UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
West Coast Region
501 West Ocean Boulevard, Suite 4200
Long Beach, California 90802-4213

December 22, 2021

Refer to NMFS No:
WCRO-2021-02166

Mitch Dallas
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Lisa Wooninck
Superintendent
Monterey Bay National Marine Sanctuary
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Re: Endangered Species Act Section 7(a)(2) Biological Opinion for the California Department of Transportation's and the Monterey Bay National Marine Sanctuary's Emergency Action in Response to the 2017 Mud Creek Landslide.

Dear Mr. Dallas and Dr. Wooninck:

Thank you for the California Department of Transportation's (Caltrans) letter of September 2, 2021, and the Monterey Bay National Marine Sanctuary's (MBNMS) letter of October 5, 2021, requesting initiation of consultation with NOAA's National Marine Fisheries Service (NMFS) pursuant to section 7 of the Endangered Species Act of 1973 (ESA) (16 U.S.C. 1531 et seq.) for the emergency action in response to the 2017 Mud Creek landslide.

This document transmits NMFS' final biological opinion based on the NMFS West Coast Region's (WCR) review of the emergency action and its effects on ESA-listed species and designated critical habitat.

This opinion considers the effects of the emergency action in response to the 2017 Mud Creek landslide, namely the rescue, relocation, and monitoring of black abalone (*Haliotis cracherodii*) that were at risk of burial or being dislodged by slide materials. Caltrans, as assigned by the Federal Highway Administration (FHWA), carried out the emergency action. The MBNMS also participated in and provided funding to support the emergency action. Caltrans conducted additional activities to restore and reopen Highway 1, but determined that those activities had no effect on ESA-listed resources.

To develop this opinion, we used information presented in the Biological Assessment prepared by Caltrans as well as in a black abalone survey report and rescue/relocation protocol developed

as part of the emergency response. We also reviewed available scientific literature on pertinent subjects. A complete administrative record of this consultation is on file at the NMFS WCR Long Beach Office.

Based on our analysis, it is our biological opinion that the emergency action (i.e., the rescue, relocation, and monitoring of black abalone in response to the 2017 Mud Creek landslide) is not likely to jeopardize the continued existence of endangered black abalone. NMFS provided recommendations to minimize adverse effects on black abalone during the emergency response. The action agencies complied with all of the recommendations provided by NMFS in carrying out the emergency action. This opinion provides discretionary Conservation Recommendations that would improve our understanding of the long-term effects of sedimentation events on black abalone and their habitat, as well as the effectiveness of relocation efforts for enhancing black abalone populations.

Please contact Susan Wang at Susan.Wang@noaa.gov if you have any questions concerning this consultation, or if you require additional information.

Chris Yates
Assistant Regional Administrator
for Protected Resources

Enclosure

cc: Karen Grimmer – MBNMS, Karen.Grimmer@noaa.gov
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Administrative File: 151422WCR2021PR00187

Endangered Species Act (ESA) Section 7(a)(2) Biological Opinion
for the
Emergency Actions and Funding in Response to the 2017 Mud Creek Landslide

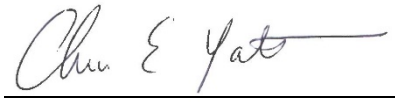
NMFS Consultation Number: WCRO-2021-02166

Action Agencies: California Department of Transportation and the Monterey Bay National Marine Sanctuary

Affected Species and NMFS' Determinations:

ESA-Listed Species	Status	Is Action Likely to Adversely Affect Species?	Is Action Likely to Jeopardize the Species?	Is Action Likely to Adversely Affect Critical Habitat?	Is Action Likely to Destroy or Adversely Modify Critical Habitat?
Black abalone (*Haliotis cracherodii*)	Endangered	Yes	No	No	NA

Consultation Conducted By: National Marine Fisheries Service, West Coast Region

Issued By: 

Chris Yates
Assistant Regional Administrator for Protected Resources
West Coast Region
National Marine Fisheries Service

Date: *December 22, 2021*

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ACRONYMS

BA	Biological assessment
Caltrans	California Department of Transportation
CDFW	California Department of Fish and Wildlife
CFR	Code of Federal Regulations
DQA	Data Quality Act
ESA	Endangered Species Act
FHWA	Federal Highway Administration
ITS	Incidental Take Statement
MARINe	Multi-Agency Rocky Intertidal Network
MBNMS	Monterey Bay National Marine Sanctuary
NMFS	National Marine Fisheries Service
SSC Pacific	Department of the Navy's SPAWAR Systems Center, Pacific
SWFSC	Southwest Fisheries Science Center
UCD	University of California, Davis
UCSB	University of California, Santa Barbara
UCSC	University of California, Santa Cruz
WCR	West Coast Region

1. INTRODUCTION

This Introduction section provides information relevant to the other sections of this document and is incorporated by reference into Sections 2 and 3, below.

1.1. Background

The National Marine Fisheries Service (NMFS) prepared the biological opinion (opinion) and incidental take statement (ITS) portions of this document in accordance with section 7(b) of the Endangered Species Act (ESA) of 1973 (16 U.S.C. 1531 et seq.), as amended, and implementing regulations at 50 CFR part 402.

We completed pre-dissemination review of this document using standards for utility, integrity, and objectivity in compliance with applicable guidelines issued under the Data Quality Act (DQA) (section 515 of the Treasury and General Government Appropriations Act for Fiscal Year 2001, Public Law 106-554). The document will be available within two weeks at the NOAA Library Institutional Repository [https://repository.library.noaa.gov/welcome]. A complete record of this consultation is on file at the NMFS West Coast Region (WCR) Long Beach Office.

1.2. Consultation History

On May 20, 2017, the largest recorded landslide in Big Sur occurred at Mud Creek, Monterey County, California. About 5 million cubic yards of slide material buried approximately one-quarter-mile of Highway 1 and about 1,700 linear feet (about 518 linear meters) of rocky intertidal habitat. The slide buried an estimated two acres of rocky intertidal and 13 acres of subtidal habitat.

On June 5, 2017, the California Department of Transportation (Caltrans), as assigned by the Federal Highway Administration (FHWA), submitted an Emergency Notification to NMFS WCR about the landslide and Caltrans' response plan. NMFS responded to the Emergency Notification with general avoidance and minimization measures for ESA listed species and critical habitat (i.e., conduct surveys for protected resources; avoid and minimize sediment introduction into the marine environment). NMFS notified Caltrans that the landslide site was adjacent to and within marine waters that may support ESA-listed steelhead, green sturgeon, black abalone, sea turtles, whales, and pinnipeds, as well as critical habitat for these species. Caltrans subsequently determined that their emergency response would have no effect on ESA-listed species and critical habitat except for black abalone.

On July 24-25, 2017, Caltrans worked with biologists from the University of California, Santa Cruz (UCSC) to assess the status of black abalone and their habitat in the areas adjacent to the landslide. The assessment results are reported in UCSC's initial findings report (Raimondi et al. 2017).

On October 17, 2017, NMFS WCR provided a letter to Caltrans to recommend that Caltrans work with a multiagency team to rescue and relocate black abalone at risk of being buried or dislodged by continued erosion of sediment from the landslide, as part of the emergency response. The NMFS WCR letter outlined appropriate procedures for black abalone rescue and

relocation. Several phone discussions were held to coordinate efforts, resulting in a black abalone rescue and relocation effort on November 2-3, 2017. The rescue and relocation efforts were primarily carried out by UCSC biologists under the direction of Caltrans. The Monterey Bay National Marine Sanctuary (MBNMS) provided funding and staff support for the rescue and relocation efforts.

On September 2, 2021, NMFS WCR received a letter from Caltrans requesting formal emergency consultation under Section 7 of the ESA for Caltrans' emergency action in response to the 2017 Mud Creek landslide. As part of the consultation request, Caltrans provided a biological assessment (BA) describing their emergency activities and the effects on ESA-listed species and designated critical habitat (Caltrans 2021). Caltrans concluded that the only emergency response activities that adversely affected ESA-listed resources were the rescue and relocation of black abalone and that the only ESA-listed resources that were adversely affected were black abalone. Caltrans concluded that other emergency response activities, such as construction activities to reopen Highway 1, did not affect ESA-listed species or designated critical habitat. Caltrans also concluded that the rescue and relocation of black abalone did not affect any other ESA-listed species or designated critical habitat.

On October 5, 2021, NMFS WCR received a letter from the MBNMS requesting formal emergency consultation under Section 7 of the ESA for MBNMS' funding to UCSC and participation in the black abalone rescue and relocation effort in response to the 2017 Mud Creek landslide. MBNMS' consultation request letter referred to Caltrans' BA for a description of the emergency activities conducted and the effects on ESA-listed black abalone.

We reviewed the consultation request letters from Caltrans and MBNMS along with Caltrans' BA submitted on September 2, 2021. After evaluating all of the information provided, we agreed that Caltrans' emergency actions and MBNMS' funding and participation to carry out the emergency action in response to the Mud Creek landslide qualified for emergency consultation. We also agreed that Caltrans and MBNMS satisfied the requirements for initiating formal consultation under 50 CFR § 402.14(c) and initiated formal consultation on September 2, 2021.

To conduct our analysis for this consultation, we relied on information contained in Caltrans' BA, as well as reports documenting the 2017 Mud Creek black abalone survey results (Raimondi et al. 2017) and the 2017 black abalone rescue and relocation (Bell and Raimondi 2020). We also obtained additional information from Caltrans, MBNMS, UCSC, and the Southwest Fisheries Science Center (SWFSC) regarding the effects of the rescue and relocation activities on black abalone.

1.3. Federal Action

Under the ESA, "action" means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies (50 CFR § 402.02).

The Federal action consists of two actions taken in response to the 2017 Mud Creek landslide:

1) Caltrans' emergency action to rescue and relocate black abalone at risk of being buried or dislodged by slide materials due to the continued erosion and movement of sediment following the landslide; and
2) MBNMS' funding to UCSC and participation in carrying out the emergency rescue and relocation of black abalone.

The Federal actions qualify for emergency consultation because they were conducted in response to the Mud Creek landslide that occurred on May 20, 2017. The Mud Creek landslide fits the regulatory definition of an emergency (i.e., situations involving acts of God, disasters, casualties, national defense or security emergencies, etc.). (50 CFR § 402.05)

The Federal action began in May 2017, when the emergency event (Mud Creek landslide) occurred. The Federal action was ended in November 2018, when post-release monitoring of rescued black abalone at the relocation site was completed and transitioned to regular annual monitoring surveys (covered under an existing ESA scientific research permit and the associated biological opinion). We describe the Federal action in more detail below.

We considered, under the ESA, whether or not the emergency action caused any other activities that result in consequences to ESA-listed species and determined that it did not.

1.3.1. Caltrans Emergency Action

Caltrans conducted emergency actions in response to the 2017 Mud Creek landslide under the authority of the FHWA. Caltrans' emergency actions consisted of Highway 1 reconstruction activities and black abalone rescue and relocation activities.

Emergency Highway 1 reconstruction activities to restore the highway included:

- construction of a highway alignment on top of the slide;
- construction of a rock revetment inland of the toe of the slide, outside of the intertidal zone, designed to keep slide material (e.g., sediment and rocks) from entering the ocean during construction activities; and
- monitoring of sediment movement during highway reconstruction and after reopening of the highway.

Black abalone rescue and relocation activities included:

- surveys of black abalone populations in adjacent habitats both north and south of the landslide;
- rescue (removal and collection) of black abalone at risk of being buried or dislodged by slide material;
- transport and short-term holding of rescued black abalone;
- handling, genetic sampling (epipodial clipping), and tagging of rescued black abalone;
- relocation site preparation (selection and preparation of cracks and crevices);
- release of rescued black abalone at the relocation site;
- post-release monitoring of the black abalone (both resident and rescued/relocated abalone) at the relocation site; and

- processing of dead or severely injured black abalone.

To avoid and minimize effects on ESA-listed resources, Caltrans sought and incorporated input from MBNMS and NMFS to develop their proposal for Highway 1 reconstruction activities and to obtain their California Coastal Commission Emergency Coastal Development Permit (G-3-17-040 issued on July 31, 2017). Caltrans concluded that the emergency Highway 1 reconstruction activities had no effect on ESA-listed species and designated critical habitat, because these activities occurred outside of the intertidal zone and did not result in sediment input into the marine environment. Therefore, this consultation focuses on the emergency black abalone rescue and relocation activities, described in detail in Section 1.3.3 (Black Abalone Rescue and Relocation Activities).

1.3.2. MBNMS Emergency Action

The MBNMS provided funding to UCSC to work with Caltrans in carrying out the black abalone rescue and relocation activities described in Section 1.3.3 (Black Abalone Rescue and Relocation Activities). A MBNMS ecologist worked closely with the team and participated in carrying out the rescue and relocation activities.

1.3.3. Black Abalone Rescue and Relocation Activities

Activities were conducted according to best practices as described in the Final White Abalone Recovery Plan (NMFS 2008) and adjusted as needed for black abalone. The black abalone-specific best practices are documented in the Mud Creek black abalone translocation manual by Bell and Raimondi (2020). Black abalone rescue and relocation activities included:

- surveys of black abalone populations in adjacent habitats both north and south of the landslide;
- rescue (removal and collection) of black abalone at risk of being buried or dislodged by slide material;
- transport and short-term holding of rescued black abalone;
- handling, genetic sampling (epipodial clipping), and tagging of rescued black abalone;
- relocation site preparation (selection and preparation of cracks and crevices);
- release of rescued black abalone at a relocation site;
- post-release monitoring of the black abalone (both resident and rescued/relocated abalone) at the relocation site; and
- processing of dead or severely injured black abalone.

In July 2017, Caltrans worked with UCSC to survey black abalone populations and habitat adjacent to the slide (Raimondi et al. 2017). They found 186 black abalone along a 263 foot (80m) segment of rocky intertidal habitat located approximately 800 feet (245m) north of the slide. They also found 27 black abalone within a 328 feet (100m) segment of rocky intertidal habitat located approximately 656 feet (200m) south of the slide.

Monitoring indicated continued erosion of the landslide, which was expected to occur at a faster rate entering the winter months due to increased ocean swell associated with winter storms. By late September 2017, eroded slide materials had buried about half of the segment to the north where black abalone were found in July. In October 2017, NMFS WCR requested that Caltrans work with a multiagency team to rescue and relocate black abalone at risk of being buried or dislodged by continued erosion of sediment from the landslide, as part of the emergency response. The NMFS WCR request outlined appropriate procedures for the rescue and relocation to minimize adverse effects on black abalone. The Final ESA Recovery Plan for Black Abalone (NMFS 2020) identifies emergency rescue and relocation of black abalone as an important recovery action.

On November 2, 2017, a team led by Caltrans and UCSC surveyed the rocky intertidal habitat up to about 1,640ft (500m) north of the landslide (Caltrans 2021). The surveys focused on the segment where black abalone were found in July and an additional 574ft (175m) upcoast from there, as this stretch of coast was considered vulnerable to burial by sediment erosion from the landslide. The team observed 334 black abalone within this area and identified those that could be safely removed. Only those black abalone that were accessible (i.e., not deep in crevices) and could be removed with minimal injury (e.g., not clamped tightly to the substrate) were collected and removed from the area. To further minimize injury, abalone collections were conducted by experienced personnel. On November 3, 2017, the team surveyed a 2,133ft (650m) segment of rocky intertidal habitat south of the landslide, including the area surveyed in July, and did not find any live black abalone because the area had been buried by eroded slide materials.

The team rescued a total of 45 black abalone. The rescued black abalone were removed from the site and transported in mesh bags via vehicle to The Abalone Farm in Cayucos, California, where they were held for one day in tanks with flowing seawater. Captive holding of black abalone at The Abalone Farm was covered under ESA Scientific Research and Enhancement Permit 19571, issued under Section 10(a)(1)(A) of the ESA to the SWFSC for black abalone captive holding and research. Short-term holding of the rescued black abalone was necessary because researchers did not have sufficient time to process the abalone and relocate them to the field site on the same day. For safety reasons, field work was limited to daytime low tides, allowing only a few working hours per day.

While held in captivity, the abalone were measured, weighed, photographed, assessed for injuries, and genetically sampled by collecting an epipodial clip. Abalone that were obviously sick or severely injured and considered not likely to survive were sacrificed and preserved for necropsy. Abalone that were severely injured and not likely to survive translocation to the field site were transported to a holding facility for rehabilitation and long-term holding. Abalone that were deemed healthy enough for translocation were tagged with two Floy shellfish tags glued to the shell as well as with a shell notch. Shell notching took about 5-10 minutes and involved using a rotary tool to cut a 1mm thick, 2-4mm deep notch into the growing edge of the shell.

Of the 45 rescued black abalone (Bell and Raimondi 2020):

- Five were sacrificed and preserved for necropsy ((Moore 2018, appendix in Caltrans 2021): two had severely shrunken feet indicative of withering syndrome and three sustained severe injuries during collection. The five abalone were preserved and sent to

the California Department of Fish and Wildlife (CDFW) Shellfish Health Laboratory for analysis.

- Nine were transported by vehicle to the SWFSC La Jolla Laboratory for rehabilitation and long-term holding. These abalone were incorporated into the SWFSC's captive research program under ESA Permit 19571. These nine abalone had suffered severe injuries during collection and were considered unlikely to survive if released to the field. Of the nine, two died 11 days after collection due to deep wounds and a third individual died 41 days after collection, due to severe damage to the shell and foot.
- Thirty-one were transported by vehicle and released at the relocation site in Piedras Blancas on November 4, 2017. Researchers placed individual black abalone within pre-selected cracks and crevices at the relocation site, ensuring that each abalone firmly adhered to the substrate. The translocated abalone ranged in size from 40 to 155 mm SL. Only three were less than 65 mm SL; most were greater than 110 mm SL.

Following the release of the black abalone at the relocation site, researchers continued to monitor both the released black abalone and resident black abalone that were already at the site. Post-release monitoring was conducted during every daytime low tide series (approximately every two weeks) for the first few months following the translocation. Researchers searched for translocated black abalone within the cracks and crevices, noting the presence of translocated abalone (based on tags or notched shells) and resident black abalone. As much as possible, researchers recorded the distance moved from the original crack/crevice in which the abalone were initially placed. Researchers also collected empty tagged shells to estimate mortality.

Post-release monitoring of the rescued and resident black abalone as part of the emergency action was conducted through November 2018. Researchers continue to monitor the relocation site once per year, on the same schedule as the adjacent long-term monitoring site. This annual monitoring is conducted under ESA Scientific Research Permit 18761-2R issued to UCSC for black abalone monitoring throughout California.

Based on observations through November 2019, researchers have confirmed five mortalities among the 31 black abalone translocated to the site (Bell and Raimondi 2020). Researchers noted that many of the translocated black abalone moved within the first few days after they were released, with some abalone moving 10 m or more away from where they were initially placed. Some of the translocated abalone were not observed again, possibly due to tag loss, movement out of the area, movement to inaccessible habitat (e.g., deep into crevices where they cannot be seen), or mortality. Movement was observed across all size classes.

Researchers observed movement among the resident black abalone, including movement of resident abalone out of the cracks and crevices where translocated black abalone were placed (Bell and Raimondi 2020). These resident black abalone appeared to return to these cracks and crevices over time. Black abalone numbers within the adjacent long-term monitoring site remained stable. Researchers observed some of the tagged, translocated black abalone in the long-term monitoring site, which is 20 m away from the relocation site.

2. ENDANGERED SPECIES ACT: BIOLOGICAL OPINION AND INCIDENTAL TAKE STATEMENT

The ESA establishes a national program for conserving threatened and endangered species of fish, wildlife, plants, and the habitat upon which they depend. As required by section 7(a)(2) of the ESA, each Federal agency must ensure that its actions are not likely to jeopardize the continued existence of endangered or threatened species or to adversely modify or destroy their designated critical habitat. Per the requirements of the ESA, Federal action agencies consult with NMFS and section 7(b)(3) requires that, at the conclusion of consultation, NMFS provide an opinion stating how the agency's actions would affect listed species and their critical habitats. If incidental take is reasonably certain to occur, section 7(b)(4) requires NMFS to provide an ITS that specifies the impact of any incidental taking and includes reasonable and prudent measures and terms and conditions to minimize such impacts.

2.1. Analytical Approach

This biological opinion includes a jeopardy analysis. The jeopardy analysis relies upon the regulatory definition of "jeopardize the continued existence of" a listed species, which is "to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species" (50 CFR § 402.02). Therefore, the jeopardy analysis considers both survival and recovery of the species.

The ESA Section 7 implementing regulations define effects of the action using the term "consequences" (50 CFR § 402.02). As explained in the preamble to the final rule revising the definition and adding this term (84 FR 44976, 44977; August 27, 2019), that revision does not change the scope of our analysis and in this opinion we use the terms "effects" and "consequences" interchangeably.

We use the following approach to determine whether the emergency action is likely to jeopardize listed species:

- Evaluate the rangewide status of the species adversely affected by the emergency action.
- Evaluate the environmental baseline of the species.
- Evaluate the effects of the emergency action on species and their habitat using an exposure-response approach.
- Evaluate cumulative effects.
- In the integration and synthesis, add the effects of the action and cumulative effects to the environmental baseline, and, in light of the status of the species, analyze whether the emergency action is likely to directly or indirectly reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species.
- If necessary, suggest a reasonable and prudent alternative to the action.

2.2. Rangewide Status of the Species

This opinion examines the status of each species that is adversely affected by the emergency action. The status is determined by the level of extinction risk that the listed species face, based on parameters considered in documents such as recovery plans, status reviews, and listing decisions. This informs the description of the species' likelihood of both survival and recovery. The species status section also helps to inform the description of the species' "reproduction, numbers, or distribution" for the jeopardy analysis.

2.2.1. Rangewide Status of Black Abalone

Black abalone are marine snails with one shell and a large muscular foot used for movement as well as to hold tightly onto hard substrates to avoid being dislodged by wave action (Cox 1960). Black abalone occupy rocky habitats from the upper intertidal to 6 meters depth. Historically, black abalone occurred from Crescent City (Del Norte County, California) to southern Baja California (Geiger 2004), but the current range is from Point Arena, California, to Bahía Tortugas, Mexico (74 FR 1937, 14 January 2009). Black abalone are most commonly observed in the middle and lower intertidal, in habitats with complex surfaces and deep crevices that provide shelter for juvenile recruitment and adult survival (Leighton 1959, 2005; Cox 1960; Leighton and Boolotian 1963; Douros 1985, 1987; Miller and Lawrenz-Miller 1993; VanBlaricom et al. 1993; Haaker et al. 1995). They are able to withstand extreme variations in temperature, salinity, moisture, and wave action, and are usually strongly aggregated, with some individuals stacking two or three on top of each other (Cox 1960; Leighton 2005).

Abalone are broadcast spawners, meaning that individuals release their gametes into the water column and rely on external fertilization. Thus, abalone must be in close enough proximity to one another to successfully reproduce. Abalone also have a short planktonic larval stage (about 3-10 days) before settlement and metamorphosis (McShane 1992). Larval black abalone are believed to settle on rocky substrate with crustose coralline algae, which serves as a food source for post-metamorphic juveniles, along with microbial and diatom films (Leighton 1959; Leighton and Boolotian 1963; Bergen 1971). Reproductive maturity is reached at a size of about 50 mm shell length in females and about 40 mm in males (Leighton 1959; Ault 1985). Spawning has not been observed in the wild, but likely occurs from spring to early autumn (Leighton 1959, 2005; Leighton and Boolotian 1963; Webber and Giese 1969) and may extend into winter months (VanBlaricom et al. 2009).

2.2.1.1. Population Trends

Based on fisheries and long-term monitoring data since the 1970s, black abalone are believed to be naturally rare at the northern (north of San Francisco) (Morris et al. 1980) and southern (south of Punta Eugenia; P. Raimondi, pers. comm., cited in VanBlaricom et al. 2009) extremes of the species' range. Areas of highest abundance occurred south of Monterey, particularly at the Channel Islands off southern California (Cox 1960; Karpov et al. 2000). Rogers-Bennett et al. (2002) estimated a baseline abundance of 3.54 million black abalone in California, based on landings data from the peak of the commercial and recreational fisheries (1972-1981). This estimate provides a historical perspective on patterns in abundance and a baseline against which to compare modern day trends. We note, however, that black abalone abundances in the 1970s to

early 1980s had reached extraordinarily high levels, particularly at the Channel Islands, possibly in response to the elimination of subsistence harvests by indigenous peoples and large reductions in sea otter populations. Thus, our understanding of black abalone abundance and distribution for this time period may not accurately represent conditions prior to commercial and recreational harvest of black abalone in California.

Beginning in the mid-1980s through the 1990s, black abalone populations declined dramatically due to the spread of withering syndrome (Tissot 1995), a disease caused by a pathogen that affects the animal's digestion and causes starvation leading to foot muscle atrophy, lethargy, and death (Friedman and Finley 2003; Braid et al. 2005). Withering syndrome results in rapid (within a few weeks) and massive (reductions of over 80%) mortalities in affected populations (Neuman et al. 2010). Overall, populations throughout southern California and as far north as Cayucos declined in abundance by more than 80%; populations south of Point Conception declined by more than 90% (Neuman et al. 2010). Historical abalone harvest contributed to some degree, but the primary cause of these declines was withering syndrome. The disease has also affected populations in Baja California, but little is known about the species' status in Mexico.

Populations north of Cayucos have not yet exhibited signs of the disease, but all are likely infected by the pathogen. Abalone may be exposed to and infected by the pathogen without showing symptoms; however, once symptoms develop, the animals succumb to death within days to weeks (Friedman et al. 1997a, 2000, 2002). The pathogen has been detected in all coastal marine waters off southern California to Sonoma County and at Southeast Farallon Island (Moore et al. 2002; Friedman and Finley 2003) (pers. comm. with Jim Moore, CDFW, 20 November 2015; pers. comm. with Jim Moore, CDFW, cited in VanBlaricom et al. 2009).

Of the populations affected by mass mortalities associated with withering syndrome, most remain at low densities and are below the estimated levels needed to support successful reproduction and recruitment (e.g., 0.34 abalone per m^2) (Neuman et al. 2010). Populations not yet affected by the disease (north of Cayucos) have densities greater than this threshold value (1.1 to 10.5 abalone per m^2), whereas populations affected by the disease (south of Cayucos) have densities below this threshold value (0 to 0.5 abalone per m^2) (Neuman et al. 2010).

Despite these low densities, researchers have observed evidence of recent recruitment and increases in abundance at several locations throughout southern California, including the Palos Verdes Peninsula, Laguna Beach, Santa Cruz Island, San Miguel Island, and San Nicolas Island (Richards and Whitaker 2012; Eckdahl 2015; Kenner 2021). These observations for black abalone, and similar observations for other abalone species in California, indicate that we need to consider additional factors when assessing population viability. Recent studies also indicate the potential for disease resistance in wild black abalone populations. A bacteriophage has been discovered that infects the pathogen, reduces its lethal effects, and improves the survival of infected abalone (Crosson et al. 2012; Friedman and Crosson 2012; Friedman et al. 2014). Genetic-based disease resistance may also exist and is the subject of ongoing studies at the University of Washington (VanBlaricom et al. 2009).

2.2.1.2. Additional Range-wide Threats

Elevated water temperatures resulting from local discharges, warm water events, and climate change could exacerbate disease effects on black abalone. Disease transmission and manifestation is intensified when local sea surface temperatures increase by as little as 2.5 ºC above ambient levels and remain elevated over a prolonged period of time (i.e., a few months or more) (Friedman et al. 1997b; Raimondi et al. 2002; Harley and Rogers-Bennett 2004; Vilchis et al. 2005). The disease appears to progress northward along the coast with increasing coastal warming and El Niño events (Tissot 1995; Altstatt et al. 1996; Raimondi et al. 2002), and poses a continued threat to the remaining healthy populations. In 2015-2016, researchers observed increased numbers of diseased individuals at the long-term monitoring sites, likely due to warmer water conditions (pers. comm. with Karah Ammann, UCSC, on 8 March 2016). It is not yet known how elevated water temperatures may affect the bacteriophage and genetic resistance.

Climate change and ocean acidification may also have range-wide effects on black abalone. In addition to increasing susceptibility to disease, warming ocean temperatures could reduce the growth of macroalgae (an important food source for black abalone) and shift the distribution of black abalone if temperatures in the southern part of the range increase above the optimal range. Sea level rise could alter the distribution and availability of rocky intertidal habitat. Black abalone may be able to adapt to changes in their habitat conditions, depending on the time frame over which these changes occur, but some populations and habitats may be lost.

Ocean acidification could hinder normal growth, development, and survival of black abalone by altering pH levels, carbonate availability, and the growth of crustose coralline algae, an important component of juvenile settlement habitat (Crim et al. 2011). Studies on other abalone species indicate varying effects depending on the species, the life stage, the degree to which pH levels decrease, and the presence of other stressors. Potential effects of ocean acidification on black abalone include reduced reproduction, abundance, and recruitment. Studies specific to black abalone are needed to evaluate effects on different life stages and under multiple stressors.

2.2.1.3. Updates to Threats since November 2018

The emergency Federal action was completed in November 2018. This section discusses additional information since 2018 regarding threats and their effects on the species' status.

The relative effect of illegal harvest on black abalone status and recovery is poorly understood and requires further evaluation. Illegal harvest of black abalone is an ongoing threat, particularly because of the relative accessibility of black abalone compared to other abalone species. In 2020, CDFW and researchers throughout the California coast noted an increase in the number of people visiting the rocky intertidal and harvesting or temporarily removing invertebrates, most likely due to the economic and social effects of the COVID-19 pandemic (unpublished observations by John Ugoretz, CDFW, Multi-Agency Rocky Intertidal Network (MARINe) meeting, 3 October 2020). This increase in human use activities poses a direct threat to black abalone populations because of the potential increase in illegal harvest as well as trampling of intertidal habitats. The increased harvest activities may also indirectly affect black abalone by altering the invertebrate community.

Sedimentation events have also emerged as an important threat to black abalone populations and habitat, because they can result in direct burial and mortality. The 2017 Mud Creek landslide (the emergency event discussed in this consultation) resulted in the burial of approximately 518 linear meters (1,700 linear feet) of shoreline and an estimated two acres of rocky intertidal habitat, as well as the loss of an unknown number of black abalone within that habitat. In August 2020, severe wildfires burned along the central California coast, followed by an atmospheric river rain event in January 2021, resulting in massive debris flows that buried large expanses of rocky intertidal habitat and black abalone populations. In response, UCSC coordinated with NMFS, CDFW, and MBNMS to rescue and relocate black abalone within affected areas of the coast, using methods similar to those used for the Mud Creek emergency action. The 2021 emergency rescue and relocation is a separate action from the 2017 Mud Creek Landslide emergency response and is, therefore, not analyzed in this biological opinion. Researchers continue to evaluate the effects of this debris flow event on black abalone at the population and species level, as well monitor how the affected populations recover. Climate change may increase the frequency, severity, and extent of wildfires and subsequent effects on nearshore habitats and communities, including black abalone and their habitat.

Oil spills and spill response activities also pose a threat to black abalone and their habitat. The severity of effects depends on the location, size, and scope of the spill. In 2015, the Refugio Beach oil spill in Santa Barbara County impacted approximately 1,500 acres of shoreline habitat, including rocky intertidal and sandy beach habitat (Refugio Beach Oil Spill Trustees 2021). Three black abalone were found within the affected area (pers. comm. with Jack Engle, University of California, Santa Barbara (UCSB), and Pete Raimondi, UCSC, on June 5-6, 2015). The Damage Assessment and Restoration Plan includes support for translocation efforts to restore black abalone populations and thus restore the rocky intertidal habitat within the impacted area (Refugio Beach Oil Spill Trustees 2021). In October 2021, an oil spill occurred off Orange County (Southern California Spill Response 2021). Response efforts include deployment of booms and berms to protect sensitive habitats, surveys to assess impacts to shoreline and subtidal habitats, and clean-up activities. Assessments are ongoing and include evaluating effects on black abalone and their habitat within the affected areas.

2.2.1.4. Overall Status and Recovery Needs

Black abalone face high risk in each of four demographic risk criteria: abundance, growth rate and productivity, spatial structure and connectivity, and diversity (VanBlaricom et al. 2009). Although we know withering syndrome has affected populations in Baja California, little information exists regarding the species' status in that portion of the range. Long-term monitoring data in California indicates that populations affected by the disease remain at low abundance and density. The declines in abundance have potentially resulted in a loss of genetic diversity, though this needs to be evaluated. Some sites in southern California have shown evidence of recruitment; however, natural recovery of severely-reduced populations will likely be a slow process. Illegal harvest is a concern, particularly in areas with relatively easy public access. Withering syndrome and other diseases continue to pose a threat to the remaining healthy populations (Raimondi et al. 2002; NMFS 2020). Elevated water temperatures and ocean acidification are range-wide threats that have the potential to exacerbate disease effects, reduce

habitat quality and availability, and reduce the survival, growth, and development of black abalone. In addition, emergency events such as oil spills, landslides, and debris flows can affect large stretches of coast and result in the loss of populations.

Recovering the species will involve protecting the remaining healthy populations and increasing the abundance and density of populations that have declined, while also finding practical ways to address ongoing and emerging threats. Continued long-term monitoring will be critical to track and evaluate the species' status and the progression of withering syndrome along the coast. We must also raise the public's awareness, improve enforcement of protections, and evaluate the feasibility and effectiveness of recovery tools, such as habitat restoration, local aggregation, translocation, and captive propagation and outplanting. Emergency response activities such as those discussed in this consultation help to protect and preserve existing populations by removing and relocating at-risk abalone from harm's way, so that they can be used to enhance or re-establish populations. Lessons learned from emergency rescue and relocation activities can also be used to refine translocation protocols for future restoration efforts.

NMFS issued a Final ESA Recovery Plan for Black Abalone (NMFS 2020) to guide the implementation of priority recovery actions. Recovery actions identified in the plan include long-term population monitoring, population and habitat restoration, disease research and management plans, emergency response planning, coordination with Mexico, and outreach and education. NMFS has also appointed a recovery implementation team to coordinate and facilitate on-the-ground recovery efforts for black abalone. These actions are expected to advance recovery for black abalone.

2.3. Action Area

"Action area" means all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR § 402.02).

The action area for the 2017 Mud Creek emergency black abalone rescue and relocation consists of the following, which are connected by their transit routes. To protect the location of black abalone, we do not provide a map of the black abalone monitoring, rescue, or relocation sites:

- Black abalone monitoring sites adjacent to the Mud Creek landslide, consisting of approximately 325 linear meters (1,067 feet) of shoreline to the north and 350 linear meters (1,150 feet) of shoreline to the south. Along these stretches of shoreline, monitoring was conducted within an approximately 10 m (33 ft) wide area of rocky intertidal habitat.
- Black abalone rescue site: an approximately 100 linear meter (328 feet) stretch of rocky intertidal habitat (total area about 960 m^2 or 3,150 ft^2) to the north of the Mud Creek landslide. The black abalone population and habitat within this area had not yet been buried by sediment eroding from the landslide, but were considered at risk of burial. Black abalone monitoring and rescue/collection were conducted within this area.

- Black abalone relocation site at Piedras Blancas, where rescued black abalone were released and post-release monitoring of rescued and resident black abalone were conducted.
- Black abalone temporary holding facility: The Abalone Farm in Cayucos, CA, where black abalone were held overnight and processed for relocation, long-term holding, or necropsy/analysis.
- Black abalone long-term holding facility: The SWFSC La Jolla Laboratory – John Hyde's lab, where injured black abalone were transported for rehabilitation and incorporation into the captive population (covered under ESA Permit 19571).
- Black abalone necropsy facility: The CDFW Shellfish Health Laboratory at the University of California, Davis (UCD) Bodega Marine Laboratory, where black abalone specimens were sent for necropsy.

2.4. Environmental Baseline

The "environmental baseline" refers to the condition of the listed species, without the consequences to the listed species caused by the proposed action. The environmental baseline includes the past and present impacts of all Federal, State, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultations, and the impact of State or private actions which are contemporaneous with the consultation in process. The consequences to listed species from ongoing agency activities or existing agency facilities that are not within the agency's discretion to modify are part of the environmental baseline (50 CFR § 402.02).

In this environmental baseline, we discuss how different factors and activities have affected black abalone within the action area. For the field sites included in the action area, these factors and activities include the effects of the 2017 Mud Creek landslide, long-term monitoring of black abalone, and disease. For the captive facilities included in the action area, these factors and activities include captive holding, research, and enhancement activities involving black abalone.

2.4.1. Effects of the 2017 Mud Creek Landslide

The Mud Creek landslide occurred on May 20, 2017, along the Big Sur coast in Monterey County, and resulted in the loss of black abalone populations and habitat within the initial area buried by the slide as well as adjacent areas buried by continued erosion of slide materials following the initial event. The loss of black abalone populations and habitat is likely a long-term loss, due to the extent and magnitude of the landslide.

The slide displaced about 75 acres of land, with slide material extending 600 feet into the ocean, creating 15 acres of new land (Figure 1). The slide destroyed a quarter-mile section of Highway 1 and buried about two acres of rocky intertidal habitat and 13 acres of subtidal habitat within the MBNMS (Caltrans 2021).

Figure 1. Aerial photo of the Mud Creek Landslide taken on May 20, 2017 (by Jonathan Warrick, USGS)

The slide buried about 1,700 linear feet (518 linear meters) of rocky intertidal habitat, including the black abalone populations and designated critical habitat within that segment of the coast (Caltrans 2021). Prior to the slide, the site was not accessible for monitoring. Thus, data are not available to estimate the number of black abalone lost due to burial by the landslide. Based on surveys of adjacent areas, the area buried by the landslide like included good quality habitat that supported healthy black abalone populations.

Following the initial landslide in May 2017, wave action and nearshore ocean currents caused erosion and movement of slide materials up and downcoast as well as subtidally (Caltrans 2021). In July 2017, UCSC and Caltrans surveyed the rocky intertidal habitat adjacent to the slide and found that eroded slide material had buried the rocky intertidal habitat as far as 804 ft (245 m) to the north and 656 ft (200 m) to the south of the slide (Raimondi et al. 2017). Dead black abalone, red abalone, and other large invertebrates were found in these segments, likely killed by burial and scour (Caltrans 2021). Live black abalone were found beyond these areas, including 186 black abalone within a 263 ft (80 m) segment to the north and 27 black abalone within a 328 ft (100 m) segment to the south (Raimondi et al. 2017). However, by September 2017, slide materials had buried about half of the 263 ft (80 m) segment to the north (Caltrans 2021). This observation and the potential for increased erosion during the winter months indicated that black abalone in adjacent habitats were at risk of burial.

On November 2, 2017, UCSC and Caltrans re-surveyed the north segment where black abalone were found in July, as well as an additional 175 m upcoast, and found 334 black abalone (Caltrans 2021). Within the segment where 186 black abalone were found in July, only 86 remained. Much of the downcoast portion of this segment had been scoured and buried by eroded sediment from the slide, whereas the upcoast portion remained much as it was in July. On

November 3, 2017, UCSC and Caltrans also re-surveyed the south segment and found that all of the black abalone and habitat surveyed in July had been buried by eroded sediment from the slide. They surveyed a 2,133ft (650m) segment of habitat south of the landslide and found no black abalone (Caltrans 2021).

Subsequent monitoring of sediment dispersal occurred at least weekly until the reopening of Highway 1 in July 2018 (pers. comm. with Mitch Dallas, Caltrans, on July 25, 2018) and has been conducted periodically since (Caltrans 2021). Slide materials continued to move and buried a portion of the rescue site, although the upcoast portion of the rescue site remains unaffected by slide materials (pers. comm. with Christy Bell, UCSC, August 30, 2021). Wave action and currents have helped to wash away slide material from the adjacent areas both north and south of the slide, allowing some recovery of the rocky intertidal habitat, starting with the recolonization of algal species (Caltrans 2021). Black abalone in adjacent areas may move into and re-establish populations in these previously buried areas; however, recovery could take years to decades.

2.4.2. Effects of Long-Term Monitoring

Since 1997, researchers have monitored black abalone populations at the relocation site on an annual basis as part of the long-term monitoring program led by the Multi-Agency Rocky Intertidal Network (MARINe). Prior to the ESA listing of black abalone in 2009, no ESA permit was required. After the ESA listing, monitoring activities were conducted under Permit 14400 from 2010 to 2016 (issued to the Channel Islands National Park) and under Permit 18761 from 2016-2020 (issued to UCSC). In 2020, Permit 18761 was renewed and assigned a new number (18761-2R).

Long-term monitoring activities include counting, measuring, and visually assessing the health of individual black abalone at established monitoring sites. These activities can cause minor, temporary stress to individual black abalone. Some abalone may clamp down more tightly to the substrate or, in some cases, move to seek more shelter. Monitoring activities have not resulted in injuries to the abalone or mortality. Researchers do not remove the abalone from the substrate. Researchers also minimize touching or disturbing the abalone and their habitat as much as possible. Overall, monitoring activities have had minor, temporary effects on individual black abalone.

Long-term monitoring data from MARINe shows that the black abalone population at the relocation site declined from 2010 through 2020. The decline could be due to various factors, including natural population fluctuation, disease, and increased water temperatures.

Long-term monitoring has not been conducted at the Mud Creek landslide site or at the adjacent monitoring and rescue sites to the north and south. Prior to the landslide, the remoteness and difficult access prohibited monitoring along that segment of coast (Bell and Raimondi 2020).

2.4.3. Effects of Disease

Withering syndrome is an ongoing threat to black abalone populations in the action area. Disease-related declines have not been observed in Monterey County and north, but have been

observed south of Monterey County (NMFS 2020). Thus, disease may be one of the causes for the black abalone declines observed at the relocation site.

As discussed in Section 2.2.1 (Rangewide Status of Black Abalone), elevated water temperatures can accelerate rates of disease transmission and disease-induced mortality (Ben-Horin et al. 2013) and may be exacerbated by climate change (Di Lorenzo and Mantua 2016). The presence of the bacteriophage and potential genetic disease resistance may ameliorate the effects of withering syndrome (Friedman and Crosson 2012; Friedman et al. 2014; Crosson et al. 2014).

Black abalone throughout California are likely all infected with the pathogen, because the pathogen is present throughout the species' range in California. Five of the rescued black abalone were sacrificed due to severe injuries (n=3) or a severely shrunken body (n=2). Analysis of these five abalone indicated all were infected but with varying levels of the pathogen (Moore 2018, appendix to Caltrans 2021). The two shrunken abalone had very high levels of the pathogen as well as histological evidence of withering syndrome, whereas the three healthy but severely injured abalone had nearly absent to relative low levels of the pathogen and almost no histological evidence of infection (Moore 2018, appendix to Caltrans 2021). This analysis confirms that black abalone at Mud Creek are infected with the pathogen and individuals can develop withering syndrome, although most appear to be healthy. Abalone at the relocation site have not been sampled or analyzed for withering syndrome.

2.4.4. Effects of Captive Holding, Research, and Enhancement Activities

At the time of the landslide in 2017, black abalone were already being held in captivity at the SWFSC La Jolla Laboratory (n=16) and the CDFW Shellfish Health Laboratory (n=15). The SWFSC La Jolla Lab had 16 black abalone that were originally collected in 2006-2008 by researchers at the University of California, Santa Barbara (UCSB) prior to the species' listing under the ESA in 2009. These abalone were initially held at UCSB. In 2013, 12 of these black abalone were transferred from UCSB to the Department of the Navy's SPAWAR Systems Center, Pacific (SSC Pacific), Environmental Sciences Division in San Diego. In August 2013, NMFS issued Scientific Research Permit 17405 to Dr. David Lapota at the SSC Pacific to develop captive breeding methods for black abalone using these animals. Due to unforeseen circumstances, the Navy could not continue the abalone research program at the SSC Pacific and transferred the black abalone to the SWFSC La Jolla Lab in December 2014. Of the original 12 black abalone transferred from UCSB, two died while at the SSC Pacific facility, due to disease (Lapota 2015). Two more died about two months after transfer to the SWFSC La Jolla Lab, most likely due to health issues (pers. comm. with Paula Sylvia, SWFSC, on 4 April 2015). In December 2016, the remaining black abalone at UCSB (n = 8) were transferred from UCSB to the SWFSC La Jolla Lab.

In 2017, the CDFW Shellfish Health Lab had 15 black abalone in captivity. Nine were originally collected in the late 1980s from sites that include Año Nuevo Island, Carmel, Santa Rosa Island, and the Vandenberg Air Force Base. In July 2016, an additional six black abalone (originally collected from Carmel) were transferred from Dr. Carolyn Friedman's lab at the University of Washington.

In July 2016, NMFS issued Permit 19571 to allow the SWFSC La Jolla Lab to hold black abalone in captivity as well as conduct broodstock conditioning, breeding, and grow-out studies, with the goal of developing reliable captive propagation methods. The Permit allowed additional black abalone to be received from other facilities, law enforcement cases, and emergency response activities. The permit also allowed various facilities to receive and analyze black abalone specimens and samples, including the CDFW Shellfish Health Lab. In 2017, the permit was modified to add the CDFW Shellfish Lab and the Abalone Farm as approved facilities for holding live black abalone.

2.4.5. Effects of Other Factors

In 2021, researchers at UCSC led an effort to rescue and relocate black abalone at risk of burial from debris flows along the Big Sur coast. These debris flows were caused by severe fires followed by heavy rains. Some of the rescued black abalone were relocated to a site adjacent to the Mud Creek landslide where sediments are stable, to enhance the existing black abalone population. This and future relocations may support faster recovery of black abalone populations within the areas adjacent to the landslide that were buried (and subsequently unburied) by slide materials.

Other factors affecting black abalone are described in Section 2.2 (Rangewide Status of the Species) and include illegal harvest, climate change, and ocean acidification. Illegal harvest is likely not a threat to black abalone populations within the action area, due to the remote location and restricted access. Climate change effects (e.g., elevated water temperatures, sea level rise) and ocean acidification likely affect black abalone populations within the field sites, as these threats are widespread throughout the coast. Specific effects associated with climate change and ocean acidification have not been evaluated within the action area.

2.5. Effects of the Action

Under the ESA, "effects of the action" are all consequences to listed species or critical habitat that are caused by the action, including the consequences of other activities that are caused by the action (50 CFR § 402.02). A consequence is caused by the action if it would not occur but for the action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action (50 CFR § 402.17). In our analysis, which describes the effects of the emergency action, we considered the factors set forth in 50 CFR § 402.17(a) and (b).

We use the "exposure-response-risk" approach to analyze the effects of the emergency action on black abalone. First, we evaluate the exposure of individual black abalone to the effects of the action. Next, we evaluate how individual black abalone responded to those effects. We then evaluate how those responses are expected to reduce an individual's fitness (i.e., growth, survival, annual reproductive success, and lifetime reproductive success). Finally, we evaluate the risk to black abalone at the individual, population, and species levels, to determine whether the emergency action could appreciable reduce the species' likelihood of survival and recovery in the wild.

2.5.1. Effects of the Action on Black Abalone

The Mud Creek landslide emergency response involved monitoring, collection, transport, short-term holding, and relocation of black abalone at risk of being buried or dislodged by slide material following the initial landslide. Activities included collecting, handling, measuring, tagging, and relocating individual black abalone, as well as the collection of genetic samples and the sacrifice of shrunken and severely injured individuals. Rescue and relocation activities involved 45 black abalone that were collected from the rescue site north of and adjacent to the Mud Creek landslide. Additional black abalone were affected by monitoring activities at the field sites adjacent to the landslide (north segment: n=334; south segment: n=27, based on survey data) and by release/monitoring activities at the relocation site (n=100 black abalone, based on MARINe data for 2017).

We describe the effects of the emergency activities in more detail in the sections below. NMFS provided Caltrans with procedures to guide the rescue and relocation efforts and minimize adverse effects on black abalone. Caltrans implemented these procedures in carrying out the rescue and relocation efforts.

2.5.1.1. Monitoring

UCSC and Caltrans monitored black abalone populations in adjacent areas both north and south of the landslide prior to and during the emergency response activities. They also monitored black abalone at the relocation site prior to and following the release of the rescued black abalone, to track the movements and survival of the rescued abalone as well as the black abalone that were already present at the site (resident abalone). Monitoring activities involved counting individuals, measuring shell length, and assessing the health and habitat of individuals.

Monitoring activities caused minor, temporary stress to individuals. Researchers avoided touching the abalone unless necessary to count the number of individuals (e.g., where abalone were deep in crevices and could not be counted visually), measure the shell length, and identify tags on the shell. As much as possible, researchers avoided touching living tissues, such as the mantle, and limited any contact with the shell or mantle to a few seconds. Black abalone responded to touch by temporarily clamping down more tightly onto the substrate. Rarely, an abalone moved, typically to seek shelter and better protection. These responses are similar to how an individual would respond to a wave or to being touched by another organism (e.g., shore crabs, drift macroalgae).

Researchers did not report any injuries or mortalities due to monitoring activities. Researchers wore soft-soled shoes and avoided walking on vulnerable species to minimize trampling effects on the rocky intertidal. This also helped to avoid accidentally stepping on a black abalone, although the potential was very low given that the abalone were generally in cracks and crevices.

2.5.1.2. Collection and Transport

Within the north segment, 45 black abalone were collected to rescue them from the threat of being buried or dislodged by slide materials. All 45 were transported to The Abalone Farm for short-term holding and processing. Of these, 31 were transported to the relocation site for

release, nine were transported to the SWFSC La Jolla Lab for long-term holding and rehabilitation, and five were sacrificed and sent to the CDFW Shellfish Health Lab for analysis.

Transport activities caused minor, temporary stress to individual black abalone. Abalone were transported via vehicle using established abalone transport protocols (NMFS 2008, 2015). To minimize stress, researchers wrapped the abalone in moist cloths, placed them in coolers, and maintained appropriate moisture, air, and temperature levels throughout transport.

For most of the 45 abalone, collection activities caused temporary stress and minor injuries. To minimize injuries, only experienced personnel were allowed to remove abalone from the substrate. Researchers identified those abalone that were easily accessible (i.e., not deep in a crack or crevices) and could be removed without injury. Researchers followed best practices for collection (NMFS 2008, 2015), such as using abalone irons or other instruments with a blunt edge and thin profile and only inserting these instruments on the posterior end or sides (avoiding the head) of the abalone. If an abalone clamped down and could not be removed on the first attempt, researchers waited until the abalone relaxed before attempting again.

Even with these measures, a few of the abalone suffered severe injuries. Of the 45 collected, five were considered not likely to survive because they had severe injuries (n=3) or were severely shrunken due to disease (n=2). These five abalone were sacrificed and sent to the CDFW Shellfish Health Lab for analysis. Researchers identified an additional nine black abalone with injuries that were deemed non-lethal. These nine abalone were transported to the SWFSC for long-term holding and rehabilitation (under Permit 19571). Of these nine abalone, three died shortly after arrival at the SWFSC, likely due to injuries from collection activities. Of the 31 abalone released to the wild, one was later discovered to be severely injured and should have been sent to the SWFSC for rehabilitation; it died shortly after release. Overall, collection activities caused severe injuries to 13 of the 45 rescued abalone, resulting in seven mortalities.

2.5.1.3. Captive Holding, Sampling, and Tagging

The 45 rescued black abalone were transported to The Abalone Farm for short-term holding (two days) and processing, which included measuring, weighing, genetically sampling, and assessing the health of the abalone. As described above, five severely injured/shrunken black abalone were sacrificed and sent to the CDFW Shellfish Health Lab for analysis and nine injured black abalone were sent to the SWFSC La Jolla Lab for long-term holding and rehabilitation (covered under Permit 19571 issued to the SWFSC). The remaining 31 black abalone were tagged prior to release to the relocation site.

Captive holding, sampling, and tagging caused minor, temporary stress to the black abalone. Researchers implemented measures to minimize stress and injury. First, researchers minimized handling and the number of times the abalone needed to be removed from the tanks. Second, when removal was necessary (i.e., for tagging and transport to the relocation site), researchers carefully removed the abalone by hand, by using an abalone iron, or by using a flat, thin, blunt instrument. When handling the abalone, researchers minimized the time out of water and limited any contact with soft tissues as much as possible.

The collection of epipodial clippings for genetic analysis caused minor injuries that are not expected to result in long-term harm or injury to the abalone. The epipodial clipping method is a well-established, non-lethal method that has been used to collect tissue samples from abalone in the field and in captivity, with minimal effects on individuals (Hamm and Burton 2000; Gruenthal and Burton 2008; Gruenthal et al. 2014; Coates et al. 2014). Researchers only collected samples from the epipodial tentacles on the sides or posterior of the abalone.

Shell notching and attaching numbered tags to the shell also caused minor, temporary stress to individual abalone, primarily due to handling out of water. To minimize stress, researchers kept the abalone moist, limited the time out of water, and avoided touching or injuring the soft tissue.

2.5.1.4. Relocation to Field Site

Of the 45 rescued black abalone, 31 were released at the relocation site adjacent to existing long-term monitoring plots. Relocation involved surveying the field site to: evaluate habitat quality, quantity, and capacity; identify specific cracks and crevices to place the abalone; and record the number of resident black abalone already present within those cracks and crevices. In selecting the site and specific locations to place the rescued black abalone, researchers considered the presence of resident black abalone and the amount of space and food resources to support additional black abalone.

Researchers then assessed, tagged, transported, released, and monitored the rescued abalone after release. We discussed the effects of assessing, tagging, transporting, and monitoring above. In this section, we focus on the effects of the release on the rescued black abalone as well as on the resident black abalone already present at the relocation site.

For most of the rescued black abalone, release to the relocation site caused short-term stress. To minimize stress and optimize survival, researchers selected cracks and crevices with good quality habitat for black abalone and placed each individual black abalone within the pre-selected cracks and crevices, ensuring that the abalone adhered to the substrate. Two black abalone appeared to reject one of the cracks and would not adhere to the substrate; however, when introduced to a different crack, the abalone adhered right away (Bell and Raimondi 2020).

Within a few days following release, some of the rescued abalone moved 10 m or more away from where they were initially placed (Bell and Raimondi 2020). This movement may have been in response to stress, or the abalone may have been seeking better habitat conditions or searching for their home scars (large black abalone establish a home base) (Bell and Raimondi 2020). The number of tagged abalone observed declined over time, with 24-27 observed within two days after release, 17 observed about 16 days after release, and 10 observed about 6 weeks after release (pers. comm. with Christy Bell, UCSC, appendix to Caltrans 2021). In 2020, researchers observed two potential rescued abalone, but could not confirm because they suspected that the tags had fallen off and the shell notches had filled in (pers. comm. with Christy Bell, UCSC, August 30, 2021). Initial observations indicate high survival of the rescued abalone following release. However, the actual survival rate is difficult to assess because of tag loss over time,

movement of the abalone deep into cracks and crevices where they cannot be detected, and movement of the abalone out of the initial area where they were released.

Of the 31 black abalone released at the site, five confirmed mortalities have been recorded as of August 2021 (Bell and Raimondi 2020) (pers. comm. with Christy Bell, UCSC, August 30, 2021). One mortality was found intact in its shell two days after release and was determined to be an injured abalone that should have been sent to the SWFSC Lab for rehabilitation (Bell and Raimondi 2020). The remaining four mortalities were confirmed based on empty tagged shells found two weeks (n=1), three months (n=2), and nine months (n=1) after release (Bell and Raimondi 2020). The cause of death is not known but may be due to stress or injuries associated with collection and relocation activities, predation, natural mortality, or a combination of these and other factors.

Release of the rescued black abalone at the site caused short-term stress to resident black abalone. Researchers noted movement of the resident abalone, with some leaving the cracks and crevices where rescued black abalone were placed but eventually returning (Bell and Raimondi 2020). The resident abalone may have detected the injuries of the rescued black abalone and moved to avoid predation. Since 2017, black abalone numbers at the long-term monitoring plots have been stable, with some rescued abalone found in the plots more than 20 m away (Bell and Raimondi 2020).

2.5.1.5. Population and Species Level Effects

We evaluate how the effects of the emergency action on black abalone at the individual level may affect black abalone at the population and species level. We conclude by evaluating whether the emergency action appreciably reduced or could appreciably reduce the species' likelihood of surviving and recovering in the wild. We consider the effects of the emergency action within the context of the species' status and recovery needs.

Out of all the activities conducted, the collection and removal of black abalone from the rescue site caused the greatest stress, injury, and mortality to individual black abalone. Thirteen were severely injured and either sacrificed (n=3) or sent to the SWFSC (n=9) for long-term holding and rehabilitation, with three individuals dying within a few days to weeks after arrival; one additional injured abalone was inadvertently released to the relocation site and died shortly after (Bell and Raimondi 2020). In addition, release activities also resulted in stress and mortality, with five confirmed mortalities out of the 31 black abalone released at the relocation site.

Monitoring, transport, captive holding, handling, genetic sampling, and tagging activities resulted in minor, temporary stress. Genetic sampling (epipodial clipping) also resulted in minor injuries. All of these activities were conducted using standard methods and best practices to reduce stress and injury. At most, we expect the stress and injuries to cause minor, temporary reductions in individual growth and development, based on what is known from similar work conducted as part of the long-term monitoring program (under Permit 18761) and the captive research program (under Permit 19571). We do not expect the minor, temporary stress, injuries, and reductions in growth and development to affect the viability of individuals or populations.

Overall, the rescue and relocation activities resulted in the loss of 45 black abalone from the population at the Mud Creek north segment (the rescue site), representing about 13.5% of the 334 black abalone observed at the rescue site. Of the 45 black abalone collected, two died due to disease, seven died due to severe injuries sustained during collection/removal, and four died of unknown causes following release to the relocation site. Although the removal of 45 black abalone represents a substantial loss for the population at the rescue site, we consider that these black abalone were at risk of burial, injury, and death if they were not removed. Following the rescue, slide materials continued to move and buried a portion of the rescue site (pers. comm. with Christy Bell, UCSC, August 30, 2021). The number of black abalone buried and killed within this portion is not known.

The emergency action removed these abalone from potential burial and provided opportunities to advance recovery of black abalone. First, the rescued black abalone were used to enhance population viability at the relocation site, adding an additional 26 black abalone to the existing population. Relocation activities caused some of the resident black abalone to move out of the cracks and crevices where rescued black abalone were placed. However, this disturbance was temporary. Resident black abalone appeared to move back into those cracks and crevices over time and numbers at the long-term monitoring site have remained stable. Second, the rescued black abalone enhanced the captive population at the SWFSC, adding an additional six black abalone to the existing captive population. These abalone were rehabilitated and may be used in captive studies, such as broodstock conditioning and spawning experiments to develop reliable captive propagation methods for black abalone. Finally, the emergency action provided researchers hands-on field experience and resulted in many lessons learned regarding logistics, collection, transport, holding, tagging, and relocation that can be applied to future emergency response and population restoration activities. The emergency action addressed an important recovery action highlighted in the Final ESA Recovery Plan for Black Abalone (NMFS 2020), to plan and prepare for the removal and relocation of black abalone in response to emergency events such as spills, landslides, and other sedimentation events.

2.6. Cumulative Effects

"Cumulative effects" are those effects of future State or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation [50 CFR §§ 402.02 and 402.17(a)]. Future Federal actions that are unrelated to the action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA.

Some continuing non-Federal activities are reasonably certain to contribute to climate effects within the action area. However, it is difficult if not impossible to distinguish between the action area's future environmental conditions caused by global climate change that are properly part of the environmental baseline *vs.* cumulative effects. Therefore, all relevant future climate-related environmental conditions in the action area are described earlier in the discussion of the environmental baseline (Section 2.4).

We expect the threats and factors described in Section 2.4 (Environmental Baseline) (i.e., disease, long-term monitoring, and movement of slide materials from the Mud Creek landslide) will continue to affect black abalone within the action area. We did not identify additional State

or private activities that are reasonably certain to occur within the action area and that could result in cumulative effects on black abalone. In general, development activities are not allowed in rocky intertidal habitat. Oil spills and the introduction of pathogens could occur within the action area; however, we would not consider these activities to be reasonably certain to occur, given the unpredictability and uncertainty in the timing, location, scope, and severity of such events.

2.7. Integration and Synthesis

The Integration and Synthesis section is the final step in assessing the risk that the emergency action poses to species. In this section, we add the effects of the action (Section 2.5) to the environmental baseline (Section 2.4) and the cumulative effects (Section 2.6), taking into account the status of the species (Section 2.2), to formulate the agency's biological opinion as to whether the emergency action is likely to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing its numbers, reproduction, or distribution.

2.7.1. Black Abalone

Black abalone populations have declined throughout a large portion of their range. Although historical overfishing contributed to these declines, the main cause was disease-induced mass mortalities. Affected populations remain at low abundance and density and are subject to demographic risks such as reduced reproduction and recruitment, loss of genetic diversity, and poor connectivity among populations. Recruitment has been observed at a few sites in southern California, indicating some natural recovery is occurring. Populations north of Cayucos remain healthy and stable, but withering syndrome may spread northward with warm water events. Other threats, such as illegal harvest and elevated water temperatures, continue to affect black abalone populations. Oil spills, sedimentation events, and other pathogens also pose a potential threat to the species. Threats of sedimentation and illegal harvest may increase in the coming years, given the severe wildfires and increases in intertidal harvest and human use activities observed in 2020-2021. At the same time, conservation efforts are ongoing to enforce protections, advance our understanding and management of threats, respond to emergency events, track the species' status and progress toward recovery, improve habitat, and increase public awareness of abalone conservation needs.

The emergency action directly addressed an important recovery need for black abalone. The Final ESA Recovery Plan for Black Abalone (NMFS 2020) identifies emergency events such as spills, landslides, and other sedimentation events as threats to black abalone populations. The Recovery Plan recommends developing and implementing emergency response plans that include rescue and relocation of black abalone. Although we cannot predict when or where emergency events may happen, the ability to quickly mobilize a response may help save black abalone and minimize the negative effects on populations and the species.

The emergency action involved the rescue and relocation of 45 black abalone at risk of being buried or dislodged by sediments from the Mud Creek landslide. The landslide had already buried a 1,700 m (518 ft) stretch of coast, including an unknown number of black abalone. Continued erosion of slide materials in the months following the landslide led to the burial of rocky intertidal habitats and black abalone populations both north and south adjacent to the slide.

The emergency action involved surveying the adjacent sites to assess the black abalone populations and removing 45 black abalone from the north site (rescue site). Most of the observed black abalone were left in place because they were not accessible and/or could not be removed without risking serious injury. Removal activities caused severe injuries to 13 of the rescued black abalone, of which seven died due to those injuries. Release to the relocation site also resulted in four confirmed deaths of unknown cause. Other activities (transport, captive holding, handling, genetic sampling, tagging) likely added stress to the rescued abalone, although standard protocols and best practices were used to minimize stress as much as possible.

The emergency action resulted in the removal and loss of 45 black abalone from the population north of Mud Creek; however, a number of these abalone likely would have been killed as slide materials subsequently buried the downcoast section of the rescue site. The emergency action rescued a portion of the at-risk black abalone, allowing these individuals to be relocated to another field site to enhance the viability of the existing black abalone population at the relocation site. Several severely injured black abalone were also transferred to the SWFSC for long-term holding and rehabilitation, adding to the existing captive population thus supporting future research and captive propagation efforts to recover the species.

Considering the status of the species, the environmental baseline, and cumulative effects, we do not expect the emergency action reduced fitness at the population and species level. The emergency action supported and enhanced recovery efforts by: (a) rescuing black abalone at risk of being buried or dislodged by slide materials; (b) enhancing the existing population at the relocation site; (c) enhancing the existing captive population at the SWFSC; and (d) advancing our knowledge and experience regarding emergency rescue and relocation methods, to inform future emergency response planning.

2.8. Conclusion

After reviewing and analyzing the current status of the listed species, the environmental baseline within the action area, the effects of the emergency action, the effects of other activities caused by the emergency action, and the cumulative effects, it is NMFS' biological opinion that the emergency action is not likely to jeopardize the continued existence of endangered black abalone. Critical habitat has been designated for black abalone but the action agency determined that the emergency action had no effect on designated critical habitat. Therefore, effects on designated black abalone critical habitat were not analyzed.

2.9. Incidental Take Statement

Section 9 of the ESA and Federal regulations pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without a special exemption. "Take" is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. "Harm" is further defined by regulation to include significant habitat modification or degradation that actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns, including breeding, spawning, rearing, migrating, feeding, or sheltering (50 CFR § 222.102). "Harass" is further defined by interim guidance as to "create the likelihood of injury to wildlife by annoying it to such an extent as to significantly

disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering." "Incidental take" is defined by regulation as takings that result from, but are not the purpose of, carrying out an otherwise lawful activity conducted by the Federal agency or applicant (50 CFR § 402.02). Section 7(b)(4) and section 7(o)(2) provide that taking that is incidental to an otherwise lawful agency action is not considered to be prohibited taking under the ESA if that action is performed in compliance with the terms and conditions of this ITS.

The recommendations provided by NMFS during the emergency response (See 2.9.4 Terms & Conditions, below) function in place of terms and conditions with respect to the incidental take caused by the emergency response, and are incorporated here as terms and conditions of this consultation. Thus, to the extent that the emergency response action was performed in compliance with those recommendations, the associated incidental take is considered exempt from the ESA take prohibition.

2.9.1. Amount or Extent of Take

In this biological opinion, NMFS determined that incidental take occurred as follows:

The emergency action in response to the Mud Creek landslide included monitoring, rescue, and relocation activities that resulted in the take of endangered black abalone. Take of juvenile and adult black abalone occurred during the following activities:

- Monitoring of black abalone populations adjacent to the Mud Creek landslide to assess the risk of being buried or dislodged by eroding slide materials: Take activities included touching the abalone to count and measure individuals. A total of 547 black abalone were observed during the surveys (and a portion measured to determine shell length):
    - North segment: July - 186 black abalone; November - 334 black abalone;
    - South segment: July - 27 black abalone; November – 0 black abalone.
- Removal of 45 at-risk black abalone from the rescue site, followed by transport to The Abalone Farm for short-term holding (two days) and measuring, weighing, genetic sampling (epipodial clip), and tagging. Thirty-one of these black abalone were transported and released at the relocation site; nine were transported to the SWFSC for long-term holding and rehabilitation; and five were sacrificed due to severe injuries (n=3) or severely shrunken feet (n=2) and sent to the CDFW Shellfish Health Lab for analysis.
- Monitoring (count, measure) of black abalone populations at the relocation site to assess the existing population (n = 100) and track the survival and movements of rescued and resident black abalone.

The emergency action resulted in lethal take of 13 of the rescued black abalone; five were sacrificed because they were severely injured (n=3) or severely shrunken (n=2), three died after transport to the SWFSC, and five died after release to the relocation site.

2.9.2. Effect of the Take

In this biological opinion, NMFS determined that the amount or extent of anticipated take, coupled with other effects of the emergency action, is not likely to result in jeopardy to the species.

2.9.3. Reasonable and Prudent Measures

"Reasonable and prudent measures" are measures that are necessary or appropriate to minimize the impact of the amount or extent of incidental take (50 CFR § 402.02).

The reasonable and prudent measures for the emergency action consist of the recommendations provided by NMFS during the emergency response, as detailed below. The action agencies complied with all of the recommendations provided by NMFS in carrying out the emergency action. These reasonable and prudent measures do not include NMFS' recommendations related to Caltrans' emergency Highway 1 reconstruction activities, because Caltrans concluded that the reconstruction activities had no effect on ESA-listed species and designated critical habitat (see Section 1.3.2 MBNMS Emergency Action).

1) Abalone survey and collection: Survey the coastal rocky reef habitat adjacent to and potentially affected by the Mud Creek landslide to count the number of black abalone, characterize habitat quality, and estimate the number of black abalone accessible for collection, as well as the number that cannot be collected and may be buried or dislodged by sediment. If time and conditions allow, collect the abalone the same day or on subsequent days within the same low tide cycle. The geographic scope of survey and rescue efforts will be determined based on field conditions, the status of black abalone populations and their habitat, and the extent and speed of sedimentation effects.

2) Abalone transport and holding: Rescue and relocation activities can only be safely and effectively conducted during negative daytime low tides (or close to negative low tides) and appropriate sea conditions. Temporary holding at a captive facility may be required for at least one day to several weeks. Animals are to be held in captivity until field conditions allow placement of the animals at the relocation site (e.g., during the same low tide cycle or the next daytime low tide cycle).

3) Abalone relocation: Relocation should occur during appropriate field and tidal conditions. Animals are to be transported using appropriate transport protocols, placed in pre-identified crevices, and monitored on at least an annual basis.

2.9.4. Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the ESA, the Federal action agency must comply (or must ensure that any applicant complies) with the following terms and conditions. Caltrans, MBNMS, or any applicant has a continuing duty to monitor the impacts of incidental take and must report the progress of the action and its impact on the species as specified in this ITS (50 CFR § 402.14). If the entity to whom a term and condition is directed does not comply with the following terms and conditions, protective coverage for the action would likely lapse.

The terms and conditions for the emergency action consist of the recommendations provided by NMFS during the emergency response, as detailed below. The action agencies complied with all

of the recommendations provided by NMFS in carrying out the emergency action. These terms and conditions do not include NMFS' recommendations related to Caltrans' emergency Highway 1 reconstruction activities, because Caltrans concluded that the reconstruction activities had no effect on ESA-listed species and designated critical habitat (see Section 1.3.2 MBNMS Emergency Action).

1. The following terms and conditions implement reasonable and prudent measure 1 (Abalone survey and collection):
    a. Timing of field surveys and collection activities: during daytime low tides when sea conditions are safe for field work.
    b. Collection methods: use abalone irons or other flat, blunt-edged tools to remove abalone. To minimize injury, only personnel with experience are allowed to collect abalone. Record injuries and freeze or preserve (e.g., in formalin) dead/dying abalone for necropsy by the CDFW Shellfish Health lab.

2. The following terms and conditions implement reasonable and prudent measure 2 (Abalone transport and holding):
    a. Transport methods: Abalone should be transported according to methods described in the abalone transport protocols (NMFS 2008 and 2015). This involves wrapping the animals in damp cloths and placing them in coolers to keep them within the appropriate temperature range. Animals are to be transported by vehicle to the relocation site or to temporary holding facilities.
    b. Holding facilities: Abalone may be held at approved facilities listed under Permit 19571 (i.e., the SWFSC and The Abalone Farm in Cayucos).
    c. Short-term holding conditions: Maintain the abalone and conduct regular cleaning and health monitoring. Note dead/dying abalone and send to the CDFW Shellfish Health Laboratory for necropsy, if needed.
    d. Tagging: If needed and recommended by UCSC and CDFW, tag the abalone (e.g., numbered, colored tags glued to the shell) to monitor survival over time after placement at the relocation site.
    e. Sampling: If needed and recommended by UCSC and CDFW, collect tissue samples and fecal samples using non-lethal methods to inform genetic and disease risk assessment.
    f. Severely injured abalone: Abalone that are severely injured and not likely to survive in the wild should be transferred for longer-term holding, monitoring, and rehabilitation at the SWFSC La Jolla Lab.

3. The following terms and conditions implement reasonable and prudent measure 3 (Abalone relocation):
    a. Site preparation: Prior to relocation, UCSC and other NMFS-approved biologists are to identify crevices for placement of the black abalone at the relocation site.
    b. Site selection: Relocation sites should be outside of the effects of the landslide, adjacent to or within an existing long-term monitoring site (monitored annually), and preferably in an area with restricted public access.
    c. Transport methods: Abalone should be transported according to methods described in the abalone transport protocols (NMFS 2008, 2015).

2.10. Conservation Recommendations

Section 7(a)(1) of the ESA directs Federal agencies to use their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of the threatened and endangered species. Specifically, conservation recommendations are suggestions regarding discretionary measures to minimize or avoid adverse effects of an action on listed species or critical habitat or regarding the development of information (50 CFR part§ 402.02).

NMFS has the following conservation recommendations:

1) The Federal action agencies should continue to monitor sediment movements and their effects on black abalone populations adjacent to the Mud Creek landslide. This monitoring would provide valuable information on the long-term effects of the landslide on those populations and whether additional rescue and relocation efforts may be needed.

2) The Federal action agencies should monitor the adjacent habitats north and south of the Mud Creek landslide, to evaluate the recovery of the habitat and black abalone populations over time. This monitoring would provide valuable information on the recovery of black abalone and their habitat following sedimentation events, to inform our understanding of this threat and guide future response efforts.

3) The Federal agencies should continue to monitor black abalone populations at the relocation site, to evaluate the survival and movements of the rescued and relocated abalone as well as the effects of the relocation on resident abalone. This monitoring would inform our evaluation of the effectiveness of the rescue and relocation efforts in enhancing existing populations, to guide future response efforts.

2.11. Reinitiation of Consultation

This concludes formal consultation for Caltrans' emergency rescue and relocation of black abalone in response to the Mud Creek landslide and MBNMS' participation in and funding to support the emergency action.

Under 50 CFR § 402.16(a): "Reinitiation of consultation is required and shall be requested by the Federal agency or by the Service where discretionary Federal agency involvement or control over the action has been retained or is authorized by law and: (1) If the amount or extent of taking specified in the incidental take statement is exceeded; (2) If new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not previously considered; (3) If the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in the biological opinion; or (4) If a new species is listed or critical habitat designated that may be affected by the identified action."

In the context of this opinion, the incidental take has already occurred and the reinitiation triggers set out in 50 CFR § 402.16(a)(1), (3), and (4) are not applicable.

3. DATA QUALITY ACT DOCUMENTATION AND PRE-DISSEMINATION REVIEW

The Data Quality Act (DQA) specifies three components contributing to the quality of a document. They are utility, integrity, and objectivity. This section of the opinion addresses these DQA components, documents compliance with the DQA, and certifies that this opinion has undergone pre-dissemination review.

3.1. Utility

Utility principally refers to ensuring that the information contained in this consultation is helpful, serviceable, and beneficial to the intended users. The intended users of this opinion are Caltrans and MBNMS. Other interested users could include CDFW, UCSC, and the SWFSC. Individual copies of this opinion were provided to the Caltrans and MBNMS. The document will be available within two weeks at the NOAA Library Institutional Repository [https://repository.library.noaa.gov/welcome]. The format and naming adhere to conventional standards for style.

3.2. Integrity

This consultation was completed on a computer system managed by NMFS in accordance with relevant information technology security policies and standards set out in Appendix III, 'Security of Automated Information Resources,' Office of Management and Budget Circular A-130; the Computer Security Act; and the Government Information Security Reform Act.

3.3. Objectivity

Information Product Category: Natural Resource Plan

Standards: This consultation and supporting documents are clear, concise, complete, and unbiased; and were developed using commonly accepted scientific research methods. They adhere to published standards including the NMFS ESA Consultation Handbook, ESA regulations, 50 CFR § 402.01 et seq., and the Magnuson Stevens Act implementing regulations regarding Essential Fish Habitat, 50 CFR part 600.

Best Available Information: This consultation and supporting documents use the best available information, as referenced in the References section. The analyses in this opinion contain more background on information sources and quality.

Referencing: All supporting materials, information, data and analyses are properly referenced, consistent with standard scientific referencing style.

Review Process: This consultation was drafted by NMFS staff with training in ESA, and reviewed in accordance with West Coast Region ESA quality control and assurance processes.

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