determining the extent of the issue requires greater collaboration with stakeholders including maritime organisations and the Workshop **recommends** that increased efforts are made by the IWC, SPAW and others to raise awareness and encourage reporting to the IWC database as well as any regional databases. This includes encouraging the establishment of strandings networks where these do not exist and the provision of additional information to existing ones.

### 5.2.2 *Shipping and other stakeholder information*

Griffiths gave a presentation which summarised the situation with regard to cruise shipping in the Caribbean area. The Caribbean has the biggest market share of cruise ships in the world. There were 8,100 ‘port calls’ in 2013 in an area roughly encompassing the Wider Caribbean. The trend is broadly for more each year, although this is levelling out with the biggest growth expected in Asia. The places with the highest numbers of port calls are the Bahamas (1,600 in four years), Mexico (Yucatan only), and the US Virgin Islands (750). Each individual port call is not necessarily made by a different ship, but is an individual visit by a ship. There are more port calls that could be included in the counts for this area - data for the US ports was not fully available (e.g. Miami is a large port that serves this area but was not included in this data). Peak season for cruise ships in the Caribbean is October-March, which is also peak humpback whale migration season.

AIS information clearly shows heavy passenger routes around the area (this is vessels of 300 tonnes and higher). Quite a few of these are short-distance overnight ferries, which go quite slowly (around 10 knots) for reasons of fuel economy, travelling through the night to arrive at dawn. It may be possible to use the AIS data to find the average speeds of these vessels. The Workshop **agrees** that AIS (or similar data) can be very valuable as part of risk assessment work on ship strikes. It notes that there are a number of commercial websites where such information can be obtained (e.g. [www.marine-traffic.com](http://www.marine-traffic.com)). It also notes that care must be taken when using data from commercial sites as it is not always known how the raw data has been processed (i.e. what assumptions have been used) and filtered.

#### 5.2.2.1 PANAMA CANAL AUTHORITY PERSPECTIVE

Jaen indicated that Panama is visited by around 17,000 vessels a year, of which around 14,000 transit the Canal. The number of vessels has remained relatively constant over the last 40 years although the amount of cargo being carried has increased. The market segment during 2013 was 24 % dry-bulk, 20% tanker, 7% general cargo, 26% container, 9% refrigerated, 6% vehicle carrier, 2% passenger and 6% others. Dry-bulk, tankers and general cargo (51%) normally have a sea speed of less than 15 knots. Containers, refrigerated, vehicle carriers and passenger ships (43%) normally have a sea speed over 15 knots.

On the Caribbean Sea side of the canal the traffic disperses along four routes: (1) transit to Gulf of Mexico (Yucatan Strait); (2) transit along the east coast of North America (via the Windward Passage); (3) to Europe (via Mona Passage); and (4) to the east coast of South America (north of Colombia).

On the Pacific Ocean side most of the traffic goes across the Gulf of Panama, around the Peninsula de Azuero and south of Coiba National Park. This traffic goes or comes from the Far East and the west coast of North America. The second group crosses the Gulf of Panama coming or going from the west coast of South America. A minor group goes or comes from the southwest Pacific.

Jaen indicated that his experiences of working with mariners suggested there was broad support for Traffic Separation Schemes (TSS). However there was less universal support for speed restrictions as these require extra time from engineer officers to establish the change of speed and shipping companies themselves may not support the extra passage time. The Panama TSS was approved by the International Maritime Organization (IMO) (see Item 6.2.3 below) and the Pacific section prescribes a recommendatory speed reduction to 10 knots for four months of the year when whales are most abundant.

The Workshop welcomed this report. The Panama TSS is discussed further under Item 6.2.3.

### 5.2.3 *High risk areas and species*

#### 5.2.3.1 **CARIBBEAN (LIFE WEB, UNEP-CEP, RAC REMPEITC)**

Jean summarised progress on the UNEP LifeWeb programme (LifeWeb Spain, 2014). This is a major ongoing study of the human impact on marine ecosystems – maps and charts have been produced showing species richness, species range maps, human activities and the potential impact of these on marine mammals. There is an acknowledged lack of data, e.g. bycatch data, in some places, and some maps have been ‘extrapolated’ from relatively small areas or limited data. Range maps for around 25 species were produced and critical areas for further research were identified. Eventually, after further refinement, this material will be placed on the web. The idea of the LifeWeb report and the accompanying one-day workshop was to find areas to focus further detailed effort on rather than an end in itself. The maps can be used to identify data gaps which may then suggest areas for further study. Although some people involved in the project were pushing for the creation of MPAs based only on these maps and without any further research, this has not happened. Research in the area is ongoing – recently some cetaceans were tagged and followed. Additional studies will help to refine and develop the dataset.

The strengths and limitations of this study and approach are discussed fully under Items 5.2.4 and 6.2.2. In particular, it was noted that use of range maps based on limited data, extrapolation or expert opinion are not sufficient to identify high risk areas.

#### 5.2.3.2 **THE USE OF MODELS: THE ETP EXAMPLE**

Félix presented information on the activities of the Permanent Commission for the South Pacific (CPPS) in implementing the Southeast Pacific Marine Mammal Action Plan. This includes training activities with IWC and NOAA, the development of an information system on marine biodiversity with a focus on cetaceans, and habitat modelling work on five species of large whales in the Eastern Tropical Pacific (ETP). CPPS recently published an atlas on distribution, migrating routes, critical habitats and threats for marine mammals in the ETP, which includes information on ship strikes. Current work includes habitat modelling and satellite tracking for collision risk assessment in Ecuador. CPPS has recommended increased reporting of collisions in the area.

CPPS are also involved in *Sibimap.net* – which is a regional database on cetaceans and turtles. 26 cases of ship strikes were recorded in this system – mainly humpback but also fin and southern right whales. Félix confirmed that he would introduce these data into the ship strikes database. He also recognised that there are probably other unreported ship strikes in this area. CPPS is also working on ongoing projects with NOAA, and also with Guzman from the Smithsonian on tagging, and Redfern on spatial modelling.

It was suggested that whaling catch data for the region (including the revised Soviet catch data) should be included in this dataset as this will provide considerable information on past occurrence and distribution. These data are available from the IWC Secretariat. Félix recognised that there is probably quite a lot of additional data that has not been reported and as noted above, there is a need to engage shipping and maritime authorities to submit this potential data, perhaps by holding a regional workshop similar to the present one. Again the Workshop highlighted the importance of raising awareness with all stakeholders within the relevant region. Félix also noted the importance of having improved information on abundance and relative density and the need for systematic efforts throughout the region as well as information from platforms of opportunity such as whalewatching vessels.

#### 5.2.3.3 **COUNTRY SPECIFIC INFORMATION**

In response to a question from the group about information on ship strikes, high risk areas and species from other countries in the region that were not specifically noted on the agenda, Guzman noted that a dead sperm whale was recently brought into the Port of Balboa at the Pacific entrance to the Panama Canal, but it was not known where the initial collision occurred. It was noted that at the recent IWC rangewide workshop on North Pacific gray whales, available information on ship strikes had been compiled (IWC, 2014b).

### 5.2.4 *Data gaps in the wider Caribbean on whale and shipping distribution*

While data on shipping in the Wider Caribbean is fairly extensive and readily available, it was agreed that data on marine mammal abundance and distribution are extremely limited in the wider Caribbean area. The Workshop **welcomes** the work completed as part of the UNEP LifeWeb program that resulted in the development of range maps for some 25 marine mammal species within the region. Each map indicates areas where species are expected to be present. However, they contain no information about species density within the range or critical habitat. Consequently, whilst a valuable first step, the Workshop **cautions** that the ways in which these maps can be used in risk assessment and marine spatial planning is limited. For example, a species richness map derived from all 25 species will prioritise species that have restricted area distributions over species that have a broader distribution. For an individual species, use of the range map can show where human threats occur within the range, but cannot identify areas of highest risk. To move forward with reliable designation of marine protected areas and ship-strike mitigation efforts on a sound scientific basis, a high priority needs to be placed on obtaining better abundance and distribution data throughout this area (e.g. through systematic marine mammal surveys).

The Workshop **recognises** the logistical and financial difficulties inherent in undertaking the ‘ideal’ i.e. a major synoptic survey covering the whole region (*c.f.* the ACCOBAMS Survey Initiative discussed in the Beaulieu report) to

provide a baseline for the region upon which to begin to evaluate and prioritise all potential threats, not just ship strikes. However, as part of a strategy to develop research plans (as was developed for the ACCOBAMS Survey Initiative), it **recommends** that a regional expert group be established to examine and develop a number of (not mutually exclusive) options and overall strategy for obtaining better quantitative data including:

- (a) the careful use of opportunistic effort (e.g. on vessels crossing the region, whalewatching vessels etc.) to inform options (b) and (c);
- (b) the use of spatial modelling approaches using data from 'potentially appropriate regions elsewhere' in conjunction with the limited information available within the region, to suggest areas upon which to base smaller systematic effort; and
- (c) a costed proposal to undertake a suitable baseline survey or surveys (which may incorporate national efforts if co-ordinated survey designs and methods are used) for the wider region which may focus on particular priority species and methods (e.g. visual, acoustic, mark-recapture).

However, if extensive surveys were required, it was noted that many of the 31 countries in the region lack the resources with which to undertake extensive, systematic ship or aerial surveys, especially over the time periods that would likely be needed in order to establish the degree of certainty needed to convince managers and impacted stakeholders to initiate any significant mitigation measures based upon stable high risk areas.

Bédel and Jean informed the group that in addition to the AGOA Sanctuary waters, the French MPA Agency has undertaken line transect surveys since 2012, in the waters of Anguilla, St. Marteen, Saba and St. Eustatius, in partnership with those Islands and with the support of SPAW-RAC. However, she noted that convincing governments in the region to undertake surveys targeted at just marine mammals was difficult and that they were more likely to consider supporting multi-purpose or multi-species surveys.

In addition, potential alternate methods for collecting relevant data on both cetaceans and ship strikes were discussed. These included the possibility of using existing abundance and distribution data from whalewatching operations, the establishment of opportunistic sightings networks, surveys of local fishermen and the placement of marine mammal observers aboard Oceanographic surveys. With regard to the latter, Félix informed the group that part of the cetacean distribution data that had been used for modeling in the Eastern South Pacific, was collected by observers aboard Oceanographic surveys. However, all opportunistic efforts would require some time and resources and therefore their biases and limitations would need to be carefully considered against the type and accuracy of information required. It was noted that some systematic data, that has not yet been fully utilised, may already exist. For instance, the fast ferries to Isla Margarita off Venezuela had struck whales in the past and so had consulted with local scientists and placed observers on their vessels for some time. The Workshop **recommends** identifying and utilising already existing data on ship strikes collected by, for example, the shipping industry for the safety of their operations and passengers, such as from the ferries, and **encouraged** the industry in all countries to collect such data.

With regard to the lack of information on cetaceans and the issue of ship strikes in particular, it was noted that managers would need to know if there was a population of cetaceans whose abundance was low enough that it might be impacted by ship strikes, and, if so, they would need extensive baseline information about the seasonality and longevity of any 'hot spots' and high risk areas. The former would require less effort (and resources) than the latter. In some areas, existing data might be utilised to establish reasonable population estimates. For instance, it was noted that in some areas in the region, long-term photo-id catalogues of resident sperm whale populations might be used.

The Workshop **recommends** that SPAW implement actions in the MMAP aimed at identifying areas where long-term photo-ID catalogues of sperm whale and other cetaceans populations may currently exist and encourage the holders of such data to produce population estimates.

With regard to improving the reporting of ship strikes in the region, the Workshop **agrees** that this was primarily a matter of education and capacity building. It was suggested that the stranding networks in the region were probably not aware of the IWC ship strike database. The Workshop **recommends** that information on the importance of reporting such incidents, and instructions how to do so, should be distributed to them. It was noted that the IWC and SPAW had co-sponsored some training for veterinarians from the region in the determination of human impacts, such as ship strikes, with stranded animals, but that more training will be valuable. Most discussion on improving the awareness and reporting of ship strikes from the shipping industry focused on how best to ensure relevant information is distributed through the IMO. It was noted that the IWC has previously brought the issue of ships colliding with whales to the attention of the IMO, and that guidance information had subsequently been provided and adopted. In addition, the IWC had conducted a session at the IMO explaining the IWC ship strike database, however simple instructions on the importance and use of the IWC ship strike database that could be distributed to shipping interests, would be helpful to raise awareness and reporting. Therefore the Workshop **recommends** that the IWC develop simple and specific instructions for mariners about what to do if ship strike is observed, and that this be brought to the MEPC at the IMO.

In response to a question about the number and consistency of IWC member countries reporting ship strikes through annual National Progress Reports, it was noted that only a few countries consistently reported. As with many countries in the Wider Caribbean, some of this may be due to a lack of infrastructure (e.g. reporting or stranding networks), and

some may be reflective of a true lack of strikes. However, given that the Workshop **agrees** that in most cases it is likely due to the former, the Workshop **recommends** that IWC member countries make a more concerted effort to report strikes to the IWC database, either through establishing the needed capacity (e.g. establishing or reinforcing stranding networks) or better outreach to existing infrastructure.

## 6 SUMMARY AND EVALUATION OF EXISTING MITIGATION ACTIONS

### 6.1 Global and other non-Caribbean

#### 6.1.1 Technological

Silber presented on the use of technologies to reduce vessel collisions with whales. Advances in developing and refining various technologies may aid in the detection of whales at sea. Devices that have received consideration for this purpose include, for example, heat-detecting devices; infra-red and other enhanced optics; SONAR or other forms of 'active' acoustics; passive acoustics; LIDAR; satellite imagery; and satellite tagging. A 2008 workshop reviewed and assessed technologies as a means of reducing vessel strikes of whales. The workshop concluded that various technologies may have application in this context, but none were judged fully capable of addressing this situation in their present form.

The Workshop noted that detection of whales is only a part of the equation: even if detection is at or near 100%, there may be little the mariner: (a) is able to do given that substantial distances are needed to stop or turn a large vessel; or (b) might be willing to do in the light of any information provided. The posting of additional look-outs and vessel-mounted active acoustics devices, for example, provide only 'near-field' detection and may provide the mariner with little time to react. In addition, we now know that, in some contexts, asking mariners to voluntarily take actions to avoid whales (and, even if required to do so), few, if any, may actually respond by taking evasive action such as altering course or speed. Workshop participants also concluded that among the technologies considered, passive acoustic detection and predictive modelling (provided that it is based on adequate data e.g. see discussion under Item 5.1.5.1) are among the most promising. Both of these approaches are relatively cost-effective, safer and possibly more comprehensive than surveys with low coverage over wide areas, are applicable year-round, and may allow for advanced planning on long trips. Maritime interests strongly advocated for the use of information (such as predictive modelling) that would allow for avoidance of whale aggregation areas via advanced voyage planning; mariners are likely to do this if armed with sufficient information.

In discussion, it was noted that observers on the bridge have a large blind spot in front of the vessel, and that a large vessel can take many miles to come to a stop although this varies widely between vessels of different designs. This means that the effectiveness of observers to avoid cetacean strikes are reduced, especially given that observers cannot be effective in the hours of darkness (this is especially relevant to the cruise industry because cruise ships often make transits between ports at night), and in light of the often unpredictable behaviour of whales including their non-response to approaching vessels.

The excellent work undertaken in recent years regarding the use of traffic separation schemes (TSS) and routing to improve not only mariners safety but also to reduce the risk of ship strikes (e.g. Panama, USA, Spain) has been extremely valuable. However, the Workshop **recognises** that this work has also revealed that the reverse may be true, i.e. TSS also have the potential to increase the likelihood of ship strikes if the routes go through high density cetacean areas. Research in feeding areas has also revealed that strategies developed for one species may not be optimal for other species (Redfern *et al.*, 2013). These situations may be problematic both for cetaceans and mariners. The Workshop notes that there are several hundred such schemes throughout the world that have been established primarily for safety of mariners. It is clearly not practical to examine all of these in the light of cetacean data but the Workshop **agrees** that for certain priority populations that may be vulnerable (e.g. see the list of populations suggested by the IWC Scientific Committee as possible candidates for Conservation Management Plans), there is merit in examining whether schemes exist within the range of these species, and if so, examining whether the existing cetacean data suggest that they may warrant investigation to determine whether simple improvements may be possible that reduce the likelihood of ship strikes without affecting unduly shipping.

In addition, the Workshop **recommends** that an appropriate mechanism be developed with IMO to encourage consideration of cetacean distribution and occurrences when new or revised routing schemes are brought to IMO.

Laist reported that a paper is in the final stages of preparation for publication in *Endangered Species Review* by Megan McKenna and John Calambokidis analysing the behaviour of feeding blue whales during close approaches by commercial ships in the shipping lanes of Los Angeles and Long Beach in southern California. The paper provides the first information on the underwater behaviour of whales near ships using D-tags to record whale diving and movement patterns and shows that blue whales may 'dip dive' when a vessel approaches and remain submerged while it passes. The Workshop **agrees** that further studies using D-tags applied to whales in or near shipping lanes off major ports may represent the best opportunity to correlate reliable data on whale behaviour and response (or lack thereof) with ship speeds available through AIS records during close approaches by ships. Such information can be of broad value in

developing mitigation measures. The value of telemetry data in examining potential changes or establishing TSSs is illustrated in Irvine *et al.* (2014).

In a related discussion on behaviour, it was noted that some technologies aimed at ‘warning’ whales away from an oncoming vessel may mean they are deterred from their preferred habitat which could be especially detrimental to endangered populations. Anecdotal and scientific (Novacek/Tyack study) evidence suggests that whales do not react reliably to warning sounds of varying types and that in some cases such sounds may actually encourage whales to come to the surface and spend more time there i.e. increasing risk of collision. It was noted that in the USA at least, a permit would be required to introduce additional loud sounds into the water as it may be considered ‘harassment’ of an endangered species.

Couvat introduced Couvat and Gambaiani (2013), which is a 2013 review of the technological measures implemented worldwide to reduce the risk of ship strikes. He noted that although continual improvements were taking place, the major drawbacks inherent in each tool had not yet been overcome. He drew particular attention to three new methods:

- (1) The use of drones for the detection of marine mammals. Small drones are becoming more commercially accessible and several models could be used for marine mammal prospecting. Some have already been successfully tested for that purpose. However, for the purpose of reducing ship strikes, drones might have a limited range but this technology is evolving fast.
- (2) The results of the LIDO program (Listening to the Deep Ocean environment). LIDO is an international project with stations in the Mediterranean Sea, Atlantic and Pacific Oceans. It is based on passive acoustics and allows the real-time long-term monitoring of marine ambient noise as well as marine mammal sounds at cabled and standalone observatories. The main advantage of this system is that it can localise any kind of acoustic sources in three dimensions and automatically detect and classify cetacean acoustic signals. Moreover, in the near future the LIDO project will be coupled with the Ambient Noise Imaging (ANI) technology, which allows to detect non-vocalising individuals using ambient noise, thus overcoming a major drawback of passive acoustics.
- (3) Use of the REPCET system (REal-time Plotting of CETaceans). REPCET is a collaborative software developed by scientists, the shipping industry and the maritime authorities, to allow ships to inform each other of the positions of the whales sighted by the crew in real-time through satellite communication. Positions are displayed on an interactive map on deck and collision risk areas grow with time around the initial position of the whale, accounting for the movement of the animal. It is currently being developed in the framework of the Pelagos Sanctuary, in the western Mediterranean Sea, and 11 ships were equipped with the system at the time of the current Workshop. The system is evolutionary and can be coupled with other tools like prediction models and automatic night detection tools. Moreover, this system is applicable worldwide in other areas affected by collisions. Collaborations are underway with British and Spanish NGOs for the Bay of Biscay and the Strait of Gibraltar. Thoughts on the issue of ship strikes in the Caribbean between SPAW-RAC, ACCOBAMS and the Pelagos Sanctuary were initiated in 2011 and presented during the 2<sup>nd</sup> ICMMPA (International Conference on Marine Mammal Protected Areas) in Martinique Island. The use of REPCET coupled with a training program for ship crews were the main potential measures mentioned.

The general Workshop conclusion on technological tools is that none of the solutions available at the moment are perfect or assured to address the problem, or applicable worldwide. The review chapter introduced by Couvat suggested that a combination of complementary tools adapted to the biological and economical characteristics of the concerned area, coupled with adequate education measures, is the best option to significantly reduce the risk of ship strikes.

In discussion, the Workshop noted the general absence of controlled studies to demonstrate the effectiveness of mitigation measures, including the commercial programme REPCET. As noted in Beaulieu (IWC, 2011), although systems might be able to alert mariners to the presence of whales in an area, there is no specific advice for mariners upon what actions to take (apart from reducing speed, see below). It was unclear how effectively mariners were able to respond since changing course would require knowledge of the presence or absence of whales along the new track.

Macdonald introduced progress made at the Stellwagen Sanctuary for reducing ship strikes - see Wiley *et al.* (2013). Because of its close proximity to transiting ships, Stellwagen Bank National Marine Sanctuary had become a ‘hot spot’ for collisions between vessels and whales. To reduce incidents near the Sanctuary and in its surrounding waters, the managers of the Sanctuary:

- (1) identified a new Boston Traffic Separation Scheme (BTSS) route to spatially separate whales and ships;
- (2) gained stakeholder and government acceptance for the route;
- (3) verified mariner compliance;
- (4) assessed approaches to improve whale detection; and
- (5) improved communications.

To understand the spatial distribution of whales, the managers of the Sanctuary:

- (1) plotted the distribution and relative abundance of right and other baleen whales within the sanctuary and adjacent waters;
- (2) identified whale high-use areas;
- (3) modelled various TSS reconfigurations through the Sanctuary to spatially separate whales and ships; and
- (4) calculated the risk reduction and industry impact of alternative routes.

The combined agendas of industry priorities, conservation needs, and federal planning activities came into alignment and in December 2006 the IMO accepted a proposal submitted by the USA to reroute the BTSS. The new BTSS became operational in July 2007. Subsequent monitoring using Automatic Identification System (AIS) demonstrated high compliance by transiting vessels. Since the BTSS rerouting, there has been no documented case of a ship striking a whale in the sanctuary area.

Working with industry, government and academic partners, the managers of the Sanctuary developed a strategy that led to development of a near real-time acoustic detection system in the BTSS, which consists of ten automatic detection buoys that 'listen' for right whale 'up calls' and using a satellite connection advises mariners to slow to ten knots and heighten observation when activated. This is available online at [www.listenforwhales.org](http://www.listenforwhales.org).

These developments led to production of the *Whale Alert* app, available on iTunes. *Whale Alert* is a free iPad/iPhone-based mobile application that notifies mariners (and other users) regarding right whale protection and management information along the US eastern seaboard, including: current ship location, ship speed restriction zones, mandatory ship reporting areas, and areas to be avoided.

In discussion the Workshop **recognises** the value of the work undertaken at Stellwagen and noted that although risk of strike was still present in the new TSS, the overall effect had been to reduce vulnerability, and that no ship strikes had been recorded from the Sanctuary area since 2007. The effectiveness of the TSS had been assisted by the local oceanographic conditions which caused whales to aggregate in particular locations. The Workshop **endorses** the 'App' approach which was an excellent example of collaboration between industry and other organisations. The Workshop also noted that the seafloor hydrophone arrays were recording right whale calls for a longer period (up to 220 days per year) than had been expected from previous knowledge of right whale distribution and migration studies.

#### 6.1.1.1 THERMAL IMAGING TECHNOLOGY

The Workshop noted that a new thermal imaging technology to detect whale blows had recently been successfully trialled by the German research vessel *Polarstern* in Antarctic waters. The methods would now be trialled in warmer waters around the Canary Islands to test their effectiveness under these conditions.

#### 6.1.2 Operational

Silber presented Vanderlaan and Taggart (2007) which analysed the relationship between vessel speed and the fate of a whale involved in a ship strike. Based largely on this study, the United States NOAA Fisheries established a regulation in December 2008 requiring vessels  $\geq 65$  feet in length to travel at speeds of 10 knots or less at prescribed times and locations along the US eastern seaboard to reduce the likelihood of fatal collisions with the endangered North Atlantic right whale. Silber discussed a recent study (Silber *et al.*, 2014) that quantified mariner response to the regulation. Amongst other things, extensive outreach efforts were undertaken to notify affected entities both before and after the regulation went into effect, including several programs that provided non-punitive notifications of violations of the regulation. Using Automatic Identification System data (that provided a rather precise census [rather than a sample] of every trip in the speed restriction zones) the authors had remotely monitored vessel operator compliance with the speed regulation. The speeds of 201,862 trips made between November 2008 and August 2013 by 8,009 individual vessels were quantified. Comparison of speeds were made both when the restrictions were in effect and in the same geographic locations when the restrictions were not in effect. Several hundred vessel operators ( $n=437$ ) or their parent companies, some of whom had been observed exceeding the speed limit, were contacted through one of four non-punitive notification programs. A fraction ( $n=26$  vessels/companies) received citations and fines.

The study found:

- despite the considerable efforts to inform mariners, initial compliance was low (<5% of the trips were completely <10 knots) but improved in the latter part of the study;
- trips by cargo vessels exhibited the greatest change in behaviour followed by tanker and passenger vessels; tanker vessels made small relative adjustments in speed (few trips were completely under 10 knots), but their typical at-sea speeds are around 10-14 knots suggesting that their preferred strategy was to avoid fines by traveling at under 12 knots;
- the effectiveness of several notification/enforcement programs in improving compliance was assessed; each program improved compliance to some degree and some may have influenced compliance across the entire regulated community; in order of effectiveness, these were enforcement-office information letters, monthly summaries of vessel operations, and direct at-sea radio contact by the US Coast Guard; and



- citations/fines appeared to have the greatest influence on improving compliance in notified vessels/companies - statistically significant changes in operations occurred after fines were issued, and the impact of enforcement efforts likely impacted compliance across the entire regulated community.

A related modelling study (Conn and Silber, 2013) concluded that these speed restrictions had reduced the probability of a fatal ship strike of a right whale by 90%. A study of ship hull hydrodynamics involving a scale-model whale and ship in a flow-tank simulation found that 'propeller draw' and hull configuration would result in a whale being pulled towards the hull, the magnitude of the draw was related to ship speed. Thus a whale at the surface, near the surface or even engaged in a dive might be pulled toward the ship. The whale could be expected to be pushed away by the 'bow cushion' of water in front of the bow and then drawn back in amidships. The models used in this experiment were to scale but did not take into account whale behaviour or life-like whale tissue.

In discussion, the Workshop noted that the hydrodynamic effect of a bow cushion and the subsequent draw towards the hull (experienced for example when two ships pass at close quarters) were well known and could be expected to move objects away from an oncoming vessel. However, suction from the vessels propeller and from the hull itself will then cause objects to be drawn back towards the vessel from aft of the mid-ship area and this effect also extends up to 15-20m below the vessel as well as to the sides.

The Workshop congratulated the authors on this work and discussed the appropriate speed to recommend to reduce severity of ship strikes. It noted that lower speeds may compromise manoeuvrability and the ability to keep to schedule (although this can be ameliorated by advanced voyage planning) and may therefore reduce compliance rates, while higher speeds caused a steep increase in the severity of a strike. The Workshop **agrees** that available information indicates that the probability of a strike being lethal is reduced according to the curve shown in Fig. 1. In areas where there is a high risk of ship strikes and it is not possible to separate whales and vessels through routing measures, restriction in speed is the most effective way to reduce lethal strikes. In areas where 10 knots has been used, it has been found to be effective (Conn and Silber, 2013; Laist *et al.*, 2014).

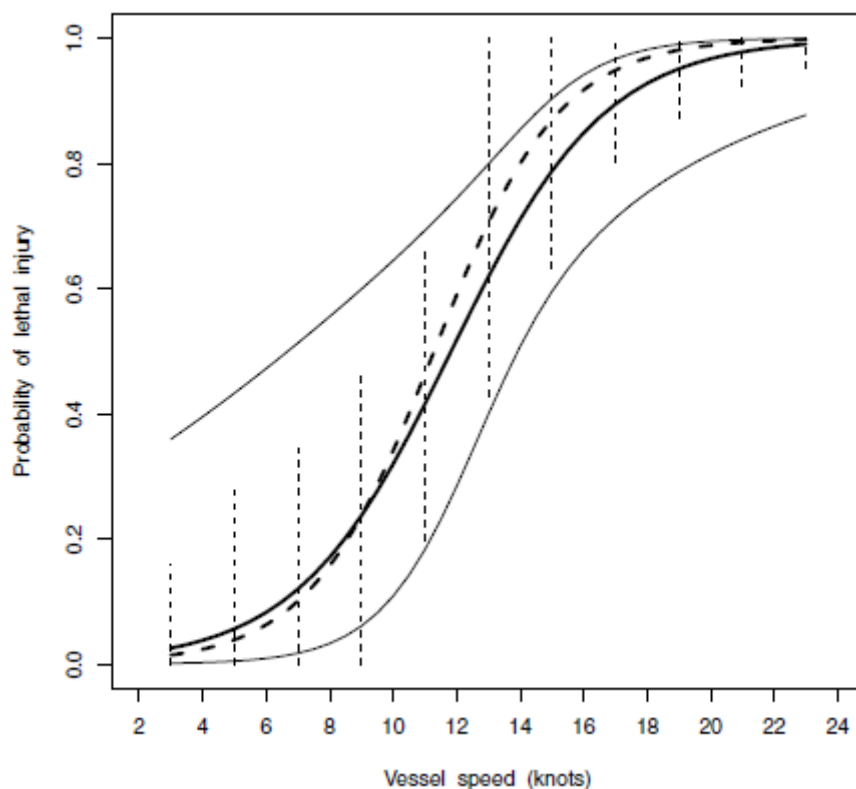


Fig.1. Probability of a lethal injury resulting from a vessel strike to a large whale as a function of vessel speed based on the simple logistic regression (solid heavy line) and 95% CI (solid thin lines) and the logistic fitted to the bootstrapped predicted probability distributions (heavy dashed line) and 95% CI for each distribution (vertical dashed line) where each datum (triangle) is the proportion of whales killed or severely injured (i.e. lethal injury) when struck by a vessel navigating within a given two-knot speed class. There are no data in the 4-6 knot speed class. [Taken from Vanderlaan and Taggart (2007), used with permission].

Silber continued with a presentation of recent work on time and area specific speed restrictions (Conn and Silber, 2013). He noted that collisions with vessels are a serious threat to a number of endangered large whale species, the North Atlantic right whale in particular. In late 2008, the US National Oceanic and Atmospheric Administration issued mandatory time-area vessel speed restrictions along the US eastern seaboard in an effort to mediate collision-related mortality of right whales. All vessels of 65 feet and greater in length are restricted to speeds of 10 knots or less during

seasonally implemented regulatory periods. He modelled the mortality risk of North Atlantic right whale when the vessel restrictions were and were not in effect, including: (1) estimation of the probability of lethal injury given a ship strike as a function of vessel speed; (2) estimation of the effect of transit speed on the instantaneous rate of ship strikes; and (3) a consideration of total risk reduction. Logistic regression and Bayesian probit analyses indicated a significant positive relationship between ship speed and the probability of a lethal injury. The study found that speeds of vessels that struck whales were consistently greater than typical vessel speeds for each vessel type and regulatory period studied; a use-availability model fit to these data provided strong evidence for a linear effect of transit speed on strike rates. Overall, the study estimated that vessel speed restrictions reduced total ship strike mortality risk levels by 80-90% with levels that were closer to 90% in the latter two of the four active vessel speed restriction periods studied. To the author's knowledge, this is the most comprehensive assessment to date of the utility of vessel speed restrictions in reducing the threat of vessel collisions to large whales. The findings indicate that vessel speed limits are a powerful tool for reducing anthropogenic mortality risk for North Atlantic right whales.

The Workshop discussed the drivers behind the acceptance of the speed restrictions and noted that the punitive measures had shown considerable effect. However, the Workshop noted that a reduction in the overall mean speed may have been achieved through the advocacy campaign, even if the 10 knot threshold had not been achieved, and this would still have had a conservation benefit. On this question of compliance, CLIA noted that it was part of its contract with cruise passengers that its members vessels would comply fully with all maritime regulations.

MacDonald introduced Wiley *et al.* (2011) which investigated AIS records from the Stellwagen Bank National Marine Sanctuary and applied hypothetical speed restrictions to observed ship traffic. For 2006, the study calculated a predicted probability of lethality for each grid cell within the Sanctuary from the cell's mean speed and a mortality curve. The study showed that the mean speed within the Sanctuary was 13.5 knots and that the choice of speed restriction had a major effect on mortality levels. The study also noted that the overall mortality reduction in any area, where speed limits were considered or imposed, would necessarily be related to the pre-existing average speeds in that area.

The Workshop **noted** that the Stellwagen Bank Sanctuary provided a unique opportunity to study overlap of whale and shipping densities and to evaluate the effectiveness of different management regimes which could be applied to other areas.

Laist introduced a study (Laist *et al.* (2014) evaluating the effectiveness of the December 2008 vessel speed regulations to reduce lethal collisions between right whales and ships over 65 feet (19.8m) along the US east coast. The regulations require all ships >65 feet to use speeds of 10 knots or less in ten seasonal management areas (SMAs) during periods of peak right whale occurrence. The authors assessed differences in ship-struck carcass discovery rates inside or within 45n.miles of any SMA boundary during SMA effective dates during an 18-year pre-rule period and 5-year post-rule period. The 45n.mile radius around SMAs was used to account for carcass drift between time of death and carcass discovery. The analysis revealed that 15 of 17 ship-struck right whales found along the US coast during the pre-rule period were discovered in or near SMAs for an average discovery rate of 0.72 carcasses per year (range 0 to 2 per year) in or near SMAs. In the 5-year post-rule period no carcasses were discovered in those areas. This represented a statistically significant reduction and is more than twice as long as the longest pre-rule period without finding a ship-struck carcass in or near SMAs. The analysis indicates the rule has been effective at reducing lethal right whale collisions with ships.

In discussion, the Workshop **endorses** the conclusion that speed reductions to 10 knots help to prevent lethal ship strikes. It **noted** that the relationship between effectiveness and compliance is important, and that even if compliance with speed limits is less than 100% it will still yield conservation benefit. The Workshop **stresses** the importance of informing the shipping industry of the success of the speed reduction measures in order to confirm their value and to further encourage compliance.

Ritter and Panigada introduced Ritter *et al.* (2014) and Ritter and Panigada (2014) which were guidance notes to the cruise industry and recreational sailing groups on planning measures to reduce ship strikes (these are summarised under Item 7).

### 6.1.3 Legal and voluntary

Silber *et al.* (2012) noted that in the last decade or so a number of countries have turned to the IMO for assistance in reducing vessel collisions with large whales. As the recognised authority on worldwide navigational safety, the IMO has also a history of involvement in marine environmental safety. It was first approached for the purpose of reducing vessel strikes of whales in 1998 by the USA through submission of an information paper on the vulnerability of North Atlantic right whales to ship strikes; a step that helped sensitise the IMO to this issue. This was followed by a proposal to establish a Mandatory Ship Reporting system in key right whale habitat in US waters to alert mariners about ways to avoid ship strikes with right whales. In the years that followed Spain, Canada, and the USA sought and received IMO endorsement of various routing measures to reduce vessel strikes of whales. In recent years a number of additional actions have been taken around the world to establish IMO-endorsed vessel strike reduction measures; some proposals are now pending, including the creation of Traffic Separation Schemes (TSSs) in waters off Panama.

The process, including submission of a proposal to the IMO, the IMO's review of the proposal, and the establishment of the measure generally by the member state(s) generally takes about two years. In preparing a proposal to the IMO, it is

imperative to provide sufficient information to the IMO about: (a) the purpose of, and justification for, what is being proposed; (b) the magnitude of the impact (including economic) on the vessels affected and the expected consequences (including navigational safety) for the maritime community; and (c) the expected outcomes. Because of its truly global reach and its capacity to inform nearly all maritime states, the IMO can be an important asset in efforts to reduce threats to the marine environment that result from activities by shipping interests.

In discussion, the Workshop **recognises** the IMO as the competent body for introduction of marine navigation measures on either safety or environmental grounds. The process for adopting new routing measures commences with the establishment of a compelling need, including a description of the impact on the industry.

The Workshop **considered** the possibility of the IMO adding a provision to its process for establishing new routing measures that would require applications to consider the effect on local cetacean populations. This would allow opportunity to consider reduction in speed, and also ensure that any new routing measures took account of cetacean distributions. The Workshop **further considered** a communication to the IMO to describe the effectiveness of speed reduction measures in reducing the severity of ship strike events. It **agrees** that both these ideas were valuable and requests the IWC Secretariat to consult with IMO on the appropriate processes to follow.

The Workshop then discussed the importance of providing guidelines to industry and noted a conclusion from the 2012 Tenerife workshop to provide information on marine environmental measures in a single source for ships undertaking international voyages. Silber noted that this was a large task but that work on '*A Mariners Guide to Large Whales and Whale Conservation Measures in the North Atlantic Ocean*' was underway. The Workshop **commends** this work and suggested that ultimately such a document could contain reference to other environmental management measures including protected areas. The Workshop further **recognises** the importance of feedback from mariners and all industry sectors and encouraged outreach through the Nautical Institute in the completion of this project.

Panigada presented an update on specific management measures currently taken in the Mediterranean Sea, i.e. currently are: (1) the Notice to Mariners to protect cetaceans from the risk of ship collisions in the Strait of Gibraltar; and (2) the new location for the 'Cabo de Gata' Traffic Separation Scheme.

With regard to the Strait of Gibraltar, Panigada reported that in 2005 a critical area for sperm whales was identified in the zone. A Notice to Mariners was published in January 2007 by the 'Instituto Hidrográfico de la Marina' (Spanish Navy Hydrographical Institute under the Ministry of Defense). This notice establishes a security area characterised by high densities of sperm whales, where crossing ships are recommended to limit maximum speed to 13 knots, following the suggestions by Laist *et al.* (2001), and to navigate with particular caution. The notice was to be broadcast regularly by VHF radio from April to August and included in the Nautical Charts. The recommendation is poorly known by mariners; it could be improved by the notice being broadcasted regularly by VHF radio as originally planned, and also included in the training literature for the ferry companies.

Regarding the waters off the Natural Park of Cabo de Gata-Níjar, Panigada reported that these are an extremely valuable and sensitive coastal habitat and one of the most important Special Areas of Conservation for the bottlenose dolphin (*Tursiops truncatus*) and the loggerhead turtle (*Caretta caretta*) within the framework of the European Union's Habitat Directive. The Spanish Maritime Authorities promoted, inside the IMO, the repositioning of the TSS of Cabo de Gata from 5 to 20n.miles off the coast. The new location, operating since the 1 December 2006, was published in the Notice to Mariners and the International Nautical Charts.

The first initial results showed an increase of the relative density of pilot whales (*Globicephala melas*) in the area, both for 2007 and 2008 with respect to the previous years. These preliminary results suggest that the new southerly position of the Cabo de Gata TSS may have had positive benefits on these populations.

Panigada also reported on a proposal, led by France, to register the Pelagos Sanctuary as a PSSA under the IMO framework. Discussion is currently taking place regarding the area suggested for the establishment of the PSSA in the Pelagos Sanctuary under the framework of the IMO which does not represent a comprehensive representation of cetaceans' habitats in the area, since critical habitats for fin whales are also present towards the Balearic Islands. In addition, there is evidence from ship strikes risk maps and traffic maps of areas of high risk in the Gulf of Lion, outside the proposed PSSA borders. Careful attention should be devoted to extending the surface of the proposed PSSA so that all critical habitats for cetaceans in the region will be covered. Attention should be also dedicated to speed limits within the new area; while it is widely recognised that a reduction in speed may decrease the chances of collision risk, a sharp decrease may drive ship captains to increase speed while transiting outside the PSSA borders, thus increasing the risk of ship strikes in the ACCOBAMS area.

The Workshop thanked Panigada for his reports and noted the importance of setting PSSA measures in connection with actual cetacean distribution rather than political boundaries for sanctuaries.

#### 6.1.4 Summary of potential impacts and concerns for shipping

The Workshop **emphasised** the importance of working with a broad range of industries in developing proposals for mitigating ship strikes, and **commends** the work undertaken to date to engage with industry. In this context, the Workshop **noted** the essential requirement for high quality data to describe the problem and the expected effect of any mitigation, both in terms of risk reduction for cetaceans and the consequences for vessel routing.

The Workshop emphasised the global distribution of shipping operations and cetaceans and **re-affirmed** the primacy of the IMO as the competent international organisation responsible for vessel routing measures.

## 6.2 Wider Caribbean Region

### 6.2.1 SPAW Marine Mammal Action Plan

Jean introduced UNEP (2008). This is the UNEP Marine Mammal Action Plan (MMAP) for the Wider Caribbean Area. A section in the MMAP concerns human impacts on marine mammals including cetacean strikes. The Plan calls for analysis of the risks and improved understanding of how vessel strikes affect marine mammal populations. There have been disentanglement workshops where, on the day before the training, a training on the forensic detection of ship strikes on stranded animals was taught. The REPCET system is being considered for use in this area, but more AIS data are needed for this to be effective. There are major technical problems with this system in the Caribbean area, mainly to do with the military.

The Workshop **endorses** the priority action in the SPAW MMAP Secretariat to enter into an MOU with the IWC on the exchange of information (i.e. both organisations to exchange of information and expertise). The Workshop also **recommends** that SPAW try to acquire real time and historical ships track data for the Caribbean (AIS, LRIT, etc.) and the technical expertise to process it.

The Workshop also **recommends** that SPAW and its member countries investigate the best means to inform commercial ships, recreational boaters, and other maritime interest, when a voyage enters a Sanctuary or Marine Protected Areas (for example through the organisation of a Workshop).

The SPAW MMAP is still primarily at the data collection stage. With regard to ship strikes, information on cetacean distribution, strike numbers and risk assessments are needed. Although there is substantial shipping traffic through the region, without cetacean distribution and strike data, it cannot be determined if ship strikes are truly a problem. Redfern noted that when using range maps, given the lack of sightings data supporting them, any ship strike risk assessment will be biased toward areas with the highest density of shipping. The group discussed how the IWC might be able to assist. The Workshop **recognises** that there are cases where extrapolation from data rich to data poor areas is acceptable (see Item 5.1.5.1 on blue whales in Sri Lanka) and similar extrapolation could be useful in the Caribbean region.

### 6.2.2 UNEP-CEP spatial modelling

Jean introduced LifeWeb Spain (2014), a major marine spatial planning project to (1) produce range maps for various cetacean species (usually based on expert judgement rather than data), and (2) collect data on shipping, shipping regulations and conflicts. She noted that there are multiple ways to analyse the data from the project, e.g. interested parties can look at different factors depending who is involved. Scenarios were presented as ideas to show how things may work. When presenting findings to industry, she commented that presentation is important and that there is a need to provide persuasive arguments that the data do correspond to the predicted scenarios and that resultant recommendations are justified.

The Workshop **agrees** that the adopted approach was potentially useful, especially in regions with limited resources, multiple country jurisdictions and where the species distribution would likely cross national boundaries. The project had brought many countries together and had already generated new co-operation between several. However, the Workshop refers to its earlier discussions and recommendations under Item 5.2.4. It **cautioned** against the results being treated as being adequate for targetting management initiatives before sufficient (or in some cases, any) data are available. Although this has not happened yet, the Workshop identified it as a potential danger, given similar experiences in other parts of the world.

### 6.2.3 Panama TSS proposal

Guzman presented a paper on the Panama TSS proposal (Guzman *et al.*, 2013). Humpback whales (*Megaptera novaeangliae*) are at the species most often believed killed by ship strikes in some countries along the region, and although central America is a wintering area for populations from both the Northern and Southern Hemispheres, existing efforts to reduce ship-whale collisions are meagre. The authors evaluated the potential collisions between vessels and humpback whales wintering off Pacific Panama by following the movements of 15 whales tagged with satellite transmitters and comparing these data with tracks plotted using AIS real-time latitude-longitude points from nearly 1,000 commercial vessels. Movements of whales (adults and calves) in the Gulf of Panama coincide with major commercial maritime routes. AIS vessel data analysed for individual whale satellite tracks showed that 53% (8 whales) of whales had 98 encounters within 200m with 81 different vessels in just 11 days. In early 2012, the implementation of a 65n.mile Traffic Separation Scheme (TSS) and a 10 knot maximum speed for vessel routing into the Gulf of Panama during the wintering season was suggested. In so doing, the area for potential whale-vessel collisions could be reduced by 93%. This paper prompted the need for a local policy.

Consequently, a plan for designing TSSs was presented to the Panama Maritime Authority (AMP) technically supported and consented by the Maritime Chamber of Panama, the Panama Canal Authority (ACP) and the Smithsonian Institution. This encompassed four TSSs, one for the Caribbean and three for the Pacific, and included a network of three Pacific TSS providing an extensive Inshore Traffic Area allowing more coastal safety for fishing vessels and over ten sensitive marine protected areas, and a speed limit at the main TSS-Gulf of Panama, during the peak four months of

wintering whales. The plan was submitted to IMO and approved at NAV-59 in September 2013 and at MSC-93 in May 2014, to be implemented in December 2014.

The process of seeking IMO approval of the Panama TSSs was complicated and IWC members could learn from this experience. Proponents should consider working with someone inside the organisation in order to make sure any documents are submitted correctly, and to the correct session. Countries could sponsor a proposal at IMO, rather than the proposal coming directly from the IWC. Any proposal must treat each country (or a group of countries) in the area individually, as well as involving all stakeholders, and encourage data collection in each place.

The Workshop **commends** the authors and the Government of Panama on the strong use of scientific data, extensive engagement with the industry and relevant local agencies, as well as the use of other successful previous proposals (e.g. of TSS adjustments), and the thoroughness and speed of their successful effort at IMO. In particular the Workshop **noted** that the combination of respect for both the science and the human element was a good model for success. The Workshop also **commends** the content of the proposal itself for its integration of other environmental concerns, including routing which avoided several coastal Marine Protected Areas, one of which is a World Heritage site. In discussion, the authors noted that the TSSs for both the Caribbean and Pacific approaches to the Canal were originally combined in one proposal, but after consultation with IMO personnel they were split into two, in order to avoid any difficulties with one affecting the other. This emphasises the importance of collaboration with member governments on any submission to the IMO.

The Workshop **recommends** that for any TSS or other ship routing measures stakeholders be engaged from the beginning and consulted often and regularly throughout the process, for example Panama's role in the study on the study of whale and vessel distribution on the Pacific side of Panama.

#### 6.2.4 *CPPS eastern South Pacific*

The Workshop **commends** the great efforts made by the CPPS in promoting whale research and conservation in southeast Pacific countries (see also Item 5.2.3.2), and **recommends** building on recent cooperation with the IWC (i.e. the entanglement response training) and expanding this collaboration to include working with the IWC SSWG and the Scientific Committee regarding exchange of information, networking and mitigation measures to reduce collision risk.

#### 6.2.5 *Other countries*

There was no further information presented here.

## 7 DISCUSSION OF POTENTIAL ACTIONS

### 7.1 Global

#### 7.1.1 *Specific data collection*

Population of the Ship Strikes Database is high priority for IWC. There should be an effort to increase submissions to the Ship Strikes Database on a global scale. This could be done by targeting places where it is known or suspected that there are ship strikes which are not being reported to the database. The Secretariat could be asked to contact relevant organisations to encourage submissions to the database. On a more immediate level the database could be displayed more prominently on the IWC website to make sure it can be easily found.

There is a need to **recommend** that individual countries (i.e. Contracting Governments to the IWC) get involved. This was especially emphasised in the discussions of IMO (see Item 6.2.3) as any documents submitted to this organisation would need to have a sponsor or group of sponsors associated with it. The IWC could also officially approach non-member governments from e.g. Sri Lanka or Canada. There has been interest from both of these areas – a delegate from Sri Lanka was planning to attend this Workshop, and the DFO in Canada is aware of the database.

During discussion it was noted that ship strikes may not be being reported as there is a lack of simple methods for doing so for some areas or a lack of the appropriate detecting infrastructure to do so. The Workshop **re-emphasised** that there are many ways to submit data on ship strikes, e.g. via existing stranding networks or institutions involved in cetacean research (such as ARAP), as well as directly to the IWC Ship Strikes Database, which is being upgraded to *inter alia* improve submission methods.

Any future IMO proposal should draw attention to the IWC Ship Strikes Database and encourage submission of reports to it. It was suggested that one route to be explored was to emulate a recent policy in the airline industry where as an incentive to report a 'near miss' with another plane the pilot was promised amnesty from prosecution. However, although the idea was considered to have some merit, in many cases a whale collision is not the fault of the captain or pilot of a ship anyway, and the industries would not support a measure which appeared to increasingly blame them for accidents.

#### 7.1.2 *Targeted (effective) outreach*

There is a need to approach vessel operators directly with regard to the danger to vessels of hitting cetaceans. To do this contacts in the industry are needed. Some delicacy is needed with the initial approach and negotiations – ferry

companies may not want to advertise that they might hit whales during passenger transits, for example. Companies need to be persuaded that reporting cetacean strikes will ultimately improve the safety of their operations.

One approach could be to use existing strandings networks. The IWC SC sub-committee on environmental concerns has provided advice to stranding networks on this issue in the past. There is also a Stranding Expert Group within the SC and a partial list of stranding networks around the world exists. Recent entanglement training workshops involving these networks in the Caribbean area have been well-received. In addition the SPAW has been building stranding network capability. They were unaware of the IWC stranding network list until recently. Resources such as this list need to be made more prominent.

Ritter presented Ritter *et al.* (2014). Collisions between sailing vessels and cetaceans have been reported for a number of species, and this appears to be an increasing problem (Ritter, 2009). Many of these collisions have caused serious damage to the vessel or even vessel loss, as well as serious or fatal injury to the whale. This document was developed to provide information on the ship strike issue to sailors and regatta/offshore race organisers as well as to highlight mitigation options. The document highlights that in the absence of sufficient information on effective technological solutions, current options for reducing risk are limited to avoiding action by the vessel and routing vessels away from areas with large numbers of whales. Routing advice always has to consider what data are available regarding whales, i.e. which species present the greatest collision risk, what their behavioural characteristics and movement patterns are. Moreover, advice has to be based on oceanographic features and the existence of marine protected areas, etc. Discrete procedures suggested for off-shore sailing races within four subject areas are: (1) collating baseline data, e.g. on seasonal and temporal patterns of whale distribution and movements, seasonal migration and large oceanographic and physiographic features; (2) route planning - which ideally should take place at the planning stage of the event - including allowing for the concept of physical or virtual marks defining the race route or to allow for as wide a time window as possible in order to coincide with seasons when whale density is likely to be lowest; (3) informing sailors, about areas where whales are most likely to be encountered, providing general advice on cetacean species, preparation of briefing materials, etc.; and (4) reporting, with an emphasis on making use of the IWC global database. The document lists known ship strike mitigation measures, educational resources, reporting tools and websites relevant for sailors and sailing race organisers.

In discussion it was noted that WWF is starting to collaborate with the organisers of the Global Ocean Race, IOC, and the Swedish Government. Ritter and Panigada will join this collaboration as IWC ship strikes coordinators in an advisory role. This role should be formalised as an official IWC collaboration.

Panigada summarised Ritter and Panigada (2014) which is the SC's draft guidelines for cruise ship operators. Collisions between cruise ships and cetaceans have been reported for a number of species, with large whales being the most commonly reported hit. Many of these collisions have caused serious or fatal injury to the whale. Only a very small proportion of collisions are likely to result in the whale becoming stuck on the bow of a ship, but these are the ones that get noticed. The ship strike data coordinators established a number of contacts with the cruise ship industry and felt that producing a guidance document would be welcome, not the least because whales struck by cruise ships receive a considerable media attention, thus having a potential negative impact on the cruise company. Ritter and Panigada (2014) was developed to provide information on the issue for cruise line operators as well as to highlight mitigation options. The document sets out some general information on the issue and highlights that in the absence of sufficient information on effective technological solutions, current options for reducing risk are limited to avoiding action by the vessel, reducing cruising speeds, and routing vessels away from areas with large numbers of whales. The document follows a similar format to the guidance for off-shore recreational boating events with information on seven main subject areas: (1) collating baseline data before voyage planning, to identify potential cetacean hot spots; (2) route planning to avoid such areas and to comply with speed restrictions; (3) informing captains, crew and staff about species most likely to be encountered, providing briefing materials on what to do and look for in the event of a collision; (4) operational measures including reducing speed, avoidance manoeuvres, and advice on what to do if a collision has occurred; (5) operational guidelines during whale watching activities; (6) technological solutions; and (7) reporting, with an emphasis on making use of the IWC global database. It was noted that this document does not take into account the important fact that most cruise ships travel mainly at night. There will be more of these guidelines documents produced for other types of vessel.

In discussion it was noted that there is a need to decide how to distribute these two documents. Use could be made of the people participating at this Workshop.

The information needs careful targeting so that it is seen by the right people. It was suggested that quite a lot of the advice is quite generic and there could be a one-page summary, perhaps laminated, with the more specific advice targeted at individual industries. This could take the form of a flash card with salient points to keep on the bridge. A longer document could be produced for distribution to industries and one portable, laminated page for captains.

Cruise lines were chosen in the first instance because this industry seemed to be more open than some others to working on the ship strikes issue. In general the more collaboration that can be achieved the more successful the end result will be (*c.f.* the TSSs at Stellwagen Bank).

It was also noted that a guidance document needs to show ship's captains where to go to get the information on whale distribution and what they are supposed to do to avoid whales. It was noted that this is a difficult issue to give advice on.

Couvat reported that there has recently been an IMO workshop for renewing the Polar Code. Ship strikes were mentioned at this workshop as Recommendation 24. This stipulated that voyage planning should be mandatory and cetacean hotspots should be crossed at reduced speeds.

#### 7.1.3 *Important Marine Mammal Areas (IMMAs), Marine Mammal Protected Areas (MMPAs) and voyage planning*

It was suggested that MMPAs could have speed limits or other rules comparable to the regulations used in National Parks on land. Vehicles that enter land-based or marine protected areas may be recreational or commercial. On land, parks are able to manage the disparate uses of commercial or transiting vehicles as well as recreational users. The same could be done inside MMPAs. National Parks have simple warning signs about animals (e.g. deer, frogs etc.) to make people travelling through the area aware of their surroundings, promoting a 'go slow' ethic, and MMPAs could attempt something similar. It was noted that the Stellwagen iPad app functions along these lines. It was estimated that there are around 500 MMPAs whose managers could be approached.

The Workshop **recommends** that the IUCN Marine Mammal Protected Area Task Force (MMPATF) investigate the idea of developing a 'go slow' ethic or speed limits for marine mammal protected areas (MMPAs) as an aid to viewing as well as not disturbing marine life - similar to common practice in many land-based National Parks and reserves. 'Signage' could come through maps, apps and other methods of conveying messages to ships both tourist and commercial.

The Workshop **recommends** the following:

- that the MMPATF develop a database to contact the approximately 500 MMPA (Marine Mammal Protected Areas) managers to survey possible concerns about ship strikes, to encourage data reporting for ship strikes to the IWC database, as well as strandings, and to try to gauge if ship strikes are a problem in MMPAs; and
- that the MMPATF investigate Marine Mammal Protected Area (MMPA) management plans for guidelines, regulations or rules related to ship strike as well as speed concerns for pleasure as well as transiting vessels.

The Workshop also **recommends**, in light of the Important Marine Mammal Areas (IMMAs) criteria under preparation, for the IUCN Marine Mammal Protected Areas Task Force to consult the IWC SC for advice before the criteria are finalised. The Workshop **recognises** that the identification of IMMAs could facilitate consideration of high priority areas for ship strike mitigation.

#### 7.1.3.1 **MODELLING OF ETP, AND IUCN MMPA TF DRAFT CRITERIA FOR DISCUSSION**

The ETP area has exceptional datasets associated with it, and these might be a good place to start with further work testing IMMA criteria. In addition, ecosystem research is being carried out here as well and could be very helpful to testing the criteria. Noting that the Eastern Tropical Pacific region is a data-rich area, the Workshop **recommends** that the modelling of marine mammal species and ecosystems in this region be utilised to the extent feasible to help test and fine-tune draft criteria for the Important Marine Mammal Areas (IMMAs), and to help develop a draft list of IMMAs for this region.

#### 7.1.3.2 **SPECIFIC SHIPPING INDUSTRY/IMO/STAKEHOLDER INPUT**

Examples of efforts to engage industry in observing and reporting marine mammals include the Smart Oceans Smart Industries programme of the World Ocean Council (WOC), which is facilitating and scaling up industry data gathering. This could be expanded further to include observation of marine mammals. This would necessarily be opportunistic data, so there are some limits on the use of this, but careful drafting of guidelines right at the start (by the SC) to present to industry would mitigate some of the problems known to be associated with platforms of opportunity.

In discussion of which industries to approach, it was noted again that cruise ships mostly travel in the dark and so would have limited opportunities to observe cetaceans. Cruises to Alaska are an exception as passengers want to see the scenery of the Inside Passage and this could be one area to target. Firms offering day trips could also be targeted. The Southern Ocean Research Programme (SORP) organisation has produced a leaflet aimed at tourists visiting the Antarctic which informs them where to send good quality photos of whales, scars, flukes, etc.

National navies could also be approached, e.g. the Dutch navy have an app for reporting sightings of marine mammals. This could be investigated to see if the shipping industry could use it. The WOC indicated its willingness and ability to engage a wide range of ocean industry sectors with information on the tools, technologies and practices for observing, reporting and avoiding marine mammals.

#### 7.1.4 *Advance results of Tenerife meeting*

Ritter introduced a recent result arising from the Tenerife meeting. The IWC has identified the Canary Islands as a hot spot for ship strikes. The Canary Islands Cetacean Stranding Net reports an average of two strandings of sperm whales per year with signs of collision (Carrillo and Ritter, 2010). The rate of ship strikes increased in 1998, in coincidence with the introduction of fast ferries in the archipelago and the resulting increase in the number of transits and the average speed of the ferries. There is a trend towards faster ferries in the last decade for all companies. A recent study

reports that the actual level of mortality likely exceeds the maximum production rate of the number of sperm whales found in the archipelago (a paper by Fais *et al.* has been submitted to *Biological Conservation* on this topic). In addition to sperm whales, ship strikes involving a further six cetacean species have been recorded in the islands, including several species of rorquals (*Balaenoptera* spp.) and beaked whales (*Ziphius* sp.).

In February 2014, the Cetacean Research Group (GIC) at the University of La Laguna, formed a 'Working Group for the Prevention of Cetacean Ship Strikes'. This working group includes the Canary Islands Government, maritime authorities (Harbour Master, Director of Safety at Sea), Canarias Conservación (from the Canary Islands Cetacean Stranding Net) and the most important companies which run inter-island ferries operating in the archipelago (Armas, Trasmediterranea, Fred Olsen). It also has the support of the Spanish Ministry of Environment. The objective of this working group is to promote the application of mitigation measures. It has started to assess which mitigation measures used elsewhere might be effective and practical in the Canary Islands.

The archipelago is an IMO-endorsed PSSA (Particularly Sensitive Sea Area). Within this area, potential mitigation measures include (but are not restricted to): (i) modification of IMO shipping lines crossing known areas of concentration of sperm whales in the archipelago; (ii) real-time sharing of sighting information among all ships, using the mandatory reporting system CANREP for passing ships, and a dedicated system (e.g. REPCET) for ships routinely using the area; (iii) information to mariners and educative programs in the maritime teaching centres (University and technical schools); (iv) testing of systems to improve the detectability of whales, such as IR detection of blows, which is apparently effective in cold waters (Zitterbart *et al.*, 2013), and needs to be tested in warm waters; (v) identification of discrete areas of importance to apply spatial mitigation or reduce ship speed. These measures will be discussed at the second meeting of the group (19<sup>th</sup> June) and future meetings.

#### 7.1.5 *Outreach at the Canal and other concentration points*

Jaen talked about distributing information at the Canal about the new TSS schemes. At present, no information on whales or the existing TSS is passed to ships as they transit the Canal as the TSS was only adopted one month ago, and will be implemented next December. Information will be sent to ships on the TSS when it is available through the charts and publications publishers. It will be possible to pass on other information as well but there is a need to work out the best way for doing so. The Panama Canal Authority may work with the Smithsonian Institute and with ARAP, to produce a postcard for the bridge as suggested, which will also be given to different agencies and companies. There are also plans to distribute information to students of the Nautical Schools – this way younger people coming into the industry will have stronger knowledge of the new rules and recommendations, etc.

#### 7.1.6 *Advancing modelling efforts including evaluating mitigation strategies*

Aspects of this topic were also discussed under Item 5.1.5.1. A number of potential mitigation methods for vessel strikes have been developed. However, while essential, it is extremely difficult to examine their likely efficacy or cost effectiveness, not the least because of sample size difficulties. Some approaches (e.g. reducing speed, changing routes) are easier to evaluate (e.g. Vanderlaan and Taggart, 2007) than others (e.g. those that alert mariners to cetaceans in an area such as REPCET, passive buoys or the presence of observers). A number of studies have been undertaken to try to model various aspects of vessel/cetacean interactions (Clyne and Leaper, 2004; Frantzis *et al.*, 2014) and the Workshop **agrees** that a concerted effort to develop a broad simulation-based approach is warranted. As part of this process it notes the development of 'simulated whale' datasets held by the IWC Scientific Committee developed as part of the efforts to obtain agreed abundance estimates for Antarctic minke whales; these datasets allow for *inter alia* different whale distributions, swimming behaviour and dive patterns as well as visibility of whales to observers and survey design. Such an approach could be expanded to examine various scenarios associated with the ship strike issue and mitigation measures. While there was insufficient time at the Workshop to explore this issue further, the Workshop **recommends** that the IWC Scientific Committee establishes an expert group to build upon existing approaches to take this idea further with a view to developing a broad simulation framework that could be used to examine the likely effectiveness of various mitigation strategies.

#### 7.1.7 *Other*

It was noted that the US Navy is very strong on reporting ship strikes and it was suggested that other navies could be approached. This might be something that the IWC's Contracting Governments could do. France has been training crews for ten years on ship strikes, including Navy crews. They are very interested in the topic, and they are willing to record sightings (although not in real time for operational reasons).

## 7.2 Wider Caribbean

### 7.2.1 *Specific data collection*

In Saint Lucia there is a log book/reporting sheet system to report sea turtle activities. Any turtle nesting or other related activities that are reported to the Department of Fisheries are recorded in this logbook which provides data to the WIDEr Caribbean Sea Turtle (WIDECASST) and its range states database. Such a system could be emulated and further developed for marine mammal strandings as part of the region's marine mammal strandings network data collection and reporting; this is part of the Marine Mammal Action Plan. The Workshop **recommends** that a standardised and simple logbook for marine mammal strandings be made available to all stranding networks in the region, especially as it relates to ship strikes and their mitigation.



### 7.2.2 *Targeted (effective) outreach (cruise ship industry, port authorities, yachts and sailboats)*

The ship strikes data coordinators have identified a need for more outreach to industry and other organisations in the region to increase submissions to the database. They need names and organisations to approach, for example local stranding networks. SPAW is trying to compile a list of these starting with a list of whalewatching operators. There are several people who could be approached to help with this (e.g. Jean and Thomas). It was noted that there is some reluctance in the wider region to put names on lists in case of future repercussions or large amounts of work being given to tiny organisations who could not cope with it. It is important to inform people about what any requested data is for and to show the results of any work done.

The Workshop **recommends** a proposal by Bédél that a network of country coordinators for marine mammal strandings be developed for the region modelled on the WIDECAST network (a turtle information network) facilitated by dedicated regional coordinators with national focal points (mailing list, sharing guides). The Workshop also **recommends** that the SPAW RAC continue to promote stranding networks for the countries of the Wider Caribbean Region.

### 7.2.3 *Sanctuary Network actions*

MacDonald introduced the 'sister sanctuary' concept. NOAA's Stellwagen Bank National Marine Sanctuary (SBNMS) and its Caribbean partners have developed a Sister Sanctuary Program (SSP) that emphasises the critical need to take a broader management view toward transboundary conservation of marine mammal species by providing critical support for a shared population of (in this case) almost 1,000 individual humpback whales, which spend the spring and summer in the rich feeding grounds of SBNMS in the Gulf of Maine before heading south in the late autumn to the warmer waters of the Caribbean Sea to mate and give birth to their young.

In December 2006, the first Sister Sanctuary linkage protecting an endangered migratory marine mammal species on both ends of its range was established between SBNMS and the Dominican Republic's Marine Mammal Sanctuary. In 2011, this was expanded to include a sister sanctuary partnership between SBNMS and the AGOA Marine Mammal Sanctuary in the French Antilles; and, in 2012, the Government of Bermuda joined the SSP to help protect humpback whales along the migratory corridor between SBNMS and the Caribbean.

Formal plans are currently underway between SBNMS and the Dutch West Indies wherein the waters of the EEZ around the islands of Saba and St. Eustatius will be legally designated a Sanctuary for marine mammals (planned for 2014) and a Sister Sanctuary partnership will follow. Through these collaborative actions, the Sister Sanctuary Program partners are forming the first international Marine Mammal Protected Areas Network under the framework of UNEP's Caribbean Environment Programme and its Specially Protected Areas Wildlife Programme (SPAW), which is supported by the SPAW Regional Activity Center in Guadeloupe.

The Workshop **recommends** that the Marine Mammal Sanctuary network in the region develop and share expertise for expanded surveys and telemetry to understand inter-island movements and habitat use of migratory and resident populations of whales, in particular as it relates to shipping and strikes. They also **recommends** that the sanctuaries continue to share educational materials, especially on the current topic, where appropriate.

The Workshop also **recommends** that existing (and any future) Sanctuaries in the region enter into partnership network agreements as appropriate.

Although it is difficult and sometimes costly to do, it is important that under these partnerships any photo-id catalogues and photographs are shared; data sharing dramatically increases the value of photo-identification data. The Workshop **recommends** that photo-id catalogues are shared and contribute to central catalogues where available (e.g. the North Atlantic Humpback Whale Catalogue administered by the College of the Atlantic).

### 7.2.4 *Identifying high risk areas where it may be possible to re-route shipping or restrict speeds*

As is apparent from the earlier discussions, as yet there are insufficient data to identify high risk areas within the region. Recommendations on how to improve this situation are given under Item 5.2.4.

## 8 PRIORITY RECOMMENDATIONS AND ACTIONS

### 8.1 Overall conclusions

The Workshop **reiterates** the findings of the Beaulieu workshop in recognising the variety of reasons that the IWC and others are interested in the issue of ship strikes ranging from animal welfare and human safety through to population level threats (see Annex E for a summary of recommendations from the Beaulieu meeting). All are important. These different perspectives can in some cases lead to different approaches to the issue and assignment of priorities. From an animal welfare perspective, ship strikes are always a problem and it is clear that they occur in most regions of the world although reporting is patchy and represents minimum numbers. From a conservation perspective, the Workshop **agrees** that apart from for certain very small populations (e.g. western North Atlantic right whales, eastern North Pacific right whales, southeastern Pacific right whales, Arabian Sea humpback whales, western gray whales, blue whales off Sri Lanka and sperm whales in the Canary Islands) where even small numbers of mortalities due to ship strikes are problematic, for most large whales there is insufficient knowledge to evaluate the extent to which ship strikes constitute

an important threat at the population level. From both perspectives, the Workshop therefore **concludes** that the highest priority for the IWC at this time is to place emphasis on the collection and reporting of data to the IWC Global Ship Strikes Database which will both: (1) facilitate a proper evaluation, prioritisation and monitoring of ship strikes as a threat to various populations and regions; and (2) assist in the development of mitigation measures. Associated recommendations to improve reporting and data collection, including those relating to stranding networks, are given under Items 8.2 and 8.3.

In tandem with this effort, the Workshop **recognises** the importance of the species distribution modelling exercises (where sufficient data exist) to identify the important areas for cetaceans at appropriate temporal and geographical scales to compare with potential threats, including ship strikes; where insufficient data exist efforts to obtain this at the regional level are essential. This information is required both to evaluate and prioritise efforts as well as to assist with mitigation and monitoring measures. Associated recommendations are given under Item 5.1.5.2.

With respect to mitigation measures, the Workshop **agrees** that those that separate whales from vessels (or at least minimise co-occurrence) in space and time to the extent possible are the most effective, where this is possible (e.g. routing schemes). The Workshop **emphasises** that the most effective and only demonstrated general method to ameliorate lethal strikes available at present is reduced speed (see Item 6.1.2). The efficacy of other measures (e.g. alerting mariners that whales may be in the area, such as having observers onboard or systems such as REPCET) including technical solutions requires careful evaluation before they can be endorsed. At present, apart from recommending that vessels go slowly, it is not possible to provide advice on simple avoidance strategies in the presence of whales. Associated recommendations are given under Item 6.

## 8.2 Global recommendations

### 8.2.1 *IWC Co-operation with the International Maritime Organisation*

The Workshop **emphasised** the global distribution nature of the ship strikes problem and **re-affirms** the primacy of the IMO as the competent international organisation responsible for vessel routing measures and the need for the IWC to work with the IMO on this issue.

In this context, the Workshop **recommends** that the IWC maintains and develops a close relationship with the IMO. To establish a presence at and to build a long-term working relationship with the IMO, the IWC Secretariat (or its representative, who could be a representative from a member state of IWC and IMO) should routinely attend relevant sessions of the IMO's Marine Environment Protection Committee (MEPC) and other appropriate IMO committee/subcommittees. The IWC already has an agreement of co-operation with the IMO dating from 2009; the IWC should take advantage of and build on this existing relationship (e.g. notifying member countries of relevant agenda topics, assisting member nations with the process of submitting national proposals).

More particularly, the Workshop **recommends** the submission of a 'Substantive Document' to MEPC. The IWC Secretariat should submit the document (perhaps under the 'report from other organisations' agenda item or under the 'other' agenda item) to MEPC 68 in May 2015). The document should provide the report of the present Panama Workshop including a summary of its relevant outcomes. The document should also provide results of recent scientific studies regarding the issue of ship strikes of large whales; descriptions of the measures used to reduce the occurrence of fatal strikes and their relative effectiveness; and any other relevant information. The report should be accompanied by a request to the IMO Secretariat to allow the IWC to make a presentation about the goals, mission, and function of the IWC and ship strikes contemporaneous with the introduction of the document in Plenary.

In addition, the document should:

- (a) reference previous submissions to the IMO on this matter;
- (b) reiterate the concerns about ship strikes of cetaceans worldwide;
- (c) describe the function and importance of the IWC's global 'ship strike database';
- (d) provide specific information on how to report the occurrence of a ship strike of a whale; and
- (e) request that the MEPC (a) bring this information to the attention of Member Governments and international organisations for action and (b) urge IMO members to report ship strikes to the IWC global ship strikes database.

The document should be drafted and formally submitted by the IWC, ideally co-sponsored by a number of interested Member States (in particular) as well as relevant intergovernmental and non-governmental organisations.

To be considered at MEPC 68, the document (6 pages or less) must be submitted to the MEPC no later than March 2015. A draft should be prepared in adequate time to allow for adequate review and consideration by member states for co-sponsorship. The IWC could also consider submitting the document to both MEPC and Safety of Navigation Sub-Committee back to back, if there are instructions, to reach a wider audience at the IMO.

With respect to routing/traffic separation schemes, the Workshop **recommends** that an appropriate mechanism be developed with IMO to encourage consideration of cetaceans when new or revised routing schemes are brought to IMO.

The Workshop **also recommends** that for any such schemes, stakeholders be engaged from the beginning and consulted often and regularly throughout the process.

#### 8.2.2 *Important Marine Mammal Areas (IMMAs, MMPAs) and voyage planning*

The Workshop **recommends** that the IUCN Marine Mammal Protected Area Task Force (MMPATF):

- (1) investigates the idea of developing a 'go slow' ethic or speed limits for marine mammal protected areas (MMPAs) using maps, 'apps' and other methods of conveying messages to ships;
- (2) develop a database of the approximately 500 MMPA (marine mammal protected areas) managers to facilitate contact with them in a systematic way with respect to: data reporting for the IWC ship strikes database, as well as strandings; concerns they may have about ship strikes, to gauge if ship strikes are a problem in MMPAs;
- (3) investigate Marine Mammal Protected Area (MMPA) management plans for guidelines, regulations or rules related to ship strikes for transiting vessels as well as vessels based in the area (including pleasure craft); and
- (3) in light of the IMMA criteria under preparation, consults the IWC Scientific Committee for advice before the criteria are finalised.

Noting that the Eastern Tropical Pacific region is a data-rich area, the Workshop **recommends** that the modelling of marine mammal species and ecosystems in this region be utilised to the extent feasible to help test and fine-tune draft criteria for the Important Marine Mammal Areas (IMMAs).

### 8.3 Wider Caribbean (UNEP-CEP-SPAW)

#### 8.3.1 *Collaboration*

The Workshop **endorses** the development of an MoU between the SPAW Marine Mammal Action Plan (MMAP) Secretariat and the IWC Secretariat on the exchange of information.

The Workshop **recommends** building on recent CPPS cooperation with the IWC (i.e. the entanglement response training) and expanding it to include working with the IWC SSWG and the Scientific Committee regarding exchange of information, networking and mitigation measures to reduce collision risk.

The Workshop **recommends** that organisations within the region should continue to promote information about the existing databases and the use of them at a global and regional level (e.g. the IWC ship strike database, the North Atlantic Humpback Whale Catalogue etc.).

#### 8.3.2 *Improved knowledge of cetacean distribution and abundance*

As noted under Item 5.2.4, while data on shipping in the Wider Caribbean is fairly extensive and readily available, it was agreed that data on marine mammal abundance and distribution are extremely limited in the wider Caribbean area. The Workshop **recognises** the logistical and financial difficulties inherent in undertaking the 'ideal' research programme i.e. a major synoptic survey covering the whole region to provide a baseline for the region upon which to begin to evaluate and prioritise all potential threats, not just ship strikes. However, as part of a strategy to develop a practical way forward (as was the case for the ACCOBAMS Survey Initiative), it **recommends** that a regional expert group be established to examine and develop a number of (not mutually exclusive) options and overall strategy for obtaining better quantitative data including:

- (a) the appropriate use of opportunistic effort (e.g. on vessels crossing the region, including whalewatching vessels) to inform options (b) and (c);
- (b) the use of spatial modelling approaches using data from 'potentially appropriate regions' elsewhere in conjunction with the limited information available within the region to suggest areas upon which to base smaller systematic effort; and
- (c) the development of a costed proposal to undertake a suitable baseline survey or surveys for the wider region which may focus on particular priority species and methods (e.g. visual, acoustic, mark-recapture).

The Workshop **recommends** that UNEP-CEP-SPAW implement actions in the Marine Mammal Action Plan (MMAP) aimed at identifying areas where long-term photo-identification catalogues of sperm whales and other cetaceans populations exist and encourage the holders of such data to share information and collaborate to produce information on movements, structure and where possible abundance estimates.

The Workshop **also recommends** that the SPAW RAC continue to promote stranding networks for the countries of the Wider Caribbean Region. It **recommends** that a standardised and simple logbook for strandings be made available for to all stranding networks in the region, especially as it relates to ship strikes and their mitigation.

The Workshop **recommends** that a network of country coordinators for marine mammal strandings be developed for the region modelled on the WIDECAST (Wider Caribbean Sea Turtle Conservation Network), facilitated by dedicated regional coordinators with national focal points (mailing list, sharing guides).

#### 8.3.3 *Vessel traffic and ship strikes*

The Workshop **recommends** that SPAW acquire real time and historical ships track data for the Caribbean (AIS, LRIT, etc.) and the technical expertise to process it.

The Workshop **recommends** that SPAW and its member countries investigate the best means to passively and actively inform commercial ships, recreational boaters, and other maritime interests, when a voyage enters a Sanctuary or Marine Protected Area.

The Workshop **recommends** the identification and utilisation of existing data on ship strikes collected by, for example, the shipping industry for the safety of their operations and passengers (e.g. ferries) and **encourages** the industry in all countries within the region to collect such data and report it to regional bodies and the IWC ship strikes database.

#### 8.3.4 *Targeted actions and outreach for identified hotspots*

The Workshop **commends** the work undertaken thus far on one of the best long-term datasets in the world for habitat modelling in the Eastern Tropical Pacific. It noted the potential of using this dataset to explore certain generic questions including the relationship between reliable predictions and, for example, length of datasets and/or geographical extent of datasets. It **recommends** investigation of these issues by ‘censoring’ the datasets in various ways and comparing the reliability of the predictions against those from the full dataset. Similarly, it **recommends** exploration of the relationship between use of presence/absence data and presence-only data.

#### 8.3.5 *Priority actions for Marine Mammal Sanctuary Network*

The Workshop **recommends** that existing (and any future) Sanctuaries in the region enter into a partnership network agreement.

The Workshop **recommends** that the Marine Mammal Sanctuary Network in the region:

- (1) develops and shares expertise for expanded surveys and telemetry to understand inter-island movements and habitat use of migratory and resident populations of whales, in particular as it relates to shipping and strikes;
- (2) continues to share educational materials, especially on ship strikes, where appropriate;
- (3) promotes the sharing that photo-id catalogues are shared between networks and contributed to central catalogues where available (i.e. the North Atlantic Catalogue).

### 8.4 **Priority actions for IWC**

#### 8.4.1 *Collaboration*

The recommendations under Items 8.2.1 and 8.3.1 highlight collaboration with IMO, UNEP-CEP-SPAW and CPPS. In addition, the Workshop **commends** the IWC’s current cooperative work with IGOs and NGOs and **recommends** that it expand the work with regional organisations, NGOs and IGOs (e.g. CPPS, SPAW and other UNEP Regional Seas programmes) on the ship strikes issue. The Workshop notes that some organisations have databases on cetaceans, experts and well-established communication mechanisms with countries. The Workshop **recommends** that the IWC works with both Parties and non-Parties of IWC on the issue of ship strikes, as well as assisting with training programmes on marine conservation that may help to increase awareness on the issue (including the IWC ship strike database), improve the quality of population and marine spatial analyses for the species, promote regional networking and advance the goals of the IWC on this issue.

In addition to IMO, the Workshop **strongly recommends** that the IWC increases its engagement with the maritime sector (e.g. shipping associations, and other maritime user groups and associations such as the World Ocean Council, which has offered to assist in engaging the diverse ocean business community on the issue of ship strikes).

#### 8.4.2 *Ship Strike Five-Year Strategic Plan on ship strikes*

The Chair noted that work to prepare the Five-Year Plan was going ahead through the IWC Conservation Committee’s Ship Strikes Working Group, and that the results of this Workshop would be helpful and included where appropriate.

#### 8.4.3 *IWC Ship Strikes Database*

The Workshop **affirms** that the IWC Ship Strikes Database is a crucial tool in addressing the issue of ship strikes around the world. Populating the database is a high priority in terms of assessing priorities. The Workshop **strongly recommends** that:

- (1) IWC member countries place greater emphasis on publicising the database and the need to report ship strike data directly into it within their countries, including within the relevant government departments (including the navy and coast guard) as well as maritime users in general;
- (2) IWC member countries all also submit relevant information to the Scientific Committee including through national Progress Reports;

- (3) the IWC continues to fund the ship strikes database co-ordinators and that the co-ordinators continue to publicise the database; and
- (4) the IWC increases its efforts to publicise the database to other intergovernmental and regional organisations, as well as all parts of the maritime sector.

#### 8.4.4 The IWC Scientific Committee

The Workshop **recognises** the expertise of the IWC Scientific Committee with respect to many aspects of the ship strikes issue. It has highlighted a number of areas for which the Committee can provide advice to other organisations including IUCN (Item 8.2.2) and CPPS (Item 8.3.1). The Workshop **agrees** that the IWC Scientific Committee should continue to provide advice and collaborate with other organisations and research groups on matter related to ship strikes and encourages the submission of relevant work to the Committee.

The Workshop highlighted two areas where Scientific Expertise could prove extremely valuable.

- (1) While there was insufficient time at the Workshop to explore the use of simulation modelling to examine potential mitigation measures, as discussed under Item 7.1.6, the Workshop **recommends** that the IWC Scientific Committee establishes an expert group to build upon existing modelling approaches with a view to developing a broad simulation framework that could be used to examine the likely effectiveness of various mitigation strategies.
- (2) The Workshop **commended** the work undertaken thus far on one of the best long-term datasets in the world for habitat modelling in the Eastern Tropical Pacific. It noted the potential of using this dataset to explore certain generic questions including the relationship between reliable predictions and, for example, length of datasets and/or geographical extent of datasets. It **recommends** investigation of these issues by ‘censoring’ the datasets in various ways and comparing the reliability of the predictions against those from the full dataset. Similarly, it **recommends** exploration of the relationship between use of presence/absence data and presence-only data. It **agrees** that presentation of this work to the Scientific Committee could prove mutually valuable to the scientists undertaking the work (e.g. Redfern and colleagues) and to the Committee’s work.

#### 8.5 Other possible priority actions

The Workshop **agrees** that further studies using D-tags applied to whales in or near shipping lanes off major ports may represent the best opportunity to correlate reliable data on whale behaviour and response (or lack thereof) with ship speeds available through AIS records during close approaches by ships. Such information may be of broad value in considering mitigation measures, including TSSs. The Workshop **recommends** that further studies using D-tags be considered and the information shared.

### 9 OTHER RELEVANT TOPICS

There were no other topics discussed at the Workshop.

### 10 REVIEW AND ACCEPT REPORT

The report was provided to participants to review on Monday June 30<sup>th</sup>, and was adopted ‘by post’.

#### References

- Barlow, J., Ferguson, M.C., Becker, E.A., Redfern, J.V., Forney, K.A., Vilchis, I.L., Fiedler, P.C., Gerrodette, T. and Ballance, L.T. 2009. Predictive modelling of cetacean densities in the eastern Pacific Ocean. US Department of Commerce, National Marine Fisheries Service, Southwest Fisheries Science Center, La Jolla, CA.
- Carrillo, M. and Ritter, F. 2010. Increasing numbers of ship strikes in the Canary Islands: Proposals for immediate action to reduce risk of vessel-whale collisions. *J. Cetacean Res. Manage.* 11(2): 131-38.
- Clyne, H. and Leaper, R. 2004. Modelling collisions between whales and ships. Assessing the potential for vessels to take avoiding actions in response to sightings of whales. Paper SC/56/BC6 presented to the IWC Scientific Committee, July 2004, Sorrento, Italy (unpublished). 12pp. [Paper available from the Office of this Journal].
- Conn, P.B. and Silber, G.K. 2013. Vessel speed restrictions reduce risk of collision-related mortality for North Atlantic right whales. *Ecosphere* 4(4): 1-16.
- Couvat, J. and Gambaiani, D. 2013. Evaluation of the technical solutions and management measures implemented at the international level to reduce the risks of collisions between ships and large cetaceans. *Souffleurs d'Ecume* September 2013: 106pp.
- Forney, K.A., Ferguson, M.C., Becker, E.A., Fiedler, P.C., Redfern, J.V., Barlow, J., Vilchis, I.L. and Ballance, L.T. 2012. Habitat-based spatial models of cetacean density in the eastern Pacific Ocean. *Endangered Species Research* 16: 113-33.
- Frantzis, A., Leaper, R., Paraskevi, A. and Lekkas, D. 2014. Distribution patterns of sperm whales in relation to shipping density in the Hellenic Trench, Greece. Paper SC/65b/HIM07 presented to the IWC Scientific Committee, May 2014, Bled, Slovenia (unpublished). 11pp. [Paper available from the Office of this Journal].
- Government of Belgium. 2011. Ship strikes: follow-up on recommendations made and measures identified at the Beaulieu Workshop. Paper IWC/63/16 presented to the Annual Meeting of the International Whaling Commission, July 2011, Jersey, Channel Islands (unpublished). 2pp. [Paper available from the Office of this Journal].
- Guzman, H.M., Gomez, C.G. and Guivara, C.A. 2013. Potential vessel collisions with Southern Hemisphere humpback whales wintering off Pacific Panama. *Marine Mammal Science* 29(4): 629-42.
- Hoyt, E. 2011. *Marine Protected Areas for Whales, Dolphins and Porpoises: a world handbook for cetacean habitat conservation and planning*. Earthscan/Routledge and Taylor and Francis, London and New York. 477pp.

- Hoyt, E. and Notarbartolo di Sciara, G. 2013. Report of the Workshop for the Development of Important Marine Mammal Area (IMMA) Criteria, Marseille, France, 22 October 2013. 20pp.
- Irvine, L.M., Mate, B.R., Winsor, M.H., Palacios, D.M., Bograd, S.J., Costa, D.P. and Bailey, H. 2014. Spatial and temporal occurrence of blue whales off the US west coast, with implications for management. *PLOS One* 9(7, e102959): 10pp.
- International Whaling Commission. 2011. Report of the Joint IWC-ACCOBAMS Workshop on Reducing Risk of Collisions between Vessels and Cetaceans. . Paper IWC/63/CC8 presented to the Annual Meeting of the International Whaling Commission, Jersey, Channel Islands (unpublished). 42pp. [Paper available from the Office of this Journal].
- International Whaling Commission. 2014a. Report of the Scientific Committee. *J. Cetacean Res. Manage. (Suppl.)* 15:1-80.
- International Whaling Commission. 2014b. Report of the Workshop on the Rangewide Review of the Population Structure and Status of North Pacific Gray Whales, 8-11 April 2014, La Jolla, California, USA. *J. Cetacean Res. Manage. (Suppl.)* 16:in press.
- Laist, D.W., Knowlton, A.R., Mead, J.G., Collet, A.S. and Podesta, M. 2001. Collisions between whales and ships. *Marine Mammal Science* 17(1): 35-75.
- Laist, D.W., Knowlton, A.R. and Pendleton, D. 2014. Effectiveness of mandatory vessel speed limits for protecting North Atlantic right whales. *Endangered Species Research* 23: 133-47.
- LifeWeb Spain. 2014. LifeWeb-Spain UNEP-CEP Meeting on Scenarios for Transboundary Marine Mammal Management in the Wider Caribbean, San Juan, Puerto Rico, 23-24 April 2014. 53pp.
- Priyadarshana, T., Madusanka Randage, S., Alling, A., Calderan, S., Gordon, J., Leaper, R. and Porter, L. 2014. Preliminary results of surveys to investigate overlap between shipping and blue whale distribution off southern Sri Lanka. Paper SC/65b/HIM06 presented to the IWC Scientific Committee, May 2014, Bled, Slovenia (unpublished). 11pp. [Paper available from the Office of this Journal].
- Redfern, J.V., McKenna, M.F., Moore, T.J., Calambokidis, J., DeAngelis, M.L., Becker, E.A., Barlow, J., Forney, K.A., Fiedler, P.C. and Chivers, S.J. 2013. Assessing the risk of ships striking large whales in marine spatial planning. *Conservation Biology* 27(2): 292-302.
- Ritter, F. 2009. Collisions of sailing vessels with cetaceans worldwide: First insights into a seemingly growing problem. Paper SC/61/BC1 presented to the IWC Scientific Committee, June 2008, Funchal, Madeira (unpublished). 13pp. [Paper available from the Office of this Journal].
- Ritter, F. 2012. Collisions of sailing vessels with cetaceans worldwide: first insights into a seemingly growing problem. *J. Cetacean Res. Manage.* 12(1): 119-27.
- Ritter, F. and Panigada, S. 2014. IWC guidance for cruise line operators to minimise risk of collisions with cetaceans. Paper SC/65b/HIM05 presented to the IWC Scientific Committee, Bled, Slovenia (unpublished). 7pp. [Paper available from the Office of this Journal].
- Ritter, F., Panigada, S. and Leaper, R. 2014. IWC guidance for organisers of off-shore recreational boating events to minimise risk of collisions with cetaceans. Paper SC/65b/HIM04 presented to the IWC Scientific Committee, Bled, Slovenia (unpublished). 4pp. [Paper available from the Office of this Journal].
- Silber, G.K., Vanderlaan, A.S.M., Tejedor Arceredillo, A., Johnson, L., Taggart, C.T., Brown, M.W., Bettridge, S. and Sagarminaga, R. 2012. The role of the International Maritime Organization in reducing vessel threat to whales: process, options, action and effectiveness. *Marine Policy* 36: 1221-33.
- United Nations Environment Programme. 2008. Action plan for the conservation of marine mammals (MMAP) in the wider Caribbean region. 39pp.
- Vaes, T. and Druon, J.N. 2013. Mapping of potential risk of ship strike with fin whales in the Western Mediterranean Sea. A scientific and technical review using the potential habitat of fin whales and the effective vessel density. *JRC Scientific and Policy Reports*: 28pp.
- Vanderlaan, A.S.M., Corbett, J.J., Green, S.L., Callahan, J.A., Wang, C., Kenney, R.D., Taggart, C.T. and Firestone, J. 2009. Probability and mitigation of vessel encounters with North Atlantic right whales. *Endangered Species Research* 6: 273-85.
- Vanderlaan, A.S.M. and Taggart, C.T. 2007. Vessel collisions with whales: the probability of lethal injury based on vessel speed. *Marine Mammal Science* 23(1): 144-56.
- Wiley, D., Hatch, L., Thompson, M., Schwehr, K. and MacDonald, C. 2013. Marine sanctuaries and marine planning. Protecting endangered marine life. [www.uscg.mil/proceedings](http://www.uscg.mil/proceedings). *National Ocean Policy*: 6pp.
- Wiley, D.N., Thompson, M., Pace, R.M., III and Levenson, J. 2011. Modeling speed restrictions to mitigate lethal collisions between ships and whales in the Stellwagen Bank National Marine Sanctuary, USA. *Biological Conservation* 144: 2377-81.
- Zitterbart, D.P., Kindermann, L., Burkhardt, E. and Boebel, O. 2013. Automatic round-the-clock detection of whales for mitigation from underwater noise impacts. *PLOS One*: DOI: 10.1371/journal.pone.0071217.

## Annex A

### List of Participants

Sophie Bedel  
Sanctuaire AGOA, Parc National de Guadeloupe, MPA Agency, France  
*Sophie.bedel@aires-marines.fr*

Simon Brockington  
Secretariat, International Whaling Commission, UK  
*Simon.brockington@iwc.int*

Robert Brownell Jr.  
International Union for the Conservation of Nature (IUCN), USA  
*rlbcetacea@aol.com*

José Julio Casas  
Maritime International University of Panama, Marine Science Faculty, Panama

Frederic Chemay  
Environment Ministry, Belgium  
*Frederic.chemay@environnement.belgique.be*

Andrea Cooke  
Secretariat, International Whaling Commission, UK  
*Andrea.cooke@iwc.int*

Jerome Couvat  
Souffleurs d'Ecume, France  
*Jerome.couvat@souffleursdecume.com*

Greg Donovan  
Secretariat, International Whaling Commission, UK  
*Greg.donovan@iwc.int*

Fernando Felix  
Comisión Permanente del Pacifico Sur, Ecuador  
*Fefelix90@hotmail.com*

Robert Griffiths  
Cruise Lines International Association, USA  
*rgriffiths@cruising.org*

Hector Guzman  
Smithsonian Tropical Research Institute, Panama  
*guzmanh@si.edu*

Paul Hoetjes  
Ministry of Economic Affairs, Dutch Caribbean  
*Paul.hoetjes@rijksdienstcn.com*

Paul Holtus  
World Ocean Council, USA  
*Paul.holtus@oceancouncil.org*

Erich Hoyt  
Whale and Dolphin Conservation and IUCN Marine Mammal Protected Area Task Force, UK  
*Erich.hoyt@mac.com*

Fernando Jaen  
Panama Canal Authority, Panama  
*fejean@pancanal.com*

Sandra Jean  
SPAW Regional Activity Center (UNEP-SPAW-RAC), Guadeloupe  
*Sandra.jean.carspaw@guadeloupe-parcnational.fr*

David Laist  
Marine Mammal Commission, USA  
*dlaist@mmc.gov*

Craig MacDonald  
Stellwagen Bank National Marine Sanctuary, NOAA, USA  
*Craig.macdonald@noaa.gov*

Jorge Maksabedian  
Commissioner for Mexico, International Whaling Commission, Mexico  
*Jorge.maksabedian@semarnat.gob.mx*

David Mattila  
Secretariat, International Whaling Commission, UK/NOAA, USA  
*David.mattila@iwc.int*

Thomas Nelson  
Department of Fisheries, Ministry of Agriculture and Food Production, St. Lucia  
*Thomas.nelson@govt.lc*

Anna Nuñez Pereligina  
Panamanian Aquatic Resources Authority (ARAP), Panama  
*Annanu1011@yahoo.com*

Judy Andrea Pacheco Garzón  
San Andreas Island, Columbia  
*pachecoandrea@yahoo.com*

Simone Panigada  
ACCOBAMS/IWC, Italy  
*panigada@inwind.it*

Jessica Redfern  
NOAA Southwest Fisheries Science Center (SWFSC), USA  
*Jessica.redfern@noaa.gov*

Fabian Ritter  
MEER/IWC, Germany  
*ritter@m-e-e-r.de*

Lorenzo Rojas-Bracho  
Natural Areas Management Commission (CONAMP-IUCN), Mexico  
*lrojasbracho@gmail.com*

Peter Sanchez  
South Pacific Whale Sanctuary, Dominican Republic  
*Peter\_sanchez132@hotmail.com*

Greg Silber  
NOAA National Marine Fisheries Service, USA  
*Greg.silber@noaa.gov*

Lisette Trejos  
Panamanian Aquatic Resources Authority (ARAP), Panama



# Annex B

## Agenda

1. INTRODUCTIONS
2. CONFIRM CHAIR AND RAPPORTEURS
3. REVIEW AND ADOPT AGENDA
4. BACKGROUND AND CONTEXT (IWC AND UNEP-CEP)
5. SUMMARY OF CURRENT INFORMATION AND DATA GAPS
  - 5.1. Global
    - 5.1.1. Lessons from the 2010 Joint IWC/ACCOBAMS workshop (IWC/63/CC8)
    - 5.1.2. Objectives of IWC database and ways in which the data may contribute to workshop
    - 5.1.3. Identified data gaps in addressing ship strikes worldwide (e.g. understanding factors that most contribute to risk such as vessel speed, size and type)
    - 5.1.4. Shipping and other stakeholder perspective
    - 5.1.5. High risk areas and species
      - 5.1.5.1. Modeling approaches including shipping and whale data with global implications or applicability
      - 5.1.5.2. MMPAs and IUCN-IMMAs
    - 5.1.6. Other
  - 5.2. Wider Caribbean Region
    - 5.2.1. Existing information on ship strikes
    - 5.2.2. Shipping and other stakeholder information
    - 5.2.3. High risk areas and species
      - 5.2.3.1. Caribbean (Life web, UNEP-CEP, RAC REMPEITC)
      - 5.2.3.2. The use of models: the ETP example (Life web, UNEP-CEP, NOAA)
      - 5.2.3.3. Country specific information
    - 5.2.4. Data gaps in the wider Caribbean on whale and shipping distribution (group discussion)
6. SUMMARY AND EVALUATION OF EXISTING MITIGATION ACTIONS
  - 6.1. Global and other non-Caribbean
    - 6.1.1. Technological
    - 6.1.2. Operational
    - 6.1.3. Legal and voluntary
    - 6.1.4. Summary of potential impacts and concerns for shipping
  - 6.2. Wider Caribbean Region
    - 6.2.1. SPAW marine mammal action plan
    - 6.2.2. UNEP-CEP spatial modeling?
    - 6.2.3. Panama TSS proposal
    - 6.2.4. CPPS Eastern South Pacific
    - 6.2.5. Other countries
7. DISCUSSION OF POTENTIAL ACTIONS
  - 7.1. Global
    - 7.1.1. Specific data collection
    - 7.1.2. Targeted (effective)
    - 7.1.3. Important Marine Mammal Areas (IMMAs, MMPAs) and voyage planning
      - 7.1.3.1. Use modeling of ETP, and IUCN MMPA TF draft criteria for discussion
      - 7.1.3.2. Specific shipping industry/IMO/stakeholder input
    - 7.1.4. Advance results of Tenerife meeting
    - 7.1.5. Outreach at the Canal and other concentration points
    - 7.1.6. Other
  - 7.2. Wider Caribbean
    - 7.2.1. Specific data collection?
    - 7.2.2. Targeted (effective) outreach

- 7.2.3. Sanctuary Network actions
- 7.2.4. Advancing spatial monitoring
- 7.2.5. Identifying high risk areas where it may be possible to re-route shipping or restrict speeds

## 8. PRIORITY RECOMMENDATION AND ACTIONS

### 8.1. Global

#### 8.1.1. Technological

#### 8.1.2. Operational

##### 8.1.2.1. Important Marine Mammal Areas (IMMAs, MMPAs) and voyage planning

##### 8.1.2.2. Use modeling of ETP, and IUCN MMPA TF draft criteria for discussion

#### 8.1.3. Educational tools

##### 8.1.3.1. Shipping industry/IMO/stakeholder input priority education tools

##### 8.1.3.2. Advance results of Tenerife meeting

##### 8.1.3.3. Outreach at the Canal?

### 8.2. Wider Caribbean (UNEP-CEP-SPAW)

#### 8.2.1. Marine mammal action plan items

#### 8.2.2. Targeted actions and outreach for identified hotspots

#### 8.2.3. Priority actions for MM Sanctuary Network

### 8.3. Priority actions for IWC

#### 8.3.1. Ship Strike Five Year Strategic Plan

#### 8.3.2. IWC Ship Strike Database

#### 8.3.3. IMMAs

### 8.4. Other possible priority actions

#### 8.4.1. Assisting voyage planning (IMMAs, MMPAs)

#### 8.4.2. Education (IGO and national role)

#### 8.4.3. New technology

#### 8.4.4. Other

## 9. OTHER RELEVANT TOPICS

## 10. REVIEW AND ACCEPT REPORT

## Annex C

### List of Acronyms

ACCOBAMS	Agreement on the Conservation of Cetaceans of the Black Sea, the Mediterranean Sea and Atlantic Contiguous Area
ARAP	Autoridad de los Recursos Acuáticos de Panama
ASCOBANS	Agreement on the Conservation of Small Cetaceans of the Baltic and North Seas
AWMP	Aboriginal Whaling Management Procedure
AIS	Automatic Identification System
ATBA	Areas To Be Avoided
CEP	Caribbean Environment Programme
EMSA	European Maritime Safety Agency
ETP	Eastern Tropical Pacific
IAATO	International Association of Antarctic Tour Operators
ICS	International Chamber of Shipping
IMMA	Important Marine Mammal Area
IMO	International Maritime Organization
IMO-MEPC	International Maritime Organization's Marine Environment Protection Committee
IMO-STCW	International Maritime Organization's Standards of Training, Certification and Watch keeping
ISAF	International Sailing Federation
IWC	International Whaling Commission
LRIT	Long Range Identification and Tracking
MMPA	Marine Mammal Protected Area
MMAP	Action Plan for the Conservation of Marine Mammals (UNEP)
MSRS	Mandatory Ship Reporting System
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
REMPEC	Regional Marine Pollution Emergency Response Centre for the Mediterranean Sea
REPCET	REal-time Plotting of CETaceans
RMP	Revised Management Procedure
SPAW	Protocol Concerning Specially Protected Areas and Wildlife
SSWG	Ship Strikes Working Group
TSS	Traffic Separation Scheme
UNEP	United Nations Environment Programme
USCG	United States Coast Guard

## Regional Passenger Ship Routes in the Wider Caribbean Area

Robert Griffiths



Marine Traffic, June 13, 2014

June 18, 2014

Rob Griffiths

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## Annex E

### Recommendations from the Ship Strikes Workshop at Beaulieu, 21-24 September 2010

Originally prepared by the Government of Belgium for the IWC/63 Annual Meeting

	Recommendations/Measures	Prop. Time line	Possible stakeholders	Prop. Priority	Fund. Need	Rep. Page
<b>Scientific</b>	Data requirements					
	Cetacean abundance, density, movements and stock structure data collection	Short/Medium	Contracting Governments	High	YES	4
	Basin-wide survey in ACCOBAMS Area waters	Short	Italy	High	YES	4
	Stranding networks					6
	Necropsies (validation studies for fat emboli using lung tissue)	Short/Medium	University of Las Palmas with others		YES	6
	Standardization of protocols	Short/Medium	Contracting Governments	High	YES	6
	Training in forensic methods	Short/Medium			NO	6
	Establish basin wide Stranding Network in Mediterranean	Medium	ACCOBAMS members	High	NO	6
	Investigate use of drift models, incl. Identifying data gaps	Medium	IWC SC/USA		?	7
	Encourage reporting carcasses (relevant to chapter 5 of IMO's SOLAS Convention)	Short	IMO member states		NO	7
	Direct observations					
	Encourage reporting of collisions to IWC database	Short	Contracting Governments	High	NO	7
	Dedicated observers in high risk areas	Short/Medium	Contracting Governments		YES	8
	Reporting of near misses (incl. clear definition)	Short/Medium	Contracting Governments		NO	8
	Risk analyses					9
	Collaboration between cetacean and shipping experts	Short	IWC SC		YES	12
	Shipping and whale data overlay	Medium	IWC SC		YES	12
	Creation of risk models (incl. speed, noise, time of year, ....)	Medium	IWC SC		YES	13
	Shipping-whale data and ship strike fatalities data overlay	Medium	IWC SC		YES	13
<b>Reporting</b>	Encourage reporting of ship strikes to IWC	Short	Contracting Governments	High	NO	20
	Further development of IWC centralized database	Short	IWC SC		YES	20
	Improve collaboration between regional and global databases	Short	IWC data review group	High	NO	20
	Achieve mandatory reporting	Long	Contracting Governments/IMO members		NO	20
	Strengthening existing stranding networks	Medium	Contracting Governments/Authorities		/	20
	Increased training measures of mariners on importance of reporting strikes	Medium	Shipping industry		/	20
	Determination of Conservation objectives by the appropriate authorities	Medium	Authorities		NO	13

Work plan	Ranking of potential mitigation measures with level of risk at population level	Medium	Authorities		NO	13
	Quantification of expected risk reduction for any mitigation measure	Medium	IWC SC		/	13
	Utilization of IMO guidance document (MEPC.1/Circ.674)	Medium	IMO members		NO	13
	<i>Potential measures</i>					
	ATBAs and re-routing including TSS	Medium	Contracting Governments	High	NO	13
	Dynamic management areas	Medium	Contracting Governments		NO	14
	Evaluation of implementation/compliance	Long	Contracting Governments		NO	14
	Evaluation of effectiveness	Long	IWC SC		/	14
	Speed restrictions	Medium	Contracting Governments		NO	14
	Evaluation of implementation/compliance	Long	Contracting Governments		?	15
	Evaluation of effectiveness	Long	IWC SC		?	15
	Dedicated observers and trained crew on board	Medium	Contracting Governments		YES	16
	Increased training measures and awareness (incl. mariners)	Medium	Contracting Governments/IMO members		YES	16
	Land-based observation in high risk areas	Medium	Scientists		YES	16
	Technological approaches	Long	Shipping Industry/NGOs		YES	17
	<i>Specific cases</i>					
	Strait of Gibraltar: Reduction of speed	Medium	Spain	High	NO	19
	Pelagos Sanctuary: Designation of a PSSA under IMO	Medium/Long	Pelagos Parties/IMO		NO	19
	Southwest of Greece: Possible routing measures	Medium	Greece		NO	19
	Canary Islands: Dedicated observers on fast and high speed vessels	Short	Canary Islands government	High	?	19
	Training and education for observers	Short	Canary Islands government	High	YES	19
	Speed restrictions in SACs and high risk areas	Short/Medium	Canary Islands government		NO	19
	Possibly change in routing	Short/Medium	Canary Islands government		NO	19
	Establish a joint Stranding Investigation Working Group (IWC & ACCOBAMS)	Short	IWC & ACCOBAMS		NO	20
	Review existing protocols and tools for determining the role of human interaction in stranding of cetaceans	Short	IWC SC		NO	
	Identify, develop, review and validate tools, techniques and methods to address key issues relative to strandings	Medium	IWC SC		/	
	Develop a multidisciplinary approach and methodology to address different experience levels	Medium			/	
	Develop and implement training	Medium			YES	
	Built capacity in range states without stranding programmes	Medium			YES	
	Plan and hold a range-wide stranding coordination meeting for ACCOBAMS members	Medium	ACCOBAMS		YES	
	Mediterranean basin-wide survey (summer 2012)	Short	Italy		YES	21
	Improved reporting to the IWC global ship strike database	Short	Contracting Governments		YES	21
	Development of appropriate modelling techniques to identify high priority areas	Medium	IWC SC		YES	21
	Review of process		SC / CC		NO	21