5. Recommendations

This review highlights the fact that mid-water trawls and gillnets pose a considerable threat to certain small cetacean species in European waters. The most vulnerable species in the NE Atlantic and surrounding seas are the common dolphin, the striped dolphin and, most critically, the harbour porpoise. By-catch of the dolphin species occurs mainly in mid-water trawls, in the North Sea, Celtic Sea and the Bay of Biscay. Harbour porpoises are caught mainly in set gillnets and are vulnerable in the central and northern North Sea, Baltic and Swedish Seas and the Celtic Sea. The number of porpoises in the Baltic Sea has been in decline, as recognised for a number of years, and porpoises are no longer sighted in the southern North Sea or in the English Channel.

The widespread distribution and movements of cetacean populations generally make it difficult to achieve conservation aims by designating protected areas, e.g. SACs under the Habitats Directive. Except in rare cases, as with the bottlenose dolphins in the Moray Firth, Scotland, it is essential to focus on the causes of population decline rather than on specific geographical areas. By-catch of cetacean species in commercial fisheries has been shown to be, or is thought to be, unsustainable in many fishing grounds in European waters and it is now imperative that changes be made to the European fisheries management system to ensure that the problem is addressed in the future.

The European Commission has made a significant contribution to addressing this problem in European waters, by funding a number of studies of cetacean by-catch, reviewed here and listed in Appendix I. Nevertheless, substantial uncertainties remain regarding distribution, abundance, and growth rates of cetacean populations, rates of fishery by-catch mortality and the efficacy of different methods for by-catch reduction. However, we unequivocally recommend that action not be delayed pending the results of further research.

5.1. The options

In the most simplistic terms, the available options for managing cetacean by-catch are as follows:

- Do nothing.
- Monitor by-catch rates but do nothing to mitigate the problem.
- Monitor by-catch rates and make attempts to mitigate the problem with gear modifications and by-catch reduction devices, as and when funding allows.
- Monitor by-catch rates and make attempts to mitigate the problem with gear modification and by-catch reduction devices with money specifically allocated to ensure a long-term approach.
- Monitor by-catch rates and close areas, seasons and fisheries according to the highest mortality rates.
- Assume there is a problem and ban commercial fishing to allow for stock recovery.
- Assume there is a problem and ban commercial fishing forever.

The above list briefly highlights the extreme ways we, as a Union of countries, can address the problem of by-catch, from the improbable permanent closure of all fisheries, to the alarmingly less improbable option of ‘doing nothing’.

Currently, most countries in the EU take the third option of carrying out short-term projects which aim to determine by-catch rates and to implement mitigation measures as and when funding allows. While this is clearly better than the first two options, the resulting data are often fragmentary and not easily compared, and the reduction in by-catch achieved is probably minimal.

We must therefore seek to achieve another option. A possible approach would be introduce measures such as those taken in the USA under the auspices of the MMPA. This is undoubtedly successful. However, against the background of the existing system of fisheries management, such a "single sector" approach, focused entirely on marine mammal conservation, may be difficult, and certainly expensive, to impose against the wishes of other vested interests. More ambitiously, these marine mammal conservation measures, should be

added in the ground-rules of the CFP, explicitly setting out to meet multiple economical, social, ecological and environmental objectives and achieves them through devolved management bodies in which all legitimate interests have full representation. If achievable, a clear advantage is that conservation measures would not be seen as an additional cost imposed on an already economically challenged industry.

We have highlighted the need for action reflected in the literature. Most papers that discuss the impact of by-catch have recorded a removal rate higher than the estimated net population growth rate. However no studies in European waters have produced sufficient data to detect interannual variation in by-catch rate or to monitor the success of BRDs. Because long-term monitoring of by-catch occurs in the USA, such data are available for waters under US jurisdiction and, furthermore substantial and verifiable by-catch reduction has been achieved, with the co-operation of the industry. Consequently, we recommend that efforts be made to introduce comparable measures.

5.2. Recommendations

To address the problem of by-catch, three main objectives must be met, preferably with financial and legislative support. Firstly, to determine the extent of the problem in an area or fishery, secondly to design and test ways to alleviate the problem and, thirdly, to achieve the above with full consideration of the livelihoods of fishermen in question. The following are suggestions we recommend as progressives steps toward achieving these objectives.

5.2.1. Funding

“Endangered species policy is as much a question of social choice as of biology…and yet the consistent exclusion of economic behaviour [of humans] in the calculus of endangered species protection has led to ineffective, and in some instances, counterproductive conservation policy” (Shogren *et al*. 1999).

Wildlife managers and conservationists in the USA are considerably ahead of the their European counterparts in confronting economic arguments by assigning explicit utility values to living natural resources. Thus the first point to make is that cetacean populations have intrinsic economic value, be it as a necessary part of marine ecosystem function, an indicator of a healthy marine environment, a recreational resource for whale-watchers, or even as a fishery resource. This value is already recognised in numerous international agreements and European Community Directives (see Section 4) but is not, yet, explicitly taken into account in managing fisheries.

If it is necessary to identify a specific sectoral budget to pay for cetacean conservation measures, then clearly the fisheries sector is an obvious starting point. A proportion of money generated by licence fees or trading in quotas could be set aside to fund by-catch reduction programmes. While this could be seen as a tax, there are, as previously discussed, obvious direct economic benefits to fishermen from avoidance of cetacean entanglement, and the potentially huge indirect benefit of being able to promote "dolphin-friendly" fish products. It is perhaps wise not to shy away from addressing the other side of marine mammal-fishery interactions, namely the perceived competition between marine mammals and fishermen for dwindling fish stocks. Of course, more effective conservation of fish stocks would ameliorate

this problem, but limited and controlled culling of grey seals could be another option to bring to the bargaining table.

5.2.2. Legislative framework required

In the USA, the statutes of the MMPA are contained in Article 16 of the United States Code and constitute a part of federal law which must be adhered to by each of the 52 states. The Department of Commerce can devolve responsibility for the implementation of the mandates to individual states, although only after approval of their implementation plans. Driscoll (1999) stated that “countries throughout the world look to the United States for guidance on marine mammal conservation and then establish policies of their own that are patterned after the MMPA and the ESA”. Here we suggest that the European Union do just that.

The only legislation in the EU that directly controls the exploitation of living marine resources, including harvesting by fishermen, is the CFP. However this includes no provision for the protection of marine mammals.

There are two basic options for change: to amend the current CFP to include provisions for marine mammal conservation or to enact these provisions in a separate EU MMPA. The former would have the advantage of explicitly offering integrated management of living marine resources. The latter would have the advantage of running less risk of dilution by other sectoral interests. In any case, the second option would explicitly impinge on the implementation of the CFP and require, *de facto,* integrated management of living marine resources.

The US Government's NMFS has been successful in achieving the objectives of the US MMPA, which are reviewed annually, as is the progress toward them. This system provides a template, which could and should be adapted to suit the EU. With a legislative framework in place, the onus will be on the government of each Member State to fund the monitoring of by-catch and the design and field testing of by-catch reduction measures. The mechanism by which this is achieved needs some attention, since the co-operation of the fishing industry is essential. The necessary revenue may be raised from the fisheries sector by taxing licences or trading in quotas but this would clearly be unpopular unless fishermen see some tangible

benefits. Apart from avoidance of the direct costs caused by cetacean entanglement, incentives could include increased quotas in return for compliance and the opportunity to market environmentally friendly products at premium prices.

5.2.3. Objective 1: Determining the extent of the problem: monitoring programs

Before embarking on a unified monitoring program to assess by-catch in fisheries in all European bodies of water, it would be necessary to convene a panel of scientists, fishery managers and fishermen, representative of each Member State to discuss the practicalities of the monitoring program. With a standardised protocol, discussed and understood by all, the data from each fishing ground would be comparable which would permit identification of the major problem areas and assist the development of adaptive management strategies. The possible outcomes of monitoring programmes must be clearly flagged, including a clear indication that fishery closure is, at most, the option of last resort.

Suggestions for discussion by the review panel for European waters are as follows:

- The type of monitoring method deployed.
  This could comprise a combination of standardised logbook maintenance and onboard observer coverage. If logbooks are to be implemented, it would be necessary to design a standard format which prompts standard answers[33] or simply requires nominal answers such as ‘yes’, ‘no’ or ticked boxes. This will encourage returns from fishermen through being quicker to fill out than a blank sheet, as well as ensuring comparable data. Discussion should also include the data required from the logbook and the training procedures undergone by observers to ensure standardised data returns. Questions of confidentiality of data must be addressed.
- The spatiotemporal stratification used.
  Will the study sites be divided by port, by ICES subdivisions or by Member State boundaries etc? Will temporal stratification involve fishery seasons or meteorological seasons?

[33] See Appendix XI for example of logbook format

- The measure of total annual effort.

  This will vary enormously in different countries and so the methods available should be prioritised according to their utility for estimating by-catch rates. All areas should aim to achieve the best estimation method possible, but may move down through the prioritised list as necessary.

- The sampling unit used for each fishery.

  This should be kept as standard as the measure of total annual fishing effort will allow. Soaktime multiplied by net length to incorporate a measure of effort is the most commonly used measure in gillnets while that in trawl observations is the number of cetaceans caught per haul. Generally the aim should be to keep the sampling units as standardised, and thus as comparable, as possible.

- Percentage of fishing effort to be monitored.

  The US MMPA mandates that 20-35% of all category I fisheries be monitored and 100% of all distant water fleets. An inventory of fisheries in EU waters has proved elusive during the course of this study, however, a similar classification system would be required and mandates laid down in the EU MMPA stipulating the optimal level of coverage of each category to afford the collection of enough data for robust statistical analysis at minimal cost. This will require some simple simulations to generate estimates of required sample sizes given different average by-catch rates.

- Data sheets.

  The optimal data for collection should be discussed to ensure standardised returns from each observer and each member state. Efforts should be made to ensure that data quality is not compromised by considerations of data quantity.

- Duties of observers.

  Discussion is required to determine whether the observer responsibility will be limited to recording marine mammals or if they will also monitor fish discards. The former may be more costly but the latter will necessitate the application of a correction factor to ensure the data is not compromised by the reduced efficiency of "off-watch" observers (Bravington & Bisack 1996).

- Analysis of the data.

  Discussion should include the methods used to interpret the resulting data sets and the designation of responsibility for the analysis. Should there be a central database? Should each Member State analyse its own data independently or should it be done

centrally? The 'ownership' (and publication) of the resulting data should be discussed, with clear recognition both of commercial confidentiality and intellectual copyright issues. The EU MMPA should specify guidelines for analysis.

5.2.4. Objective 2: Determining ways to alleviate the problem: mitigation measures

Prior to decisions on which by-catch reduction measures to deploy on a large scale, it is likely that field tests of different mitigation methods would be carried out under project-based funding to determine which is likely to be the most effective.

We recommend:

- Field trials of the Dukane and Pice pingers on set gillnet fisheries in European waters. Dukane pingers have been shown to be successful in field trials in the NW Atlantic. However, it will be necessary to determine their success rate in fisheries with different target catches. We recommend that their voluntary application in fisheries be encouraged within a designated time if they prove successful. Success will be defined in terms of limiting disruption to the fishing process as well as reducing cetaceans by-catch.
- As above, for passive reflectors, following principles of good design as set out by Goodson (1993), taking into account the acoustic capabilities of the cetaceans.
- Field tests of the effects of changes in fishing strategy:
    - Reduction in night fishing, given that most studies indicate that cetacean by-catch occurs mainly at night.
    - Reduction in gillnet soaktime and changes of depth of set.
    - Modifications to the deployment of trawling gear, e.g. tow depth and speed, haulback speed and time of day and tide.
- Field tests of the effects of gear modifications[34]:
    - Reduced gillnet length
    - Increased bridle gaps
    - Exclusion devices

[34] See Appendix XII for suggested gear modification

5.2.5. Objective 3: Assurance of co-operation from fishermen

As discussed earlier, we feel that communication between all parties is a pre-requisite to solving the by-catch problem. However, lines of communication between managers, fishermen and scientists have to be opened. Failing this, observer programs and mitigation field trials will be met with resistance.

A number of measures can be taken to ensure co-operation from fishermen. A requirement to comply with by-catch monitoring and mitigation measures could be attached to the issuing of fishing licences, certainly for fishing in the equivalent of "Category I fisheries", as happens in the USA. Obviously, legal sanctions may be necessary to back up any system, but threats are not conducive to mutual respect or to achieving management objectives. However, there are many possible ways to encourage voluntary co-operation, including reward schemes (e.g. increased quota allocations, bounty payments for handing in carcasses), involvement of fishermen throughout the decision-making process and explicit recognition of social and economic objectives (i.e. the livelihood of fishermen) in defining management objectives.

Fishery managers and fishermen should be consulted at each stage of the design, testing and distribution of by-catch reduction devices and measures. This will not only improve the practical design of the by-catch reduction devices and strategies for their deployment but will be a direct acknowledgement of the expertise of the fishermen. One of the biggest problems encountered when testing BRDs has been attachment of the device to the net without affecting the deployment of the net and its hanging geometry. Clearly, the input of fishermen to help solve these problems is invaluable.

Assurance must be given that fishery closures will be considered only as a final option, when everything else has failed, and that permanent closures are not an option. In the event of short-term closure, compensation could be offered to those fishermen who co-operated with efforts to reduce by-catch.

Direct financial rewards for co-operation with logbook and carcass retrieval schemes have not proved very successful in the past. However, it may have been the rewards, rather than the principle, which were at fault. After all, what is an extra £50 to a fisherman at the end of a lucrative fishing season, especially if attending to the logbook means time lost from the job

at hand? The US MMPA allocates permits to category I fishermen to allow them to incidentally take marine mammals. They retain the right to withdraw this permit should the rules be violated. The removal of rights in response to a lack of co-operation is effectively a negative insurance of compliance and may be considered by some to be antagonistic. In the TRP organised in 1998 by the NMFS in the USA, the use of acoustic deterrent devices was directly rewarded with the right to fish in previous closed areas. Here we advocate such positive reward schemes, which enable the fishermen to influence the value of their 'reward' and to maximise their gains. We suggest issuing additional quota (or the equivalent) to European fishermen who comply with the use of BRDs and/or who agree to co-operate with observer schemes. This additional quota could be "top-sliced" prior to allocation of quotas and held back for this purpose.

Good publicity will smooth the way towards co-operation. Following the mass stranding of common dolphins on the SW coast of England, the English set gillnet hake fishery received bad press because their association with the high mortality was assumed. This led to the fishermen offering to co-operate with an observer scheme to prove their 'innocence' in the stranding event. However, bad publicity on a national scale, directed at the fishing industry as a whole, cannot be so easily redressed and can be costly. Here we suggest again a positive reinforcement system whereby fishermen receive good publicity for using "dolphin-friendly-gear" and/or "dolphin friendly strategies". A successful marketing campaign could even lead to increased prices for "by-catch free fish".

A controversial but potentially fruitful approach would be to 'trade' voluntary co-operation from fishermen in by-catch reduction measures for action in controlling other kinds of marine mammal-fishery interactions. In particular, this might involve a controlled cull of grey seal stocks. In areas where fishermen perceive that they suffer substantial losses in their catch to direct competition with seals, such a trade-off may provide an effective incentive. Such an approach would need to be treated with extreme caution however and is certain to be opposed by environmental and animal welfare groups. Thus, even if the option was offered, it might prove impossible to deliver. It should be noted that previous seal culls have been halted following adverse publicity and, given the complexity of marine food webs and population processes, it is difficult to provide a watertight scientific case for a detectable benefit to fishermen. Ultimately, this approach would have to be considered to be every bit as extreme as fishery closures and should only be considered as a last resort.

Suggested by-catch reduction measures must be fair and realistic. If pingers cannot be applied without significantly reducing the target fish catch then we have to rule out their use or go back to the drawing board. If field studies demonstrate that banning night-time fishing will substantially reduce fish catches, fishermen should be allowed to continue fishing at night, meanwhile exploring other by-catch reduction options. To achieve an effective and adaptable management system, we must ensure that the effects of all actions are monitored and that all parties concerned are given a voice throughout the entire design, testing and implementation process.