ICES Special Request Advice
Northeast Atlantic ecoregions
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EU additional request on mitigation measures to reduce bycatches of common dolphin (*Delphinus delphis*) in the Bay of Biscay and Iberian Coast

Advice summary

ICES concludes that taking into account the data from 2019–2021, most of the proposed scenarios to reduce bycatch of the common dolphin (*Delphinus delphis*) in the Bay of Biscay and Iberian Coast as described in the ICES advice in 2020 are likely to still reduce bycatch below the potential biological removal (PBR) limit. ICES notes that uncertainty in knowledge of the extent and the dynamics of the species' distribution area and abundance, as well as the availability of reliable bycatch estimates for the entire range of the species distribution area, are of concern.

None of the scenarios, when evaluated with the data from 2019–2021, met the candidate management objective of reducing estimated bycatch to less than 10% of the PBR. This is in contrast to the previous results using 2016–2018 data and is due to greater bycatch arising from a combination of improvements to the knowledge base (including bycatch rates, métiers covered, and effort reporting) and changes in the distribution of common dolphin within the Bay of Biscay.

ICES advises for the common dolphin in the Bay of Biscay and Iberian Coast a combination of temporal closures of all métiers of concern and the application of pingers on pair trawlers to mitigate bycatch outside of the periods of closure.

Given the low observation rates in several métiers of concern, ICES reiterates the issues of data quality, representivity and coverage. ICES recommends enhanced monitoring to assess the effectiveness of management measures (including pinger use) and to augment precision in bycatch mortality estimates of common dolphin.

Request

DGMARE Special request to ICES:

Concerning common dolphin in the Bay of Biscay, ICES is requested to:

- *evaluate whether the scenarios described in the ICES advice of 26 May 2020[*] are still valid taking into account the data from 2019-2021.*
- *update the scenarios taking the most recent data of 2019-2021 into account, including the updated total effort. This updating should include any results of current mitigation trials, to the extent that ICES considers these reliable. At-sea monitoring data and strandings based estimates should be included in this work, where possible. The same thresholds, as developed at WKEMBYC 2020 and reflected in the ICES advice of 26 May 2020, should be used.*

The latest ICES advice of 26.5.2020 on dolphins in the Bay of Biscay is limited to an analysis of data reported by Member States until 2018, while the Commission would require an analysis of more recent data.

Elaboration on the advice

Common dolphin in the Bay of Biscay

Common dolphins in the Northeast Atlantic are considered a single panmictic population that ranges from Northwest Africa to Norway and west at least to the Mid-Atlantic ridge. Abundance estimates rely largely upon the SCANS surveys of July 2005 (supplemented by an offshore CODA survey in July 2007), and July 2016 (with abundance estimates from the latest one [SCANS-IV] in summer 2022 not yet being available [ICES, 2022]). Large-scale and regional surveys indicate strong movements within the species' range both seasonally and from year to year. The surveyed area is smaller than the assessment unit for this species (Figure 1); therefore, the overall size of the eastern North Atlantic population remains unknown. A total estimate of common dolphins, focused largely upon shelf seas, from the 2016 surveys of 634 286

[*] ICES. 2020. EU request on emergency measures to prevent bycatch of common dolphin (*Delphinus delphis*) and Baltic Proper harbour porpoise (*Phocoena phocoena*) in the Northeast Atlantic. *In* Report of the ICES Advisory Committee, 2020. ICES Advice 2020, sr.2020.04. https://doi.org/10.17895/ices.advice.6023

(95% CI: 352 227–1 142 213) was used by ICES to estimate potential biological removal (PBR) in the scenario evaluations in 2020 (ICES, 2020a).

The focus of mitigation measures has been on the Bay of Biscay and Iberian Coast ecoregion because that is where common dolphins are most abundant and bycatch appears to be greatest. The species, however, also occurs beyond this ecoregion, where it is subject to bycatch that has not been fully quantified. Therefore, because the PBR calculation is for the whole managmenet area, it should be considered that the bycatch estimate for the Bay of Biscay and Iberian Coast is an underestimation of the total bycatch when comparing with PBR objectives. This advice includes the divisions 8.a–d and 9.a, although it is noted that the species occurs beyond these areas, including the adjacent divisions 6.a–b, 7.a–e, g–h, and j–k, 8.e, 9.b, 10, and 12 (Figure 1)

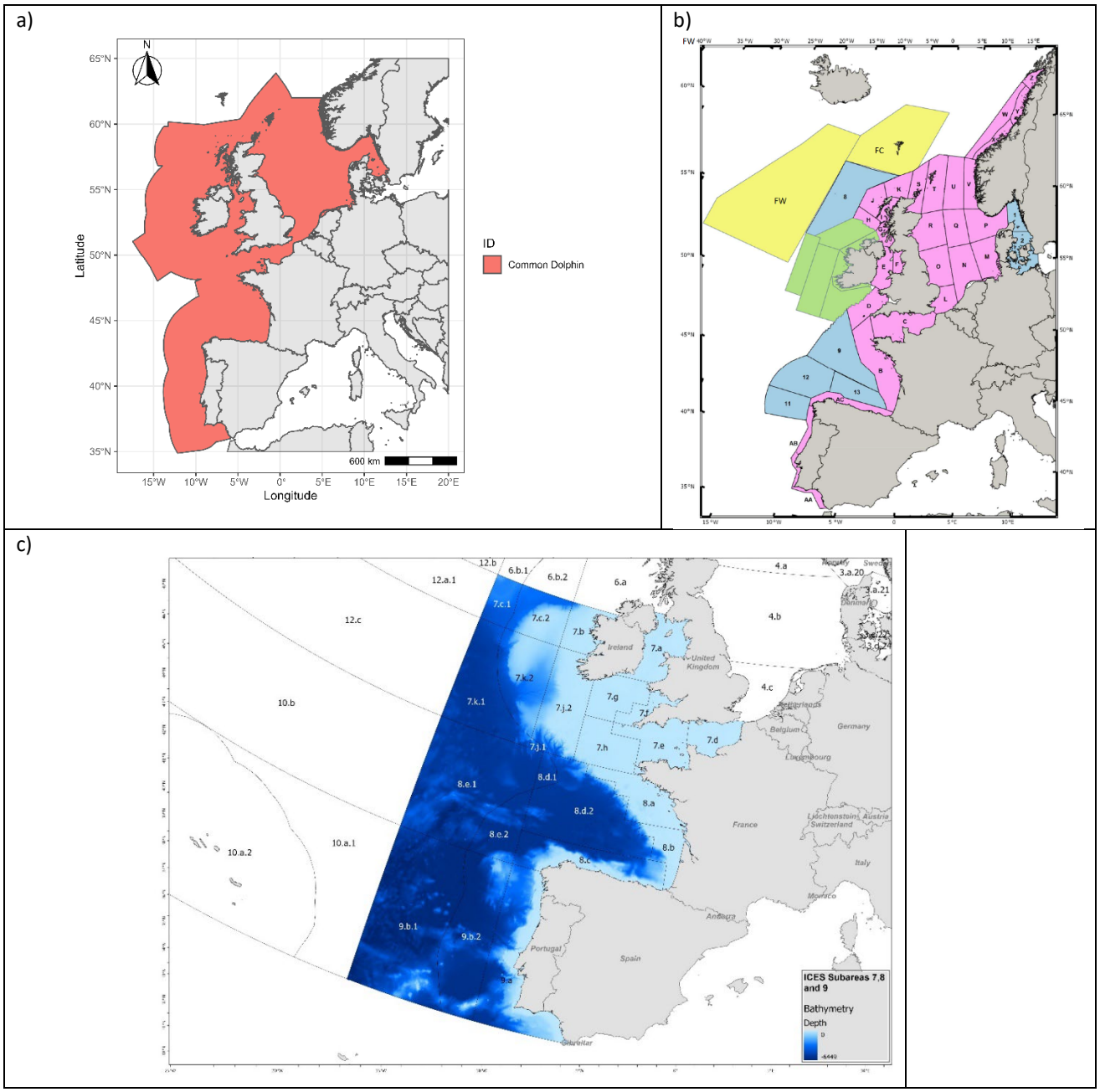

Figure 1 Maps showing a) the common dolphin assessment unit (Source: ICES, 2021); b) SCANS-III & Irish ObSERVE Survey Area upon which abundance estimate is based (Source: Hammond *et al.*, 2021); c) ICES areas 7, 8, and 9 with depth contours.

The efficacy of the mitigation scenarios included in the 2020 ICES advice on common dolphins in the Bay of Biscay (ICES, 2020a) were reassessed. Scenarios and methods remained unchanged, to ensure comparability between both

evaluations. As in 2020, ICES used the potential biological removal (PBR) algorithm to estimate the level of anthropogenic mortality that should allow the population to be maintained at or above 50% of the carrying capacity 95% of the time. This was used as a quantitative interpretation for a potential management objective that could satisfy the aims of ensuring the "long-term viability" (EU, 2017) of the population and as a means to measure the limit to mortality that might threaten the conservation status of the species (EU, 2019). Given the uncertainties around the bycatch estimates and common dolphin abundance data, ICES also used four alternative limits for anthropogenic mortality: less than 75% of PBR, less than 50% of PBR, less than 20% of PBR, and less than 10% of PBR. Less than 20% of PBR was calculated that equates to the mPBR (modified PBR) which was recently developed and agreed by OSPAR (OSPAR, 2021). Reducing bycatch to less than 10% of PBR was used as a quantitative interpretation of what "minimise and where possible eliminate" bycatch (EU, 2019) might mean, while acknowledging that this may be insufficient to meet the requirements of strict protection under Council Directive 92/43/EEC (EU, 1992). The development of these potential management objectives was necessary to enable a quantitative interpretation of the EU legislation, but the objectives may be insufficient to meet the legislative requirements.

It is important to note that the reduction of fishing effort for métiers of concern implied by the various scenarios is not redistributed or displaced within the assessment unit either spatially or temporally. Furthermore, ICES has not evaluated the consequences of the large reductions in fishing effort for some fleets fishing in ICES Subarea 8 and Division 9.a implied by all scenarios, neither in terms of potential effort redistribution towards other gears nor in terms of socio-economic impacts.

The use of pingers has been mandatory for French PTM/OTM/PTB vessels > 12 m in the first four months of the year since 2020 (Arrêté du 26 Décembre 2019[†]) and year-round for all French PTM/OTM/PTB since 2021 (Arrêté du 27 Novembre 2020[‡]) in ICES divisions 8a-d. Since 2020 the use of pingers has been mandatory for all Spanish trawlers while operating in ICES Subarea 8 and the northern part of Division 9.a (Orden APA/1200/2020)[§]. All the explored bycath mitigation scenarios assume full compliance with pinger use on all mentioned métiers and correct use of pingers in all cases. As a result, no additional pinger related reduction in bycatch rates were applied to these métiers. Scenarios combining temporal closures and pinger use will therefore result in identical bycatch estimates as those scenarios considering temporal closures only in a number of cases (scenarios A/M, C/L, D/H, and O/N).

Fifteen mitigation scenarios (A to O; Table 1) were explored to identify mitigation measures for each of the five management objectives described above (Table 2).

a) None of the scenarios explored reduce the annual common dolphin mortality below **10% of the PBR** for mortality estimates derived from either observers at sea or strandings (Table 1).

b) None of the scenarios explored reduce the annual common dolphin mortality below **20% of the PBR** (mPBR) for mortality estimates derived from both observers at sea and strandings.

   To reduce annual common dolphin mortality to **below 20% of PBR** for mortality estimates derived from observers at sea only, the following measure should meet this objective (Table 1):

   - Scenario O (three-month closure [Jan–Mar] + one month [mid Jul–mid-Aug] all métiers) and scenario N (scenario O + pinger PTM/PTB rest of year).

[†] Arrêté du 26 décembre 2019 portant obligation d'équipement de dispositifs de dissuasion acoustique pour les chaluts pélagiques dans le golfe de Gascogne. NOR : AGRM1928574A. JORF n°0302 du 29 décembre 2019. Texte n° 98. https://www.legifrance.gouv.fr/jorf/id/JORFTEXT000039686029 *in French*

[‡] Arrêté du 27 novembre 2020 portant modification de l'arrêté du 26 décembre 2019 portant obligation d'équipement de dispositifs de dissuasion acoustique pour les chaluts pélagiques dans le golfe de Gascogne. NOR: MERM2033160A. JORF n°0292 du 3 décembre 2020. Texte n° 54. https://www.legifrance.gouv.fr/jorf/id/JORFTEXT000042602319 *in French*

[§] Orden APA/1200/2020, de 16 de diciembre, por la que se establecen medidas de mitigación y mejora del conocimiento científico para reducir las capturas accidentales de cetáceos durante las actividades pesqueras. Orden APA/1200/2020. https://www.boe.es/eli/es/o/2020/12/16/apa1200 *in Spanish*

c) To reduce annual common dolphin mortality to less than **50% of PBR** for mortality estimates derived from both observers at sea and strandings, the following measures should meet this objective (Table 1):
   - The above scenario (including estimates based on either observers at sea or strandings only)
   - Scenario A (four-month closure [Dec–Mar] all métiers) and scenario M (scenario A + pinger PTM/PTB rest of year).

   To reduce annual common dolphin mortality to less than **50% of PBR,** for mortality estimates derived from observers at sea only, the following measure should also meet this objective (Table 1):
   1. Scenario C (two-month closure [mid-Jan–mid-Mar] all métiers and scenario L (scenario C + pinger PTM/PTB rest of year).

d) To reduce annual common dolphin mortality to less than **75% of the PBR**, for mortality estimates derived from both observers at sea and strandings, the following measures should meet this objective (Table 1):
   - All above scenarios (including estimates based on either observers at sea or strandings only)

   To reduce annual common dolphin mortality to less than **75% of the PBR**, for mortality estimates derived from observers at sea only, the following measures should also meet this objective (Table 1):
   - Scenario D (six-week closure [mid-Jan–end of Feb] all métiers) and scenario H (scenario D + pinger PTM/PTB rest of year)
   - Scenario G (pinger PTM/PTB all years and same six-week closure all other métiers)
   - Scenario B (annual effort reduction of 40% all métiers).

e) To reduce annual common dolphin mortality to **less than PBR**, for mortality estimates derived from both observers at sea and strandings, the following measures should meet this objective (Table 1):
   - All above scenarios, with the exception of scenarios G and B.

   To reduce annual common dolphin mortality to **less than PBR**, for mortality estimates derived from observers at sea only, the following measures should also meet this objective (Table 1):
   - All above scenarios
   - Scenario E (four-week closure [mid-Jan–mid-Feb] all métiers)
   - Scenario I (pinger PTM/PTB all year and same four-week closure all other métiers).

The main risk associated with these objectives/measures is that they may not take sufficient account of the uncertainty around bycatch estimates, i.e bycatch estimates are assumed accurate and the wide confidence intervals around estimates (Table 3) are not taken into account. The success of these measures is dependent on fishing effort being reduced and not redistributed and is sensitive to the uncertainties around bycatch estimates (all scenarios), the timing of the peak dolphin mortality (scenarios D/H, G, E, and I), and enforcement of correct pinger use being in place (all scenarios).

Table 1 Scenarios used to assess possible bycatch reduction measures for the common dolphin in the Bay of Biscay and Iberian Coast. Métiers of concern are those with recorded bycatch of common dolphins in ICES databases.

Scenario	Description	Explanation
A	Four-month closure (December–March) – all métiers	Four-month closure from December to March of all métiers of concern
B	Annual effort reduction of 40% – all métiers	Flat annual 40% reduction in total effort for métiers of concern, does not consider strandings patterns
C	Two-month closure (mid-January–mid-March) – all métiers	Two-month closure of all métiers of concern determined, using the % mortality in the peak period based on strandings
D	Six-week closure (mid-January–end of February) – all métiers	Six-week closure of all métiers of concern determined, using the % mortality in that peak period based on strandings
E	Four-week closure (mid-January–mid-February) – all métiers	Four-week closure of all métiers of concern determined, using the % mortality in that peak period based on strandings
F	Two-week closure (mid-January–end of January) – all métiers	Two-week closure of all métiers of concern determined, using the % mortality in that peak period based on strandings

Scenario	Description	Explanation
G	Pinger all PTM/PTB all year and same six-week closure all other métiers	PTM/PTB to use pingers all year + a six-week closure of all other métiers of concern determined, using the % mortality in that peak period based on strandings
H	6-week closure (mid-January to end of February) all métiers (including PTM/PTB) and pinger PTM/PTB for the rest of the year	Six-week closure of all métiers of concern determined, using the % mortality in that peak period based on strandings + PTM/PTB to use pingers during the rest of the year
I	Pinger all PTM/PTB all year and same 4-week closure all other métiers	PTM/PTB to use pingers all year + a four-week closure of all other métiers of concern determined, using the % mortality in that peak period based on strandings
J	Pinger all PTM/PTB all year and same 2-week closure all other métiers	PTM/PTB to use pingers all year + a two-week closure of all other métiers of concern determined, using the % mortality in that peak period based on strandings
K	Pinger all PTM/PTB all year	PTM/PTB to use pingers all year, no other measures introduced
L	Two-month closure all (mid-January to mid-March) + pingers	Two-month closure for all fleets + pingers on PTM/PTB for the rest of the year
M	Four-month closure all (mid-January to mid-March) + pingers	Four-month closure for all fleets + pingers on PTM/PTB for the rest of the year
N	Four-month closure (three in winter + one in summer) + pingers	Closure for three months in winter (January–March) and one month in summer (mid-July–mid-August) for all fleets + pingers on PTB/PTM for the rest of the year
O	Four-month closure (three in winter + one in summer)	Closure for three months in winter (January–March) and one month in summer (mid-July–mid-August) for all fleets

Table 2 Proposed scenarios for the four tested management objectives, expected outcomes, and evaluation of associated risks for the common dolphin in ICES Subarea 8 and Division 9.a. For further information on performance of scenarios, see Table 4. None of the scenarios explored reduced the annual common dolphin mortality below 10% of the PBR for mortality estimates derived from either observers at sea or strandings and so they are not included in this table.

Scenarios that meet the objective	Expected outcomes	Relative risk of not achieving the objective	Comment on the scenario risk
Management objective: < 20% PBR(mPBR)			
O and N. O: three-month (Jan–Mar) and one-month (mid-Jul–mid-Aug) closure all métiers; and N: O + pingers on PTM and PTB gears for the rest of the year	Bycatch reduction: 88% Efficiency score: 2.6	Medium	Risk around the timing of the shorter second closure. This approach enables the pinger trials already begun in the French PTM and Spanish PTB fleet to continue to verify effectiveness. Monitorng data provide estimates below 20% of PBR, whereas strandings provide estimates just above 20% of PBR.
Management objective:< 50% of PBR			
C and L. C: two-month closure (mid-Jan–mid-Mar) of all métiers; and L: C+ pingers on PTB and PTM gears for the rest of the year	Bycatch reduction : 66% Efficiency score : 4	Very high	Longer-term closure that would cover the peak mortality. This approach enables the pinger trials already begun in the French PTM fleet and Spanish PTB fleet to continue to verify effectiveness. Bycatch inferred from strandings remains above 50% of PBR.

Scenarios that meet the objective	Expected outcomes	Relative risk of not achieving the objective	Comment on the scenario risk
A and M. A: four-month closure all métiers (Dec–end of Mar); and M: A + pingers on PTM/PTB gears for the rest of the year	Bycatch reduction: 80% Efficiency score: 2.4	Low	Long-term closure that would cover the peak mortality. This approach enables the pinger trials already begun in the French PTM and Spanish PTB fleet to continue to verify effectiveness.
Management objective:< 75% of PBR			
G.-Pinger PTM/PTB all year and six-week closure of all other métiers of concern (mid-Jan–end of Feb)	Bycatch reduction: 43% Efficiency score: 3.9	Very high	Closure achieves greater proportion of the bycatch reduction than use of pingers, and a six-week closure is more likely to capture the peak in mortalities. This approach enables the pinger trials already begun in the French PTM fleet and Spanish PTB fleet to continue to verify effectiveness. High risk of not achieving the objective, reached only with estimates of mortality based on observers at sea. Bycatch inferred from strandings remain above PBR.
B. Annual fishing effort reduction of 40% in métiers of concern	Bycatch reduction: 40% Efficiency score: 1	High	Does not rely on pinger deployment. Lost the opportunity to continue pinger trials already begun in French PTM and Spanish PTB fleet to continue to verify effectiveness. High risk of not achieving the objective, reached only with estimates of mortality based on observers at sea. Bycatch inferred from strandings remains above PBR.
D and H. D: six-week closure (mid-Jan–end of Feb.) of all métiers; and H: D+ pingers on PTB and PTM gears for the rest of the year	Bycatch reduction: 54% Efficiency score: 4.5	Medium	Closure achieves greater proportion of the bycatch reduction than use of pingers, and a six-week closure is more likely to capture the peak in mortalities. This approach enables the pinger trials already begun in the French PTM fleet and Spanish PTB fleet to continue to verify effectiveness.
Management objective: PBR			
E. Four-week closure of all métiers (mid-Jan–mid-Feb)	Bycatch reduction: 34% Efficiency score: 4.4	Very high	Four-week closure is still relatively short and could miss the peak in mortalities. Does not rely on pinger deployment. High risk of not achieving the objective, reached only with estimates of mortality based on observers at sea. Bycatch inferred from strandings remain above PBR.
I. Pinger PTM/PTB year-round and four-week closure of all other métiers of concern (mid-Jan–mid-Feb)	Bycatch reduction: 27% Efficiency score: 3.7	Very high	Closure achieves greater proportion of the bycatch reduction than use of pingers, but four-week closure is still relatively short and could miss the peak in mortalities. This approach enables the pinger trials already begun in the French PTM fleet and Spanish PTB fleet to continue to verify effectiveness. High risk of not achieving the objective, reached only with estimates of mortality based on observers at sea. Bycatch inferred from strandings remain above PBR.

Recommendations

Relevant EU regulations (i.e. Habitats Directive, MSFD, and EU Technical regulations for Fisheries) require to minimizing and where possible eliminating bycatch of common dolphin. EU legislation requires that bycatch of marine mammals should not exceed pre-determined levels (EU, 2019). ICES notes that robust methods for setting limits for bycatch of protected species already exist (ICES, 2013, 2014), but quantitative conservation objectives are not yet well-defined. ICES reiterates its previous advice that it is willing to assist EU competent authorities in establishing quantitative conservation or management objectives, involving both managers and scientists.

ICES recommends an adaptive management approach with enhanced monitoring of seasonal common dolphin abundance and bycatch in fisheries. Sequential implementation of progressively more constraining management measures (in terms

of effort reduction) over a five-year period could be used to achieve the management objectives proposed by ICES (e.g., bycatch reduction below 50% of PBR within a six-month period, and below 10% of PBR in five years from now). The proposed time period would allow for the development and implementation of fishing gears that have a low bycatch risk to cetaceans and other protected, endangered, and threatened species (PETS). This would be akin to the approach taken for management of "strategic stocks" within the US Marine Mammal Protection Act (US Government, 2017).

ICES still considers that temporal closures in Subarea 8 and Division 9.a in métiers of concern (Table 4) are likely to be the most effective management measures for reducing bycatch mortality in the short term. ICES notes that the performance of the proposed technical management measures (i.e. pingers) is conditional upon the pingers performing optimally in both PTM and PTB gears. There is presently limited, but promising, evidence of the effectiveness of pingers in mitigating common dolphin bycatch; preliminary trials carried out to assess the effectiveness of the Dolphin Deterrent Device (DDD) pinger in French PTM resulted in a 65% reduction in the bycatch rate (Rimaud *et al*., 2019). The DDD-03 pinger was reported to be highly effective at reducing common dolphin bycatch in the UK bass pair-trawl fishery – though it was noted that a fully controlled experimental trial was not undertaken and pingers were used voluntarily by vessels (Northridge *et al*., 2011). ICES also strongly recommends ongoing data acquisition and field trials to reliably assess the efficiency of the proposed technical mitigation measures in reducing common dolphin bycatch and refers here to the French large-scale experiment in the Bay of Biscay on the application of new mitigation devices and to enforce monitoring by the use of onboard cameras[**††]. ICES also recommends compliance monitoring of pinger use (both voluntary and mandatory).

Enhanced monitoring is required to assess the effectiveness of proposed management measures and augment precision in population abundance, seasonal distribution, and bycatch mortality estimates. More complete monitoring should be implemented throughout the range of the species in the Northeast Atlantic (ICES subareas 6–9) to achieve representative coverage of the métiers of concern. Where technical measures are used, at-sea control systems should be implemented to check if pingers are adequately deployed and operational. Regional-scale (e.g. Bay of Biscay) abundance surveys should also be carried out on a seasonal basis to monitor short-term changes in distribution and density of common dolphins, which will also help assess the continued appropriateness of the proposed management measures in time. ICES recommends to maintain or reinforce existing national stranding networks in the Northeast Atlantic common dolphin range, and encourage cooperation to fulfil analyses and data collection to further evaluate life history parameters and the impacts of other threats on the population, as well as tagging experiments of dolphin carcasses to refine key parameters for estimating bycatch mortality from stranding data at a broader scale.

Basis of the advice

PBR bycatch limit calculations

ICES has evaluated bycatch of common dolphins against PBR (Wade, 1998) and four alternative limits for anthropogenic mortality: less than 75% of PBR, less than 50% of PBR, less than 20% of PBR, and less than 10% of PBR. The additional alternative limit for anthropogenic mortality management included in the current advice (20% of PBR) compared with the previous advice (ICES, 2020a) equates to the mPBR (modified PBR), recently developed and agreed by OSPAR (OSPAR, 2021).

Testing of bycatch reduction scenarios

ICES used the estimates of common dolphin bycatch mortality from at-sea monitoring and strandings to explore a range of mitigation scenarios. Different temporal fisheries closures for the metiers of concern , year-round total fishing effort

[**] Arrêté du 29 décembre 2022 relatif à l'amélioration de la collecte de données sur les captures accidentelles d'espèces protégées et à l'expérimentation de dispositifs techniques de réduction des captures accidentelles de dauphin commun à bord de navires de pêche sous pavillon français. NOR : PRMM2237098A. JORF n°0303 du 31 décembre 2022. Texte n° 10. https://www.legifrance.gouv.fr/eli/arrete/2022/12/29/PRMM2237098A/jo/texte *in French.*

[††] Arrêté du 27 décembre 2022 relatif à l'obligation de participer à un programme d'observation embarquée des navires de pêche de plus de quinze mètres sous pavillon français. NOR : PRMM2237097A. JORF n°0302 du 30 décembre 2022. Texte n° 3. https://www.legifrance.gouv.fr/eli/arrete/2022/12/27/PRMM2237097A/jo/texte *in French.*

reductions for the same métiers, technical mitigation approaches (in this case, pingers) and combinations of temporal closures and use of pingers were investigated. ICES considers that mitigation and/or closures applied to all fisheries of concern would be a more equitable and reliable method of achieving bycatch reduction.

Having established the current anthropogenic mortality limit as 4927 common dolphins for the Northeast Atlantic assessment unit using the PBR approach (ICES, 2020a), and based on the considerations above and without prejudice to all applicable requirements under EU law and methodologies to be established in relation to those requirements, four quantitative management objectives were proposed, against which reduction in bycatch mortality achieved under each of the "emergency measures scenarios" could be tested. Monitoring data were available for ICES Subarea 8 and Division 9.a, and the scenarios were tested for these areas. The overall bycatch mortality obtained from strandings for 2019–2021 could be underestimated, as only strandings collected along French coasts (Subarea 8, and Division 7.e) were used for bycatch estimates, highlighting mainly mortality in ICES divisions 8.a–c.

Tested management objective 1: reduce bycatch to PBR

The objective is to reduce bycatch to PBR, which should ensure that the population is at 50% of carrying capacity (K) 95% of the time over the long term. This is one interpretation of "long-term viability" (EU, 2017) of the population and a means to measure the limit to mortality that might threaten the conservation status of the species (EU, 2019). This management objective results in an annual anthropogenic mortality limit of 4927 common dolphins for the Northeast Atlantic management unit.

Tested management objective 2: reduce bycatch to < 75% of PBR

Given the high levels of uncertainty around the the abundance estimate used in the PBR calculation and the bycatch estimates, a "precautionary approach" was taken and the objective of achieving levels of bycatch that are below 75% of the PBR was tested. This management objective results in an annual anthropogenic mortality limit of 3695 common dolphins for the Northeast Atlantic management unit.

Tested management objective 3: reduce bycatch to < 50% of PBR

This potential management objective applies a greater level of precaution that potential management objective 2 and aims to restrict levels of bycatch to below 50% of the PBR. This management objective results in an annual anthropogenic mortality limit of 2464 common dolphins for the Northeast Atlantic management unit.

Tested management objective 4: reduce bycatch to < 20% of PBR

This potential management objective applies a greater level of precaution that potential manamgent objective 3 and aims to restrict levels of bycatch to below 20% of the PBR. This is also equivalent to the mPBR level developed and adopted by OSPAR. This management objective results in an annual anthropogenic mortality limit of 985 common dolphins for the Northeast Atlantic management unit.

Tested management objective 5: reduce bycatch to < 10% of PBR

This potential management objective aims to provide an interpretation of what "minimise and where possible eliminate" might mean in the context of bycatch reduction. This objective currently results in an annual anthropogenic mortality limit of 493 common dolphins for the Northeast Atlantic management unit.

Bycatch estimates derived from monitoring programmes and from strandings data correspond to consolidated datasets from the years 2019–2021. To determine bycatch levels associated with each scenario, fishing effort data from ICES Regional Database (RDB) or ICES WGBYC database depending on the quality of the data available (for details see ICES [2023]), as well as bycatch rates obtained from observer programmes, were used to determine annual bycatch removal by the following métiers: PTM_DEF, PTM_SPF, PTB_DEF/MPD, GTR_DEF, OTM_DEF, OTB_DEF, PS_SPF, GNS_DEF, GTR_DEF, and LLS_DEF (in ICES Subarea 8 and Division 9.a). Métier-specific bycatch rates (individuals/day-at-sea fished) were derived for the observer monitoring data, pooled over 2019–2021 and divisions 8.a–d and 9.a. To estimate 95% confidence intervals around the bycatch rate, the Poisson distribution was assumed, and confidence intervals were estimated with bootstrapping. The bycatch rate was then raised to annual bycatch estimates, using an annual average of the available métier-specific fishing effort for 2019–2021 (Table 3). Due to the insufficient temporal resolution of the observer data from bycatch monitoring, the temporal pattern of bycatch mortality obtained from the strandings data along the French coast (ICES Subarea 8, and Division 7.e) was used to allocate the total bycatch derived from monitoring

programmes to fortnights. As strandings data cannot currently provide métier information on bycatch, the bycatch estimates derived from monitoring programmes for each métier were used to proportionally allocate the total bycatch derived for strandings to individual métiers. The joint use of these datasets enabled fine-scale temporal and métier-specific bycatch estimates to be derived for both methods. Finally, the efficiency of each tested scenario was evaluated for bycatch estimates derived from both monitoring and strandings data (Table 4). The two series of métier-specific bycatch estimates were seen as two views of the same phenomenon and were considered, within their uncertainty range, to contain the true bycatch level.

Although the bycatch was estimated within the current analysis for ICES Subarea 8 and Division 9.a – which represents the majority of the total (current) bycatch in the management unit – this bycatch is considered an underestimate of the total bycatch across the entire management unit (NE Atlantic). ICES considers that management objectives (< 75% or < 50% of PRB) could take this bycatch underestimation into consideration.

The bycatch reduction rate was calculated for each scenario, as was the fishing effort reduction rate. An efficiency score for each scenario was obtained by dividing the bycatch reduction rate with the effort reduction rate (Table 4). This efficiency score could be seen as a rough cost-effectiveness index for each scenario, considering that a reduction of effort would incur a cost for the industry (ICES, 2020b, 2023).

Table 3 Comparison of common dolphin bycatch rates and estimates by métier in the Bay of Biscay and Iberian Coast between data collated for 2016–2018 (ICES, 2020b) and 2019–2021 (ICES, 2023) based on observer data. DaS = days-at-sea; fishing eff. = fishing effort (as DaS); DaS observed = monitoring effort; % cov. = % monitoring coverage (monitoring effort/fishing effort); no. spec = number of specimens observed; bycatch rate = animals/days-at-sea observed; bycatch est. = bycatch estimate. L95% CI and U95% CI = lower and upper confidence intervals. No values were provided for the 2016–2018 period for LLS_DEF, OTB_DEF and PTM_SPF, as either no monitoring or no bycatch were reported for those métiers in that time period. See https://vocab.ices.dk/?ref=1498 for a description of the métiers (métier Level 4, L4) and https://vocab.ices.dk/?ref=1499 for the description of targeted species assemblages (métier level 5, L5).

	Métier level	Métier									
	L4	GNS	GTR	LLS	OTB	OTM	PS	PTB	PTM	PTM	PTM
	L5	DEF	DEF	DEF	DEF	DEF	SPF	DEF/ MPD	DEF	SPF	LPF
2016–2018	Fishing eff. (DaS)	36836	58365			243	35564	5195	682		510
	DaS observed	536.84	339.74			0.82	334.5	67	167.17		65.16
	% cov	1.5%	0.6%			0.3%	0.9%	1.3%	24.5%		12.8%
	No. spec	2	12			1	2	10	118		1
2019–2021	Fishing eff. (DaS)	75428	162389	51196	26049	312	67890	4725	663	911	1209
	DaS observed	2103.36	970.13	186.04	508.23	0.75	626.5	465.61	344.09	47.56	265.04
	% cov	2.8%	0.6%	0.4%	2.0%	0.2%	0.9%	9.9%	51.9%	5.2%	21.9%
	No. spec	16	13	1	2	1	11	71	36	21	0
2016–2018	L95% CI	0	0.021			0	0	0.075	0.706		0
	Bycatch rate	**0.004**	**0.035**			**1.22**	**0.006**	**0.149**	**0.598**		**0.015**
	U95% CI	0.009	0.053			3.67	0.015	0.224	0.813		0.046
2019–2021	L95% CI	0.005	0.007	0	0	0	0.010	0.125	0.076	0.294	0
	Bycatch rate	**0.008**	**0.013**	**0.005**	**0.004**	**1.333**	**0.018**	**0.154**	**0.105**	**0.442**	**0**
	U95% CI	0.011	0.020	0.016	0.01	4	0.027	0.185	0.134	0.610	0
2016–2018	L95% CI	0	1203			0	0	388	408		0
	Bycatch est.	**137**	**2061**			**297**	**213**	**775**	**481**		**8**
	U95% CI	343	3092			890	532	1163	555		23
2019–2021	L95% CI	359	1172	0	0	0	650	582	50	268	0
	Bycatch est.	**574**	**2176**	**275**	**103**	**416**	**1192**	**731**	**69**	**402**	**0**
	U95% CI	825	3180	826	256	1248	1842	879	89	555	0
Change in fishing effort		105%	178%			28%	91%	−9%	−3%		137%
Change in observer coverage		91%	3%			−35%	−2%	664%	112%		72%
Change in bycatch rate		100%	−63%			9%	200%	3%	−82%		−100%
Change in bycatch estimate		319%	6%			40%	460%	−6%	−86%		−100%

Overall bycatch estimates were higher for years 2019–2021[‡‡] (9040 [95% CI 6640–13 300] based on strandings, and 5938 [95% CI 3081–9700] based on observer data [ICES, 2023]) than for years 2016–2018 (6620 [4411–10 827] based on strandings, and 3973 [1998–6598] based on observer data [ICES, 2020a]). This increase in bycatch estimates is likely partly due to a considerable increase in reported fishing effort for the métiers GNS_DEF, GTR_DEF, and PS_SPF, as well as increased monitoring for the métiers GNS, GTR, LLS, OTB, PS, PTB, PTM_DEF, PTM_SPF, and PTM_LPF. The change in fishing effort is primarily due to more accurate assignment of effort to different métiers during the data submission process. This improved data enabled ICES to further explore data using a more detailed stratification approach that considers finer spatial and temporal scales (see Additional Information section and ICES [2023]).

A relatively low bycatch rate was observed in GNS_DEF for both periods (period 1: 95% CI 0-0.01; period 2: 95% CI 0.01-0.01), but the increased fishing effort in the second period resulted in a significantly higher bycatch estimate. During the second period, bycatch rates in métier GTR_DEF decreased (period 1: 95% CI 0.02–0.05, period 2: 95% CI 0.01–0.02). However, a significant increase in fishing effort resulted in similar bycatch over the two periods. The estimate of 1192 (95% CI 650–1842) common dolphins bycaught in PS_SPF makes a significant contribution to the total mortality in the ecoregion and is an increase when compared with the 2016–2018 estimates (213 common dolphins, 95% CI 0–532), most likely due to increased fishing effort reported. The data from the second period show that there has been a significant decline in the number of bycaught common dolphins in PTM-DEF (period 1: 481, 95% CI 408–555, period 2: 69, 95% CI 50–89). The fishing effort for this latter metier is comparable between the two time periods and the reduction in observed bycatches is driving the significantly lower estimate of bycatch mortality

[‡‡] Version 2: time period corrected

Table 4 Information on the tested scenarios and synthesis of their performance over all métiers with registered common dolphin bycatch in the Bay of Biscay and Iberian Coast 2019–2021. For all scenarios, key information is given in the scenario title, total bycatch mortality as of monitoring programmes, total bycatch mortality as of stranding data, bycatch reduction obtained, effort reduction implied, and efficiency score. The efficiency score of each scenario is the bycatch reduction rate divided by the effort reduction rate. This efficiency could be considered as a rough cost effectiveness for each scenario considering that a reduction effort is a cost for the industry (see main text for further detail). Bycatch values are in number of individuals. A colour code indicating how each scenario reaches the different management objectives is presented below the table. All scenarios assume full compliance with pinger use on all PT métiers since 2019 and correct use of pingers in all cases. As a result, no additional reduction in bycatch rates was applied to these métiers. Scenarios combining temporal closures and pinger use will therefore result in identical bycatch estimates as those scenarios considering temporal closures only in a number of cases (scenarios A/M, C/L, D/H, and O/N). All scenarios were retained in the table for consistency with the earlier report (Table 8 in ICES, 2020a) and for ease of comparison.

Scenario	Basis	Total resulting bycatch - monitoring mortality	Total resulting bycatch - strandings mortality	Bycatch reduction obtained	Effort reduction needed	Efficiency score
A/M	Four-month closure (Dec–Mar) all métiers + pinger PTM/PTB rest of year	1188	1808	0.80	0.33	2.4
B	Annual effort reduction of 40% all métiers	3563	5424	0.40	0.40	1.0
C/L	Two-month closure (mid-Jan–mid-Mar) all métiers + pinger PTB/PTM rest of year	2019	3074	0.66	0.17	4.0
D/H	Six-week closure (mid-Jan–end-Feb) all métiers + all métiers and pinger PTM/PTB rest of year	2731	4158	0.54	0.12	4.7
E	Four-week closure (mid-Jan–mid-Feb) all métiers	3919	5966	0.34	0.08	4.4
F	Two-week closure (mid-Jan–end-Jan) all métiers	4869	7413	0.18	0.04	4.7
G	Pinger PTM/PTB all year & same six-week closure all other métiers	3381	5147	0.43	0.11	3.9
I	Pinger PTM/PTB all year and same four-week closure all other métiers	4328	6589	0.27	0.07	3.7
J	Pinger PTM/PTB all year and same two-week closure all other métiers	5085	7742	0.14	0.04	3.9
K	Pinger PTM/PTB all year	5938	9040	0.00	0.00	n/a
O/N	Three-month (Jan–Mar) + one-month (mid-Jul–mid-Aug) closure all métiers + pinger PTB/PTM rest of year	713	1085	0.88	0.33	2.6

% of PBR	< 10%	< 20%	< 50%	< 75%	< PBR	> PBR
Number bycatches	493	985	2464	3695	< 4927	> 4927

The scenario outcomes for the years 2019–2021 were similar to those for years 2016–2018 (ICES, 2020a). However, for the years 2019–2021, no scenario achieved an estimated mortality below 10% of PBR, as bycatch estimates were higher for this period, whereas at least two scenarios achieved this management objective for the years 2016–2018. In addition, for

the years 2019–2021, seven scenarios did not achieve the objective of reducing mortality below PBR, while only two did not achieve this management objective for the years 2016–2018.

Since the previous evaluation of data from the years 2016–2018, pinger use was implemented in all PTM and PTB fisheries in France and Spain. As a result, the benefits of all scenarios examined for the years 2019–2021 was reliant on the temporal closure components only. The increase of fishing effort between evaluation periods, most likely due to differences in reporting between submitting countries and years, may be at least partly responsible for the observed increase in bycatch estimates. Bycatch rates also differ between evaluation periods, with a decrease in bycatch rates in the PTM_DEF fishery, possibly due to the implementation of pingers in this métier. Changes in the spatial distribution of common dolphins, increased monitoring providing more reliable bycatch rates, or changes in behaviour of fishers and their fishing practices affecting bycatch may also have influenced the changes in the estimates between both evaluated periods and therefore affect the resulting efficiency of all scenarios, particularly those with two- to four-weeks closures.

Additional information

ICES notes that robust methods for setting limits for bycatch of protected species already exist (ICES, 2013, 2014) but that quantitative conservation objectives are not yet well-defined. The OSPAR Marine Mammal Expert Group (OMMEG) revisited the question using management strategy evaluation (MSE; e.g. Punt and Donovan, 2007; Punt, 2010; OSPAR, 2021). The OSPAR group (OSPAR, 2021) used the modified PBR (mPBR), which is the PBR control rule tuned to the following conservation objective: "a population should be able to recover to or be maintained at 80% of carrying capacity, with probability 0.8, within a 100-year period". A time horizon of 100 years was chosen to align with the recommendation of ICES (2013); and a probability level of 0.8 as adopted by ASCOBANS (2015). This resulted in a new bycatch threshold value of 985 common dolphins in the management unit (OSPAR, 2021).

The French project "Analyse de l'utilisation des PIngers à Cétacés pour les activités de pêche des chalutiers pélagiques et des fileyeurs" (PIC) aimed to test the efficiency of the DDD-03H on French vessels fishing with pelagic pair trawls (PTM; Rimaud *et al*., 2019). Two hundred and eighteen hauls, referred to as fishing operations (FOs) hereafter, on three pairs of trawlers alternating operations with and without DDD-03H pingers, were carried out by a combination of an observer and self-sampling by fishers. The study found that the use of pingers reduced common dolphin bycatch by 65% CI 95% ([15–98] Rimaud *et al*., 2019). Although few vessels were covered in one single fishing season (winter 2018) and only partial observation took place, including self-sampling, the study represents the best evidence available, because the project was finished and results, including statistical analyses, were published. Therefore, the efficiencies in bycatch reduction for this fleet as well as for the very similar operating vessels using bottom pair trawls (PTB) were used when calculating the scenarios for the advice in 2020 and for the current advice all scenarios assume full compliance with pinger use on all PT métiers.

Since 2019, most PTM vessels have voluntarily equipped themselves with pingers in winter. This equipment has been mandatory for French vessels > 12 m fishing with PTM/OTM/PTB in the first four months of the year since 2020 (Arrêté du 26 Décembre 2019[§§]) and year-round for all vessels fishing with PTM/OTM/PTB since 2021 (Arrêté du 27 Novembre 2020[***]). For both the French PTM fleet and other fleets equipped with pingers, it is unclear whether there was compliance monitoring to ensure they were fully functioning and deployed appropriately since in the past, this has hampered the effectiveness of pinger use in commercial fisheries.

There is currently high-level uncertainty associated with considering results from mitigation trials. ICES is aware of mitigation trials for netters that started in the Bay of Biscay in winter 2022 using two methods: pingers during net setting, and acoustic reflectors on nets. The power to detect mitigation efficiency was low, due to the small number of vessels involved in the trials. Therefore, these trials can be more considered as initial feasibility studies, and results are preliminary

[§§] Arrêté du 26 décembre 2019 portant obligation d'équipement de dispositifs de dissuasion acoustique pour les chaluts pélagiques dans le golfe de Gascogne. NOR : AGRM1928574A. JORF n°0302 du 29 décembre 2019. Texte n° 98. https://www.legifrance.gouv.fr/jorf/id/JORFTEXT000039686029 *in French*

[***] Arrêté du 27 novembre 2020 portant modification de l'arrêté du 26 décembre 2019 portant obligation d'équipement de dispositifs de dissuasion acoustique pour les chaluts pélagiques dans le golfe de Gascogne. NOR: MERM2033160A. JORF n°0292 du 3 décembre 2020. Texte n° 54. https://www.legifrance.gouv.fr/jorf/id/JORFTEXT000042602319 *in French*

to be considered in the current request. One of the objectives of the French project "LImitation des Captures Accidentelles de Dauphins cOmmuns dans le golfe de Gascogne" (LICADO) was to compare the efficiency of the pinger DDD-03H with a new pinger developed during the project with a new deterrent signal and enhanced battery life (CETASAVER). Four pairs of midwater trawlers were equipped with both pinger types in 2020 and 2021. A total of 165 fishing operations were monitored using DDD-03H and CETASAVER alternatively. During these trials, three bycatches of common dolphin were observed. The relative efficiency of the pingers could not be reliably determined due to the wide 95% confidence intervals obtained. It is therefore not possible to determine if there is a significant difference in efficiency between these two pingers, with the data currently available.

A large experiment programme has been launched by the French administration for 2023–2024[†††,‡‡‡] through which more than 200 netters in the Bay of Biscay must be equipped with one of the above mitigation devices. The efficiency of the devices will be estimate by observations on board, which are now mandatory for a large sample, and by CCTV for 100 of them.

Mitigation trials on purse-seine vessels were conducted within the Mar2020-iNOVPESCA project off the southern coast of the Algarve in Portugal (ICES, 2023). These trials were carried out during the years 2020 and 2021 in purse-seiners with most effort in the season that the fishery targets sardine (*Sardina pilchardus*) and to reduce bycatch of common dolphins that mostly feed on small pelagics and have sardine as main prey. DDD-03H pingers were tested in 518 hauls (228 control hauls and 233 using DDD-03H). Incidental captures of 38 common dolphins (80% released alive) were observed in control nets and none in nets using alarms.

In Spain during the period of 2021–2022 under the MITICET project, trials on board one pair of bottom trawlers were carried out to test the effectiveness of DDD-03H pingers to reduce common dolphin bycatch in the Bay of Biscay (ICES, 2023). The protocol for this study was an alternate haul experimental design (with and without pingers) to compare the incidental bycatch of dolphins. An electronic monitoring system (EMS) was used to document any cetacean bycatch on board in the total of the hauls. A statistically significant difference in the number of bycatch events was observed between the pingered and non-pingered hauls, indicating a reduction of more than 90% of common dolphin bycatch. The MITICET project continued in 2022, with the same experimental scheme, the only difference being that the pinger to be used in these trials will be of a different model. This new pinger is less powerful and the signal less intense so the acoustic impact on the environment is smaller, the battery life is much higher, and so it does not need to be recharged every two-three days – making its use in a commercial fishery much easier.

The results from these two pinger trial projects were not included in the scenarios because they are still ongoing and the results and analyses are not published yet.

Pinger trials have been undertaken on a variety of métiers: PTM, PTB, PS, and GNS. Only the first three métiers are considered in Table 5.

[†††] Arrêté du 29 décembre 2022 relatif à l'amélioration de la collecte de données sur les captures accidentelles d'espèces protégées et à l'expérimentation de dispositifs techniques de réduction des captures accidentelles de dauphin commun à bord de navires de pêche sous pavillon français. NOR : PRMM2237098A. JORF n°0303 du 31 décembre 2022. Texte n° 10. https://www.legifrance.gouv.fr/eli/arrete/2022/12/29/PRMM2237098A/jo/texte *in French*

[‡‡‡] Arrêté du 27 décembre 2022 relatif à l'obligation de participer à un programme d'observation embarquée des navires de pêche de plus de quinze mètres sous pavillon français. NOR : PRMM2237097A. JORF n°0302 du 30 décembre 2022. Texte n° 3. https://www.legifrance.gouv.fr/eli/arrete/2022/12/27/PRMM2237097A/jo/texte *in French*

Table 5 Summary of different mitigation trials and their characteristics carried out on midwater pair trawlers in France (PIC project), on purse-seiners in southern Portugal (iNOVPESCA project), and on bottom pair trawlers in Spain (Miticet project).

	PIC project	iNOVPESCA project	Miticet project
Métier	Midwater pair trawlers (PTM)	Purse-seiners (PS)	Bottom pair trawlers (PTB)
Country	France	Portugal	Spain
Area	Bay of Biscay (mainly ICES divisions 8.a–b)	Southern Portugal (Algarve)	Bay of Biscay (ICES divisions 8.b–c)
Year	2018 (winter)	2020–2021 (May to October)	2021 (spring) and 2022 (winter)
Pinger	DDD-03H	DDD-03H	DDD-03H
Vessels (n)	3 vessel pairs (20% of the fleet)	9 vessels (30% of the fleet)	1 vessel pair (7% of the fleet)
Protocol	1 FO with pinger/1 FO without pinger	1 FO with pinger/1 FO without pinger	1 FO with pinger/1 FO without pinger
Monitoring	1 observer and the rest self-sampling	Observers and self-sampling	Remote electronic monitoring
Fishing operations (FO)	134 without pinger/84 with pinger	228 without pinger/233 with pinger	244 without pinger/223 with pinger
Bycatch	55 dolphins in 19 FO without pinger 6 dolphins in 5 FO with pinger	38 dolphins in 15 FO without pinger no bycatch with pinger	25 dolphins in 14 FO without pinger 1 dolphins in 1 FO with pinger
Efficiency	Reduction of 65% (CI95% [15-98])	Close to 100%	95%
Used in scenarios	Yes, both in earlier (ICES, 2020a) and current advice. Also for PTB with the same efficiency of 65%	No. Results are promising but still preliminary.	No. Results are promising but still preliminary.
Source	Rimaud *et al*. (2019)	ICES (2023)	ICES (2023)

For evaluation of reported and ongoing pinger trials, it is important to include the specifications of all pinger types tested (DDD-03H, CETASAVER, DiD, etc) in different métiers: the names of the pingers, the pinger source level, the frequency and range, the métier used for testing, where on the gear the pingers were placed, the distance between pingers, whether one or more pingers were used, pinger battery life, ;pinger costs, and reference source (whether it is in a journal publication, report or pers. comm, peer-reviewed or otherwise, etc). For those projects that undertook both observer sampling and crew self-sampling, information is needed on what percentage of hauls had been monitored by observers and what percentage was self-sampled by fishers, as well as whether 'controls' were self-sampled. The number of controls vs. experimentals should be balanced. If they are not, then some consideration of this is required in the statistical analysis. A power analysis is also necessary to ensure sample sizes and observer coverage (either by observers or REM) are sufficient for statistical significance in determining the effectiveness of the mitigation measure applied.

Further exploration of scenarions and data

The bycatch estimates presented in this advice are at ICES ecoregion scale, meaning métier-specific bycatch rates calculated from monitoring data were extrapolated to the full fishing effort data for that métier across the whole ecoregion. In order to examine particular areas, métiers, and periods for evidence of elevated bycatch rates, ICES further explored available data using a more detailed stratification approach that considers finer spatial and temporal scales (ICES, 2023). For this analysis, data from three areas were considered: ICES divisions 8.a–b and 8.d (French coast and offshore Biscay), ICES divisions 8.c and 9.a (Spanish and Portuguese coasts), and ICES divisions 7.e–h and 7.j (Western English Channel and Celtic Seas) to include more of the common dolphin distribution area. Bycatch rates were calculated from at-sea monitoring data for each spatial (three areas described above), temporal (quarter) and métier level 5 combination, and were then extrapolated to the same strata using the same fishing effort dataset as used in the earlier analysis to produce more highly stratified bycatch estimates. Bycatch rates were calculated based on data pooled from 2017 to 2021, but only for those strata that had at least one common dolphin bycatch recorded. It is also important to note that particularly in divisions 8.c and 9.a there are very large fleets of small vessels (12 m or less) which, for the most part, are unmonitored and yet they carry gears that cause bycatch; this has been reported extensively in the literature but is not considered in this analysis.

The results of the analysis highlight the potential of this stratified methodology to identify métiers, areas, and quarters with higher bycatch rates. However, to achieve this, more representative bycatch sampling across all areas, métiers, and quarters is needed. With representative sampling this stratification methodology could be used in the future to adapt and fine-tune the mitigation scenarios, both spatially and temporally. This approach could also consider spatial and temporal measures, such as seasonal mandatory use of pingers or the seasonal closures of métiers with high risk of bycatch. The detailed results are presented in ICES WKEMBYC2 report (ICES, 2023).

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