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January 18, 2022

Tina Fahy
NMFS West Coast Region
1201 Northeast Lloyd
Portland, OR 97232

Re: Drift Gillnet Fishery Negligible Impact Determination (NOAA-NMFS-2021-0105)

Dear Ms. Fahy:

Oceana opposes the National Marine Fisheries Service (NMFS) proposal to issue a permit to authorize the California/Oregon large mesh drift gillnet (DGN) fishery to take Endangered Species Act (ESA) listed species during commercial fishing operations. Our opposition stems from NMFS's failure to:

1. implement an adequate observer program to monitor for the take of threatened and endangered species taken in the DGN fishery particularly with known underreporting by fishermen;
2. implement appropriate conservation measures to limit the take of rare and endangered species in the California drift gillnet fishery, principally hard caps that would close the fishery if take limits were reached; and
3. adequately analyze fishery impacts on threatened and endangered humpback whale populations by failing to account for the 3 distinct population segments (DPS) identified in 2016 and underestimating the relative contribution of the DGN fishery to humpback whale mortality and serious injury (M/SI) in light of recent bycatch events.

We also remained concerned over NMFS's interpretation of negligible impact under the "Guidance for Determining Negligible Impact under the Marine Mammal Protection Act (MMPA) Section 101(a)(5)(E)." According to the most recent stock assessment, human-caused serious injury and mortality to humpback whales exceeds the potential biological removal (PBR) for humpback whales. And NMFS recognizes that the fishery grossly underreports marine mammal interactions in violation of the MMPA. As explained in more detail below, NMFS determination of negligible impact for the DGN fishery is not justified.

I. The monitoring program for the DGN fishery is insufficient for accurate estimates of endangered species takes and fishermen are failing to self-report marine mammal takes in violation of the MMPA.

In the federal register notice for this action NMFS states that because a monitoring program exists, MMPA monitoring requirements are satisfied. Such reasoning fails to consider whether the monitoring program in place is sufficient for accurate estimates of marine mammal and endangered species bycatch. And, upon reasonable inspection, it is not.

The existing monitoring program for the California DGN fishery does not meet the MMPA's requirement to provide statistically reliable estimates of M/SI (16 U.S.C. § 1387(d)). There is no minimum level of observer coverage in the DGN fishery and observer coverage have averaged 20% over the past 2 decades. Current annual observer coverage is consistently inadequate to accurately and precisely document the take of many marine mammals. A recent publication by Alexandra Curtis and NMFS scientist James Carretta[1] estimates that *at a minimum*, 95% of California drift gillnet sets must be observed to know if bycatch has occurred in any given 1-year period for protected species including minke whales, bottlenose dolphins, humpback whales, Dall's porpoise, gray whales, and sperm whales (Table 1). In addition, the study calculated a minimum observer coverage of 80% is required to know whether bycatch is exceeding the Potential Biological Removal for ESA-listed sperm whales in any given year.

	A. Minimum observer coverage (%) needed to observe any bycatch with 95% probability		B. Minimum observer coverage (%) needed to achieve an estimation CV of 0.3	
Species	**1-year**	**5-year**	**1-year**	**5-year**
Loggerhead sea turtle	95	92	98	92
Minke whale	95	92	98	92
Bottlenose dolphin	95	92	97	92
Humpback whale	**95**	**92**	**98**	**92**
Dall's porpoise	95	92	97	93
Leatherback sea turtle	95	88	96	87
Gray whale	95	88	96	87
Sperm whale	**95**	**91**	**97**	**92**
Short-finned pilot whale	94	81	96	81
Northern elephant seal	92	62	93	71
Risso's dolphin	94	78	95	87
Pacific white-sided dolphin	92	53	92	74
Long-beaked common dolphin	89	34	89	62
Northern right whale dolphin	84	25	96	54
Northern fulmar	88	33	92	68
California sea lion	40	8	75	35
Short-beaked common dolphin	21	4	47	16

Table 1. *Minimum observer coverage levels needed in the DGN fishery over a 1-year and 5-year duration to achieve, A) the objective of observing any bycatch that occurs with 95% probability and, B) the*

[1] Curtis, K.A. and Carretta, J.V. 2020. Assessing observer coverage needed to document and estimate rare event bycatch. Fisheries Research 225:105493.
https://www.sciencedirect.com/science/article/abs/pii/S0165783620300102

objective of an estimation coefficient of variation (CV) of 0.3. ESA-listed marine mammals in bold. Adapted from Curtis and Carretta 2020 (footnote 1). Available: *https://www.sciencedirect.com/science/article/abs/pii/S0165783620300102*

Observer coverage levels fluctuated widely in recent years despite a 30 percent observer coverage target[2] and recommendations by the Pacific Fishery Management Council to achieve 100 percent monitoring. In 2020-21 fishing season, only 15 percent of drift gillnet sets were observed. The average observer coverage level over the past fifteen fishing years was 20 percent (2006-07 to 2020-21) with a historic low of 10.8% in the 2015-16 fishing season (figure 1). NMFS acknowledged in the 2004 DGN fishery Biological Opinion, and restated in the 2013 Biological Opinion that, "observer coverage in the DGN is usually around 20 percent and so it is not possible to state with certainty the actual number of entanglements based on observer records."[3]

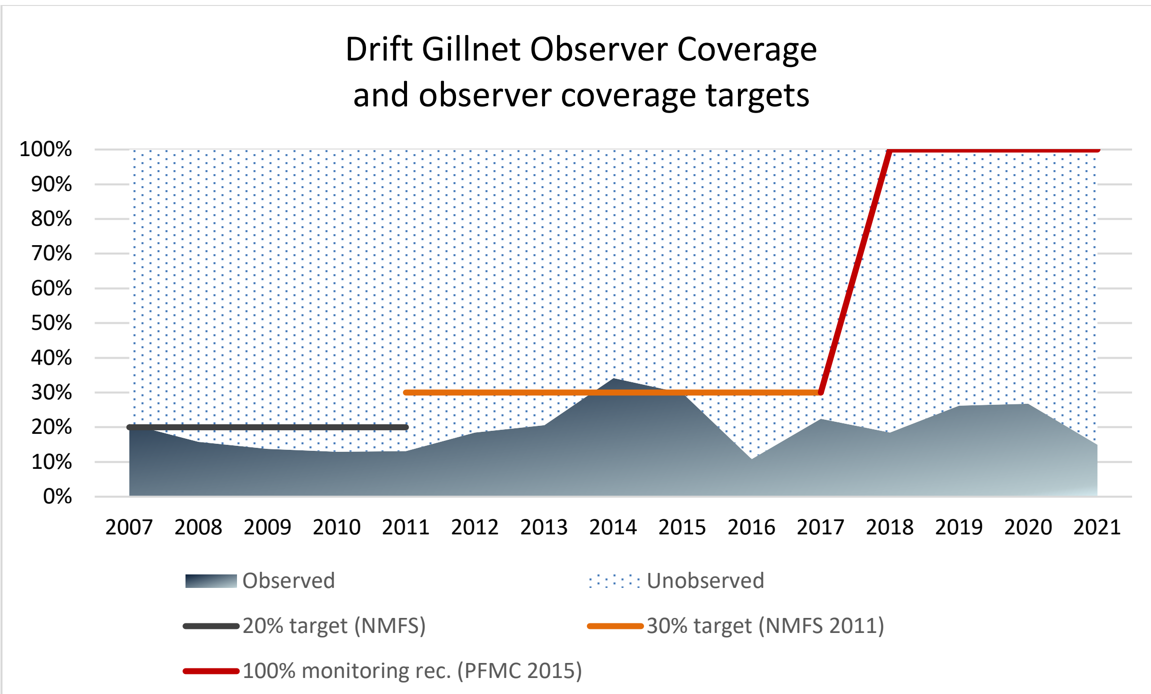

Figure 1. *Actual observer coverage levels ('observed') compared to target observer coverage levels and the PFMC's 2015 recommendation that 100 percent of fishing effort by monitored by 2018. Year in the x-axis is the end of the fishing year (e.g. the 2020-21 fishing year is 2021 in the figure).*

[2] In the 2011 NMFS recommended 30 percent observer coverage for this fishery "to better document bycatch of rare and sensitive species." National Marine Fisheries Service. 2011. U.S. National Bycatch Report [W. A. Karp, L. L. Desfosse, S. G. Brooke, Editors]. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-F/SPO-117E, 508 p. at 359. Available at: http://www.nmfs.noaa.gov/by_catch/National_Bycatch_Report/2011/4_5_SouthwestRegion.pdf

[3] NMFS. Biological Opinion on the continued management of the drift gillnet fishery under the Fishery Management Plan for U.S. West Coast Fisheries for Highly Migratory Species (May 2, 2013). At, 5.

Given that 80% of sets are unobserved, on average, and some vessels never take aboard any observers, we suspect a serious sampling bias due to the 'observer effect' as bycatch rates estimated from observed trips may not accurately reflect bycatch rates of the whole fleet because fishermen may behave differently when an observer is present. And we know, based on analysis of observer data and takes that are self-reported by commercial fishermen, that DGN fishermen drastically underreport marine mammal takes (see analysis attached). Federal regulations require vessel owners/operators to report all marine mammal interactions within 48 hours (per 50 CFR § 229.6) and they must maintain "an accurate and complete record of catch" (50 CFR § 660.708).[4] The failure to report marine mammal interactions is a violation of the MMPA.

NMFS should not issue an incidental take permit for the DGN fishery without 100 percent monitoring. 100 percent observer coverage is needed for accurate and precise estimates of rare event marine mammal bycatch (e.g., endangered species) because of the large uncertainty in actual catch due to underreporting and the inability to accurately estimate catch without high levels of coverage as documented by NMFS own scientists. Before issuing any incidental take permits, we request NMFS act to implement the Pacific Fishery Management Council's decision for protected species hard caps, remove the unobservable vessel exemption, and require 100 percent monitoring of the DGN fishery.[5]

II. NMFS should phase out and prohibit large-mesh DGN gear and the meantime implement hard caps to limit the take of protected species.

Management of the DGN fishery has drastically fallen behind the global curve of responsible fishery management. Swordfish drift gillnets are prohibited in many regions around the world like the Mediterranean Sea and off Canada. On the high seas, large scale driftnets are prohibited. In the U.S., swordfish driftnets are prohibited off the East Coast[6], and are not permitted by Oregon[7] or Washington[8] states. In fact, no other U.S. region allows large mesh drift gillnet gear. Ultimately NMFS should phase out and prohibit large-mesh drift gillnets and transition to a sustainable swordfish fishery using buoy and harpoon fishing gears.

In September 2015, after a years-long process incorporating input from fishery stakeholders, the Pacific Fishery Management Council recommended that NMFS increase bycatch monitoring to 100 percent, eliminate the "unobservable exemption" for certain DGN vessels, and set hard caps on the injury and mortality of nine sea turtle and marine mammal species most at risk from entanglement in swordfish

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[4] "Catch" is defined in regulation as "any activity that results in killing any fish or bringing any live fish on board a vessel." 50 C.F.R. § 600.10. "Fish" is further defined to mean "any finfish, mollusk, crustacean, or parts thereof, and *all other forms of marine animal and plant life other than marine mammals and birds*." *Id*. (emphasis added).
[5] Pacific Fishery Management Council final preferred alternatives for drift gillnet fishery hard caps and monitoring at: http://www.pcouncil.org/2015/09/38641/california-large-mesh-drift-gillnet-fishery-management-final-preferred-alternatives/
[6] 64 Fed. Reg. 4055, Jan. 27, 1999
[7] PFMC (2021). 2020 Highly Migratory Species Stock Assessment and Fishery Evaluation Report. Pacific Fishery Management Council, Portland, OR. at p12.
[8] Drift gillnet gear is not a legal gear for targeting swordfish or sharks in Washington and under federal law, all waters west of Washington state are closed to drift gillnets (50 CFR §660.713 d(8)).

drift gillnets. If these hard caps were reached, the fishery would close for the remainder of the season and up to 2 years based on a rolling cap average.

The hard caps would have applied to endangered fin, humpback, and sperm whales, short-fin pilot whales, and common bottlenose dolphins; as well as endangered leatherback, loggerhead, olive ridley, and green sea turtles. NMFS strongly supported and voted in favor of the action in 2015 when the council made its final recommendation. During Council deliberations on the final action, NMFS stated that the Council built a strong record for this action under the MSA including considering the economic and social impacts of this action to communities up and down the coast.[9]

The agency released a draft rule implementing the hard caps in October 2016. In an unprecedented move coinciding with the new Trump administration that was hostile to conservation, and which promoted deregulation,[10] NMFS withdrew the proposed rule in June 2017 and did not implement the Council's recommendation to achieve 100 percent monitoring by 2018 or remove the "unobservable exemption" for certain DGN vessels.

In doing so, NMFS ignored the will of its federal fishery advisors, the State of California, California state legislators and Congressional members, and the more than 58,000 members of the public who weighed in to support these caps. After NMFS illegally withdrew the proposed rule on June 12, 2017, a federal district court remanded the rule to NMFS on October 24, 2018. During this time NMFS made no attempt to consult with the Council on proposed changes to the regulations. NMFS had ample opportunity to consult with the Council numerous times including at the November 2018, March 2019, April 2019, June 2019, September 2019, and November 2019 Council meetings as well as outside of these meetings.

Now, following multiple lawsuits, the decision of hard caps is back before the Council. All social, economic, and ecological factors were carefully weighed by the Council and NMFS in crafting the original hard cap regulations as indicated by NMFS's statements during Council deliberations, particularly regarding the social value of whales and sea turtles. What is more, the California Drift Gillnet Transition Program, the economic value of the DGN fishery, and the advent of a clean and profitable alternative gear type – deep set buoy gear – entirely undercuts the agency's rationale for withdrawing the original hard cape rule; the potential economic impact of hard caps on the DGN fleet.[11] NMFS should now implement protected species hard caps as previously recommended by the PFMC before any MMPA permits are authorized.

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[9] Assistant Regional Administrator, Bob Turner, NMFS speaking in support for the overall hard cap motion and against the idea of not including the proposed caps for marine mammals. Council recorded audio file: 9-13-15am2Copy.mp3 at 1:14, *available at* https://www.pcouncil.org/documents/2015/09/september-2015-meeting-recordings.pdf/ .

[10] NOAA Fisheries (2018). Presentation to the CCC highlighting the drift gillnet hard cap rule withdrawal as part of its 'deregulatory' agenda. https://media.fisheries.noaa.gov/dam-migration/reg-reform-update-feb2018-ccc.pdf

[11] Oceana (November 6, 2020) letter to the Pacific Fishery Management Council. Agenda Item I.4 Drift Gillnet Hard Caps Update. Available: https://pfmc.psmfc.org/CommentReview/DownloadFile?p=c3a86287-b53c-4ca3-948a-c1b4e6423e02.pdf&fileName=Oceana%20PFMC%20Comment%20Letter%20DGN%20Hard%20Cap%20-%20Agenda%20Item%20I.4%20November%202020.pdf

III. NMFS has failed to adequately consider fishery impacts on the Mexican and Central America humpback DPSs

We are concerned that NMFS appears to be cherry picking the science used to determine negligible impacts in this fishery and increase the PBR for humpback whales, with a bias toward inflating the PBR and underestimating recent take in the fishery. Importantly, NMFS established separate DPSs for humpback whales in 2016, including the Mexican and Central American DPSs. However, in the stock assessment and NID, NMFS combines these two DPSs to get a single PBR for the CA/OR/WA stock.

The most recent humpback whale stock assessment report increased the PBR from 16.7 to 28.7 whales per year.[12] Part of this increase results from an increase in population size through 2018 observed from multiple surveys. However, these same surveys indicated that since 2018, the population has declined (See Figure 2). However, these recent declines are not considered in the current humpback whale stock assessment or NMFS NID analysis, resulting in a higher minimum population size and corresponding PBR.

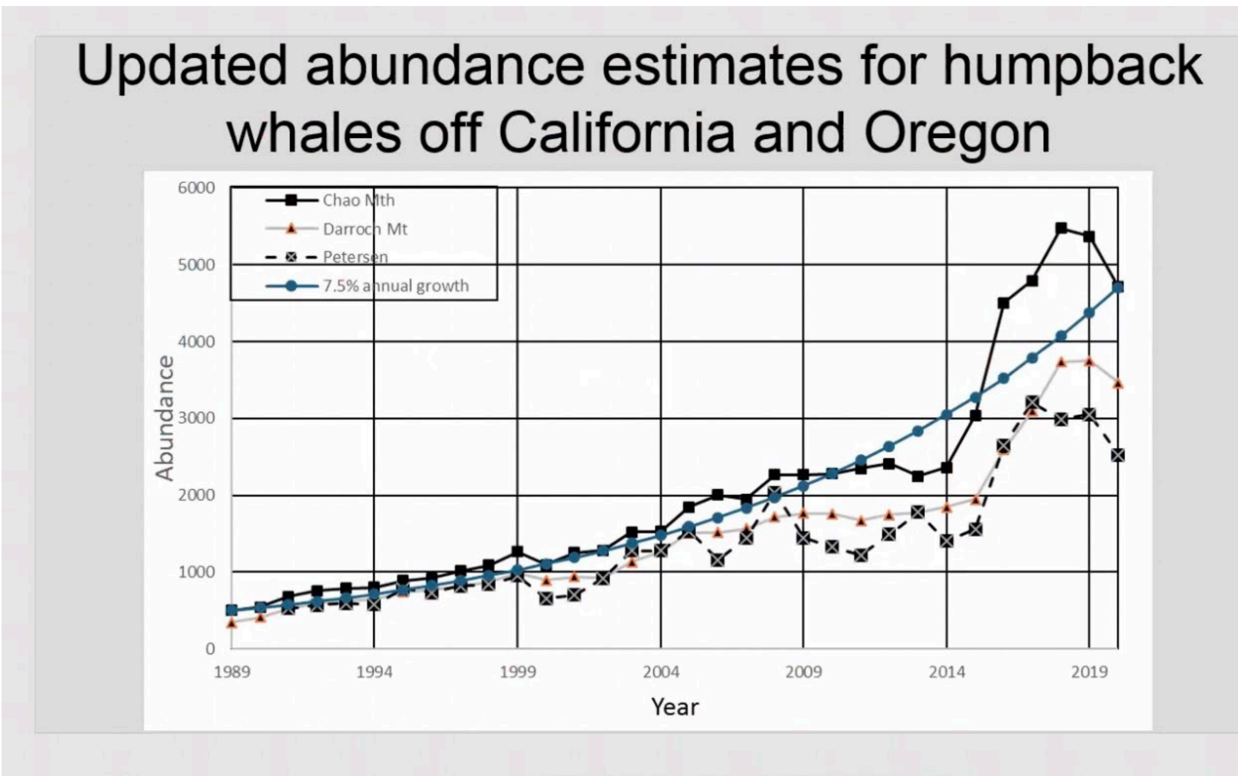

Figure 2. *Updated abundance estimates for humpback whales off California and Oregon presented by Cascadia Research (Calambokidis, presentation to California Dungeness Crab Fishing Gear Working Group, October 6, 2022. Survey results in 2020 across all three indices indicated a decline relative to the 2018 population size used in the most recent NMFS stock assessment (Carretta et al. 2021).*

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[12] Carretta et al. 2021 Draft 2021 Pacific SARS. https://media.fisheries.noaa.gov/2021-10/Draft%202021%20Pacific%20SARS.pdf

There were 2 observed humpback whale entanglements in DGN gear in 2021, which were not considered in the NID. In January 2021, the DGN fishery caught and injured 1 threatened or endangered humpback whale in 22 observed drift gillnet sets, [13] which based on observer coverage in the 2020-21 fishing season, was estimated as 7 total takes in the 2020-21 fishing season using a ratio estimator approach . In those 22 observed sets, the fishery caught 1 marine mammal for every 12 swordfish landed. NMFS has not released regression tree estimates for the 2020-21 fishing season to date.

NOAA Fisheries also reported another observed humpback entanglement in DGN gear in December 2021.[14] Observer coverage for the 2021-22 fishing season is not available as the fishing season has not yet concluded, but using an estimate of 20% observer coverage, this would be approximately 5 total takes using a ratio estimator approach. An estimated take of 12 humpback whales over the last two seasons clearly is not a negligible impact.

Using NMFS own data, total cumulative annual human-caused mortality from fishery impacts (annual MSI 26.6) and estimated vessel strikes (annual MSI = 22) together exceed the new 28.7 whale PBR by 69% (total cumulative annual MSI = 48.6) (Carretta et al. 2021).

IV. Opposition to application of NMFS NID Guidance for ESA-listed species

Oceana incorporates comments previously submitted on the draft NID guidance in our letter dated April 17, 2020 (attached) that detail how the new guidance for determining negligible impact for ESA-listed species is inadequate, does not align with the approach to marine mammal conservation under the MMPA, and insufficiently protective of ESA-listed species. When there are multiple human activities affecting an ESA-listed species, NMFS must consider the cumulative impacts of all human-cause M/SI, rather than breaking down these impacts into small enough pieces such that each piece is considered negligible. Similarly, when fisheries are responsible for enough M/SI that it nearly exceeds PBR, NMFS should consider the totality of fishery impacts on the species instead of looking at each individual fishery in order to piecemeal decision making and reduce the potential severity of fishery M/SI. Under NMFS's determination of negligible impact for the DGN fishery, this scenario is playing out for humpback whales.

V. Conclusion

Given fisheries account for the majority of the PBR being exceeded for humpback whales, the failure of NMFS to account for the DPSs, the relative contribution of the DGN fishery to humpback whale M/SI in light of recent bycatch events, the underreporting of marine mammal bycatch events, the insufficient observer coverage to detect population-level impacts to ESA-listed whales, and the absence of hard caps on ESA-listed species, the fishery should be denied an Incidental Take Permit.

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[13] NMFS West Coast Region Observer Program. Available https://media.fisheries.noaa.gov/2021-07/DN2020-21_NMFS-WCR_ObserverProgram_CatchSummary.pdf?null

[14] NMFS 2021 West Coast Region Whale Entanglement Summary provided by CDFW to Dungeness Crab Fishing Gear Working Group. January 12, 2022.

Instead, NMFS should work to fully phase out all remaining federal drift gillnet permits consistent with California state policy, immediately implement hard caps with 100% observer coverage, and authorize and permit deep-set buoy gear as recommended by the Pacific Fishery management Council in 2019.

Sincerely,

Geoff Shester, Ph.D.
California Campaign Director & Senior Scientist

Attachments:

Curtis, K.A. and Carretta, J.V. 2020. Assessing observer coverage needed to document and estimate rare event bycatch. Fisheries Research 225:105493.

Enticknap, B., Shester, G., and Brock, T. 2021. Underreporting of marine mammal and sea turtle bycatch in the California drift gillnet fishery. November 11. 2021.

Oceana April 17, 2020 Letter to D. Wieting, Director, Office of Protected Resources, NMFS RE: Draft Guidance for Determining Negligible Impact under MMPA Section 101(a)(5)(E), National Marine Fisheries Service Procedure 02-204-02.

Version of Record: https://www.sciencedirect.com/science/article/pii/S0165783620300102
Manuscript_85af7c033ce492eadcbc7f117b44a93d

ObsCovgTools: Assessing observer coverage needed to document and estimate rare event bycatch

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ABSTRACT

Observer program design and evaluation often overlook the challenges of documenting rare-event bycatch. To support and facilitate consideration of threatened, endangered, and protected species bycatch in evaluating observer programs and assessing fisheries impacts, we developed a software tool to assess observer coverage with respect to several objectives for documenting or estimating rare-event bycatch. The *ObsCovgTools* package for the *R* programming language, also available as an online application, predicts observer coverage performance for a given total fishery effort in relation to three metrics: (1) the conditional probability of observing any bycatch given that bycatch occurred in the fishery and the probability of any bycatch in the total fishery effort, (2) the upper confidence limit for total bycatch when none is observed, and (3) precision (coefficient of variation) of the bycatch estimate. We describe the tool; explore how specific observer coverage targets for these metrics vary with total effort, BPUE, and dispersion index; and apply it to evaluate observer coverage in the California drift gillnet fishery. Our results underscore the importance of considering effort as well as percentage in assessing how well an observer program documents bycatch. We caution that rare species interactions may not be documented in many observer programs, and should be anticipated through a complementary risk assessment approach. The tool's modular design and open source programming approach encourage adaptation and augmentation to address additional objectives or complexities in sampling design or estimation.

Keywords:

Bycatch estimation; fishery observer program; limit reference point; precision; risk assessment; software

1. Introduction

Effective bycatch management requires that bycatch be detected, identified, and monitored through a fisheries monitoring system to inform assessment, prioritization, and management action (Crowder and Murawski 1998; Hall and Mainprize 2005; Kirby and Ward 2014). At-sea observer programs remain the gold standard for obtaining independent, accurate, and verifiable scientific data on fishing operations, particularly for less frequent bycatch species that are discarded, including endangered or threatened species and other sensitive marine fauna (e.g., Karp and McElderry 1999, Davies and Reynolds 2002; Pérez Roda et al., 2019). Observer programs are most efficient and effective when they are designed to address clearly defined, specific goals and objectives (Davies and Reynolds 2002; Parkes and Kaiser 2004; Kirby and Ward 2014). In the case of bycatch monitoring, objectives should include characterizing bycatch composition and magnitude with sufficient accuracy and precision to support assessment and management (Crowder and Murawski 1998). Addressing these objectives requires designing observer programs with appropriate observer coverage for a given total effort (Hall 1999; Babcock et al., 2003; NMFS 2004; Parkes and Kaiser 2004).

The primary focus in evaluating observer coverage levels has been on the second objective – providing data to estimate bycatch magnitude with sufficient accuracy and precision, with an emphasis on precision (e.g., Lennert-Cody 2001; Bravington et al., 2003; Smith and Baird 2005; Lawson 2006). Bycatch estimates that involve rare events (the norm for threatened, endangered, and protected species) and low observer coverage levels suffer from estimation bias and imprecision (Amandè et al., 2012; Carretta and Moore 2014; Martin et al., 2015). The problem of achieving reasonable precision for rare-event bycatch has also motivated considerable effort towards developing model-based approaches to estimating bycatch that harness information in covariates of bycatch rate to reduce uncertainty (Dixon et al., 2005) and propose different parameterizations or mixed distributions to handle large numbers of zeroes (see Minami et al., 2007 for an overview of these, including hurdle and zero-inflated models). Development of model-based bycatch estimates may inform observer sampling design by guiding stratification to direct increased sampling towards those portions of the fishery where interactions are most likely, particularly for a high-priority species of conservation concern (e.g., Federal Register 2013; Carretta et al., 2017).

Far less attention has been directed towards evaluating observer programs with respect to the first objective of characterizing bycatch composition accurately (see Lyssikatos and Garrison 2018 for a well-executed example). Species that have not been documented in a fishery, whether in a given year or over the history of the fishery, are often assumed not to have been subject to any interactions during that time. Estimates drawing on multiple years of observer data, such as model-based estimates, may alleviate this problem where bycatch has been observed one or more times in the past (Carretta and Moore 2014), but fisheries with extremely low observer coverage may miss rare-event fisheries interactions with species of conservation concern for years or even decades. A thorough bycatch risk assessment should be conducted for every fishery to identify species that are at risk of interacting with it in terms of geographic, depth, and habitat overlap and susceptibility to gear type and identify populations on which fisheries interactions may have a non-negligible impact (Hobday et al., 2011).

Many fisheries observer programs face challenges that call for customized simulation approaches to sampling design, such as within-haul subsampling and variability (Karp and McElderry 1999) or the need to balance limited resources among a large number of fisheries (Wigley et al., 2007). Often, human resources or technical capacity may be lacking for customized analyses, a sampling problem may be simple enough for standard methods, or managers need more interactive information regarding how observer program performance for a given fishery is expected to vary with coverage. Rather than relying exclusively on *de novo* simulation or statistical approaches for each design question, standardized approaches should be made readily available as a starting point in assessing observer coverage needs.

Here, we present a user-friendly *R* package and shiny web application to facilitate design and evaluation of observer programs with respect to monitoring composition and magnitude of rare-event bycatch of sensitive species (Curtis 2019; Curtis and Coleman 2019). We describe the *ObsCovgTools* package, use it to explore how specific bycatch-oriented observer coverage targets vary with fishery size, bycatch rate, and dispersion index (variance to mean ratio), and demonstrate its application in a case study drawn from U.S. fisheries management.

2. Methods

2.1 Software description

The *ObsCovgTools* package for the *R* statistical programming language allows evaluation of observer coverage for a given total effort based on three metrics: (1) the probabilities of observing any bycatch and of any bycatch occurring in the total fishery effort, (2) the upper confidence limit of total bycatch that may have occurred without any being observed, and (3) the expected precision of bycatch estimates. For each metric, the user specifies total effort in the fishery and expected dispersion index (variance to mean ratio) of bycatch. For the observation probability and precision metrics, mean bycatch per unit effort (BPUE) is also user-specified. The user can also specify a desired benchmark, i.e., the desired probability of observing bycatch if it occurs, the maximum allowable upper confidence limit for bycatch when none is observed, or the desired estimation precision. For each metric, the package returns a plot of how it varies with observer coverage, and the minimum coverage corresponding to the specified benchmark, if applicable. Effort can be considered in arbitrary units and time frames relevant to management, e.g., trips or sets per year or per five years.

The package utilizes Poisson and negative binomial distributions, parameterized by user-specified BPUE and dispersion index, to simulate statistical properties of bycatch. Among the range of statistical distributions used in bycatch estimation and modeling, the Poisson and negative binomial distributions are widespread and easily parameterized given typically available summaries of bycatch data or estimates, and thus well-suited as a starting point for a user-friendly, general-purpose tool. Hurdle distributions, such as delta-lognormal, make the assumption that all zeros are structural, a poor approximation of a process producing rare events. Moreover, change in effort does not align consistently with change in any hurdle model parameter (Ancelet et al., 2010). Zero-inflated distributions require a zero-inflation parameter to differentiate structural from sampling zeros, and may not be identifiable for rare-event processes (Minami et al., 2007). The *ObsCovgTools* package can nonetheless be adapted to zero-inflated data by omitting effort believed to be associated with structural zeros. Lastly, it is worth noting that given fixed BPUE and dispersion index, negative binomial and quasi-Poisson distributions are one and the same.

For the first metric, probability of observing bycatch if it occurs, the package calculates the probability of observing any bycatch in a given amount of effort n as

$$p_B = 1 - (p_0)^n \tag{1}$$

where p_0 is the probability of zero bycatch in a unit of effort. p_0 is given by the probability mass function (PMF) for the Poisson (dispersion index = 1) or negative binomial (dispersion index >1) specified by the user-input BPUE (r) and dispersion index (d) at n=1:

$$p_0 = \begin{cases} e^{-r}, d = 1 \\ d^{-r/(d-1)}, d > 1 \end{cases} \tag{2}$$

where the negative binomial PMF at 0 for n=1 is algebraically rearranged from a more typical formulation $(k/(k+r))^k$ (Hilborn and Mangel 1997) after substituting $k = r/(d\text{-}1)$. Since rare event bycatch may or may not occur in the total fishery effort in a particular time period, the package calculates the probability of observing any bycatch as conditional on the probability of bycatch occurring in the total effort, thereby incorporating both process and observation error.

For the second metric, the upper confidence limit of total bycatch when no bycatch was observed in n effort, first the one-tailed upper confidence limit of r at confidence level 1-α is calculated by setting $\alpha = (p_0)^n$ from Equation (2) and solving for r, which rearranges to

$$r = \begin{cases} -\frac{1}{n}\log\alpha, d = 1 \\ \frac{-(d-1)\ \log\alpha}{n\log d}, d > 1 \end{cases} \tag{3}$$

To calculate the upper confidence limit for total bycatch in the fishery ($B_{1\text{-}\alpha}$), r is multiplied by total effort N and the square root of the finite population correction from Cochran (1977):

$$B_{1-\alpha} = N\, r\, \sqrt{\frac{N-n}{N-1}} \tag{4}$$

For the third metric, precision of bycatch estimates, the package follows the standard approach of simulating the response of root mean square estimation error to observer coverage (e.g., Lennert-Cody 2001; Wigley et al., 2007). The package simulates bycatch in a given amount of observed effort *n* as *n* random draws without replacement from a random sample of size *N* from the probability density function (PDF) for the Poisson or negative binomial specified by the user-input *r* and *d*. The package runs a default of 1000 simulations per observer coverage level. Bycatch estimation CV at each observer coverage level is calculated as the mean square error of estimated vs true realized BPUE in each simulation, divided by the nominal BPUE of the originating PDF.

The package is also served as a web application at https://kacurtis.shinyapps.io/obscov/ (Curtis and Coleman 2019) built using the *shiny* package for R (Chang et al., 2019).

The package is written in *R* (R Core Team 2018) and was developed with the aid of the *devtools* package (Wickham et al., 2018). It employs several other useful add-on packages, including *dplyr* (Wickham et al., 2019), *tibble* (Müller and Wickham, 2019), and *Runuran*, which includes efficient random number generation for Poisson and negative binomial distributions (Leydold and Hörmann 2019).

2.2 Workflow

For the first metric, probability of observing any bycatch, calling function *plot_probposobs()* with user-specified total fishery effort, BPUE, dispersion index, and (optionally) the desired target probability returns a plot of probability of observing bycatch — and of bycatch occurring in the total effort — versus observer coverage (Fig. 1). If output is assigned to an object, the function returns a list containing the results for minimum observer coverage needed to meet the specified probability of observing bycatch, if applicable, and the probability of bycatch occurring in the total fishery effort. The default benchmark is 95% probability of observing bycatch given that it occurred, corresponding to a high confidence of detecting any impact on the species in question.

```
> plot_probposobs(te = 10000, bpue = 0.0005, d = 2)
The probability that any bycatch occurs in the given total effort is 96.9%.
Minimum observer coverage to achieve at least 95% probability of observing
bycatch when total bycatch is positive is 73% (7300 trips or sets).
```

For the second metric, upper confidence limit of bycatch given none observed, calling function *plot_uclnegobs()* with user-specified total effort and expected dispersion index returns a plot of the one-tailed upper confidence limit versus observer coverage when no bycatch is observed (Fig. 2). The function defaults to a confidence level of 95%, but different level can be specified. Upper confidence limits for *d+/-1* are also plotted. A target upper confidence limit can be specified, e.g. aligning with a limit reference point for the species of interest

```
> plot_uclnegobs(te = 10000, d = 2, targetucl = 2, fixedoc = 20)
Minimum observer coverage to ensure that the upper confidence limit of 2 is
not exceeded when no bycatch is observed is 84.8% (8470 trips or sets).
Upper confidence limit for bycatch given none observed in 20% (2000 trips or
sets) coverage is 19.4.
```

For the third metric, bycatch estimation CV, the user first calls function *sim_cv_obscov()* to simulate bycatch CV based on user-specified observer coverage, given total effort, mean BPUE, and dispersion index. The returned list can then be provided to function *plot_cv_obscov()* to plot estimation CV versus observer coverage, with the option of specifying a target estimation CV (Fig. 3). If assigned to an object, the function returns a list containing the minimum observer coverage needed to meet the specified estimation CV. The default target CV is 0.3, which is the upper end of the recommended range for U.S. bycatch monitoring (NMFS 2004) and aligns with a key management strategy evaluation for limit reference points under the U.S. Marine Mammal Protection Act (Wade 1998). Minimum observer coverage is interpolated from the simulation results for the nearest two observer coverage levels.

```
> simlist <- sim_cv_obscov(te = 10000, bpue = 0.0005, d = 2)
> plot_cv_obscov(simlist)
Minimum observer coverage to achieve CV ≤ 0.3 is 82% (8200 trips or sets).
```

The package also includes a function (*run_shiny()*) to run the web application from within R.

3. How do observer coverage needs vary with effort, BPUE, and dispersion index?

We explored how observer coverage targets corresponding to specific objectives for each metric – 95% probability of observing bycatch, 95% upper confidence limit set to an arbitrary magnitude of 2, and estimation CV of 0.3 – vary with total effort, BPUE, and dispersion index by allowing one parameter to vary at a time. We explored the following three parameter spaces for each of the three objectives:

(1) Total effort varied from 500 to 20,000, with BPUE = 0.001 and $d = 2$;
(2) BPUE varied from 0.0001 to 0.0101, with total effort = 10,000 and $d = 2$ (this was omitted for the upper confidence limit objective since it solves for BPUE); and
(3) d varied from 1 to 5, with total effort = 10,000 and BPUE = 0.001.

The results (Fig. 4) show the importance of the number of positive observed samples as a key consideration determining the performance of a given level of observer coverage with respect to the two objectives considered. Positive observed samples are determined primarily by effort observed and BPUE. As total effort increases, given that all else is equal, the amount of observed effort needed to observe at least one bycatch event with 95% probability rises rapidly and then plateaus, while percent coverage needed drops quickly at first and then more gradually (top left panel). Observed effort needed for the maximum upper confidence limit objective rises linearly with total effort, while percent coverage is constant (top middle panel). The observed effort needed to attain the target level of bycatch estimation precision also responds more gradually than that needed for the first objective (top right panel). This result underscores the importance of observer effort as well as percent coverage in assessing how well an observer program may be documenting bycatch. Holding total effort and dispersion index constant, increasing BPUE results in exponentially decreasing minimum observer coverage needed to achieve either the first or third objective, though the drop is slower for the estimation precision objective (middle panels). Increasing dispersion index corresponds to logarithmically increasing observer coverage levels needed to meet all three objectives (bottom panels).

4. Case study: California drift gillnet fishery

We applied the *ObsCovgTools* package to marine mammals, seabirds, and sea turtles caught in the California drift gillnet fishery for swordfish and thresher sharks (CDGN). Effort in the CDGN is currently approximately 80 trips (500 sets) per year. We estimated minimum observer coverage levels needed to meet each of the following specific objectives for each species: (1) 95% probability of observing bycatch when any occurs; (2) a 95% one-tailed upper confidence limit when no bycatch is observed, equal to a limit reference point for each species; and (3) an estimation CV of 0.3. We used the most recent Potential Biological Removal calculated under the U.S. Marine Mammal Protection Act as the limit reference point for each marine mammal species (Carretta et al., 2018). For leatherback turtles (*Dermochelys coriacea*), we used an analogous reference point that has been estimated for the U.S. West Coast EEZ for the Western

Pacific population (Curtis et al., 2015). No limit reference point is available for other sea turtle or bird species, so observer coverage was not assessed in terms of an upper confidence limit target for those species.

To characterize bycatch per unit effort and dispersion index, we used observer data comprising approximately 440 trips (2,500 fishing sets) from 2002 to 2016, a period with relatively consistent fisheries regulations and approximately 20% observer coverage (Carretta and Barlow 2011, Carretta *et al*. 2017). We included all marine mammal, seabird, and turtle species caught in the fishery during this period. The species included cover a range of bycatch event frequencies (BPUE) and dispersion indices. Several of the species included are management priorities due to population status. We considered observer coverage with respect to effort in one year, five years (the time frame over which cumulative bycatch is considered for marine mammal stock assessments in the United States under the Marine Mammal Protection Act, or MMPA), and ten years. The results are presented in Tables 1-3.

If ten years of observer data are used, the scenario more closely approximating the current bycatch estimation approach in the fishery (see below), the current nominal observer coverage rate of 20% is sufficient to reach the first observer coverage objective of observing any bycatch for 12 of 17 marine mammals, seabirds, and sea turtles observed in the fishery from 2002 to 2016. The second objective of limiting the upper confidence limit of when no bycatch is observed is expected to be met for all species except leatherback turtles, which have an extremely low limit reference point. The third objective of an estimation CV of 0.3 is only expected to be met for the single most commonly encountered species. We caution that if a bycatch event is observed, the problem of estimation CV becomes paramount in assessment of bycatch magnitude versus a limit reference point.

Although the observer coverage levels needed to meet two of three objectives may be cost-prohibitive for many of the infrequently encountered species, the tool provides a useful perspective on the performance of the observer program with respect to these protected species. The prevalence of species with a total bycatch of only one or a few animals in the 15-year data set used underscores the importance of taking a broader risk assessment approach that considers which species were not observed in the portion of the fishery covered by independent observers, but may be vulnerable due to overlap with the fishery in space and time.

The recent history of bycatch estimation and management for sperm whales (*Physeter macrocephalus*) caught in the fishery provides an instructive example of the potential influence of number of observed interactions and observer coverage level on fisheries management. Protected species bycatch for the fishery used to be routinely estimated with a mean-per-unit estimator applied to a single year of observer data. In 2010, the fishery had 12% observer coverage (59 observed fishing sets out of an estimated 492 total sets) and 2 observed sperm whale entanglements in a single set (Carretta et al., 2017). The high observed BPUE in 2010 (0.03 sperm whales per set) was 30 times higher than the aggregate observed sperm whale BPUE over the 21-year period 1990 – 2010. The resulting estimate of sperm whale bycatch for 2010, 16 animals, far exceeded a biologically-based annual limit reference point ("potential biological removal" or PBR; Wade 1998) that serves as an MMPA management threshold. The PBR level at that time was 1.5 animals (Carretta et al., 2014). In response, NOAA implemented an emergency rule that mandated 100% observer coverage in deep offshore waters where the probability of sperm whale bycatch is highest (NOAA 2013, 2014). The temporary rule also included a trigger that would have terminated the fishing season if a single sperm whale was observed entangled.

Subsequently, methodological improvements to estimating rare-event bycatch were implemented in this fishery, replacing single-year mean-per-unit estimates with model-based estimates that included 26 years of data (Carretta et al., 2017). A revised bycatch estimate for sperm whales for 2010 using the new methodology was equal to the number of observed entanglements that year (two), while bycatch estimates for years previously estimated to have zero bycatch were revised to be positive. Although the value added with the model-based approach should not be discounted (Dixon et al., 2005), increasing the sample size on which the bycatch estimate is based is of primary importance to reducing volatility in year-to-year estimates of bycatch, reducing estimation bias and increasing precision (Amandè et al., 2012; Carretta and Moore, 2014), and ultimately, reducing potential 'management overreaction' to short-term fishery monitoring. Where observer coverage cannot be increased, sample size may still be vastly improved by incorporating multiple years of observer data in bycatch estimates, as long as these are reasonably consistent with respect to fisheries, environmental, and biological variables.

5. Discussion

The *ObsCovgTools* package for *R* and its companion web application provide a new tool for evaluating observer coverage, with a focus on the challenges of documenting and estimating rare-event bycatch, and for quantifying coverage needed to reach fishery management objectives for monitoring bycatch of threatened, endangered, and protected species.

The package's utilities for assessing the potential for and possible magnitude of unobserved rare event bycatch should be coupled with a risk assessment approach (e.g., Zhou and Griffiths 2008; Hobday et al., 2011; Brown et al., 2015) to assess potential impacts on vulnerable species (e.g., with small population sizes or low productivity) that have not been observed, but might interact with a fishery. This consideration should be a particular priority for fisheries with very low observer coverage levels (<10%), where occurrence of some rare event bycatch could take longer than a decade to document.

The current implementation of *ObsCovgTools* makes several simplifying assumptions. It assumes observer coverage is representative of the fishery, although biases such as nonrandom observer deployment (e.g., Babcock et al, 2003; Benoît and Allard 2009), and observer effects on fishing behavior (e.g., Wahlen and Smith 1985; Babcock et al., 2003; Benoît and Allard 2009) have been documented in fisheries worldwide. It also does not account for unobservable bycatch, e.g., due to dropping out of nets before or during retrieval (e.g., Bisack 1997; Brothers et al., 2010), low detection probability for some species (e.g., due to small size), swimming away with gear (e.g., Knowlton 2005), or fishery interactions that do not involve direct catch in gear (e.g., Ryan 1991). Finally, it does not account for hierarchical sources of variance (e.g., vessel- or trip-level variation). Violating these assumptions is likely to produce negatively biased projections of observer coverage needed to meet specific objectives. Unless hierarchical sources of variance can be ruled out as potentially important, using higher-level units of effort is advised (e.g., mean bycatch per trip and number of trips, instead of mean bycatch per set and number of sets). On the other hand, the mean-per-unit estimator that underlies the estimation CV simulations can serve as conservative benchmark that tends to project a positively biased estimation CV at a given observer coverage level when additional variability can be explained through a model-based approach.

Additional modules can easily be added to the package in the future. One important objective for observer coverage that is not yet implemented is the power to detect a change in bycatch rates in a fishery when a change in management, fishing effort, or environmental conditions occurs. More complex scenarios such as stratified sampling may also be useful additions to a future version of the package. The open-source platform used for *ObsCovgTools* lends itself to maintenance and further development by any user as the need arises.

Current observer program coverage in many fisheries is insufficient to support accurate and precise assessments of bycatch of sensitive species (e.g., Moore et al., 2009; Gilman et al., 2014). In sharing the *ObsCovgTools* package, it is our aim to facilitate and encourage the consideration of sensitive species and rare event bycatch in the design and evaluation of fisheries observer program sampling, as well as of the potential for rare fishery interactions with species not previously observed in the fishery, whose populations are vulnerable to even a small number of removals.

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Declarations of interest

None.

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Tables and Figures

Species	Total bycatch	BPUE	d	LRP	1 year % (n)	5 years % (n)	10 years % (n)
Loggerhead Sea Turtle (*Caretta caretta*)	1	0.002	1	–	95 (76)	92 (369)	88 (700)
Minke Whale (*Balaenoptera acutorostrata*)	1	0.002	1	3.5	95 (76)	92 (369)	88 (700)
Bottlenose Dolphin (*Tursiops truncates*)	1	0.002	1	11	95 (76)	92 (369)	88 (700)
Humpback Whale (*Megaptera novaeangliae*)	1	0.002	1	16.7	95 (76)	92 (369)	88 (700)
Dall's Porpoise (*Phocoenoides dalli*)	1	0.002	1	172	95 (76)	92 (369)	88 (700)
Leatherback Sea Turtle (*Dermochelys coriacea*)	2	0.005	1	0.16	95 (76)	88 (350)	72 (572)
Gray Whale (*Eschrichtius robustus*)	2	0.005	1	801	95 (76)	88 (350)	72 (572)
Sperm Whale (*Physeter macrocephalus*)	2	0.005	2	2.5	95 (76)	91 (363)	82 (658)
Short-Finned Pilot Whale (*Globicephala macrorhynchus*)	3	0.007	1	4.5	94 (75)	81 (322)	54 (430)
Northern Elephant Seal (*Mirounga angustirostris*)	5	0.011	1	4882	92 (74)	62 (250)	33 (265)
Risso's Dolphin (*Grampus griseus*)	6	0.014	3	46	94 (75)	78 (312)	49 (395)
Pacific White-Sided Dolphin (*Lagenorhynchus obliquidens*)	9	0.02	2.1	191	92 (74)	53 (213)	27 (219)
Long-Beaked Common Dolphin (*Delphinus capensis*)	12	0.027	1.5	657	89 (71)	34 (135)	17 (135)
Northern Right Whale Dolphin (*Lissodelphis borealis*)	17	0.038	1.6	179	84 (67)	25 (98.1)	12 (98.1)
Northern Fulmar (*Fulmarus glacialis*)	20	0.045	3.5	–	88 (70)	33 (132)	16 (132)
California Sea Lion (*Zalophus californianus*)	92	0.208	4	14011	40 (32)	8 (32)	4 (32)
Short-Beaked Common Dolphin (*Delphinus delphis*)	94	0.213	1.4	8393	21 (17)	4 (17)	2 (17)

Table 1. Minimum observer coverage levels needed in the California drift gillnet fishery to achieve the objective of observing any bycatch that occurs with 95% probability. Mean bycatch per unit effort (BPUE) and dispersion index (d, variance divided by the mean) are based on data from 2002 to 2016, a period with relatively consistent fisheries regulations. Limit reference points (LRP) are drawn from the most recent stock assessments for the relevant populations and from the literature (see Section 4). We included all marine mammal, seabird, and turtle species caught in the fishery during this period. We evaluated the objective for three durations over which data might reasonably be aggregated for evaluation: one year (total effort of 80 trips), five years (400 trips), and ten years (800 trips). For each time period and species, we report minimum observer coverage needed, in terms of percentage and effort (n, trips). Species are sorted by total bycatch, dispersion index, and limit reference point. The current nominal observer coverage is approximately 20%.

Species	**Total bycatch**	**BPUE**	**d**	**LRP**	**1 year % (n)**	**5 years % (n)**	**10 years % (n)**
Loggerhead Sea Turtle (*Caretta caretta*)	1	0.002	1	–	–	–	–
Minke Whale (*Balaenoptera acutorostrata*)	1	0.002	1	3.5	58 (46)	16 (13)	9 (7)
Bottlenose Dolphin (*Tursiops truncates*)	1	0.002	1	11	25 (20)	6 (5)	4 (3)
Humpback Whale (*Megaptera novaeangliae*)	1	0.002	1	16.7	18 (14)	4 (3)	2 (2)
Dall's Porpoise (*Phocoenoides dalli*)	1	0.002	1	172	2 (2)	1 (1)	1 (1)
Leatherback Sea Turtle (*Dermochelys coriacea*)	2	0.005	1	0.16	100 (80)	95 (76)	82 (66)
Gray Whale (*Eschrichtius robustus*)	2	0.005	1	801	1 (1)	1 (1)	1 (1)
Sperm Whale (*Physeter macrocephalus*)	2	0.005	2	2.5	80 (64)	30 (24)	16 (13)
Short-Finned Pilot Whale (*Globicephala macrorhynchus*)	3	0.007	1	4.5	49 (39)	14 (11)	8 (6)
Northern Elephant Seal (*Mirounga angustirostris*)	5	0.011	1	4882	1 (1)	1 (1)	1 (1)
Risso's Dolphin (*Grampus griseus*)	6	0.014	3	46	11 (9)	2 (2)	1 (1)
Pacific White-Sided Dolphin (*Lagenorhynchus obliquidens*)	9	0.02	2.1	191	2 (2)	1 (1)	1 (1)
Long-Beaked Common Dolphin (*Delphinus capensis*)	12	0.027	1.5	657	1 (1)	1 (1)	1 (1)
Northern Right Whale Dolphin (*Lissodelphis borealis*)	17	0.038	1.6	179	2 (2)	1 (1)	1 (1)
Northern Fulmar (*Fulmarus glacialis*)	20	0.045	3.5	–	–	–	–
California Sea Lion (*Zalophus californianus*)	92	0.208	4	14011	1 (1)	1 (1)	1 (1)
Short-Beaked Common Dolphin (*Delphinus delphis*)	94	0.213	1.4	8393	1 (1)	1 (1)	1 (1)

Table 2. Minimum observer coverage levels needed in the California drift gillnet fishery to achieve the objective of a 95% upper confidence limit no higher than the LRP when no bycatch has been observed. Mean bycatch per unit effort (BPUE) and dispersion index (d, variance divided by the mean) are based on data from 2002 to 2016, a period with relatively consistent fisheries regulations. Limit reference points (LRP) are drawn from the most recent stock assessments for the relevant populations and from the literature (see Section 4). We included all marine mammal, seabird, and turtle species caught in the fishery during this period. We evaluated the objective for three durations over which data might reasonably be aggregated for evaluation: one year (total effort of 80 trips), five years (400 trips), and ten years (800 trips). For each time period and species, we report minimum observer coverage needed, in terms of percentage and effort (n, trips). Species are sorted by total bycatch, dispersion index, and limit reference point. The current nominal observer coverage is approximately 20%.

Species	Total bycatch	BPUE	d	LRP	1 year % (n)	5 years % (n)	10 years % (n)
Loggerhead Sea Turtle (*Caretta caretta*)	1	0.002	1	–	98 (78)	92 (370)	86 (690)
Minke Whale (*Balaenoptera acutorostrata*)	1	0.002	1	3.5	98 (78)	92 (370)	85 (680)
Bottlenose Dolphin (*Tursiops truncates*)	1	0.002	1	11	97 (78)	92 (370)	87 (690)
Humpback Whale (*Megaptera novaeangliae*)	1	0.002	1	16.7	98 (78)	92 (370)	87 (700)
Dall's Porpoise (*Phocoenoides dalli*)	1	0.002	1	172	97 (78)	93 (380)	87 (700)
Leatherback Sea Turtle (*Dermochelys coriacea*)	2	0.005	1	0.16	96 (77)	87 (350)	77 (620)
Gray Whale (*Eschrichtius robustus*)	2	0.005	1	801	96 (77)	87 (350)	76 (610)
Sperm Whale (*Physeter macrocephalus*)	2	0.005	2	2.5	97 (78)	92 (370)	84 (680)
Short-Finned Pilot Whale (*Globicephala macrorhynchus*)	3	0.007	1	4.5	96 (77)	81 (330)	68 (550)
Northern Elephant Seal (*Mirounga angustirostris*)	5	0.011	1	4882	93 (75)	71 (290)	56 (450)
Risso's Dolphin (*Grampus griseus*)	6	0.014	3	46	95 (76)	87 (350)	74 (590)
Pacific White-Sided Dolphin (*Lagenorhynchus obliquidens*)	9	0.02	2.1	191	92 (73)	74 (300)	60 (480)
Long-Beaked Common Dolphin (*Delphinus capensis*)	12	0.027	1.5	657	89 (71)	62 (250)	44 (350)
Northern Right Whale Dolphin (*Lissodelphis borealis*)	17	0.038	1.6	179	86 (69)	54 (220)	35 (280)
Northern Fulmar (*Fulmarus glacialis*)	20	0.045	3.5	–	92 (74)	68 (280)	52 (420)
California Sea Lion (*Zalophus californianus*)	92	0.208	4	14011	75 (60)	35 (140)	22 (180)
Short-Beaked Common Dolphin (*Delphinus delphis*)	94	0.213	1.4	8393	47 (38)	16 (63)	9 (72)

Table 3. Minimum observer coverage levels needed in the California drift gillnet fishery to achieve the objective of an estimation CV of 0.3. Mean bycatch per unit effort (BPUE) and dispersion index (d, variance divided by the mean) are based on data from 2002 to 2016, a period with relatively consistent fisheries regulations. Limit reference points (LRP) are drawn from the most recent stock assessments for the relevant populations and from the literature (see Section 4). We included all marine mammal, seabird, and turtle species caught in the fishery during this period. We evaluated the objective for three durations over which data might reasonably be aggregated for evaluation: one year (total effort of 80 trips), five years (400 trips), and ten years (800 trips). For each time period and species, we report minimum observer coverage needed, in terms of percentage and effort (n, trips). Species are sorted by total bycatch, dispersion index, and limit reference point. The current nominal observer coverage is approximately 20%.

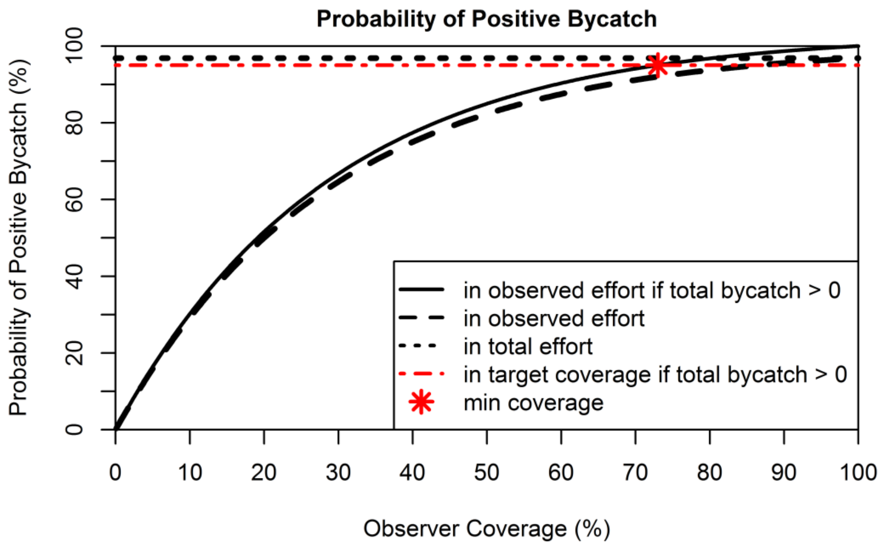

Figure 1. Example plot output from *ObsCovgTools* package for observer coverage metric of probabilities of observing any bycatch and of any bycatch in the total effort. User inputs were total fishery effort of 10,000 (arbitrary units, e.g., trips, days, sets), bycatch per unit effort of 0.0005, and dispersion index of 2. When target probability is specified, corresponding minimum observer coverage is based on the conditional probability of observing any bycatch if it occurs (solid black line), obtained by dividing the absolute probability of observing any bycatch (black dashed line) by the probability that any bycatch occurs in the given total effort.

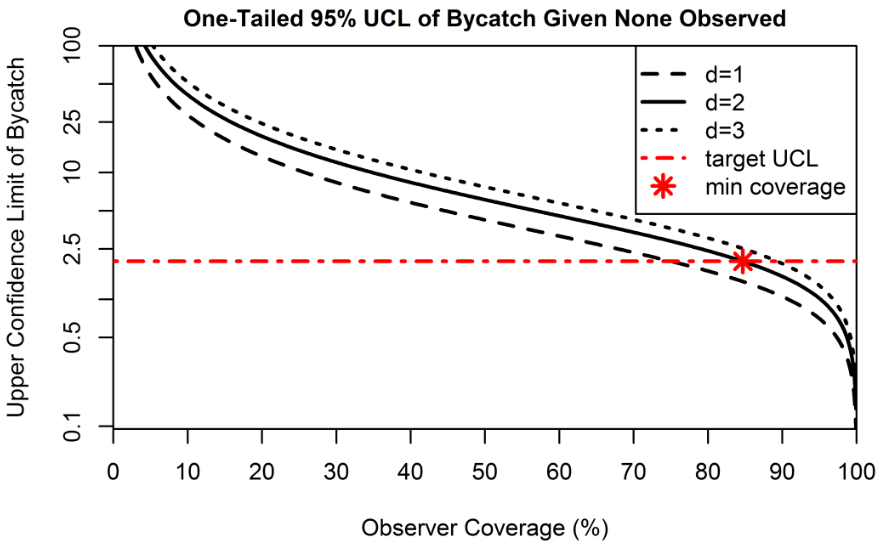

Figure 2. Example plot output from *ObsCovgTools* package for observer coverage metric of one-tailed upper confidence limit of bycatch given none observed. User inputs were total fishery effort of 10,000 (arbitrary units, e.g., trips, days, sets), dispersion index of 2, and target UCL equal to 2.

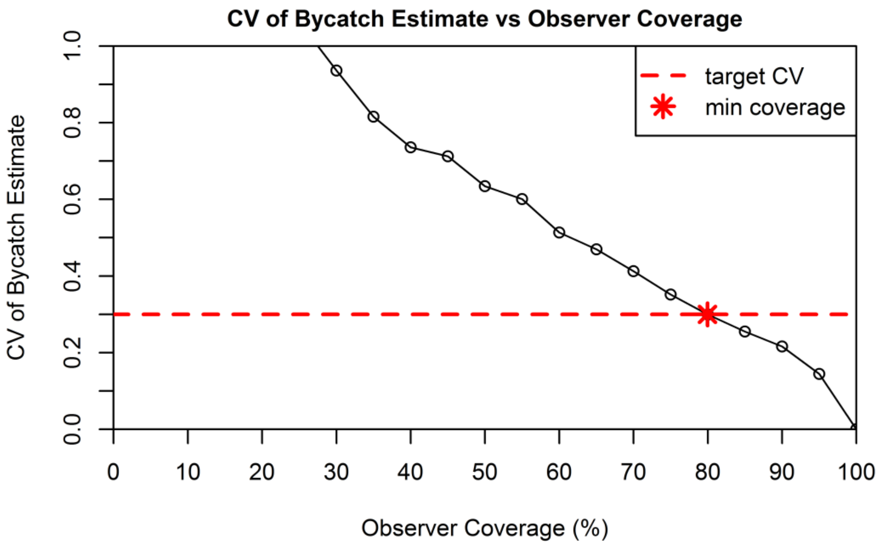

Figure 3. Example plot output from *ObsCovgTools* package for observer coverage metric of bycatch estimation CV. User inputs were total fishery effort of 10,000 (arbitrary units, e.g., trips, days, sets), bycatch per unit effort of 0.0005, and dispersion index of 2.

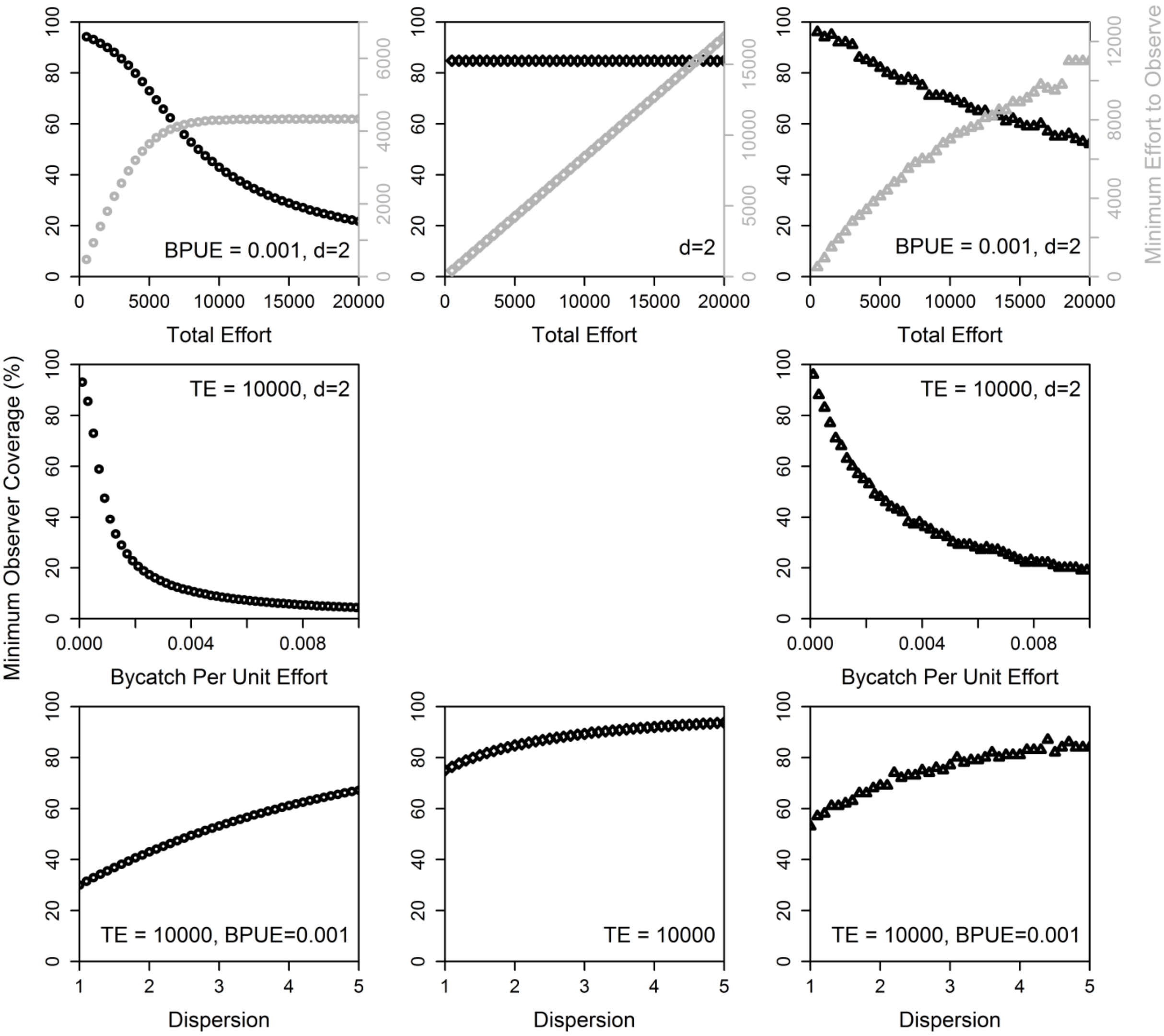

Figure 4. Variation of observer coverage needs with total effort (TE), BPUE, and dispersion index (d). Minimum observer coverage needed, in terms of percentage (black symbols) and effort to observe (gray symbols), in order to meet (1) a target probability of 95% of observing any bycatch if bycatch occurs (left panels, open circles), (2) a target upper confidence limit (UCL) given no positive bycatch in observed effort (middle panels, open diamonds) or (3) a target estimation CV of 0.3 (right panels, open triangles). Variation of observer coverage targets for each objective is explored with respect to changing TE (top panels), BPUE (middle panels), and d (bottom panels). Minimum effort to observe (gray) is omitted from the middle and bottom rows, since it varies linearly with percentage coverage when total effort is fixed. No plot exists for the UCL objective with varying BPUE, because this function solves for BPUE.

Underreporting of Marine Mammal and Sea Turtle Bycatch in the California Swordfish Drift Gillnet Fishery

November 11, 2021
Prepared by B. Enticknap, G. Shester and T. Brock, Oceana

Bycatch in commercial fishing gear is a major threat to many populations of marine wildlife. Unfortunately, inadequate observer coverage and a lack of reliable self-reporting hampers the ability of managers to limit and reduce bycatch and leads to a dearth of accurate information. This leaves fishery managers, scientists, and the public in the dark about the true level of fishery impacts. Federal regulations, however, require vessel owners/operators to report all marine mammal interactions within 48 hours (per 50 CFR § 229.6) and they must maintain "an accurate and complete record of catch" (50 CFR § 660.708).[1] At face value these reports should be the best source of information for total marine mammal and sea turtle bycatch. To get a more complete understanding of marine mammal and sea turtle bycatch in the California drift gillnet fishery when an observer is not onboard, Oceana submitted a Freedom of Information Act (FOIA) request to the National Marine Fisheries Service (NMFS) for the number of self-reported interactions with protected species in the California large mesh drift gillnet fishery, since 2001, when observers were not on board the vessels. Oceana requested the date, species, and location of each self-reported interaction, if known.

Set at night off the California coast, fishermen using mile-long large mesh drift gillnets target swordfish, but also capture, injure, and or kill many other fish species plus sea turtles, whales, dolphins, seals and other protected marine life. Onboard fishery observers monitor approximately 20 percent of the drift gillnet fishing effort, on average. The other 80 percent of the bycatch must be estimated through extrapolation (ratio estimates) or using statistical 'regression tree' estimates.

The regression tree methodology has been determined by NMFS to be the method that produces the best scientific information available for estimating rare species bycatch absent 100 percent monitoring.[2] Regression tree estimates, however, are only released periodically and provide little utility for in-season management actions. The federal Pacific Fishery Management Council voted unanimously to recommend NMFS implement 100 percent monitoring of the fleet, along with previous recommendations to establish hard caps that limit the take of certain marine mammals and sea turtles.

Oceana compared self-reported marine mammal and sea turtle takes obtained through our FOIA request to observed and total estimated protected marine life takes from 2001 to 2018 as published in the Carretta 2020 NOAA Technical Memo, "Estimates of marine mammal, sea turtle and seabird bycatch in the California large-mesh drift gillnet fishery 1990-2018".[3] From the FOIA data, we found that from

[1] "Catch" is defined in regulation as "any activity that results in killing any fish or bringing any live fish on board a vessel." 50 C.F.R. § 600.10. "Fish" is further defined to mean "any finfish, mollusk, crustacean, or parts thereof, and *all other forms of marine animal and plant life other than marine mammals and birds*." *Id*. (emphasis added).
[2] National Marine Fisheries Service (September 2018). Agenda Item H.6.a Supplemental NMFS Report I. Available: https://www.pcouncil.org/documents/2018/09/agenda-item-h-6-a-suppemental-nmfs-report-1.pdf/
[3] James V. Carretta. 2020. Estimates of marine mammal, sea turtle, and seabird bycatch

2001-2018, when an observer was not onboard, there were 28 self-reported marine mammal takes, comprising at least 6 different species (table 1) and no reported sea turtle takes. This is compared to 292 marine mammals and 4 sea turtle takes over the same time period reported by onboard observers, comprised of 16 different species (Carretta 2020). 80% of the fishing effort over this time was unobserved, yet there were 264 fewer marine mammals reported when no observer was present (figure 1).

Using the Carretta 2020 total regression tree estimates, the expected number of marine mammal takes on unobserved vessels would be the difference between the total estimate and the takes on observed trips (1,511 – 292) which equals 1,219 estimated takes on unobserved trips. However, the number of self-reported takes on these trips is only 28, which means that approximately 98% of marine mammal takes, or approximately 1,191 takes, were not reported as required by law (figure 1).[4]

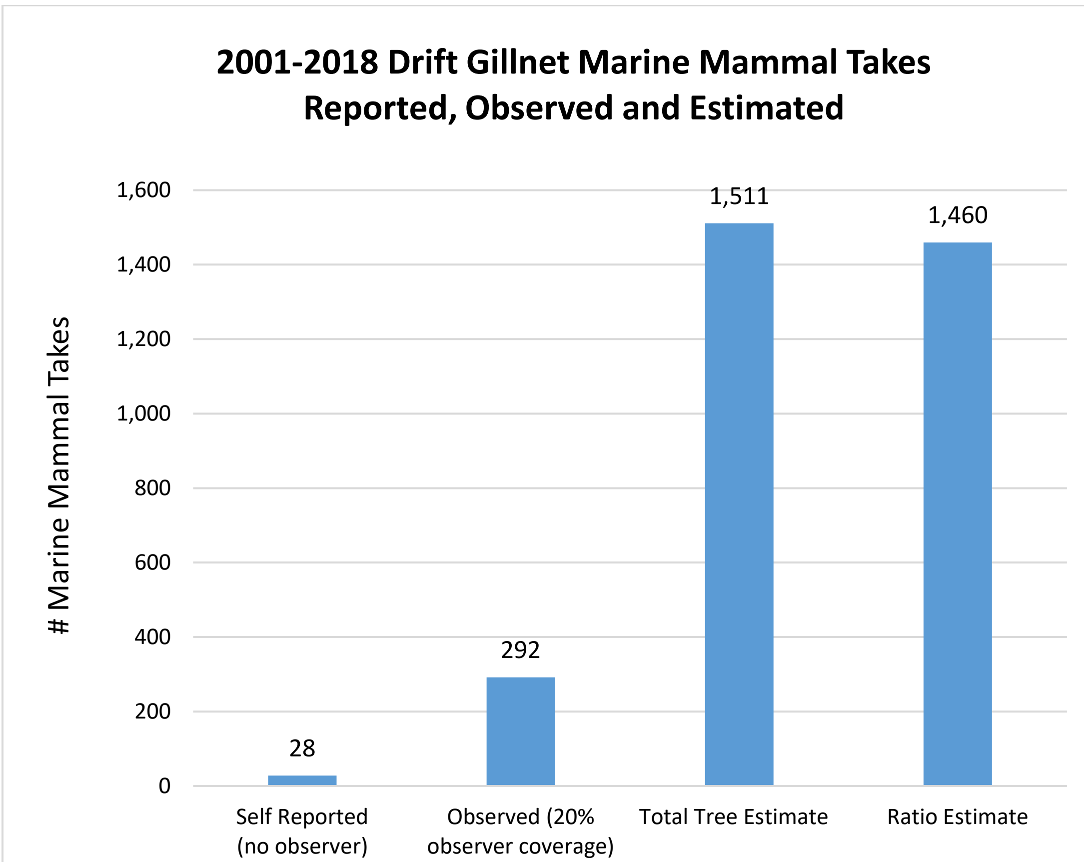

Figure 1. California drift gillnet marine mammal bycatch, 2001-2018, comparing self-reported bycatch to observed and total regression tree estimates and ratio estimates (as in Carretta 2020). Eighty percent of DGN sets were unobserved during this time frame.

There were zero self-reported marine mammal takes in 9 out of 18 years from 2001-2018 when no observer was onboard (table 1). There were also zero self-reported sea turtle takes while there were 4

in the California large-mesh drift gillnet fishery:1990-2018, U.S. Department of Commerce, NOAA Technical Memorandum NMFS-SWFSC-632.

[4] Id.

observed takes (2 leatherback sea turtles and 2 loggerhead sea turtles) and 37 expected sea turtle takes during this time based on total regression tree estimates (figure 2).

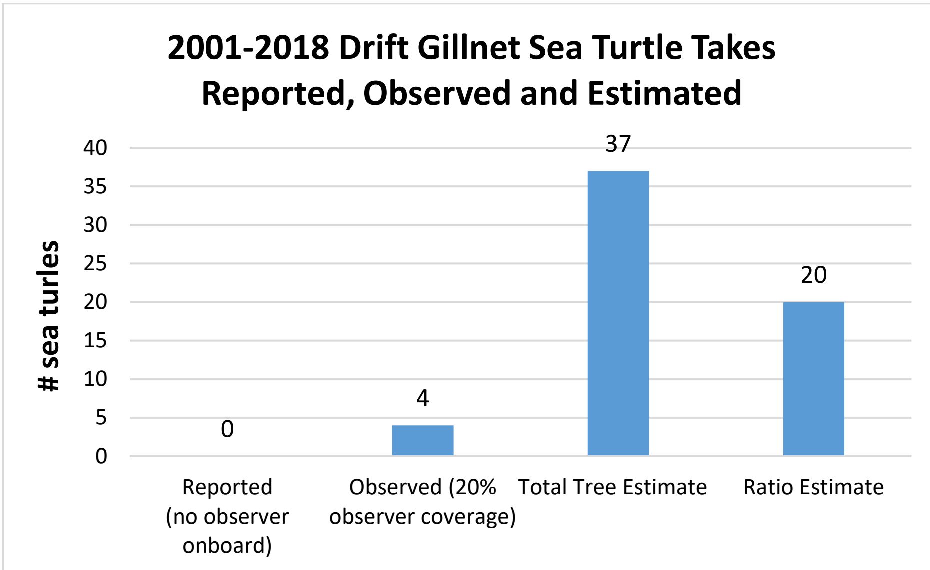

Figure 2. California drift gillnet sea turtle bycatch, 2001-2018, comparing self-reported bycatch to observed and total regression tree estimates and ratio estimates (as in Carretta 2020). 80 percent of sets were unobserved during this time frame.

Furthermore, when comparing self-reported bycatch rates to observed bycatch rates for common dolphin, California sea lions and Northern elephant seals, observed bycatch rates were up to 65x higher than self-reported bycatch rates when no observer was present (figure 3).

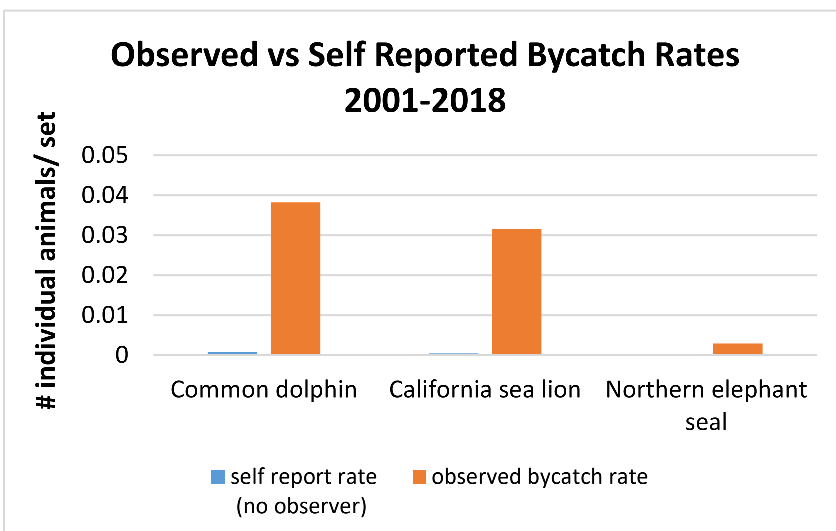

Figure 3. Observed bycatch rates (catch/ set) compared to self-reported bycatch rates in the California drift gillnet swordfish fishery when no observer was onboard. The bycatch rate of common dolphins was 43 x higher, California sea lion bycatch 65 x higher, and Northern elephant seal bycatch 36x higher when an observer was present.

Based on the findings of this FOIA request and analysis, we can only conclude California drift gillnet fishermen grossly underreport marine mammal and sea turtle interactions as required by law. Instead, it is most likely that when no observer is present marine mammals and sea turtles are discarded at sea unreported. This includes rare and endangered species like leatherback sea turtles, loggerhead sea turtles, sperm whales and humpback whales for which the Pacific Fishery Management Council previously recommended hard caps. This analysis highlights the importance of 100 percent monitoring to accurately assess protected marine life takes in the California drift gillnet swordfish fishery as well as hard caps that limit protected marine life bycatch. Ultimately, continued efforts are necessary to phase out the use of this fishing method and transition to selective deep-set buoy gear.

Table 1. Self-reported marine mammal takes in the California Drift Gillnet swordfish fishery, 2001 to 2020. This represents all self-reporting in the unobserved portion of the fleet. 80% of the fishing effort was unobserved, amounting to 12,448 unobserved sets.

Date of Mortality/Injury	Species	Number of animals
9/22/2001	Bottlenose dolphin	1
10/10/2001	California sea lion	1
11/3/2001	Unidentified small cetacean (porpoise or dolphin)	1
11/5/2001	Unidentified small cetacean (porpoise or dolphin)	1
12/29/2001	Common dolphin	1
1/24/2002	Common dolphin	1
10/13/2002	Unidentified small cetacean (porpoise or dolphin)	2
12/27/2003	Common dolphin	1
11/4/2003	California sea lion	1
12/1/2005	California sea lion	1
10/5/2006	Unidentified small cetacean (porpoise or dolphin)	1
10/31/2006	Common dolphin	1
11/2/2006	California sea lion	1
1/17/2008	Common dolphin	1
11/17/2008	Common dolphin	2
11/12/2008	California sea lion	1
11/15/2008	Common dolphin	1
10/12/2008	Harbor porpoise	1
1/18/2009	Humpback whale	1
12/11/2009	California sea lion	1
10/31/2010	Common dolphin	1
11/11/2010	California sea lion	1
11/17/2017	California sea lion	1
11/17/2017	Northern elephant seal	1
11/18/2017	Common dolphin	2
9/6/2019	California sea lion	1
10/21/2020	Pacific white-sided dolphin	1

Table 2. Observed bycatch and total estimated bycatch from 2001-2018, showing total regression tree and ratio estimates as published in Carretta 2020 (footnote 3). From 2001 to 2018 there were 3,112 observed drift gillnet sets (20% of 15,560 sets were observed).

SPECIES	OBSERVED 2001-2018	TOTAL TREE ESTIMATE 2001-2018	RATIO ESTIMATE 2001-2018
Minke whale	1	5.7	5
Fin whale	0	0.9	0
Gray whale	3	13.7	15
Humpback whale	1	5.9	5
Short-beaked common dolphin	119	628.9	595
Long-beaked common dolphin	12	43.1	60
Risso's dolphin	6	43.6	30
Short-finned pilot whale (dolphin)	3	11.6	15
Pacific white-sided dolphin	11	44.6	55
Northern right whale dolphin	24	122.3	120
Killer whale	0	0.4	0
Dall's porpoise	1	9.4	5
Bottlenose dolphin	1	5.7	5
Hubb's beaked whale	0	0.2	0
Stejneger's beaked whale	0	0.2	0
Unidentified Ziphiidae (beaked whales)	0	0.2	0
Unidentified Mesoplodon (beaked whales)	0	0.7	0
Sperm whale	2	12.3	10
Cuvier's beaked whale	0	1.5	0
Unidentified whale	1	4.9	5
Unidentified cetacean	0	1	0
California sea lion	98	501.7	490
Northern elephant seal	9	50.9	45
Steller sea Lion	0	0.4	0
Unidentified pinniped	0	0.8	0
Loggerhead sea turtle	2	20.4	10
Green sea turtle	0	1	0
Leatherback sea turtle	2	13.3	10
Olive ridley sea turtle	0	0.8	0
Unidentified turtle	0	1	0
Unidentified bird	1	6.2	5
Unidentified Cormorant	1	2.3	5
Northern Fulmar	20	80	100
TOTAL- All Species	**318**	**1635.6**	**1590**
Total Sea Turtles	4	36.5	20
Total Marine Mammals	292	1510.6	1460

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Donna Wieting, Director
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National Marine Fisheries Service
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April 17, 2020

Re: Draft Guidance for Determining Negligible Impact under MMPA Section 101(a)(5)(E), National Marine Fisheries Service Procedure 02-204-02

Dear Ms. Wieting:

Oceana does not support the National Marine Fisheries Service's draft "Guidance for Determining Negligible Impact under the Marine Mammal Protection Act (MMPA) Section 101(a)(5)(E)" and opposes final guidance that eases protections for marine mammals listed under the Endangered Species Act (ESA).[1] We understand the desire to clarify the previous negligible impact determination (NID) criteria under section 101(a)(5)(E). However, we do not support adopting a new threshold for determining negligible impact that is inconsistent with the MMPA and implements a less protective standard that does not utilize a precautionary approach. Specifically, we are concerned that the draft guidance:

1. creates an inconsistency in the standards that apply to ESA-listed marine mammal stocks under section 101(a)(5)(E) and those that apply to all marine mammal stocks under section 118 by implementing a threshold that is an order of magnitude larger than the zero mortality rate goal (ZMRG);
2. conflates the potential biological removal (PBR) level with negligible impact;
3. bases NID thresholds on total human-caused mortality and serious injury (M/SI) instead of setting a threshold for fishery-related M/SI;
4. fails to account for the negative bias in total M/SI estimates and in attribution of M/SI to individual fisheries; and
5. does not address the underlying reasons NMFS gives for revising the negligible impact criteria.

The overarching goal of the MMPA is to protect and recover marine mammals and prevent stocks from falling below their optimum sustainable population (OSP) level.[2] To achieve this goal, the MMPA sets a PBR level, which is defined as the maximum number of animals, not including natural mortalities, that

[1] 16 U.S.C. § 1531 et seq.
[2] 16 U.S.C. § 1361(2).

may be removed from a marine mammal stock while allowing that stock to reach or maintain its OSP.[3] The draft guidance, however, would allow fisheries to kill or seriously injure a greater number of marine mammals from populations failing to recover and those at risk of extinction even if the M/SI is higher than the PBR level and that stock is not maintaining its OSP. Given the many issues identified with the draft guidance, we recommend NMFS abandon the draft guidance and instead work closely with the Marine Mammal Commission (MMC) to revise the existing NID criteria under MMPA section 101(a)(5)(E) consistent with the MMPA, ESA and a precautionary approach. Additional details explaining why this course of action is necessary follows.

1. **The draft guidance creates an inconsistency in the standards that apply to ESA-listed marine mammal stocks under section 101(a)(5)(E) and those that apply to all marine mammal stocks under section 118 by implementing a threshold that is an order of magnitude larger than the ZMRG.**

A negligible impact determination (NID) under section 101(a)(5)(E) [4] must be consistent with the provisions that apply to all marine mammals under section 118. [5] Section 118(a)(1) of the MMPA requires NMFS to manage fisheries to reduce M/SI of marine mammals occurring in commercial fishing operations to insignificant levels approaching zero, which NMFS defined as 10 percent of a stock's PBR level, or the ZMRG.[6] These provisions apply to all marine mammal stocks including ESA-listed marine mammals. In addition, ESA-listed species are subject to section 101(a)(5)(E), which requires that M/SI in commercial fisheries have a negligible impact on ESA-listed marine mammal stocks.

To issue an incidental take permit to commercial fisheries that cause M/SI of ESA-listed marine mammals, NMFS must make a NID. NMFS determination of negligible impacts under section 101(a)(5)(E) is currently governed by five criteria, published in 1999.[7] The current NID criteria set the threshold for initial determination at 10 percent of PBR, so that if total human-caused M/SI are less than 10 percent of PBR, all fisheries may be permitted. The draft guidance, however, proposes to use an initial NID threshold equal to PBR.[8] This is a 10-fold increase in the M/SI that would be considered negligible and is an order of magnitude higher than the ZMRG under section 118. The draft guidance does not address this discrepancy or provide any justification for the significant change in thresholds.

As recommend by the Marine Mammal Commission,

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[3] 16 U.S.C. 1362(20).
[4] 16 U.S.C. § 1371(a)(5)(E).
[5] 16 U.S.C. § 1387.
[6] 50 CFR § 229.2; (defining "insignificance threshold," i.e., the upper limit of annual incidental mortality and serious injury of marine mammal stocks by commercial fisheries that can be considered insignificant level approaching zero mortality and serious injury rate, as 10 percent of the Potential Biological Removal level for a stock of marine mammals); Authorization for Commercial Fisheries under the Marine Mammal Protection Act of 1972; Zero Mortality Rate Goal, 69 Fed. Reg. 43338 (July 20, 2004).
[7] Taking of Threatened or Endangered Marine Mammals Incidental to Commercial Fishing Operation; Proposed Permits, 64 Fed. Reg. 28,800 (May 27, 1999).
[8] Note that the equation for NIT_t is the same equation as PBR for species listed as endangered ($NIT_t = N_{min} * 0.5R_{max} *0.1$).

> *NMFS should review the relationship between incidental take authorizations under section 118, which are linked to a mandate to reduce incidental [M/SI], initially to below the affected stocks' PBR levels and ultimately to achieve the [ZMRG], and those issued under section 101(a)(5)(E). Section 101(a)(5)(E) applies only to endangered and threatened marine mammal species, requires a [NID], and was intended to provide greater protection for endangered and threatened species than for non-listed species under section 118. . . . The MMC recommends that NMFS, in re-examining its criteria for making [NIDs], specifically consider the relationship between sections 101(a)(5)(E) and 118 of the MMPA, and whether it is appropriate to base a [NID] largely on whether the number of fishery-related serious injuries and mortalities is less than the stock's PBR.*[9]

NMFS's determination of negligible impact under section 101(a)(5)(E) is essential to effectuating congressional intent that the M/SI of ESA-listed marine mammals in commercial fisheries be reduced to the ZMRG and to achieve the overall conservation purpose of the MMPA. Therefore, NMFS must ensure negligible impacts are consistent with the ZMRG.

2. The draft guidance conflates PBR with negligible impact.

Equating PBR with negligible impact under section 101(a)(5)(E) can hardly be what Congress meant by a "negligible." There is no definition of negligible impact in the MMPA. However, as recognized by the draft guidance,

> [t]here is . . . a reference to negligible impact in the House of Representatives committee report for the MMPA Amendments of 1981, which is when Congress added "negligible impact" to the MMPA. The report states, "'negligible' is intended to mean an impact which is able to be disregarded." Further, the committee notes that Webster's Dictionary defines the term "'negligible' to mean 'so small or unimportant or of so little consequence as to warrant little or no attention.'"[10]

The draft guidance does not explain how setting a NID threshold for marine mammals listed as endangered equivalent to the PBR level meets the congressional intent under section 101(a)(5)(E).

Further, the draft guidance bases the negligible impact thresholds on the assumption that "the ESA-listed stock's dynamics conform to the underlying assumptions of PBR; that is, depleted stocks should show growth, some fraction of which can be removed without preventing recovery."[11] This assumption may not always hold true, and the guidance must make clear that a NID cannot be made for ESA-listed species that are not increasing or for which there is uncertainty around the stability of the population.

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[9] MMC Letter to Mr. Craig Heberer, NMFS Sustainable Fisheries Division, Southwest Region, November 5, 2013, p.6, *available at* https://www.mmc.gov/wp-content/uploads/ca_dgn_110513.pdf.

[10] Draft Guidance for Determining Negligible Impact under MMPA Section 101(a)(5)(E), National Marine Fisheries Service Procedure 02-204-02, p. 2, *available at* https://www.fisheries.noaa.gov/action/guidance-determining-negligible-impact-under-mmpa-section-101a5e (Draft NID Guidance), *citing* House of Representatives, Report 97-228, Sept. 16, 1981.

[11] *Id*. at 5.

3. The draft guidance should establish NID thresholds based on fisheries-related M/SI instead of all human-caused M/SI.

MMPA section 101(a)(5)(E) requires a determination related specifically to the impact of M/SI incidental to commercial fishing.[12] As noted in the current NID criteria, "the appropriate management action is to address components that account for the major portion of the total."[13] Yet, the draft guidance would allow a NID for a fishery even if it accounted for a majority of the total M/SI and a majority of a stock's PBR level. For instance, a stock's total human-caused M/SI may be slightly below PBR, but one or two fisheries may be responsible for a significant portion of that M/SI and yet still be determined to be negligible under a Tier 1 analysis.

Similarly, a stock's M/SI could be caused solely by fisheries and be above PBR, yet each fishery may receive an NID so long as each fishery's M/SI is below 13 percent of PBR under a Tier 2 analysis. NMFS provides no rational explanation why it will now use 13 percent of PBR as a threshold for negligible impact instead of a 10 percent threshold consistent with the ZMRG or how the draft guidance accounts for cumulative fishery impacts under a Tier 2 analysis. Using this proposed threshold, the agency is proposing a 30 percent increase in what is considered a negligible impact for an individual fishery.

The draft guidance must ensure that the proposed NID thresholds would not result in a situation where fisheries-related M/SI permitted by NMFS causes a non-negligible impact or appreciably reduces the likelihood of recovery of ESA-listed marine mammals as required by the ESA.[14] The most appropriate management action would be for NMFS to propose a NID threshold based solely on fisheries-related M/SI to ensure that fisheries it permits are not, individually or cumulatively, having a non-negligible impact on ESA-listed species.

4. The draft guidance fails to account for the negative bias in total M/SI estimates and in attribution of M/SI to individual fisheries.

The assumption of no biases in the estimates of these key parameters is not valid. The draft guidance creates a two-tier system for evaluating negligible impact. If the total human-caused M/SI of a stock exceeds the total threshold (PBR in the case of endangered species), then fisheries are assessed on an individual basis to determine if the M/SI attributed to that fishery has a negligible impact. For calculating the negligible impact threshold for a single fishery under the Tier 2 analysis, NMFS proposes a negligible impact factor that is meant to correspond to no more than a 1 percent delay in time to recover "assuming no biases in the estimates of abundance, M/SI, or R_{max}."[15]

However, estimates of M/SI are typically negatively biased and are considered a minimum because fishery-related M/SI is often not detected or attributed. Many fisheries have abysmally low rates of observer coverage or none, such that many marine mammal interactions are not reported. Maximum recovery rates ($R_{max)}$ are largely based on historical observations of marine mammals at their maximum

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[12] 16 U.S.C. § 1371(a)(5)(E).
[13] 64 Fed. Reg. 28800, 28801, Criteria # 2.
[14] 50 CFR 402.02.
[15] Draft NID Guidance at 4.

reproductive potential and do not consider the current stressors of climate change impacts or indirect competition with fisheries for prey. Further, stochastic events such as unusual mortality events (UAEs) are occurring at greater frequency and magnitude. NMFS must take a hard look at sources of bias of key parameter estimates before lowering thresholds.

M/SI caused by entanglement in fishing gear, particularly in fixed gear fisheries, are often not attributed to a specific fishery because there are no markings on the gear, there is only a part of the gear attached to an animal, or the SI/M was not observed or self-reported. The lack of attribution to an individual commercial fishery is especially troubling for fisheries that take critically endangered North Atlantic right whales.

As noted by the MMC in previous comments to NMFS:

> *Estimates of serious injury and mortality rates involving large whales rely principally on interactions documented by fishery observers, injuries reported by mariners and large-whale disentanglement teams, and examination of dead stranded whales. Fisheries-observer data may be used to estimate total fishery-related serious injury and mortality rates . . . Such estimates are typically negatively biased, because not all animals that are injured or die on observed fishing trips are detected by the observer, and because fishermen may alter their fishing behavior and methods in the presence of an observer.*[16]
>
> *Because not all serious injuries and mortalities are detected or reported, estimates published by NMFS are viewed as minimum estimates of total serious injury and mortality rates occurring over a given time interval. Marine mammals caught or entangled in fishing gear or stuck by vessels may not be included in published estimates because they are not discovered at sea or after stranding, are discovered but not reported, or are reported but the cause of injury or death cannot be determined or is not attributed a fishery.*[17]

The inability to properly account for total M/SI and attribute M/SI to individual fisheries is a major concern under the Tier 2 analysis proposed in the draft guidance and may cause NMFS to permit a fishery that has a non-negligible impact on an ESA-listed stock.

5. **The draft guidance does not address the underlying reasons NMFS gives for revising the negligible impact criteria.**

For the many reasons described above, the draft guidance does not address the problems identified with the current criteria for determining negligible impacts under Section 101(a)(5)(E). NMFS's reason for revising the negligible impact determination (NID) criteria is that the criteria have "proved problematic when conducting NID analyses."[18] In previous comments to NMFS, the Marine Mammal

[16] MMC Letter to Mr. Christopher Yates, NMFS Protected Resources Division, Southwest Region, July 25, 2013, p. 5, 5*available at* https://www.mmc.gov/wp-content/uploads/potfisheries_072513.pdf.
[17] *Id*. at 9.
[18] Draft NID Guidance at 3.

Commission suggested NMFS "establish improved criteria that are clear, logical, internally consistent, and cover all probable scenarios."[19]

Instead, however, the draft guidance creates blunt thresholds that equate PBR levels for endangered species with negligible impacts. Nowhere does NMFS explain how a threshold that is an order of magnitude larger than the ZMRG under section 118 is logical. Nor does the draft guidance recognize that the tiered threshold analysis can produce disparate outcomes for individual fisheries. For instance, an individual fishery may have a non-negligible impact on a stock under a Tier 2 analysis. Such a fishery would receive a NID under the draft guidance if all human caused M/SI was slightly under PBR but would not receive a NID if the total human caused M/SI is slightly over PBR. These inconsistent and illogical outcomes highlight the problems with using thresholds in management that do not look at the bigger picture. NMFS should revisit its reasoning for revising the NID criteria and think critically about whether the draft guidance meets those needs.

Conclusion

Oceana is concerned that the draft guidance is inconsistent with the overarching goals of the MMPA and could result in non-negligible impacts to ESA-listed marine mammals in the operation of commercial fisheries. We recommend NMFS abandon the draft guidance and instead work closely with the MMC to revise the existing NID criteria under section 101(a)(5)(E) consistent with the MMPA, ESA and a precautionary approach.

Sincerely,

Beth Lowell
Deputy Vice President, U.S. Campaigns

[19] MMC Letter to Mr. Yates, July 25, 2013 at 2; see also, MMC Letter to Mr. Craig Heberer, November 5, 2013 at 6.