NATIONAL MARINE FISHERIES SERVICE
ENDANGERED SPECIES ACT SECTION 7
LETTER OF CONCURRENCE

Title:	Letter of Concurrence issued for NASA's EPOCH Mission
Consultation Conducted By:	Endangered Species Division *or* Endangered Species Act Interagency Cooperation Division, Office of Protected Resources, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce
Action Agency:	The National Aeronautics and Space Administration (NASA)
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UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Silver Spring, MD 20910

JUN 5 - 2017

Refer to NMFS No: FPR-2017-9211

Ms. Lizabeth Montgomery
NASA Goddard Space Flight Center
Code 250
8800 Greenbelt Road
Greenbelt, MD 20771

Re: Request for Initiation of Informal Consultation under Section 7(a)(2) of the Endangered Species Act for NASA's EPOCH Mission

Dear Ms. Montgomery:

On April 21, 2017 NOAA's National Marine Fisheries Service (NMFS) received your request for written concurrence that the National Aeronautics and Space Administration's (NASA), proposed deployment of dropsondes and associated activities during the East Pacific Origins and Characteristics of Hurricanes (EPOCH) Mission are not likely to adversely affect species listed as threatened or endangered or critical habitats designated under the Endangered Species Act (ESA). This response to your request was prepared by NMFS pursuant to section 7(a)(2) of the ESA, implementing regulations at 50 CFR 402, and agency guidance for preparation of letters of concurrence.

Background

The EPOCH is a project managed by NASA's Goddard Space Flight Center's Wallops Flight Facility, and will directly contribute to the NASA science goal of improving capabilities to predict weather, especially extreme weather events. The main goal of the EPOCH science flight is to understand hurricane genesis and change in intensity using the combined observational data obtained from the release of dropsondes and specialized instruments augmented with data from multiple NASA satellites and computer simulations. Aircraft-based deployment of dropsondes has been performed for many years by NASA, NOAA, and United States Airforce aircraft during storm tracking and research flight operations.

Consultation History

- On September 13, 2012, NASA submitted a request for section 7 informal consultation for the Global Hawk HS3 Mission.

- On October 16, 2012, NMFS issued a concurrence letter for the Global Hawk HS3 Mission.

NMFS' letter of concurrence dated October 16, 2012, for NASA's Global Hawk HS3 Mission analyzed the three year (2012-2014) mission's use of dropsondes and effects on ESA-listed species covering regions along the Gulf of Mexico, Caribbean, Atlantic (western, central and eastern) Oceans. The EPOCH Mission is similar to the Global Hawk HS3 Mission, but is primarily focused on targeting hurricanes that occur in the East Pacific Ocean. However, if no hurricanes occur in this area, NASA proposes to conduct flights over the other ocean areas (excluding the eastern and central Atlantic and portions of the Caribbean Ocean) that were covered under previous Global Hawk HS3 Mission. The operations that will occur over any ocean basin will be conducted in a similar manner to what was described in the June 2012, Global Hawk HS3 2012 Mission Overview, and NMFS' October 16, 2012, letter of concurrence.

Proposed Action

There are four operational ocean areas of interest for the NASA EPOCH Mission: (1) East Pacific, (2) Gulf of Mexico, (3) Caribbean, and (4) western Atlantic. NASA's proposed EPOCH Mission will use the same dropsonde technologies as those deployed during the Global Hawk HS3 Mission, thus the same effects previously considered in 2012 are expected to occur for the EPOCH Mission in all ocean basins. The primary area of focus will be the Eastern Pacific, but due to the uncertainty of where hurricanes will initiate and track, NASA needs to maintain the ability to operate in the other ocean areas in the event there are no hurricanes to track in the East Pacific during the six week period. Thus NASA needs to be able to fly all regions of the East Pacific and Atlantic, Caribbean, and Gulf of Mexico Ocean basins spanning between 10 to 35 degrees north and 150 to 75 degrees west. NASA proposes to conduct up to six flights in the East Pacific (or other areas if necessary) during a six week period from July 1, 2017, to November 1, 2017.

The activities consist of flying three instruments on a Global Hawk Unmanned Aircraft System from Armstrong Flight Research Center, California, over an East Pacific hurricane. If NASA needs to fly in the other areas, the protocols will be the same as described for the Global Hawk HS3 Mission. The three instruments that will be used for the mission are the ER-2 X-band radar, the High Altitude Monolithic Microwave Integrated Circuit Sounding Radiometer, and the Advanced Vertical Atmospheric Profiling System (AVAPS). The AVAPS is a system to deploy dropsondes from aircraft, such as the Global Hawk. The Global Hawk flies at approximately 65,000 feet altitude and uses a special dropsonde launcher called Miniature In-situ Sounder Technology (MIST) to deploy the dropsondes. The system can store and release up to 100 dropsondes from the AVAPS per flight. The Global Hawk will be used only over open water when the area is clear of other aircraft, and will not release dropsondes within 12 nautical miles of shore from American or foreign countries and will not release dropsondes in any protected marine areas or preserves.

Each dropsonde is a small electronic device comprised of several ambient sensors that fall through the atmosphere once activated and released from an airborne platform. They are smaller and lighter (12.0 inches long by 1.8 inches in diameter and weighs 8.0 ounces) than other dropsondes, and are attached to a small, nylon pyramidal parachute (an eight inch square). Between the launch point and the ground, dropsondes transmit ambient temperature, pressure, humidity, and wind data that are received by instrumentation on the launch platform. The dropsonde deploys a small cone parachute on release from the aircraft, which provides a stable

orientation for the dropsonde and a predictable descent rate. The dropsondes are expendable and are not recovered. Only one dropsonde is dispensed at a time.

Action Area
The action area is defined in 50 CFR § 402.02 as "all areas to be affected directly or indirectly by the federal action and not merely the immediate area involved in the action." For the EPOCH Mission, the action area includes all areas between regions of the East Pacific, western Atlantic, Caribbean and Gulf of Mexico Ocean basins spanning between 10 to 35 degrees north and 150 to 75 degrees west. This includes airspace, land, water column, and seabed within which project aircraft would fly and expended hardware could land and ultimately come to rest.

Action Agency's Effects Determination
NASA has concluded that the proposed action may affect, but is not likely to adversely affect the following ESA-listed or proposed for listing species:

Table 1. Species Present in the Action Area – Oceans of the Eastern Pacific, Western Atlantic, Caribbean, and Gulf of Mexico.

Common Name	Scientific Name	ESA Listing (FR Number)	Critical Habitat Designation (FR Number)	ESA Status	Agency Effects Determination
Marine Mammals					
North Atlantic right whale	*Eubalaena glacialis*	March 6, 2008 (73 FR 12024)	July 5, 1994/February 26, 2016 (59 FR 28805/81 FR 4837)	Endangered	NLAA
North Pacific right whale	*Eubalaena japonica*	December 2, 1970/March 6, 2008 (73 FR 12024)	April 8, 2008 (73 FR 19000)	Endangered	NLAA
Blue whale	*Balaenoptera musculus*	December 2, 1970 (35 FR 18319)	Not designated	Endangered	NLAA
Humpback whale – Mexico DPS	*Megaptera novaeangliae*	December 2, 1970/ October 2, 2016 (35 FR 18319/81 FR 62259)	Not designated	Threatened	NLAA
Fin whale	*Balaenoptera physalus*	December 2, 1970 (35 FR 18319)	Not designated	Endangered	NLAA
Sei whale	*Balaenoptera borealis*	December 2, 1970 (35 FR	Not designated	Endangered	NLAA

Table 1. Species Present in the Action Area – Oceans of the Eastern Pacific, Western Atlantic, Caribbean, and Gulf of Mexico.					
Common Name	**Scientific Name**	**ESA Listing (FR Number)**	**Critical Habitat Designation (FR Number)**	**ESA Status**	**Agency Effects Determination**
		18319)			
Sperm whale	*Physeter macrocephalus*	December 2, 1970 (35 FR 18319)	Not designated	Endangered	NLAA
Guadalupe fur seal	*Arctocephalus townsendi*	December 16, 1985 (50 FR 51252)	Not designated	Endangered	NLAA
Marine Reptiles					
Green sea turtle – North Atlantic DPS	*Chelonia mydas*	May 6, 2016 (81 FR 20057)	September 2, 1998 (63 FR 46693)	Threatened	NLAA
Green sea turtle - East Pacific DPS	*Chelonia mydas*	May 6, 2016 (81 FR 20057)	Not designated	Threatened	NLAA
Green sea turtle - Florida and Mexico breeding colonies	*Chelonia mydas*	May 6, 2016 (81 FR 20057)	September 2, 1998 (63 FR 46693)	Endangered	NLAA
Hawksbill sea turtle	*Eretmochelys imbricata*	June 2, 1970 (35 FR 8491)	September 2, 1998 (63 FR 46693)	Endangered	NLAA
Loggerhead sea turtle – North pacific DPS	*Caretta caretta*	September 22, 2011 (76 FR 58868)	Not designated	Endangered	NLAA
Loggerhead sea turtle - Northwest Atlantic Ocean DPS	*Caretta caretta*	September 22, 2011 (76 FR 58868)	August 11, 2014 (79 FR 39856)	Endangered	NLAA
Olive Ridley sea turtle	*Lepidochelys olivacea*	July 28, 1978 (43 FR 32800)	Not designated	Threatened	NLAA
Kemp's ridley sea	*Lepidochelys kempii*	December 2, 1970 (35 FR	Not designated	Endangered	NLAA

Table 1. Species Present in the Action Area – Oceans of the Eastern Pacific, Western Atlantic, Caribbean, and Gulf of Mexico.					
Common Name	**Scientific Name**	**ESA Listing (FR Number)**	**Critical Habitat Designation (FR Number)**	**ESA Status**	**Agency Effects Determination**
turtle		18319)			
Leatherback sea turtle – Atlantic and Pacific DPSs	*Dermochelys coriaacea*	June 2, 1970 (35 FR 8491)	Designated (44 FR 17710, 77 FR 4170)	Endangered	NLAA
Fishes					
Central California Coast Steelhead	*Oncorhynchus mykiss*	August 18, 1997/January 5, 2006 (71 FR 5248)	September 2, 2005 (70 FR 52488)	Threatened	NLAA
Southern California Steelhead	*Oncorhynchus mykiss*	August 18, 1997/January 5, 2006 (71 FR 5248)	September 2, 2005 (70 FR 52488)	Endangered	NLAA
Atlantic sturgeon – Chesapeake, Carolina, South Atlantic DPSs	*Acipenser oxyrinchus oxyrinchus*	April 6, 2012 (77 FR 5879)	June 3, 2016 (81 FR 35701) Proposed	Endangered	NLAA
North American Green sturgeon, Southern DPS	*Acipenser medirostris*	June 6, 2006 (71 FR 17757)	November 9, 2009 (74 FR 52300)	Threatened	NLAA
Gulf sturgeon	*Acipenser oxyrinchus desotoi*	September, 30, 1991 (56 FR 49653)	March 19, 2003 (68 FR 13370)	Threatened	NLAA
Shortnose sturgeon	*Acipenser brevirostrum*	March 11, 1967 (32 FR 4001)	Not designated	Endangered	NLAA
Nassau grouper	*Epinephelus striatus*	June 29, 2016 (81 FR 42268)	Not designated	Threatened	NLAA
Scalloped hammerhead shark – Central and	*Sphyrna lewini*	September 2, 2014 (79 FR 38213)	Not designated	Threatened	NLAA

Table 1. Species Present in the Action Area – Oceans of the Eastern Pacific, Western Atlantic, Caribbean, and Gulf of Mexico.					
Common Name	**Scientific Name**	**ESA Listing (FR Number)**	**Critical Habitat Designation (FR Number)**	**ESA Status**	**Agency Effects Determination**
Southwest Atlantic DPSs					
Scalloped hammerhead shark Eastern Atlantic, Eastern Pacific DPS	*Sphyrna lewini*	September 2, 2014, (79 FR 38213)	Not designated	Endangered	NLAA
Oceanic Whitetip shark	*Carcharhinus longimanus*	December 29, 2016 (81 FR 96304)	Not designated	Proposed for listing as threatened	NLAA
Smalltooth sawfish - U.S. DPS	*Pristis pectinata*	April 1, 2003 (68 FR 15674)	September 2, 2009 (74 FR 45353)	Endangered	NLAA
Invertebrates					
Black abalone	*Haliotis cracherodii*	January 14, 2009 (74 FR 1937)	October 27, 2011 (74 FR 1937)	Endangered	NLAA
White abalone	*Haliotis sorenseni*	May 29, 2001 (66 FR 29046)	Not designated	Endangered	NLAA
pillar coral	*Dendrogyra cylindrus*	September 10, 2014 (79 FR 53852	Not designated	Threatened	NLAA
rough cactus coral	*Mycetophyllia ferox*	September 10, 2014 (79 FR 53852	Not designated	Threatened	NLAA
lobed star coral	*Orbicella annularis*	September 10, 2014 (79 FR 53852)	Not designated	Threatened	NLAA
mountainous star coral	*Orbicella faveolata*	September 10, 2014 (79 FR 53852)	Not designated	Threatened	NLAA
boulder star coral	*Orbicella franksi*	September 10, 2014 (79 FR 53852)	Not designated	Threatened	NLAA
elkhorn	*Acropora*	May 9,	December 26,	Threatened	NLAA

Table 1. Species Present in the Action Area – Oceans of the Eastern Pacific, Western Atlantic, Caribbean, and Gulf of Mexico.					
Common Name	**Scientific Name**	**ESA Listing (FR Number)**	**Critical Habitat Designation (FR Number)**	**ESA Status**	**Agency Effects Determination**
coral	*palmata*	2006/September 10, 2015 (71 FR 26852/79 FR 53852)	2008 (73 FR 72210)		
staghorn coral	*Acropora cervicornis*	May 9, 2006/September 10, 2015 (71 FR 26852/79 FR 53852)	December 26, 2008 (73 FR 72210)	Threatened	NLAA
Johnson's Seagrass					
Johnson's Seagrass	*Halophila johnsonii*	September 4, 1998 (63 FR 49035)	April 4, 2000 (65 FR 17786)	Threatened	NLAA

Key: 1) DPS = Distinct population segment; 2) NLAA = Not likely to adversely affect

Effects of the Action

Under the ESA, "effects of the action" means the direct and indirect effects of an action on the listed species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action (50 CFR 402.02). The applicable standard to find that a proposed action is not likely to adversely affect listed species or critical habitat is that all of the effects of the action are expected to be discountable, insignificant, or completely beneficial. Beneficial effects are contemporaneous positive effects without any adverse effects to the species or critical habitat. Insignificant effects relate to the size of the impact and should never reach the scale where take occurs. Discountable effects are those extremely unlikely to occur.

As ESA-listed species may be present within the action area, potential impacts could occur for the ESA-listed species provided in Table 1 above. NASA's request to include the Eastern Pacific Ocean in the EPOCH Mission, along with the other oceans included in the 2012 Global Hawk Mission may result in effects to species and habitats not previously considered due to the expanded action area and new species listings since 2012. Because of the larger area, there is the potential for 33 threatened or endangered species to be present during the program's activities. Of these, 13 were already included in NMFS' 2012 analysis and concurrence letter. These species are the blue whale (*Balaenoptera musculus*), fin whale (*Balaenoptera physalus*), humpback whale (*Megaptera novaeangliae*), sei whale (*Balaenoptera borealis*), North Atlantic right whale (*Eubalaena glacialis*), sperm whale (*Physester macrocephalus*), Florida and Mexico breeding populations of green sea turtle (*Chelonia mydas*), Northwest Atlantic DPS of loggerhead sea turtle (*Caretta caretta*), the Carolina and South Atlantic DPSs of Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*), gulf sturgeon (*Acipenser oxyrinchus desotoi*), shortnose sturgeon (*Acipenser brevirostrum*), elkhorn coral (*Acropora palmate*) and staghorn

coral (*Acropora cervicornis*). These species will not be discussed further in this analysis since the effects on them remain the same as what was previously considered in 2012. Since 2014, the status of the humpback whale (*Megaptera novaeangliae*) was revised (81 FR 62259), resulting with only one threatened Mexico distinct population segment (DPS) likely to be found in the action area. Additionally, on July 3, 2014, NMFS published a final rule (79 FR 38213) listing four DPSs of scalloped hammerhead shark under the ESA; and the oceanic whitetip shark (*Carcharhinus longimanus*) was proposed for listing as threatened under the ESA on December 29, 2016 (81 FR 96304).

Critical habitat has been proposed or designated for 16 of these species, but only critical habitat for North Atlantic right whales, green sea turtles, gulf and Atlantic sturgeon, smalltooth sawfish, black abalone, elkhorn and staghorn coral, and Johnson's seagrass is found within the action area. Effects of the action on proposed for listing and ESA-listed species and critical habitats not previously considered are discussed below.

Aspects of the EPOCH Mission that may affect ESA-listed, proposed species or critical habitats include the aircraft flight within the action area and deployment of the expendable dropsondes which may directly strike an animal or cause entanglement by or ingestion of the dropsonde components. These impacts could lead to injury, reduced fitness, and mortality. The likelihood that ESA-listed species would be impacted by these stressors was determined by considering factors that include: the scale and scope of the action; NMFS' expectations of how components of the EPOCH Mission are likely to behave following an oceanic landing; the life histories and distribution of ESA-listed species within the action area; and the physical characteristics of the action area.

Aircraft Overflight. Aircraft flights within the action area could affect species by causing a startle response to either visual or acoustic stimulus. However, since the EPOCH Mission's aircraft (e.g. Global Hawk) flight altitudes are approximately 65,000 feet or higher, most species would likely be unaware of the aircraft transiting above, resulting in insignificant effects on species.

Dropsonde Deployment. The deployment of dropsondes could affect species through directly landing on or striking an individual, entanglement or ingestion (Hoss and Settle 1990; Baulch and Perry 2014; Schuyler et al. 2012). A direct strike of an animal would be extremely unlikely. Because many species considered in this analysis swim below the ocean surface, the small size and weight of the dropsonde, and descent velocities of the sinking components are such that an animal could swim either vertically or laterally out of the way, thereby reducing the effect on the animal to a brief behavioral disruption such as a startle and/or avoidance response. Entanglement or attempted ingestion of the dropsonde and attached parachute would also be unlikely for the same reasons, but also because the attached parachutes fill with water as soon as they land causing them to fold in on themselves and sink quickly. The maximum float time is less than 30 minutes with an average float time of two minutes, and average sink rate of 1.15 feet per second. At this rate, each dropsonde is anticipated to sink to a depth of over 4,000 feet after one hour, well below the depths potentially affected species are likely to inhabit. Therefore, the majority of animals would likely avoid the small dropsonde and its parachute while it sinks, making the

probability of direct strike, entanglement or ingestion by any ESA-listed species very low and is expected to be insignificant and discountable.

Furthermore, once the dropsondes settle on the sea floor, it would be very unlikely for listed species to interact with them for several reasons. For marine mammals, humpback whales are expected to occupy waters approximately 20 m deep, where they do the most of their foraging (Wiley et. al 2011). The other mysticete whale species would be expected to occur in deeper waters, around 200 m off the continental shelf (Calambokidis et al., 2008) as mysticetes tend to forage in that portion of the water column (Watkins & Schevill 1976; Goldbogen et al., 2007; Horwood, 2009; Goldbogen et al., 2011). Sperm whales tend to forage in waters deeper than mysticetes (e.g., 400 to 600 m) and sometimes at or near the benthos (Mathias et al., 2012; Miller et al., 2013), but not at the depths where the majority of dropsondes are expected to settle (e.g. 4,000 m). Guadalupe fur seals are expected to be found in the tropical waters of the Southern California/ Mexico region. During breeding season (June – August), they are found in coastal rocky habitats and caves, but their distribution at other times is not well known. Although most of their heir breeding grounds on Guadalupe Island, Mexico, small populations are found off of Baja California on San Benito Island and off of Southern California at San Miguel Island thus could be present in the action area during the EPOCH Mission's activities. Their diet consists primarily of squid and a variety of fish species, thus they are expected to occupy shallower depths in the water column, well above the settling depths of the dropsondes. Therefore the likelihood of any marine mammal encountering an expended dropsonde once it has settled over the long-term is expected to be so low as to be discountable.

Although it is possible that the ultimate location of the dropsondes on the sea floor could be within the range of depths observed for diving sea turtles, particularly leatherbacks (maximum recorded dive depths to 1,280 m (Doyle et al. 2008), this occurrence is expected to be rare, since very deep dives (>300 m) are rare for this species (Houghton et al. 2008). Additionally, the short single-attachment cord from the parachute to the dropsonde, and the enclosed square-cone design of the chute, reduces the likelihood of entanglement by sea turtles (Laist 1997; Laist et al. 1999); and the color and material of the chute is such that it would not entice turtles to try to ingest it (Schuyler et al. 2012; Lazar et al 2011; Casale et al. 2008; Tomas et al. 2002). However, should they be curious and attempt to bite the parachute, the rip-stop nylon material is resistant to tears and would most likely remain intact. For these reasons, coupled with the short float (average two minutes) and the rapid sink rates, there is little risk of entanglement or ingestion by sea turtles. As a result of these factors, NMFS has determined the likelihood of a sea turtle being exposed to the potential stressors associated with the action to be so low as to be discountable.

Any listed fish species present in the action area during dropsonde deployment are likely to occupy shallower waters of the action area. Juvenile and adult sturgeon live in coastal waters and estuaries when not spawning or rearing, generally in shallow (10-50 m) nearshore areas, and typically forage on "benthic" invertebrates (e.g., crustaceans, worms, mollusks) (Johnson et al. 1997). Sub-adults and adults of green sturgeon could be located along the sea floor in shelf waters out to the 110 m contour (Erickson and Hightower 2007) during the project's activities. The oceanic whitetip shark is an epipelagic species and inhabits waters offshore on the outer continental shelf and around islands in deep water usually in the upper 80 m, and is capable of foraging at depths greater than 200 m into the mesopelagic zone (Howey-Jordan et al. 2013;

Howey et al. 2016) in tropical and warm temperate regions, mostly between 10° N and 10° S but also within 30 ° N and 35 ° S (Backus et al. 1956; Strasburg 1958; Compagno 1984; Bonfil et al. 2008). The diet of oceanic whitetip sharks includes a variety of fish, cephalopods, and may include seabirds, rays, turtles, and refuse (Compagno 1984). Within the action area, scalloped hammerhead sharks could be found in coastal warm temperate and tropical seas in the Atlantic and Pacific Oceans along the continental and insular shelves, in water depths between 450-512 m up to 1000 meters, and have been recorded entering bays and estuaries. Similar to other shark species, scalloped hammerheads feed on a variety of prey species including teleost, cephalopods, crustaceans and rays (Compagno 1984; Miller et al. 2014). Finally, the majority if salmonid species (e.g. steelhead) prefer to occupy the uppermost stratum (10-30 m) while at sea, rendering the longer-term potential for interaction with the dropsondes very unlikely. Therefore. NMFS considers the effects of the proposed action on any listed species to be insignificant and discountable.

For the invertebrate species (i.e., abalone and corals) and Johnson's seagrass, the chances of a droposonde landing atop one of these species is extremely remote. Because ESA-listed corals are sessile organisms once established along a reef, and with limited dispersion potential, they would remain in the coastal environment of the action area year-round. Thus they would not be able to move away and avoid any expended components of the dropsonde landing in the water. However, because all of the coral species are expected to be found in reefs along the coast, none are expected to be found in waters deeper than 60 m, making it extremely unlikely for dropsonde components to descend and land atop a reef. Should the descending dropsonde land in shallow water and the parachute unfurl to its full size without folding in on itself, some corals could be smothered. However, such an occurrence is considered extremely unlikely, given the minimization measures NASA will implement to avoid sensitive areas such as those with coral reefs and the short float times and rapid sink rates to great depths make the probability for entanglement or smothering of corals due to drift quite low and discountable.

Both black and white abalone could be present in the action area along the coast of California. Black abalone prefer rocky intertidal substrate and can be found in shallower waters as deep as 6 m. White abalone are found in open low and high relief rock or boulder habitat that is interspersed with sand channels, and are most abundant in waters between 30-60 m deep, making them the deepest occurring abalone species in California. Both abalone species are slow moving bottom dwellers and therefore unlikely to move out of the way of any expended dropsonde components that sink in shallow waters and thus could be covered by some of the parts. However, as with the coral species, the likelihood of a dropsonde landing in these shallow areas along the pacific coastline is so remote as to be considered discountable.

Johnson's seagrass prefers to grow in coastal lagoons in the intertidal zone, or deeper than many other seagrasses. It is found in coarse sand and muddy substrates and in areas of turbid waters and high tidal currents along small portions of Florida from central Biscayne Bay to Sebastian Inlet. The largest patches have been documented inside Lake Worth Inlet. The southernmost distribution is reported to be in the vicinity of Virginia Key in Biscayne Bay, near Miami. Although a dropsonde could ultimately settle on a bed of seagrass, the likelihood of this occurring is extremely remote, therefore effects from the action are considered insignificant and discountable.

In summary, for all of the ESA-listed species, due to the difference in depth and resultant spatial separation between species and expended dropsonde hardware in deeper waters, any interaction with an animal (or seagrass) would be extremely unlikely. Although, theoretically, the expended dropsonde hardware could land on the continental shelf within the depth range of some of the animals, the vast majority of the animals would be expected to occur higher in the water column or located close enough to the coast to be outside the 12 mile offshore boundary targeted by NASA. Plus, when considering the small size of the dropsondes, and low number deployed (90-100) within the large action area, the longer-chances of any interaction, or long-term possibility of an entanglement or ingestion by a proposed for or listed species from NASA's EPOCH Mission activities is remote, therefore expected to be insignificant and discountable.

The proposed action may occur within critical habitats for the North Atlantic right whale, black abalone, gulf sturgeon, scalloped hammerhead sharks, Johnson's seagrass, elkhorn and staghorn corals. The effects of the proposed action on critical habitat are reasonably likely to include small areas of disturbance in the water column as the components land and begin to sink, and finally small areas of substrate disturbance resulting in brief increases in turbidity if a dropsonde lands in the shallower waters. Should these impacts occur, the effects and duration are expected to be very minor and temporary. Therefore, the effects on critical habitat are expected to be insignificant and discountable.

Conclusion

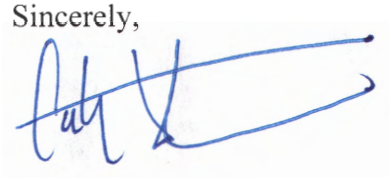
After reviewing the information described in the June 2012 Global Hawk and October 20, 2016 Hands-On Project Experience and the EPOCH Mission Overviews, additional information submitted by NASA via electronic mail on January 19 and April 21, 2017, current status of the listed species and designated critical habitat, as well as the probable effects of the action, NMFS concurs with NASA's determination that the deployment of dropsondes from aircraft managed by NASA's Goddard Space Flight Center's Wallops Flight Facility as part of the EPOCH Mission is not likely to adversely affect threatened and endangered species or adversely modify designated critical habitat.

Reinitiation of Consultation

Reinitiation of consultation is required and shall be requested by NASA or by NMFS, where discretionary Federal involvement or control over the action has been retained or is authorized by law and (1) new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered; (2) 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 this concurrence letter; or if (3) a new species is listed or critical habitat designated that may be affected by the identified action (50 CFR 402.16). This concludes ESA consultation.

Please direct questions regarding this letter to the NMFS Office of Protected Resources, Ms. Jacqueline Meyer (301) 427-8492 or jacqueline.pearson-meyer@noaa.gov.

Sincerely,



Cathryn E. Tortorici
Chief, ESA Interagency Cooperation Division
Office of Protected Resources

Literature Cited

Backus, R.H., Springer, S. and Arnold Jr., E.L. (1956) A contribution to the natural history of the white-tip shark, *Pterolamiops longimanus* (Poey). Deep-sea Research, 3, 178-188

Baulch, S., & Perry, C. (2014). A sea of plastic: evaluating the impacts of marine debris on cetaceans. *Marine Pollution Bulletin*, *80*(1), 210–221.

Bonfil, R., Clarke, S., Nakano, H., Camhi, M. D., Pikitch, E. K., and Babcock, E. A. (2008). Chapter 11: The biology and ecology of the oceanic whitetip shark, *Carcharhinus longimanus*. *Sharks of the Open Ocean: Biology, Fisheries, and Conservation*. pp. 128-139. Blackwell Publishing, Ltd. Published Online: January 28, 2009.

Calambokidis, J., E.A. Falcone, T.J. Quinn, A.M. Burdin, P.J. Clapham, J.K.B. Ford, C.M. Gabriele, R. LeDuc, D. Mattila, L. Rojas-Bracho, J.M. Straley, B.L. Taylor, J. Urban, D. Weller, B.H. Witteveen, M. Yamaguchi, A. Bendlin, D. Camacho, K. Flynn, A. Havron, J. Huggins, and N. Maloney (2008). SPLASH: Structure of Populations, Levels of Abundance and Status of Humpback Whales in the North Pacific. Final report for Contract AB133F-03-RP-00078. 58 p. Available from Cascadia Research (www.cascadiaresearch.org) and NMFS, Southwest Fisheries Science Center (http://swfsc.noaa.gov).

Casale, P., Abbate, G., Freggi, D., Conte, N., Oliverio, M., Argano, R. (2008). Foraging ecology of loggerhead sea turtles Caretta caretta i n the central Mediterranean Sea: evidence for a relaxed life history model. Marine Ecology Progress Series 372, 265–276.

Compagno, L. J. V. (1984). Sharks of the World. An annotated and illustrated catalogue of shark species to date. 4. *FAO Fisheries Synopsis*, FAO, Rome.

Doyle, T. K., Houghton, J. D., O'Súilleabháin, P. F., Hobson, V. J., Marnell, F., Davenport, J., & Hays, G. C. (2008). Leatherback turtles satellite-tagged in European waters. *Endangered Species Research*, *4*(1-2), 23-31.

Erickson, D. L., & Hightower, J. E. (2007). Oceanic distribution and behavior of green sturgeon. In *American Fisheries Society Symposium* (Vol. 56, p. 197). American Fisheries Society.

Goldbogen, J. A., Pyenson, N. D., & Shadwick, R. E. (2007). Big gulps require high drag for fin whale lunge feeding. *Marine Ecology Progress Series*, *349*, 289-301.

Goldbogen, J. A., Calambokidis, J., Oleson, E., Potvin, J., Pyenson, N. D., Schorr, G., & Shadwick, R. E. (2011). Mechanics, hydrodynamics and energetics of blue whale lunge feeding: efficiency dependence on krill density. *The Journal of Experimental Biology*, *214*(1), 131-146.

Horwood, J. (2009). Sei Whale, *Balaenoptera borealis*. In Perrin, W. F., Wursig, B., & Thewissen, J. G. M. (Eds.), *Encyclopedia of marine mammals (2nd Ed.)* (pp. 1001-1003). Accessed online via Elsevier.

Hoss, D.E. and L.R. Settle. (1990) *Ingestion of Plastics by Teleost Fishes.* NOAA Fisheries In R. S. Shomura and H. L. Codfrey (editors), Proceedings of the Second International Conference on Marine Debris, 2-7 April 1989. Honolulu, Hawaii. Memo. NMFS, NOAA-TH-NMFS-SUFSC-15L. 1990. U.S. Dep. Comer. NOM Tech

Howey-Jordan, L.A., Brooks, E.J., Abercrombie, D.L., Jordan, L.K.B., Brooks, A., Williams, S., Gospodarczyk, E. and Chapman, D.D. (2013) *Complex Movements, philopatry and expanded depth range of a severely threatened pelagic shark, the oceanic whitetip (Carcharhinus longimanus) in the western North Atlantic.* PloS one, 8, 1-12.

Howey, L.A., Tolentino, E.R., Papastamatiou, Y.P., Brooks, E.J., Abercrombie, D.L., Watanabe, Y.Y., Williams, S., Brooks, A., Chapman, D.D. and Jordan, L.K.B. (2016) Into the deep: *the functionality of mesopelagic excursions by an oceanic apex predator.* Ecol. Evol.

Johnson, J. H., D. S. Dropkin, et al. (1997). *Food Habits of Atlantic Sturgeon off the Central New Jersey Coast.* Transactions of the American Fisheries Society 126(1): 166-170.

Laist, D. (1997). Impacts of marine debris: Entanglement of marine life in marine debris including a comprehensive list of species with entanglement and ingestion records. Pages 99-139 in Coe, J. and D. Rogers (eds.), Marine Debris: Sources, Impacts, and Solutions. Springer-Verlag, New York.

Laist, D.W., Coe, J.M. and K.J. O'Hara. (1999). Marine debris pollution. Pages 342-366 in Twiss, J.R. and R.R. Reeves (eds.), Conservation and Management of Marine Mammals. Smithsonian Institution Press, Washington, D.C.

Lazar, B. and R. Gračan (2011). Ingestion of marine debris by loggerhead sea turtles, Caretta caretta, in the Adriatic Sea. Marine Pollution Bulletin 62(1): 43-47.

Mathias, D., Thode, A. M., Straley, J., Calambokidis, J., Schorr, G. S., & Folkert, K. (2012). Acoustic and diving behavior of sperm whales (*Physeter macrocephalus*) during natural and depredation foraging in the Gulf of Alaska. *Journal of the Acoustical Society of America*, *132*(1), 518-532.

Miller, M.H., Carlson, J., Cooper, P., Kobayashi, D., Nammack, M., and J. Wilson. 2014. Status Review Report: Scallopewd hammerhead shark (Sphyrna lewini). Final Report to National Marine Fisheries Service. Office of Protected Reources. March 2014. 133 pp.

Miller, B., Dawson, S., & Vennell, R. (2013). Underwater behavior of sperm whales off Kaikoura, New Zealand, as revealed by a three-dimensional hydrophone array. *The Journal of the Acoustical Society of America*, *134*(4), 2690-2700.

Schuyler Q, Hardesty BD, Wilcox C, Townsend K (2012). To Eat or Not to Eat? Debris Selectivity by Marine Turtles. PLoS ONE 7(7): e40884. doi:10.1371/journal.pone.0040884

Tomás, J., R. Guitart, et al. (2002). Marine debris ingestion in loggerhead sea turtles, Caretta caretta, from the Western Mediterranean. Marine Pollution Bulletin 44(3): 211-216.

Watkins, W. A., & Schevill, W. E. (1976). Right whale feeding and baleen rattle. *Journal of Mammalogy*, *57*(1), 58-66.

Wiley, D., C. Ware, A. Bocconcelli, D. Cholewiak, A. Friedlaender, M. Thompson, and M. Weinrich (2011), Underwater components of humpback whale bubble-net feeding behaviour, Behaviour, 148(5-6), 575–602.

Williams, Rob, Erin Ashe, and Patrick D. O'Hara. (2011). Marine mammals and debris in coastal waters of British Columbia, Canada. Marine Pollution Bulletin 62:1303- 1316.