



Marine Mammal Commission

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Vision for a Nationwide Marine Mammal Health Monitoring & Surveillance Plan in a Changing Climate

Lori Schwacke

Scientific Program Director, MMC

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Why Do We Need a Health Surveillance Plan?

- Data associating health changes with environmental measurements are scant
 - Hinders early detection of changes in population health
- Large scale systematic sampling for specific pathogens over time and space is rare, so distribution of infectious pathogens in marine mammals are largely unknown
 - Makes prediction and response preparation for disease outbreaks difficult

We need to be proactive rather than reactive

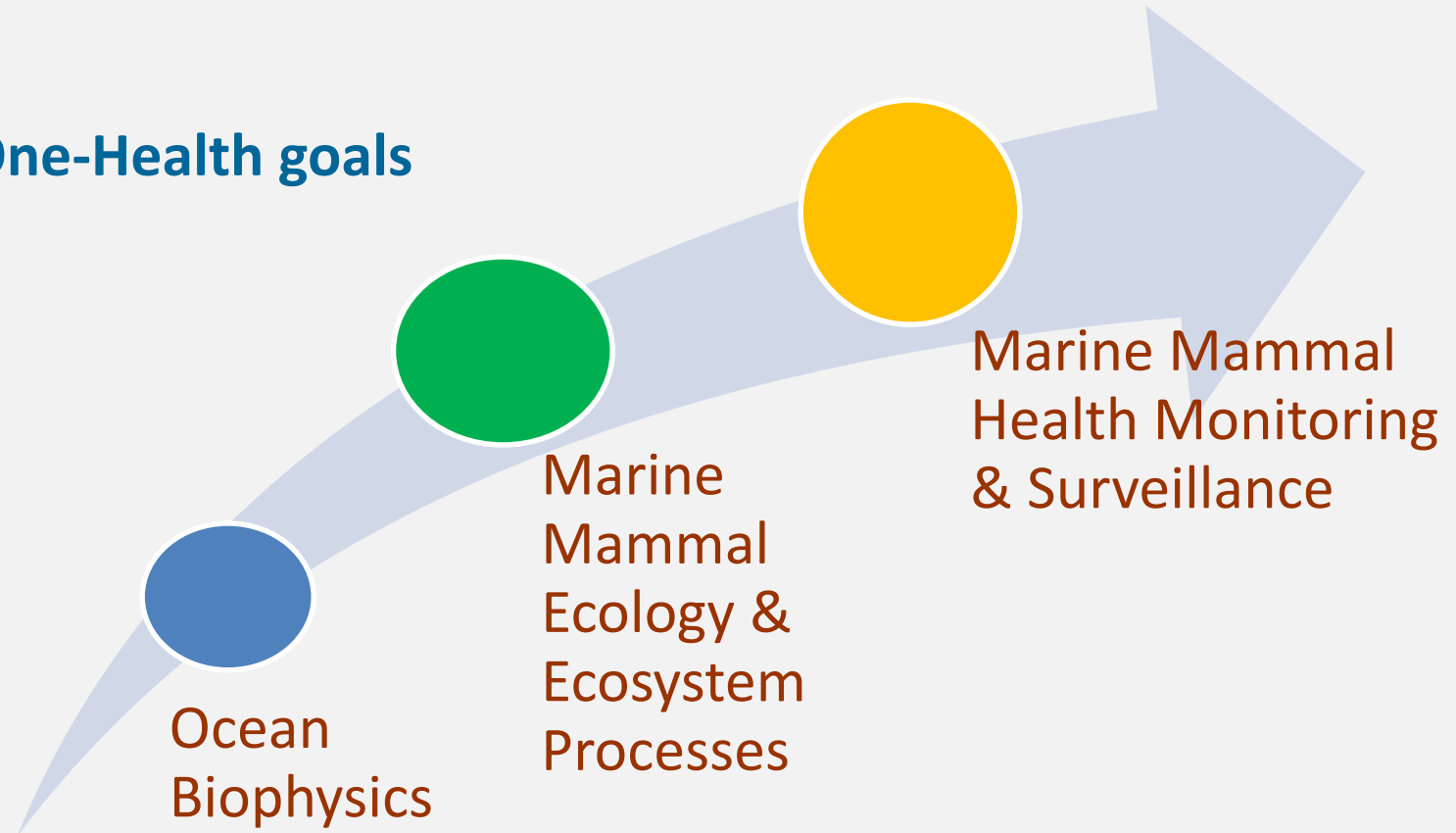


Path Toward Marine Mammals as Ecosystem Sentinels

OCEAN HEALTH
ASSESSMENT

- linking to -

GOOS & NOAA One-Health goals



Ocean
Biophysics

Marine
Mammal
Ecology &
Ecosystem
Processes

Marine Mammal
Health Monitoring
& Surveillance



Monitoring vs. Surveillance

- **Monitoring**
 - Ongoing efforts to assess the health and disease status of a given population
 - Systematic, continual, active or passive observations
- **Surveillance**
 - Implies some form of directed action will be taken if data indicate a disease level above a certain threshold
 - More intensive form of data collection
- **We need both!**



Marine Mammal Health Surveillance Workshop

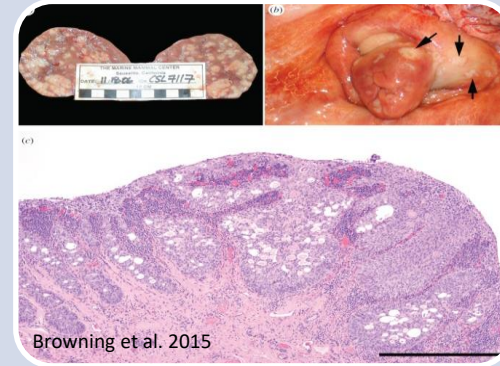
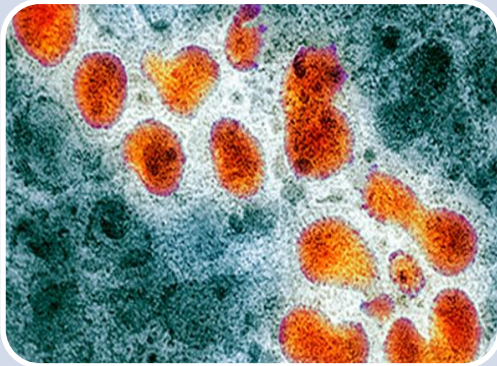
- **Purpose:** develop a national plan for temporally- and spatially-structured marine mammal health monitoring & surveillance
 - Held April 19-21 2023
 - Veterinarians, epidemiologists, statisticians/modelers, biologists, HAB researchers from NOAA, FWS, NWHC; SMEs from academia and NGOs
- **Goals:**
 1. Review primary objectives and components of a monitoring & surveillance system;
 2. Prioritize exposure parameters, species, and populations to be monitored;
 3. Discuss potential approaches for conducting monitoring and surveillance, and outline a sampling plan.



Participants

- **Meg Kirchgessner** (USFWS)
- **Michelle Barbieri, Deb Fauquier, Denise Greig, Nick Kellar, Kathi Lefebvre, Teri Rowles, Sarah Wilkin** (NMFS)
- **LeAnn White** (National Wildlife Health Center)
- **Katie Colegrove** (U of Ill)
- **Carrie Goertz** (Alaska Sea Life Center)
- **Frances Gulland, Lauri Leach, Lori Schwacke, Peter Thomas** (MMC)
- **Chris Kreuder Johnson** (U of CA, Davis)
- **Stephen Raverty** (U of British Columbia)
- **Sarah Sharp** (IFAW)
- **Nicole Stacy** (U of FL)
- **Len Thomas** (U of St. Andrews)
- **Additional Speakers:** Raphe Kudela (UC Santa Cruz), Katie Prager (U of Ill)





Infectious Agents

- Viruses
- Bacteria
- Fungi
- Protozoa/parasites

Harmful Algal Toxins

- Domoic acid
- Saxitoxin
- Brevetoxin
- Microcystins

Non-infectious Disease

- Freshwater disease
- Body condition
- Cancer
- Other pathology

Regional Concerns/Priorities

Species/Population Susceptibility

Sampling Considerations/Opportunities



Prioritization Criteria

- **Potential for population impact**
- **Climate sensitivity**
- **Zoonotic potential or ecosystem health sentinel**
 - Potential transmission to other species, including humans
 - Detection of agent informs risk to other species



Sampling Approaches

Control in sampling design

- **Strandings**
 - Often young-of-year, ill or malnourished
 - Sampling generally guided by case investigation (COD)
- **Subsistence harvests and by-catch**
 - More likely to represent overall population with respect to health
 - Specific population, often specific demographic
- **Targeted research sampling** (*e.g.*, temporary capture, remote sampling, visual/photogrammetry)
 - Can be random (in principle)
 - Can be demographically stratified, or select specific population/demographic based on research question



Identifying Focal Species

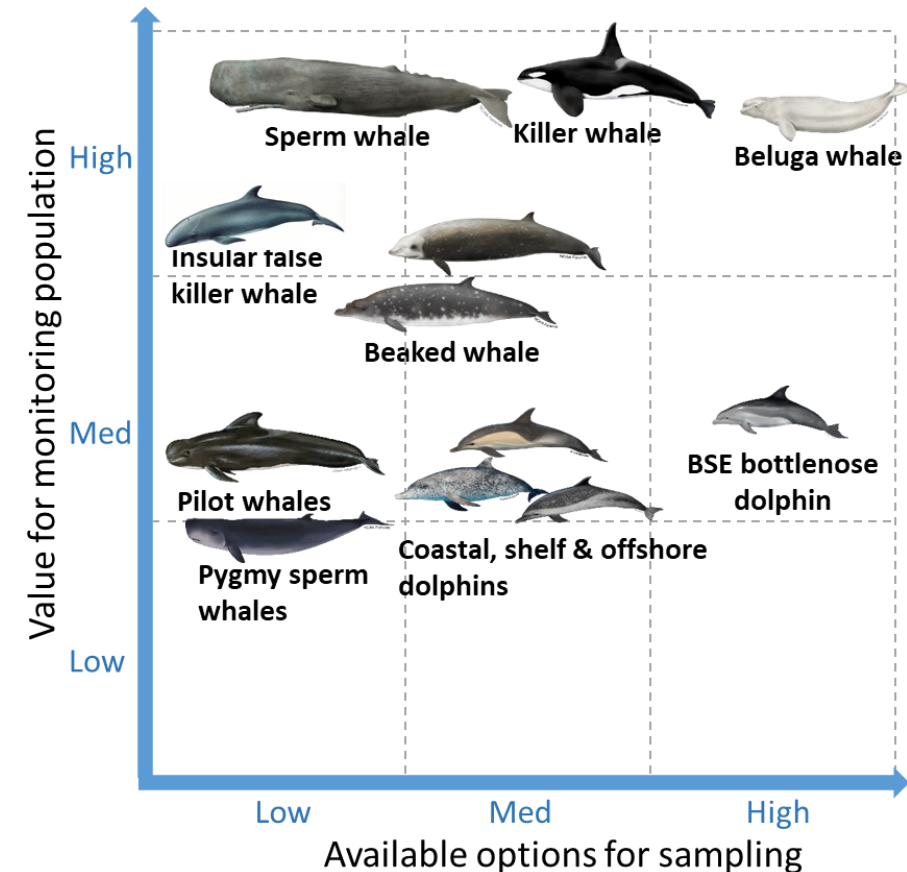
Value for monitoring

1. Management priority (e.g., ESA listed or depleted)
2. High ecological importance
3. High likelihood of being affected by changing climate
4. Exposed to multiple stressors

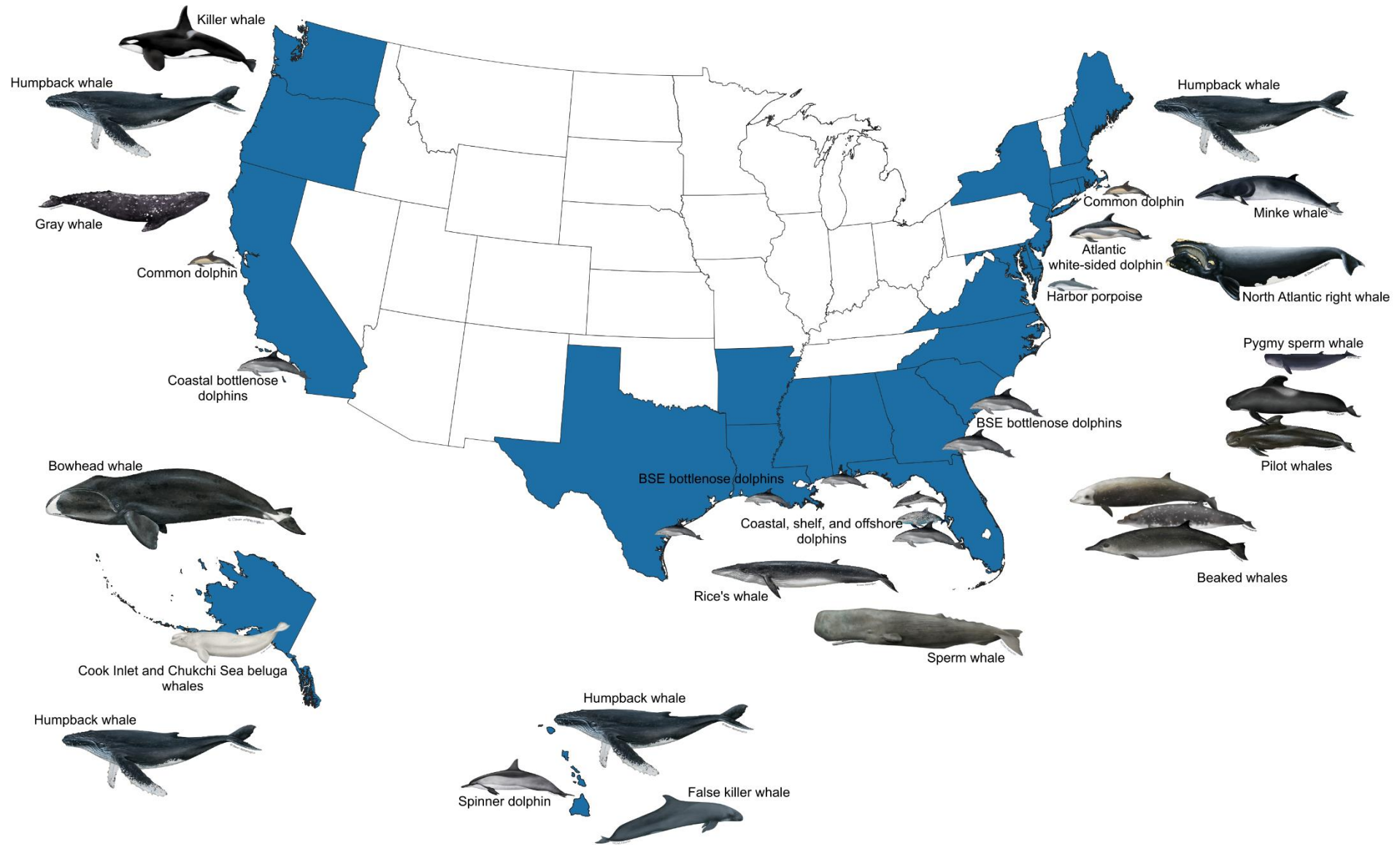
Available options for sampling

1. Feasible for hands-on sampling
2. Remote sampling options
3. Sampling from subsistence harvests or bycatch
4. Higher carcass recovery rate

Odontocetes



Cetacean Focal Species



Pinniped Focal Species



Tables for Regional Priorities

Table 1. e. Southeast US priority sampling

	Climate sensitive	Potential for population level impact	Zoonotic	Ecosystem health sentinel	Comments
BSE Bottlenose dolphin					
Viruses	Flaviviruses	Morbillivirus	Influenza		
Bacteria, fungi	<i>Erysipelothrix rhusiopathae</i> <i>Vibrio spp.</i> , <i>Paracoccidioides brasiliensis</i>	<i>Brucella spp</i>			
Protozoa, Parasites				<i>Toxoplasma gondii</i> , <i>Sarcocystis neurona</i>	
Biotoxins	Domoic acid, saxitoxin, brevetoxin	Brevetoxin		Domoic acid, saxitoxin, brevetoxin	
Non-infectious	Freshwater disease, body condition	Freshwater disease, body condition			
Pelagic dolphins & whales					
Viruses	Flaviviruses	Morbillivirus	Influenza		
Bacteria		<i>Brucella spp</i>			
Protozoa, Parasites				<i>Toxoplasma gondii</i>	
Biotoxins	Domoic acid, saxitoxin, brevetoxin	Domoic acid, saxitoxin, brevetoxin		Domoic acid, saxitoxin, brevetoxin	Exposure during feeding season may cause abortion
Non-infectious	Body condition	Body condition			
Manatee					
Viruses		Morbillivirus	Influenza	Papillomavirus	
Bacteria, fungi	<i>Leptospira spp.</i>				
Protozoa, parasites				<i>Toxoplasma gondii</i>	
Biotoxins	Brevetoxin	Brevetoxin		Brevetoxin, saxitoxin	
Non-infectious	Body condition, cold stress	Body condition, cold stress			

Table 1 c. Pacific Islands priority sampling

	Climate sensitive	Potential for population level impact	Zoonotic	Ecosystem health sentinel
Hawaiian monk seal				
Viruses	Flaviviruses e.g. West Nile Virus	Morbillivirus Influenza	Influenza	
Bacteria, fungi	<i>Vibrio cholerae</i> , <i>Leptospira</i>	<i>Brucella</i>	<i>Leptospira</i>	<i>Leptospira</i>
Protozoa, Parasites		<i>Toxoplasma gondii</i>		<i>Toxoplasma gondii</i> , <i>Sarcocystis neurona</i>
Biotoxins	Microcystins	Ciguatoxin, microcystin		Ciguatoxin, microcystin
Cetaceans				
Viruses	Flaviviruses	Morbillivirus	Influenza	
Bacteria, fungi	<i>Erysipelothrix rhusiopathae</i> , <i>Vibrio spp.</i> ,	<i>Brucella spp</i>		
Protozoa, Parasites				<i>Toxoplasma gondii</i> , <i>Sarcocystis neurona</i>
Biotoxins				Ciguatoxin



Next Steps

- **Publish workshop report online**, which will provide a resource for field biologists and researchers to prioritize sample collection/analyses that could contribute to health monitoring/surveillance to detect climate change impacts;
- **Distribute plan across agencies/organizations** and encourage funders to consider projects that could contribute to national health surveillance;
- **Develop an implementation plan**, including details of sampling plan (NOAA leads);
- Begin to **build capacity** with existing resources and through partnerships (e.g. HealthMap as step towards “Information management”);
- **Formulate recommendations for building additional capacity necessary to fully implement necessary components of plan** (may be iterative, building over time).



Thank you to the workshop participants and presenters!
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