To take or not take? Examination of the status quo process for issuing take authorizations of endangered Cook Inlet beluga whales and implications for their recovery

Mandy Migura¹ | Celeste Bollini²

¹Broad Conservation LLC, Eagle River, Alaska, USA
²Environmental Investigation Agency, Washington, District of Columbia, USA

Abstract
Endangered Cook Inlet beluga whales’ (CIBWs; Delphinapterus leucas) abundance has declined nearly 80% since the 1970s, and continues to decline 2.3% annually with less than 300 whales remaining. Despite the Marine Mammal Protection Act and the Endangered Species Act prohibiting take of protected species, exceptions allow the National Marine Fisheries Service (NMFS) to authorize take of CIBWs. Harassment, a type of take, has the potential to hinder CIBWs’ recovery by contributing to the threat of cumulative effects. Recovery action 62 in the 2016 CIBW Recovery Plan recommends NMFS reassess its current project-by-project approach for authorizing harassment takes to determine whether a comprehensive approach is more effective at reducing cumulative effects. To start this assessment, we compiled data from publicly available documents about CIBW research and incidental take authorizations effective since publication of the Recovery Plan, identified the amount of legal harassment NMFS authorized annually, and examined whether a relationship exists between total annual take authorizations and the population size. By the end of 2020, NMFS authorized nearly 120,000 takes of CIBWs cumulatively for 2017–2025. In 2020 alone, 22,350 takes were authorized, equating to 8371% of the estimated population size; research takes accounted for 99.4% of the total authorizations; and 50% of the population was authorized to be incidentally harassed. We found strong evidence of an inverse relationship between total takes authorized annually and the population size. Our results provide support for NMFS immediately implementing action 62 to take a critical look at the existing process for authorizing takes and its potential impacts to CIBW recovery. Several recommendations are provided for improving the take authorization process to help reduce the potential for cumulative effects and improve...
transparency of take data. To our knowledge, this is the first assessment of cumulative levels of take authorizations of CIBWs at this scale.

**KEYWORDS**

beluga, Cook Inlet, creeping normality, *Delphinapterus leucas*, Endangered Species Act, harassment, incidental take, Marine Mammal Protection Act, recovery plan, research take

1 | **INTRODUCTION**

In the United States, endangered Cook Inlet beluga whales (CIBWs; *Delphinapterus leucas*) are managed by the National Marine Fisheries Service (NMFS) and protected under the Marine Mammal Protection Act (MMPA) and the Endangered Species Act (ESA). For an endangered marine mammal, both laws contain prohibitions against “take” (MMPA: 16 USC 1372; ESA: 16 USC 1538), as well as methods to authorize certain types of take (MMPA: 16 USC 1374; ESA: 16 USC 1539). While the definition of take varies slightly between the two laws, both prohibit actual, or attempted, harassment, hunting, capturing, killing, or collection of protected species (MMPA: 16 USC 1362; ESA: 16 USC 1532). Although both laws identify harassment as a form of take, there are differences in how the term harassment is interpreted (MMPA: 16 USC 1362; ESA: NMFS, 2016a), which leads to instances where an activity may rise to the level of harassment under the MMPA but not the ESA. In these instances, only take authorizations under the MMPA are required.

Human activities may harass, and hence take, a protected marine mammal either directly or incidentally, and the process of how such take may be authorized varies accordingly. Directed take results from activities targeting protected species, such as scientific research or enhancement projects, commercial or educational photography, public display, or exporting or importing marine mammal parts (NOAA Fisheries, n.d.a). Conversely, incidental take results from activities not targeting the species but which affect them, such as during commercial fishing, oil and gas development, seismic surveys, military activities, or construction projects (NOAA Fisheries, n.d.a). For scientific research projects, NMFS can issue take authorizations via a Letter of Confirmation under the General Authorization (MMPA) or a Marine Mammal Scientific Research or Enhancement Permit (MMPA and ESA). For projects causing incidental take, NMFS can issue take authorizations via an Incidental Harassment Authorization (MMPA), a Letter of Authorization (MMPA), or an Incidental Take Statement (ESA). The latter is typically issued in conjunction with a Biological Opinion conducted by NMFS as part of an ESA section 7 consultation, and only when NMFS determines the activity causing take is not likely to jeopardize the continued existence of the ESA-listed species.

There are five stocks of beluga whales in the United States, all in Alaska. The Cook Inlet beluga stock is the smallest, most geographically isolated stock, and is genetically distinct from the others (O’Corry-Crowe et al., 1997). Thus, if the CIBWs go extinct, no other beluga whales will reoccupy their habitat (65 Fed. Reg. 38778). The CIBWs were designated as depleted under the MMPA in 2000 and listed as endangered under the ESA in 2008. NMFS’s abundance estimates from 2008 to 2018 indicate that the CIBW population is declining at 2.3% per year, with the most recent estimate from 2018 suggesting only 279 CIBWs remain (Shelden & Wade, 2019) in a population once numbering approximately 1300 individuals (Calkins, 1989). Given the CIBWs’ dire situation, NMFS considers them one of their “most at-risk of extinction” species and identified them as a Species in the Spotlight (NMFS, 2016b, 2021), and the International Union for Conservation of Nature (IUCN) categorizes them as critically endangered (Lowry et al., 2019).

In December 2016, NMFS published a Recovery Plan (RP) for CIBWs to promote their conservation and survival, with an ultimate goal to improve their status so that the protections of the ESA are no longer needed (i.e., recovery; NMFS, 2016c). In the RP, NMFS identified and ranked ten potential threats based on their risk to CIBW recovery, and concluded the cumulative effects of multiple stressors were a high-ranked threat (NMFS, 2016c). The RP also included a list of 64 recovery actions targeted at population monitoring and addressing the high and medium-ranked threats. Recovery action 62 stated that in 2012, when an estimated 312 belugas remained, “over 2,700 takes were requested for research and development projects” and recommended that NMFS “review the current system for allocation of takes (by harassment) of CI belugas to see if a comprehensive approach, rather than by individual project, increases managers’ ability to reduce the cumulative effects of harassment takes by numerous projects” (NMFS, 2016c at page VI-30). The inclusion of this action highlights concern regarding the increase in human activity in Cook...
In a review of NMFS's cetacean research permitting program, it was stated that on average 8586 research takes were authorized annually from 2009 to 2017 (NMFS, 2019). Even though the best available data show the CIBW population has declined nearly 80% since the late 1970s and is still declining (Shelden & Wade, 2019), NMFS continues to issue take authorizations allowing the whales to be legally, but not lethally, harassed by various types of activities.

Despite CIBW take authorizations being solely under NMFS control, nearly five years since publication of the RP, efforts to implement recovery action 62 have “not started” (NOAA Fisheries, n.d.b). Given the high concern about cumulative effects of multiple stressors, the goal of this study was to start the analysis recommended in recovery action 62 and provide information necessary for a comprehensive assessment of the current authorization process. Our objectives were to conduct an initial assessment of the extent of all CIBW harassment being authorized under the status quo process for the post-RP time period, identifying the amount of legal take NMFS deems acceptable for CIBWs, and examining whether a relationship exists between take authorizations and the population size. A review of publicly available literature regarding take authorizations and CIBW-related documents on NMFS websites suggested there has not been an examination of the total amount of take authorized (research and incidental) for this endangered species at this scale. This is likely because the status quo authorization process is designed to review requests for take at a project-by-project level in only a portion of the CIBWs’ range, rather than taking a comprehensive approach. The information presented here will be useful for NMFS as they work to implement the RP to address the threat of cumulative effects to CIBWs, especially recovery action 62, and for considering the implications to CIBWs’ recovery potential from future take authorizations.

2 | METHODS

2.1 | Data collection

To quantify the number of authorized takes effective after the publication of the RP, we conducted an online search of publicly available information to identify projects with authorized takes of CIBWs effective January 1, 2017 or later. For authorizations that began prior to 2017, and included authorized take in 2017 or later, only the annual take for the years 2017 and later were included in our analyses. Data pertaining to the type, amount, and timing of authorized takes were obtained from documents found in multiple pages nested under NMFS’s main website (NOAA Fisheries, n.d.c) and its online system for Authorizations and Permits for Protected Species (APPS; NOAA Fisheries, n.d.d). In one case, we obtained documents directly from NMFS staff in the Office of Protected Resources’ permitting division because the online link was invalid. Specifically, we retrieved data from research permits, incidental harassment authorizations, letters of authorization, biological opinions, incidental take statements, and an environmental assessment. All of the applicable projects we found online as of December 31, 2020 are summarized in Table 1, with Appendix S1 also including links to the online sources of information for each project. Authorizations issued by NMFS after December 31, 2020 were not included in our study.

When searching APPS for relevant scientific research projects, we reviewed all projects with authorized takes of belugas, but only included projects when CIBWs were included in the authorization. In one case (ID #13), CIBW takes were grouped with all beluga takes range-wide, and without knowing how many takes were specifically for CIBWs, we included the full amount of annual authorized take in our assessment. We also included data from one authorization for “whale, unidentified toothed” because the activity approved was “auditory testing on 15 individuals each of any species of non-listed/ESA-listed odontocete that strands in the U.S.” (ID #8; NOAA Fisheries, n.d.d) and CIBW often live strand in association with tidal fluctuations (NMFS, 2016c).

We preemptively excluded some activities from this assessment. First, we disregarded data associated with marine mammal parts permits, photography permits, or public viewing permits as these activities are rarely the primary source of take (e.g., many parts permits are for the receipt of parts collected by others). Second, we excluded authorizations for emergency marine mammal stranding responses associated with permit #18786 since all cetaceans are grouped together with 99,999,999 annual takes authorized to cover response activities, and inclusion of such a value would render any analysis meaningless. Permit #18786 did include a separate amount of take for health assessments on wild animals, including CIBW, and those takes were included in our assessment (ID #5). Finally, we excluded two projects with incidental take statements published in 2017. One authorized take under the ESA (NMFS, 2017a) but NMFS’s website for MMPA authorizations lists this project as “Withdrawn and Inactive” (NOAA Fisheries, n.d.e). The other was for an oil and gas lease sale, which estimated 160–305 CIBWs could be taken in the first five years of exploration, but concluded that the lease sale in and of itself would not result in take (NMFS, 2017b).
| ID # | Take type           | Permit holder organization                          | Authorization start to end date   | Authorized CIBW annual takes | Brief project overview (component which may affect CIBWs)                                                                                                                                                                                                 |
|------|--------------------|----------------------------------------------------|----------------------------------|------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1    | Research/directed  | NMFS AFSC Marine Mammal Laboratory                   | April 25, 2011 to May 1, 2017    | 12,670                      | Research on CIBWs to include, but not limited to, vessel and aerial surveys, fecal sampling, skin/blubber biopsies, suction cup tagging, photo-identification, underwater photo/video                                         |
| 2    | Research/directed  | Oregon State University                               | December 18, 2013 to December 31, 2018 | 300                         | CIBWs may be opportunistically studied via photo-identification or behavioral observations while targeting large whale species for tagging studies                                                   |
| 3    | Research/directed  | HDR                                                 | September 11, 2013 to July 19, 2019 | 62                          | Understanding of marine mammals sharing waters with US Naval training, offshore energy development, and construction via aerial and vessel surveys, behavioral focal follows, photo/video, sample collection, and passive acoustics |
| 4    | Research/directed  | Cook Inlet Beluga Whale Photo-ID Project            | May 29, 2014 to December 17, 2018 | 2014–2016 = 30 2017–2018 = 3400 | Vessel and land-based photo-identification studies of CIBWs                                                                                                                                  |
| 5    | Research/directed  | NMFS Marine Mammal Health & Stranding Response Program | June 30, 2015 to December 31, 2021 | 40 (excludes emergency response) | Miscellaneous health status research activities (e.g., acoustics, biopsy, observation, surveys) excluding captures, spider tagging, and sedation                                               |
| 6    | Incidental         | Apache Alaska Corporation                           | March 1, 2016 to February 28, 2021 | 30 (cumulative 5-year max = 150) | Seismic surveys of Cook Inlet                                                                                                                                                                 |
| 7    | Incidental         | Municipality of Anchorage, Port of Anchorage        | April 1, 2016 to March 31, 2017   | 26 (cumulative max)         | Port of Anchorage (POA) Test Pile Program - install 10 test piles to gather geotechnical and hydroacoustic data that will support the design of future port modernization                                         |
| 8    | Research/directed  | National Marine Mammal Foundation                    | March 30, 2017 to March 31, 2022  | 15 (any toothed whale, including CIBW) | Evoked potential auditory tests for stranded marine mammals                                                                                                                                   |
| 9    | Research/directed  | NMFS AFSC Marine Mammal Laboratory                   | May 23, 2017 to May 31, 2022      | 14,600                      | Renewal of ID #1. General cetacean research activities to include aerial and vessel surveys, passive acoustics, biological sampling, suction cup tagging, photo/video                                                                 |
| 10   | Research/directed  | Cascadia Research Collective                        | July 28, 2017 to August 1, 2022   | 100                         | Studies of population size, population structure, habitat use, movements, behavior and ecology of cetaceans in the Pacific Ocean and Atlantic Ocean                                                            |
| ID # | Take type       | Permit holder organization                                                                 | Authorization start to end date                                      | Authorized CIBW annual takes | Brief project overview (component which may affect CIBWs)                                                                                                                                 |
|------|-----------------|-------------------------------------------------------------------------------------------|---------------------------------------------------------------------|-----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 11   | Incidental      | Harvest, Alaska LLC, a subsidiary of Hilcorp Alaska LLC                                  | April 25, 2018 to April 24, 2019                                   | 40 (cumulative max)         | Oil and gas pipeline installation activities associated with the Cook Inlet Pipeline Cross Inlet Extension Project (CIPL)                                                                                                                                         |
| 12   | Research/directed| Cook Inlet Beluga Whale Photo-ID Project                                                   | December 17, 2018 to December 31, 2023                             | 6800                        | Renewal of ID #4. Vessel and land-based photo-identification studies of CIBWs                                                                                                                                                                                      |
| 13   | Research/directed| Oregon State University                                                                   | December 20, 2018 to December 31, 2023                             | 400 (range-wide, including CIBW) | Renewal of ID #2. CIBWs may be opportunistically studied via photo-identification or behavioral observations while targeting large whale species for tagging studies                                                                                                                                 |
| 14   | Research/directed| ABR, Inc. Environmental Research and Services                                             | February 19, 2019 to February 15, 2024                             | 150                         | Marine mammal aerial surveys via helicopter and fixed wing in Kamishak Bay, Western Cook Inlet, Alaska, for the Pebble Mine Project                                                                                                                                 |
| 15   | Research/directed| HDR                                                                                       | July 19, 2019 to July 31, 2024                                    | 62                          | Renewal of ID #3. Assessing marine mammal populations within US Navy training, offshore energy development, and nearshore construction areas via aerial and vessel surveys, behavioral focal follows, passive acoustic monitoring, and tagging techniques. |
| 16   | Incidental      | Hilcorp Alaska LLC/ Harvest Alaska                                                         | FINAL RULE: June 1, 2019 to June 1, 2024                           | FINAL RULE = 35 (cumulative 5-year max = 58) | Four stages of oil & gas activity are planned including exploration, development, production, and decommissioning activities within Hilcorp’s area of operations in and adjacent to Cook Inlet                                                                 |
|      |                 | LOA Year 1 (Modified): September 20, 2019 to September 19, 2020                           | LOA Year 1 = 35                                                   | LOA Year 2 = 10             |                                                                                                                                                                                                                                                                  |
|      |                 | LOA Year 2: April 22, 2020 to April 21, 2021                                              |                                                                     |                             |                                                                                                                                                                                                                                                                  |
| 17   | Research/directed| Marine Ecology and Telemetry Research                                                     | September 23, 2019 to September 30, 2024                           | 50                          | Research on the effects of military activities on cetaceans within and around Navy Training Ranges; aerial and vessel surveys; observation studies (photo/video); collect remains, sloughed skin, fecal samples                                                                                                                   |
| 18   | Incidental      | NOAA Fisheries AFSC                                                                       | October 7, 2019 to October 7, 2024                                | 3                           | NOAA Fisheries AFSC and International Pacific Halibut Commission fisheries and ecosystem research activities                                                                                                                                                     |
2.2 Assumptions

Take authorizations are issued on a rolling basis throughout the year, meaning a one-year authorization might cover portions of two calendar years and a five-year authorization might cover portions of six calendar years. To allow for quantitative analyses of the data annually, we assumed annual equated to a calendar year and ended our study period with authorizations issued by December 31, 2020. When effective dates did not conform to a typical calendar year (e.g., August 1, 2018 through July 31, 2019), we considered the seasonality of both industrial and research activities in Cook Inlet, which are typically constrained to the ice-free season. Thus, we included the authorized amount of take for a project only in the calendar year(s) that had take authorized in the month of June (Table 1). We selected June to represent the work season in Cook Inlet because this is when the NMFS aerial abundance surveys typically occur (Shelden & Wade, 2019) and little to no ice remains in the inlet. For example, ID #8 has a permit valid from March 30, 2017 through March 31, 2022, but we did not include the take for this project in 2022 because it did not meet the June requirement. This method avoids artificially overestimating the total amount of take authorized, which would otherwise have occurred had we included the full amount of authorized take in two partial calendar years. We note that this method resulted in the omission from our calculations of two projects identified in Table 1 (IDs #1 and #7), but this does not meaningfully impact our results. The research project for ID #1 was renewed in May 2017 (ID #9), thus take for those activities was included in 2017 calculations through the renewal. Industrial project ID #7 was only authorized a total of 26 takes between 2016 and 2017, which is less than 0.15% of total takes authorized in 2017.

2.3 Limitations

All the take authorizations included in our study only authorized harassment of CIBWs; remote biopsy was the most invasive activity authorized, with no captures or lethal activities allowed. Recognizing not all activities have the same potential to affect CIBWs (e.g., harassment from aerial surveys is less impactful than from most other activities), we attempted to further categorize the authorized takes by activity, and hence potential severity of effect. However, the way the take information was provided for research projects, sometimes grouping together activities with varying potentials of impact (e.g., aerial surveys, biological sample collection, passive acoustic monitoring) with a single annual take amount, precluded...
such an assessment. Thus, our quantitative assessment of take authorizations was limited to broadly analyzing the amounts of authorized harassment of CIBWs as either directed research take or incidental take (primarily from industrial activities). Any further division of the data would be qualitative and subjective, and would not meaningfully contribute to the goal of our study.

As our goal was to assess the amount of take authorized via the status quo authorization process and to understand the amount of legal harassment deemed acceptable for this small, declining population, we did not examine the amount of actual take incurred by permit recipients. Examining the amount of actual take to assess the effect of specific types of activities to CIBWs could be a follow-up study, however, it is worth noting that, with two exceptions, we were unable to find information about incurred takes on NMFS websites, and our request to NMFS for copies of annual reports went unfulfilled.

2.4 | Analyses

Since by the end of 2020 take had been authorized out to the year 2025, we estimated the CIBW population size through 2025 (Table 3). The 2017 abundance was
calculated as the mean of the published 2016 and 2018 abundance estimates, and we extrapolated the CIBW population size each year after 2018 assuming continuation of the 10-year abundance trend of $-2.3\%$ per year (Shelden & Wade, 2019).

Using the actual amounts of take authorized for 2017–2025 and our estimated population sizes, we examined: the amounts of take authorized annually by category (research, incidental, total); the percentage of the population authorized to be taken annually; and the number of times each individual CIBW was authorized to be taken annually (by dividing the total annual takes by the estimated population size; Table 3).

Assuming the status quo pattern continues, more takes will be authorized for 2022–2025 than those authorized by the end of 2020, therefore, we also extrapolated total annual authorized takes to year 2025 using two different methods (Projection A and B). For Projection A, we used the mean of the total annual authorized takes from 2017 to 2021 (mean = 20,769) as the annual values for 2022–2025; for Projection B, we used the mean of 2019–2021 (mean = 22,271). We chose to include Projection B because the 2019–2021 annual total takes authorized were nearly 20% higher than the 2017 and 2018 levels, with little variance between years (2019–2021 range = 22,197–22,350). Considering the consistency in annual values for the most recent 3-year period, we determined Projection B best represented the continuation of the status quo pattern. To determine whether a relationship exists between total annual authorized takes and the CIBW population size, we ran three Pearson correlation tests with statistical significance at $\alpha = 0.05$ (Table 4); once with only the 2017–2021 dataset (actual authorizations) and twice for 2017–2025 (Projections A and B).

### 3 | RESULTS

As of the end of 2020, NMFS had authorized nearly 120,000 CIBW takes cumulatively for the period 2017–2025, ranging from a high of 22,350 in 2020 to a low of 11 in 2025 (Table 2). When looking at total annual levels, 2017 and 2018 had similar authorized amounts (roughly 18,500/year), but in 2019, the number of authorizations increased by nearly 20% and stayed stable at the higher levels (roughly 22,250/year) through 2021 (Table 2; Figure 1). The increase in 2019 resulted primarily from increasing annual authorized take for two long-term research permits renewed in 2019; increasing authorized take during permit renewals appeared to be a general pattern (see Table 2). None of the renewed research projects received less take than previously authorized. Beginning 2022, the existing authorizations decrease annually from 7579 in 2022 down to 11 in 2025 (Table 2). Research takes account for the vast majority (99.7%) of the total takes authorized by NMFS over the 9-year period. The year 2025 was the only year without any research take yet authorized, and the only year when authorized incidental takes ($n = 11$) exceeded research takes (Table 2). Incidental take was authorized in every year through 2025, with the highest levels in 2020 ($n = 133$), 2018 ($n = 70$), and 2021 ($n = 49$). Incidental take authorizations in other years were 30 or less (Table 2). In 2020, 50% of the CIBW population was authorized to be incidentally harassed.

### Table 3

Comparison of the total number of takes authorized annually, as of December 31, 2020, with the estimated CIBW population size to obtain percent of the population and the number of times each beluga in the population is authorized to be taken annually

| Year | Total authorized takesa | Estimated CIBW population sizeb | Percent of the population authorized to be taken | No. of times each beluga in the population authorized to be taken |
|------|-------------------------|-------------------------------|-----------------------------------------------|---------------------------------------------------------------|
| 2017 | 18,447                  | 286                           | 6450                                          | 65                                                            |
| 2018 | 18,587                  | 279                           | 6662                                          | 67                                                            |
| 2019 | 22,197                  | 273                           | 8131                                          | 81                                                            |
| 2020 | 22,350                  | 267                           | 8371                                          | 84                                                            |
| 2021 | 22,266                  | 261                           | 8531                                          | 85                                                            |
| 2022 | 7579                    | 255                           | 2972                                          | 30                                                            |
| 2023 | 7477                    | 249                           | 2991                                          | 30                                                            |
| 2024 | 128                     | 243                           | 53                                            | 0.5                                                           |
| 2025 | 11                      | 237                           | 5                                             | 0.05                                                          |

aAuthorized as of December 31, 2020. Values for 2022–2025 are expected to increase as more take is issued after this date.

b2017 population size is the mean of survey results from 2016 and 2018, and 2019–2025 population sizes were estimated by presuming a continued 2.3% annual decline after 2018 (Shelden & Wade, 2019).
An annual comparison of estimated population size with total take authorized as of the end of 2020 revealed total authorized takes greatly exceed the CIBW population size through 2023; it is not until 2024 and 2025 that the amount of actual authorized take is less than the population size (Table 3). When looking at the percent of the population authorized to be taken annually, 2021 had the highest amount at 8531% and 2025 had the lowest at 5% (Table 3). In 2020, NMFS authorized 22,350 takes of an estimated 267 whales, which equates to each CIBW in the population authorized to be legally harassed 84 times (Table 3; Figure 1).

All three of the correlation tests comparing total authorized takes and estimated CIBW population size yielded negative correlations (2017–2021, \( r = -0.876 \); 2017–2025 Projection A, \( r = -0.366 \); 2017–2025 Projection B, \( r = -0.734 \)), with both the 2017–2021 and 2017–2025 Projection B tests indicating strong inverse relationships (Table 4). The 2017–2025 Projection B correlation was statistically significant (\( p = .024 \)).

### Table 4 Correlations of total authorized takes versus estimated CIBW population size

| Total authorized take | 2017–2021 (actual) | 2017–2025 (Projection A)\( ^a \) | 2017–2025 (Projection B)\( ^b \) | Estimated CIBW population size\( ^c \) |
|-----------------------|---------------------|-------------------------------|-------------------------------|------------------|
| Total authorized take  | Pearson correlation (\( r \)) | 1 | -0.876 | 0.051 |
|                       | Sig. (two-tailed) (\( p \)) | 5 | 5 | 5 |
| 2017–2025 (Projection A)\( ^a \) | Pearson correlation (\( r \)) | 1 | -0.366 | 0.333 |
|                       | Sig. (two-tailed) (\( p \)) | 9 | 9 | 9 |
| 2017–2025 (Projection B)\( ^b \) | Pearson correlation (\( r \)) | 1 | -0.734 | 0.024* |
|                       | Sig. (two-tailed) (\( p \)) | 9 | 9 | 9 |

### Estimated CIBW population size\( ^c \)

| Pearson correlation (\( r \)) | -0.876 | -0.366 | -0.734 | 1 |
| Sig. (two-tailed) (\( p \)) | 0.051 | 0.333 | 0.024* | |
| \( N \) | 5 | 9 | 9 | 9 |

\( ^a \)A significant correlation at the 0.05 level.

\( ^b \)In Projection A, take authorization values for 2022–2025 were projected as the average of the 2017–2021 value (\( n = 20,769 \)).

\( ^c \)In Projection B, take authorization values for 2022–2025 were projected as the average of the 2019–2021 value (\( n = 22,271 \)).

\( ^c \)2017 population size is the mean of values provided for 2016 and 2018, and 2019–2025 population sizes were estimated by presuming 2.3% annual decline after 2018 (Shelden & Wade, 2019).

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### DISCUSSION

The RP, when discussing actions for addressing the high threat of cumulative effects, expresses concern about creeping normality, which the plan defines as “the way a major negative change, which happens slowly in many unnoticed increments, is not perceived as objectionable” or “death by a thousand cuts” (NMFS, 2016c at page VI-30). The pattern of increasing authorized takes over time is an example of creeping normality in the context of takes and, subsequently, cumulative effects. This issue was specifically addressed in the RP: “Although individual activities might be deemed insignificant when considered independently, creeping normality ... can cause substantial adverse effects ... at both individual and population levels” (NMFS, 2016c at page VI-30).

A cursory review of our findings, especially the drastic decline in authorization levels in 2022 and beyond, might falsely lead to a conclusion that the RP has been successful in reducing take authorizations, and subsequently, cumulative effects to the population. However, we must emphasize that this study only included takes authorized as of the end of 2020. By that time, NMFS had already authorized nearly 120,000 takes of CIBWs for the period 2017 through 2025, and in 2021 alone, authorizations exceeded 8500% of the population size. Given our research date ended December 31, 2020, more take authorizations are likely for 2022–2025, and it would be unrealistic to assume no additional takes will be...
authorized. This is why we projected out anticipated future take authorizations through 2025. Although the scenario we felt best predicted continuation of the status quo pattern, Projection B, yielded a statistically significant inverse correlation between annual take authorizations and population size, we recognize inherent uncertainty exists around future projections and note the correlation test using only the actual take authorization data for 2017–2021 yielded the strongest inverse relationship. While we acknowledge a correlation does not indicate causation, it is apparent that the status quo process of how take authorizations are issued needs to be reexamined since all correlation scenarios indicated an inverse relationship between the variables, with take authorizations continuing to increase despite the declining abundance.

Since 99.7% of the takes authorized for 2017–2025 were for research, we questioned whether there were changes over time in the amount of take authorized specifically for research activities. NMFS (2019) indicated that take authorizations for research from 2009 to 2017 averaged 8586 annually; our study suggests research take authorizations from 2017 to 2021 averaged 20,707 annually. Between these two time periods, the average number of authorized research takes more than doubled, whereas the CIBW population was declining 2.3% annually. We also looked for changes in authorization totals of long-term research studies during their permit renewals (see Tables 1 and 2). In all but one case the numbers authorized increased, sometimes significantly, with each renewal. As an example, ID #9 (authorized 14,600 CIBW takes annually 2011–2023) was a renewal of ID #1 (authorized 12,670 CIBW takes annually 2011–2017), which itself appeared to be a renewal of permit #782-1719 (not included in our study) which authorized 585 CIBW takes annually from 2004 to 2011 (NOAA Fisheries, n.d.d). In two permit renewals, the annual authorizations for this research program increased by

FIGURE 1 CIBW take authorizations and population size relationships, 2017–2025, based on continuation of the status quo patterns observed as of December 31, 2020, with spotlight on 2020 relationships.
more than 14,000. We point this out not to draw any conclusions regarding the validity, need for, or effect of a specific project, but rather highlight that as research programs progress over the years, there is a pattern of the number of authorized takes increasing with each renewal. If this pattern continues, both Projections A and B may be underestimates since we assumed authorizations would stay consistent at either the previous 3-year or 5-year levels. We also looked for patterns in the amount of incidental take authorized over time but none emerged, other than periodic, one-year spikes in authorization totals. For example, there was a significant spike in 2020 with over 100 additional incidental takes authorized than the prior or subsequent year, however, that had little effect on the total authorized takes value.

When discussing cumulative effects, the RP also recognizes that “multiple stressors occur year-round and throughout the range of CI belugas” (NMFS, 2016c at page III-10) and that cumulative effects include “syrnergistic effects in which two stressors interact to cause greater harm than the sum of the effects of the individual component stressors” (NMFS, 2016c at page III-8). NMFS does not incorporate the RP’s definition of cumulative effects during their project assessments. Instead, biological opinions consider the existing situation (i.e., the environmental baseline), the effect of future, nonfederal activities (i.e., the ESA definition of cumulative effects), and how the new activity may change the situation (i.e., the synthesis and integration), but only within a subset of the CIBWs’ range (i.e., the action area) and often within a limited temporal scale. Our review of biological opinions found only one which attempted to quantify prior levels of annual authorized take, and that was only for research (NMFS, 2019). It is evident the common practice for CIBWs is to not explicitly review the existing level of take already authorized before authorizing new takes. Duggan (2011) postulated that failure to consider the pre-existing levels of authorized take could result in a listed species sliding toward extinction instead of away from it. For CIBWs, whose population is continuing to decline while harassment is increasing, and for whom cumulative effects are a high threat to their recovery, the practice of ignoring existing take authorizations is especially concerning. Without knowing the extent of prior take authorizations, it is difficult to know when the metaphorical thousandth cut may occur.

We suspect that the existing process of authorizing takes on a project-by-project basis, with no requirement to assess cumulative authorized take, results in NMFS being unaware of how drastically authorization of legal harassment of such a small population has increased over time. This is a progression toward death by a thousand cuts for CIBWs, especially since authorizing more takes equates to increasing CIBWs’ exposure to multiple stressors. While our study does not attempt to elucidate the actual cumulative effects from these projects, we can say that our findings indicate the status quo authorization process is not designed to reduce the threat of cumulative effects. Although authorized levels of take may be an overestimate of the number of whales actually taken, the potential exists that all of the authorized takes could be incurred. This means that in 2020 NMFS, knowingly or not, deemed it acceptable for CIBWs to be legally harassed 22,350 times, which is 8371% of the population size (Figure 1). This is on top of all the other harassment and stressors that occur but which NMFS does not authorize (e.g., high levels of vessel noise or nonpermitted pile driving, Castellote et al., 2018; vessel strikes or entanglements, McGuire et al., 2020; pollution). Presuming the population continues to decline, and without changes to the status quo process, the percent of the population and the number of times each individual will be authorized to be taken are expected to increase as new projects are permitted or existing permits are renewed. Given the unknown reasons why the CIBW population continues to decline, the increase in take authorizations may be a contributing factor to the cumulative effects for this species, and thus adding to their lack of recovery.

These issues emphasize the need for NMFS to implement recovery action 62 immediately and reassess the current take authorization process. A comprehensive, holistic approach, rather than by individual project, may increase NMFS’s ability to reduce the cumulative effects of legal harassment. NMFS started the process of conducting a multiyear programmatic review to analyze the environmental impacts of issuing incidental take of CIBWs in 2014 (79 Fed. Reg. 61616), but never completed it. NMFS should restart the analysis and look cumulatively at all authorized take, not just incidental. The Marine Mammal Commission has supported a cap on incidental take since before the publication of the RP (e.g., Marine Mammal Commission, 2016), and the RP recommends capping incidental take, research take, and total take, with “total allocated take ... capped annually at some fraction of the population estimate from the previous year” (NMFS, 2016c at page VI-30). As such, we also urge NMFS to immediately implement a limit on the total amount of take authorized annually, decreasing the limits as the CIBW population decreases.

Furthermore, our study highlights that the lack of publicly available information causes significant challenges in understanding the situation. Despite combing through numerous websites and documents to compile the information in Table 1, we were still limited in what we were able to analyze. For instance, as discussed in Methods-Limitations, the lack of information about the
specific source of harassment for each authorized take, particularly for research permits, restricted our categorization of takes to “research” or “incidental” and precluded further assessment of harassment potential from permitted activities. Moreover, we were generally unable to find information in the public domain about the reported levels of take incurred for any research project, and only found such information for two incidental take projects.

We are not the first to experience challenges locating information regarding NMFS take authorizations. Duggan (2011) was able to identify incidental take permit hotspots for US Fish & Wildlife Service (USFWS) species, but was unable to do the same for NMFS species, noting NMFS lacked a comprehensive take permitting database; he advocated for the creation of a central database of takes of endangered species to improve internal management and public transparency. Several others have also highlighted the need for systematic and comprehensive take-tracking systems, noting the benefits of such systems for improving ESA consultations by readily providing information about the cumulative take to which the species’ future existence, as well as providing scientific support for the agency to take necessary steps to prevent extinction (Duggan, 2011; Evansen et al., 2020; NMFS, 2019; Totoiu, 2011; USGAO, 2009). Thanks to litigation in the early 2000s, the USFWS recognized there were also legal benefits and developed range-wide take-tracking databases for northern spotted owls (Strix occidentalis caurina) and bull trout (Salvelinus confluentes), and for a portion of the range for marbled murrelets (Brachyramphus marmoratus) (Totoiu, 2011).

NMFS does have a mapper for projects with incidental takes (NOAA Fisheries, n.d.f) and a web-based Environmental Consultation Organizer (NOAA Fisheries, n.d.g) to track ESA consultations, however, these public pages focus on incidental take activities and provide no quantitative information about CIBW take. Our inability to find comprehensive take information for CIBWs emphasizes the need for improved transparency of NMFS’s endangered species data.

Recovery action 62 also advocates for improving the process for tracking CIBW takes because “[r]equiring more frequent reporting of takes and better tracking of take will better inform NMFS of how many takes are actually occurring, and will allow better take allocation in subsequent years” (NMFS, 2016c at page VI-30). We recommend NMFS develop a publicly-accessible, comprehensive take-tracking system for CIBWs which includes timely information about both research and incidental takes range-wide, provides greater refinement of the source of each take authorized, and compares authorization levels with reported levels of incurred take. To better understand the relationship over time between levels of take and the CIBW population size, the system should include data beginning when CIBW were listed under the ESA in 2008. The development of a CIBW take-tracking system should be a priority to aid with implementation of recovery action 62, improve transparency with the public, and better inform NMFS staff about the cumulative take for this endangered species allowing for more informed decisions to promote recovery.

Reiterating that our study was limited to analyzing take authorizations in broad categories of “research” and “incidental” without considering the potential effect to CIBWs from any specific activity, the data show the vast majority of take authorizations we reviewed were for research activities. The RP includes a specific recovery action (#45) discussing the need to refine research methods and to “[o]nly conduct research on CI belugas that has a clear connection to their recovery” (NMFS, 2016c at page VI-24). While we recognize the importance of research in elucidating gaps in the understanding of the species, we were unable to find any changes in the way CIBWs are managed for recovery since the RP was published (i.e., no new regulations promulgated protecting the whales or their habitat), despite the additional research and resources associated with CIBWs being a Species in the Spotlight (NMFS, 2016b, 2021). Furthermore, there appeared to be many research projects which did not actually conduct their authorized research activities for CIBWs, raising questions about the importance of such research for improving management of the species, and the need for authorizing take for these projects. Given the continued decline of the CIBWs and the absence of changed management strategies, despite all the research authorized, it appears there is a general disconnect between CIBW research and management for CIBW recovery. In light of the high concern of cumulative effects, and evident creeping normality in research take authorizations, we therefore recommend that NMFS ensures any research authorized for this small and declining population of whales has a high likelihood of meaningfully influencing management decisions promoting recovery.

Our study highlights several concerns associated with the existing process of authorizing takes of endangered CIBWs, the creeping normality in the number of authorized takes over time, the inverse relationship between the number of takes authorized with the population size, and the challenges of finding information in the public domain regarding the amount of total take authorized or incurred. Despite the RP identifying cumulative effects as a high threat and recommending in recovery action...
62 that an annual limit on the amount of take authorized be a fraction of the population size, the status quo process is authorizing harassment takes at orders of magnitude greater than the population size. The general trend of total annual take authorizations increasing over time means the potential for cumulative effects also increases, which may decrease the potential for recovery.

The conclusion we draw from our results is the status quo process is failing to meet the RP’s second objective to “ensure that commercial, recreational, scientific, or educational activities are not inhibiting the recovery of CI belugas,” and without a clear understanding of how much harassment is being authorized, NMFS cannot effectively reduce the threat of cumulative effects nor promote recovery. Our findings underscore the importance of immediately implementing recovery action 62 and provides support for NMFS taking a critical look at the status quo, project-by-project process for authorizing takes to see if a holistic approach will more effectively reduce the cumulative effects of harassment from numerous projects. We also recommend NMFS: (1) establish annual maximum take authorization limits, cumulatively as well as individual limits for research and incidental take, and decrease the limits as the CIBW population decreases; (2) develop a comprehensive and publicly accessible aggregate take-tracking system which includes timely information about authorized take levels, incurred take levels, and details regarding the source of each take; and (3) if authorized takes greatly exceed incurred takes, reduce the number of takes authorized to be more consistent with what is actually needed. Furthermore, the cumulative effects associated with multiple activities could be reduced by both coordinating timing of industrial activities to avoid authorizing projects with high potential to affect CIBWs (e.g., pile driving, seismic exploration) from occurring in the same year, and by implementing the recommendation in RP recovery action 45 to limit research activities to those with a clear connection to CIBW recovery and a high likelihood of influencing management decisions. We consider this list a starting point of changes NMFS can make to improve the take authorization process for CIBWs and reduce cumulative effects, recognizing it could be adopted for other species in similar situations. Others have advocated for additional changes to the authorization process at-large, which if implemented could also benefit CIBWs. Such recommendations include modifications to regulatory definitions (Duggan, 2011) and incorporation of predictive models to assess effects of each new take authorization (McGowan & Ryan, 2010). Although Tollit et al. (2016) provided NMFS with a CIBW-specific interim model assessing the population consequences of disturbance (iPCoD) from acoustic sources, we found no evidence this model, or any predictive model, was being used when authorizing take of CIBWs.

The take authorization process used for CIBWs is the standard process for marine mammals under NMFS’s jurisdiction, and is similar to the process for other endangered marine and terrestrial animal species under NMFS or USFWS jurisdictions. We suspect a lack of awareness of the cumulative amount of take being authorized, and the creeping normality of total annual authorizations, is not unique to CIBWs. This is likely a systemic issue in regards to how endangered species are managed in the United States, however, the status quo method of issuing takes on an individual project basis and not considering total takes already authorized is failing this species and the intent of the ESA. Meaningful changes in the overall take authorization process likely necessitate efforts at a national level to change policies and regulations, which often take years to accomplish. Hopefully, such change will not come too late for CIBWs.

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CONFLICT OF INTEREST
The authors declare no potential conflict of interest.

AUTHOR CONTRIBUTIONS
Celeste Bollini developed the initial idea for the study. Mandy Migura and Celeste Bollini developed the concepts within this paper collaboratively, to include data collection/analyses and manuscript reviews/revisions. Mandy Migura led the writing of the manuscript with contributions from Celeste Bollini.

ORCID
Mandy Migura – https://orcid.org/0000-0001-9312-9126

REFERENCES
Calkins, D. G. (1989). Status of belukha whales in Cook Inlet. In L. E. Jarvela & L. K. Thorsteinson (Eds.), Proceedings of the Gulf of Alaska, Cook Inlet, and North Aleutian basin information update meeting, February 7–8, 1989, Anchorage, Alaska (pp. 109–112). Retrieved August 15, 2021 from U.S. Department of Commerce, NOAA, National Ocean Service, OCSEAP. http://www.adfg.alaska.gov/static/home/library/pdfs/wildlife/research_pdfs/status_belukha_whales_cook_inlet_ch_15_donald_calkins.pdf
NMFS. (2017b). *Endangered Species Act (ESA) Section 7(a)(2) Biological Opinion for Furies Offshore Oil and Gas Exploration Drilling in the Kitchen Lights Unit of Cook Inlet, Alaska, 2017–2021*. NMFS Consultation Number: AKR-2016-9600. National Marine Fisheries Service, Alaska Region, Protected Resources Division. Retrieved August 15, 2021 from https://repository.library.noaa.gov/view/noaa/15979

NMFS. (2017a). *Endangered Species Act (ESA) Section 7(a)(2) Biological Opinion for Lease Sale 244, Cook Inlet, Alaska, 2017–2022*. NMFS Consultation Number: AKR-2016-9580. National Marine Fisheries Service, Alaska Region, Protected Resources Division. Retrieved August 15, 2021 from https://repository.library.noaa.gov/view/noaa/17143

Castellote, M., Thayre, B., Mahoney, M., Mondragon, J., Lammers, M. O., & Small, R. J. (2018). Anthropogenic noise and the endangered Cook Inlet beluga whale, *Delphinapterus leucas*: Acoustic considerations for management. *Marine Fisheries Review, 80*(3), 63–88.

Duggan, P. (2011). Incidental extinction: How the Endangered Species Act’s incidental take permits fail to account for population loss. *Environmental Law Reporter, 41*(7), 10628–10640.

Evansen, M., Li, Y.-W., & Malcom, J. (2020). Same law, diverging practice: Comparative analysis of Endangered Species Act consultations by two federal agencies. *PloS One, 15*(3), e0230477.

Lowry, L., Hobbs, R., & O’Corry-Crowe, G. (2019). *Cook Inlet beluga whale (Delphinapterus leucas) in Cook Inlet subpopulation*. In *The IUCN Red List of Threatened Species 2019*: e.T61442A50384653. Last Accessed August 15, 2021. https://doi.org/10.2305/IUCN.UK.2019-1.RLTS.T61442A50384653.en

McGowan, C. P., & Ryan, M. R. (2010). Arguments for using population models in incidental take assessments for endangered species. *Journal of Fish and Wildlife Management, 1*, 183–188.

McGuire, T. L., Stephens, A. D., McClung, J. R., Garner, C., Burek-Huntington, K. A., Goertz, C. E. C., Sheldon, K. E. W., O’Corry-Crowe, G., Himes Boor, G. K., & Wright, B. A. (2020). Anthropogenic scarring in long-term photo-identification records of Cook Inlet beluga whales, *Delphinapterus leucas*. *Marine Fisheries Review*, 82(3–4), 20–40.

NMFS. (2016a). *Interim guidance on the Endangered Species Act term “harass”, National Marine Fisheries Service Procedural Instruction 02-110-19*. National Marine Fisheries Service, Office of Protected Resources. Retrieved August 15, 2021 from https://media.fisheries.noaa.gov/apex/f?p=154:400::NO::P400_PLAN_TITLE,P400_SPECIES.RECOVERY%20PLAN%20for%20the%20Cook%20Inlet%20Beluga%20Luga%20%20Delphinapterus%20leucas*.

NOAA Fisheries. (n.d.-d). *Permits-Protected Resources: What type of permit/authorization are you seeking?* Retrieved August 15, 2021 from https://www.fisheries.noaa.gov/permits-and-forms#protected-resources.

NOAA Fisheries. (n.d.-b). *Recovery Action Database: Recovery Plan for the Cook Inlet Beluga Whale (Delphinapterus leucas)*. Retrieved August 15, 2021 from https://www.fisheries.noaa.gov/national/marine-mammal-protection/incidental-take-authorizations-oil-and-gas.

NOAA Fisheries. (n.d.-f). *Incidental take authorizations points map*. Retrieved September 20, 2021 from https://www.fisheries.noaa.gov/resource/map/incidental-take-authorizations-oil-and-gas.

NOAA Fisheries. (n.d.-e). *Marine Mammal Commission Letters and Agency Responses*.

Shelden, K. E. W., & Wade, P. R. (Eds.). (2019). *Anthropogenic scarring in long-term photo-identification records of Cook Inlet beluga whales, Delphinapterus leucas*. *Marine Fisheries Review*, 82(3–4), 20–40.

Tollitt, D., Harwood, J., Booth, C. G., Thomas, L., New, L. & Wood, J.D. (2016). *Cook Inlet beluga whale PCoA expert elicitation workshop report, September 29, 2016*. Prepared by SMRU Consulting North America, SMRUC-NA-NOAA0915. 54 p. Retrieved August 15, 2021 from http://d92381143c3d0809f56ed62.smruconsulting.netdna-cdn.com/wp-content/uploads/
Totoiu, J. (2011). Quantifying, monitoring, and tracking “take” under the Endangered Species Act: The promise of a more informed approach to consultation. *Environmental Law, 41*, 165–200.

United States Government Accountability Office [USGAO]. (2009). Report to congressional requestors: Endangered Species Act, the U.S. Fish and Wildlife Service has incomplete information about effects on listed species from section 7 consultations. May 2009. GAO-09-550. 34 p. Retrieved August 15, 2021 from https://www.gao.gov/assets/gao-09-550.pdf.

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