

Three-Year Science Plan (2017-2019)
Marine Mammal & Turtle Division
Southwest Fisheries Science Center, NOAA Fisheries

<http://swfsc.noaa.gov/mmttd.aspx>

Major Field Efforts

Annual

Gray Whale Calf Production and Condition (*pending funding*)
March-May; Piedras Blancas Lighthouse Station, CA

Coastal Bottlenose Dolphin Ecology (*suspended 2014 due to lack of funding and small boat infrastructure*)
Year-round; Southern California Bight

California Current Humpback and Blue Whale Photographic Identification (*suspended 2010 due to lack of funding*)
June-November; coastal California, Oregon, and Washington waters

Northern and Southern Resident Killer Whale Condition Assessment (*funded through 2017*)
Summer & Fall; Pacific Northwest coast

Antarctic Killer Whale Ecology (*funded through 2017*)
December-March; Southern Ocean

California Sea Lion Diet
Quarterly; San Nicolas and San Clemente islands

California Sea Lion Abundance Survey
July; southern CA

Green Turtle Biology
Year-round; San Diego Bay, San Gabriel River, Seal Beach National Wildlife Refuge

St. Croix Leatherback Turtle Life History (*pending funding*)
March-August; St. Croix, US Virgin Islands

Pacific Leatherback Turtle Life History (*pending funding*)
Papua-Indonesia, Mexico, Costa Rica

Eastern Pacific Hawksbill Turtle Life History (*suspended 2016 due to lack funds*)
El Salvador, Nicaragua & Panama

Calendar Year 2017

UAS condition monitoring of dolphins and behavioral response during controlled sonar exposure

July and October; Southern California Bight

UAS Photogrammetry of North Atlantic Right Whales

March; Cape Cod Bay, MA

Hawaiian Islands Cetacean & Ecosystem Assessment Survey (*pending funding*)

July-November; Hawaiian Archipelago; in collaboration with PIFSC

Target survey interval 5-6 years (last survey 2002)

Southern California Behavioral Response Study

July-September; Southern California Bight

Steller sea lion survey (*pending funding*)

Summer; U.S. West Coast

California Harbor Seal Survey (*pending funding*)

May-July; Coastal California

Target survey interval ~3 years (last survey 2012)

Central California Leatherback Turtle Abundance and Distribution Survey

September-October

California Harbor Porpoise Survey (*pending funding*)

August-November; Coastal California

Target survey interval 4 years (last estimates 2011/2012)

Calendar Year 2018

California Current Cetacean & Ecosystem Assessment Survey (*pending ship time and funding*)

August-November; California Current

Target survey interval 3-4-years (last survey 2014)

UAS condition monitoring of dolphins and behavioral response during controlled sonar exposure

July and October; Southern California Bight

UAS photogrammetry of North Atlantic Right Whales

March; Cape Cod Bay, MA

Central California Leatherback Turtle Abundance and Distribution Survey (*pending funding*)

September-October

UAS monitoring of large whale condition and feeding behavior (*pending funding*)
October-November; Monterey Bay and Southern California Bight.

California Northern Elephant Seal Survey (*pending funding*)
Winter; Coastal California
Target survey interval ~3 years (last survey 2013)

Calendar Year 2019

Gray Whale Abundance Survey (*pending funding*)
December 2019 – February 2020: Granite Canyon, CA
Repeated 2 back-to-back years every 3-4 years (last surveys 2014/15 and 2015/16)

Additional NOAA Research Vessel Surveys (pending ship time and funding)

Large Whale Survey: North Pacific Fin Whale Abundance and Stock Structure
August-November (120 sea days); greater north Pacific

Loggerhead Turtle Process Cruise
Fall; southern California waters

Oregon and Washington Leatherback Turtle Abundance and Distribution Survey
September-October; coastal Oregon and Washington

Eastern Tropical Pacific Cetacean & Ecosystem Assessment Survey
August-November (240 sea days, 2 ships); eastern tropical Pacific

Major Scientific Contributions and Products

Population Abundance Assessment and Trends

Mammals

- Annual revision to Marine Mammal Stock Assessment Reports (Carretta, Forney, Barlow, Moore & other Centers)
- Annual estimates of marine mammal bycatch for west-coast gillnet fisheries, including model-based inference (Carretta, Moore & West Coast Regional Office)
- Evaluate different model-based bycatch estimation approaches and develop user-friendly software tools to implement (Curtis, Moore, Carretta)
- Cetacean abundance and trend estimates for the CA Current (Moore and Barlow)
- Acoustics-based abundance estimate for deep-diving species in the CA Current (Barlow, Moore, Rankin, Keating)
- Acoustics-based models of cetacean distribution/density in central Pacific (Barlow et al., with PIFSC)
- New R.max estimates for cetacean stocks (Moore)
- Bayesian trends power analysis; recommended study design to estimate beaked whale trends in Southern CA Bight (Moore, Curtis, Barlow et al.)

Marine Mammal & Turtle Division, SWFSC, NMFS, Three-Year Plan: 2017-2019

- Development of acoustic survey, monitoring, and mitigation methods for marine mammals (Rankin, Yack, Barlow, Forney, Jacobson)
- Harbor porpoise abundance and trend estimates from visual and CPOD acoustic data - Pacific stocks (Forney, Jacobson et al.)
- Bottlenose dolphin carcass recovery estimation (Carretta)
- Vaquita abundance trends from acoustic monitoring data (multi-institutional collaboration incl MMTD)
- Assessment model for spotted and spinner dolphins integrating sightings, habitat, and life history data (Gerrodette et al. incl IATTC)
- Estimates of abundance and trends for all ETP cetaceans using Bayesian space-state models (Gerrodette, Eguchi, et al.)
- The accuracy of dolphin school size estimation (Gerrodette & Perryman)
- Development of line-transect and mark-recapture models with spatial autocorrelation (Multi-institutional collaboration: Gerrodette, Borchers, Ilian, Lindgren)
- Abundance of bottlenose dolphins in coastal waters of southern California using photographic identification and mark-recapture analysis (Weller et al.)
- Abundance of eastern north Pacific gray whales based shore-based count methods and night vision data (Durban et al.)
- Abundance of mammal-eating killer whales in coastal waters of the NE Pacific using photographic mark-recapture methods (Durban)
- Abundance and health assessment of Chilean blue whales in coastal waters of Chile using photographic mark-recapture methods (Brownell)
- Development of Bayesian mark-recapture models: meta analyses, integrating spatial data (Durban et al.)
- Proof of concept and study design for development of population matrix models that explicitly include sociality and behavior (Mesnick, Moore et al.)
- Behavioral response of ETP dolphins relative to purse-seine effort in the context of stock population trends (Mesnick, Archer et al.)
- Using UAS photogrammetry to estimate population size structure for status assessment of dolphins; meta-analysis between populations (Durban et al)

Turtles

- IUCN Red List East Pacific green turtle assessment (Seminoff, Allen and Morgan)
- ESA green turtle critical habitat determination (with other NOAA Fisheries FMC staff)
- ESA olive ridley status review (with other NOAA Fisheries FMC staff)
- ESA leatherback turtle assessment (Dutton et al.)
- Pacific Green Turtle Genetics Working Group
- Sea Turtle bycatch stock ID assessment (Stewart & Dutton)
- Genetic tools to census Hawaiian green and Texas Kemp's Ridley turtles (Frey and Dutton)
- Loggerhead abundance and distribution in southern California (Eguchi and Seminoff)
- Predicting overlap between fisheries and leatherback habitat in Central California (Eguchi and Benson)
- Leatherback density and abundance update for U.S. West Coast (Benson)
- Leatherback population/demographic model (Dutton, Stewart, Eguchi et al.)
- Leatherback mortality reference point estimation (Curtis, Moore, Benson)

- Improving capacity of stock assignment for sea turtles: using ocean circulation modeling to inform genetic mixed stock analysis (Jensen, Kobayashi, Dutton)

Population Structure

Mammals

- Complete publication of framework to define marine mammal species and subspecies globally (Taylor and Perrin et al.)
- mtDNA species IT Program (Archer/Robertson)
- mtDNA & msat quality control R code (Archer/Martien)
- Continued accrual of samples and loans from collection (Serra-Valente/Robertson *pending funding*)
- Defining units to conserve:
 - Endangered Species Act
 - Sperm whale global phylogeography (Morin et al.)
 - Fin whale taxonomy (Archer et al.)
 - Blue whale taxonomy (Lang et al.)
 - Killer whale taxonomy (Morin et al.)
 - False killer whale taxonomy (Martien et al.)
 - Hawaiian false killer whale, social structure and Ne (Martien et al.)
 - Ice seals (Lang, collaboration with NMML)
 - Western gray whale population structure (Lang et al.)
 - Melon-headed whale phylgeography and population structure (Martien et al.)
 - Beradius sp. (new species in N. Pacific) nuclear data in support of species status (Morin et al.)
 - Short-finned pilot whale taxonomy (Morin et al.)
 - Pygmy killer whale taxonomy, *pending funding* (Martien)
 - Marine Mammal Protection Act
 - Workshop defining stock structure with few or no genetic data (GAMMS III recommendation, Martien et al.)
 - Fin whale population structure within the North Pacific (Archer et al.)
 - Assessing recruitment into the Pacific Coast Feeding Group of gray whales (Lang)
 - Western gray whale relatedness and population structure (Lang)
 - Bottlenose dolphin stock structure: Channel Islands (Lang et al.)
 - Bottlenose dolphin stock structure: Hawaiian Archipelago (Martien et al.)
 - Bottlenose and Frasier's dolphin stock structure: Marianas and Hawaiian Islands (Martien et al.)
 - Pygmy killer whale global phylgeography (Hancock-Hanser et al.)
 - Pilot whales in Hawaii and Marianas (VanCise et al.)
 - Harbor porpoise, CA/OR/WA update (Morin)
 - ETP spinner and spotted dolphin population structure (Leslie et al.) (3 papers)
 - Short-finned pilot whale global phylgeography (Morin)
 - Sperm whale social structure (Mesnick)

Turtles

- Global foraging group structure of leatherback turtles determined via isoscape analysis (Seminoff et al.)
- Stock origin of green turtles foraging off the southern California, USA, using mtDNA: (LeRoux et al.)
- Sea turtle standings along the U.S. West Coast; species distribution and nesting beach origins (LeRoux et al.)
- Publish, update and assemble working database on stock structure for green, leatherback, loggerhead, and hawksbill turtles (w/ PIRO, SWR, PIFSC, SEFSC)
 - Pacific green turtles (Jensen et al.)
 - Atlantic and Indian Ocean green turtles (Jensen, Dutton et al.)
 - Pacific loggerhead turtles (Dutton, LeRoux et al.)
 - Atlantic and Pacific loggerhead turtles
 - Working database of new sequence data (Dutton et al.)
 - Rookery management units (Fitzsimmons, Dutton, Shamblin et al.)
 - Pacific leatherback turtles (Dutton et al.)
 - Atlantic leatherback turtles (Dutton et al.)
 - Eastern Pacific hawksbill turtles (Gaos et al.)
 - Pacific Island's hawksbill turtles (Dutton, Gaos et al.)
 - mtDNA sequence baseline datasets and haplotype nomenclature tool
- Determination of foraging area contributions to the leatherback nesting rookery in Jamursba Medi, Indonesia through stable isotope analysis of eggshell (Seminoff)
- Develop SNPs, whole mitgenome sequencing and genomics for all 7 species of marine turtles (Dutton, Morin et al.)
 - Hawksbill turtles (Frey, Dutton, Gaos et al.)
 - Green turtles (Roden et al.)
 - Leatherback turtles (Komoroske, Roden, Dutton)
 - Loggerhead turtles (Frey et al.)

Life History, Health, Condition

Mammals

- Length and width measurements of gray whales from vertical aerial photographs and relationships with climate/weather in the Arctic (Perryman et al.)
- UAS photogrammetry for condition monitoring of dolphins in the Southern California Bight (Durban et al.)
- UAS photogrammetry for monitoring growth, condition and entanglement wounds/incidence in North Atlantic Right Whales (Durban et al.)
- Common dolphin demography, reproduction, and niche partitioning through combined study of reproductive hormones, environmental data and data extracted from vertical aerial photographs (Chivers et al.)
- Contaminant loads
 - coastal bottlenose dolphins in the southern California Bight (Weller et al.)
 - short-beaked common dolphins in the Southern California Bight (Chivers et al.)
- Trends in causes of death among San Diego County cetacean strandings (Danil et al.)
- Domoic acid exposure of cetaceans in the Southern California Bight (Danil et al.)

- Life history parameters of Mekong River dolphins based on data from specimens taken as bycatch and photo-id studies (Brownell et al.)
- Morphology and life history parameters (timing of reproduction, length of cow/calf association) for 3 forms of spinner dolphins in the ETP based on data from specimens and aerial photographs (Chivers et al.)
- Fetal mortality of spotted and spinner dolphins in the ETP and relationship to tuna purse seine fishing effort (Chivers et al.)
- Behavioral responses of beaked whales and other odontocetes to Navy sonar exposure at the US Navy's Atlantic Test and Evaluation Center in the Bahamas (Durban et al.)
- Deriving quantitative measures of killer whale growth and body condition from aerial photogrammetry data (Fearnbach and Durban)
- Changes in body condition and reproductive success of Southern Resident killer whales relative to prey availability (Fearnbach and Durban)
- Reproduction in female Southern Resident killer whales based on dead specimens and the long-term photo-id dataset (Brownell et al)
- Endocrine evaluation of blue whales relative to shipping traffic within the Southern California Bight (Kellar et al.)
- Gene expression, endocrine and contaminant assessments of coastal and offshore bottlenose dolphins in the California Bight (Trego et al.)
- Reproductive and endocrine health assessment of Cook Inlet belugas (Kellar et al, in collaboration with AFSC)
- Advancement of biochemical laboratory techniques to maximize the use of biopsy material (Kellar et al, in collaboration with NWFSC, NIST)
- Evaluation of reproductive success relative to oil exposure in stocks of bottlenose dolphins in the northern Gulf of Mexico (Kellar et al.)
- Pharmacokinetics of hydrocortisone/cortisol in adipose tissue of dolphins (Kellar et al.)
- Adrenal health and cortisol dynamics in plasma and blubber tissue of populations of bottlenose dolphins exposed to the oiled during the Deepwater Horizon disaster (Kellar et al.)
- Cause-of-mortality specific endocrine signals in the blubber of California sea lions (Beaulieu et al.)
- Estrous and gestational endocrine signals in the blubber of short-beaked common dolphins (Robbins et al.)
- Reproductive and endocrine assessment of cetaceans with frequent exposure to MFAS sonar within adjacent to the Navy SOAR range complex (Kellar et al, **pending funding**)
- Reproductive and endocrine values of beaked whale populations in the Bahamas with varying levels of acoustic perturbations (Kellar and Durban et al.)
- Endocrine measurements and their pharmacokinetics in various sample matrices from northern elephant seals (Kellar et al.)
- Endocrine measurements and their pharmacokinetics in various sample matrices from managed-care bottlenose dolphin stocks (Kellar et al.)
- Diet and endocrine evaluation of northern Pacific humpback whales relative to prey abundance (Kellar et al.)

Turtles

- Home range of green turtles in San Diego Bay determined via GPS-tracking (Eguchi et al.)
- Oceanic life-stage elucidation for green turtles through skeletochronology and stable isotope analysis (Turner-Tomaszewicz and Seminoff)
- Biology and Conservation of Sea Turtles of West Africa (Tiwari and Fretey, editors)
- Hatchling sex ratio and pivotal temperature of eastern Pacific hawksbill turtles (Eguchi et al.)
- Internesting activity and dive behavior of leatherback turtles in Jamursba Medi, Papua (Okuyama et al.)
- Foraging activity and dive patterns of Pacific leatherback turtles during transPacific reproductive migrations (Benson et al.)
- Validation of a testosterone elisa for sex determination and reproductive assessment of six sea turtle species (Allen et al.)
- Sex ratios of six sea turtle species among multiple foraging areas worldwide (Allen et al.)
- Habitat use of north Pacific loggerhead turtles (*Caretta caretta*) and duration spent in a high-bycatch area near Baja California Peninsula using skeletochronology and stable isotope analysis (Turner-Tomaszewicz and Seminoff)
- Novel genetic tools/approaches to determine marine turtle population vital rates: age maturity, survivorship, sex ratios (Stewart and Dutton)
- Pacific green and leatherback stock-specific habitat linkage model using genetics genotyping and sequence datasets (Jensen, Roden, Dutton et al.)
- Atlantic leatherback stock-specific risk assessment; overlaying fishing, habitat and stock distribution distribution maps (Stewart & Dutton)
- Functional genomics of sea turtles (Komoroske)
- Loggerhead movements and habitat use in southern California Bight determined via satellite telemetry (Eguchi, Seminoff)

Marine Mammals and Turtles in an Ecosystem Context

Mammals

- Pinniped food consumption from scat analyses (Lowry)
- Pacific cetacean density models based on species-habitat relationships (Becker, Forney, Barlow et al.)
- Relationship between the extent of seasonal ice in the Arctic and calf production in the eastern North Pacific population of gray whales (Perryman et al.)
- Niche separation of deep-diving odontocetes in the Bahamas; from telemetry data on movements, habitat use and diving behavior (Durban et al.)
- Impact of apex predation by killer whales in marine systems (Durban et al.)
- UAS health assessment of whales around the Antarctic Peninsula to infer impacts of ecosystem change (Durban et al.)
- UAS health assessment of humpback whales on feeding grounds with contrasting environments (Durban et al.)
- Trends in cetacean abundance using species-habitat relationships (Redfern et al.)
- Transferability of habitat models built in data-rich regions to data-poor regions (Redfern et al.)
- Noise risk assessment for Southern California waters (Redfern et al.)
- Update assessment of the risk of ships striking whales off southern California (Redfern et al.)

- Risk of large whale ship strikes off San Francisco, and the US west coast (Redfern et al.)
- Comparison of MaxEnt and GAM to explore whether presence-only data improve the prediction or explanation of species distributions (Fiedler et al.)
- Analysis of tuna vessel observer effort and sightings data to assess how ETP dolphin distributions change in response to seasonal and interannual environmental variability (Fiedler)
- Causes of warming events in the California Current (Fiedler et al.)
- Atlas of physical oceanography, biological oceanography, and cetacean habitat in the ETP (Fiedler, Redfern, et al.)
- Ensemble averaging and nesting of cetacean habitat models to improve reliability of predictions (Redfern, Fiedler et al.)
- Compliance with requests to change ship speed and travel patterns in San Francisco Bay and the Monterey Bay National Marine Sanctuary using AIS data (T.J. Moore et al.)
- Primary shipping routes and temporal changes in shipping traffic patterns (T.J. Moore)
- Cetacean species richness hotspots in the eastern tropical Pacific and implications for oceanic conservation (Ballance, Redfern, Fiedler, and Pitman)

Turtles

- Foraging energetics of leatherback turtles along the central California coast (Benson et al.)
- Trophic ecology and niche width of green turtle in the eastern Pacific (Seminoff et al.)
- Trophic status and foraging plasticity in olive ridley turtles in the eastern Tropical Pacific (Peavey and Seminoff)

Additional

- Bycatch and Indirect Fisheries Impact Research: estimating bycatch, determining indirect fishery effects, determining sustainable bycatch levels for long-lived vertebrates, PBR-like framework for marine turtles, determining pinger efficacy, assessing international bycatch (Moore, Carretta, Curtis et al.)
- Sea Turtle Forensics: Determining spatial origins of hawksbill 'bekko' shell contraband confiscated by U.S. Customs (Van Houtan and Seminoff)
- Distribution and trends of sea turtle strandings along the U.S. West Coast (LeRoux et al.)
- Biodiversity conservation through mitigation, policy, economic instruments, and technical change (Dutton and Squires)
- Best practices for sea turtle nesting beach conservation (Tiwari, Dutton, Squires et al.)
- Atlas of seabird distribution in the eastern tropical Pacific from 1986-2006 (Pitman and Ballance et al.)
- Habitat use of endangered seabird species in the oceanic Pacific (Joyce and Ballance)
- Comparability evaluation for U.S. and Mexico fisheries that interact with North Pacific loggerhead turtles to inform IA regarding MSRA certification process (Seminoff, Eguchi)
- Cetacean reproductive tract anatomy with case study of variation in ETP delphinids (Mesnick et al.)
- Market-based incentives for vaquita conservation (Mesnick, Squires et al.)
- Marine mammal and sea turtle bycatch reduction in the drift gillnet fishery in Chile (Donoso, Dutton, Wang Fahy)