Long term monitoring of nearshore habitats:

Why, Where, What, How,... and results from 2007

Heather A. Coletti
USGS, Alaska Science Center

James L. Bodkin
USGS, Alaska Science Center

Thomas A. Dean
Coastal Resources Associates, Inc.

Why Monitor?

- To detect change
- To understand causes
- To predict future change
- To inform
- To contribute to problem solving

USGS
science for a changing world

Why the nearshore??

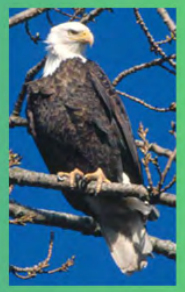
- Critical habitat (birds, mammals, fishes, kelps, inverts…)
- Nursery habitat (crab, salmon, herring…)
- Feeding habitat (Orca, sea lions, sea birds, fishes…)
- Habitat for commercial resources (herring, salmon, crab…)
- Habitat for valued subsistence resources (seals, clams, mussels…)
- Habitat for important human social activities
- An important triple interface linking the land, air, and sea
- Nearshore is understood and tractable

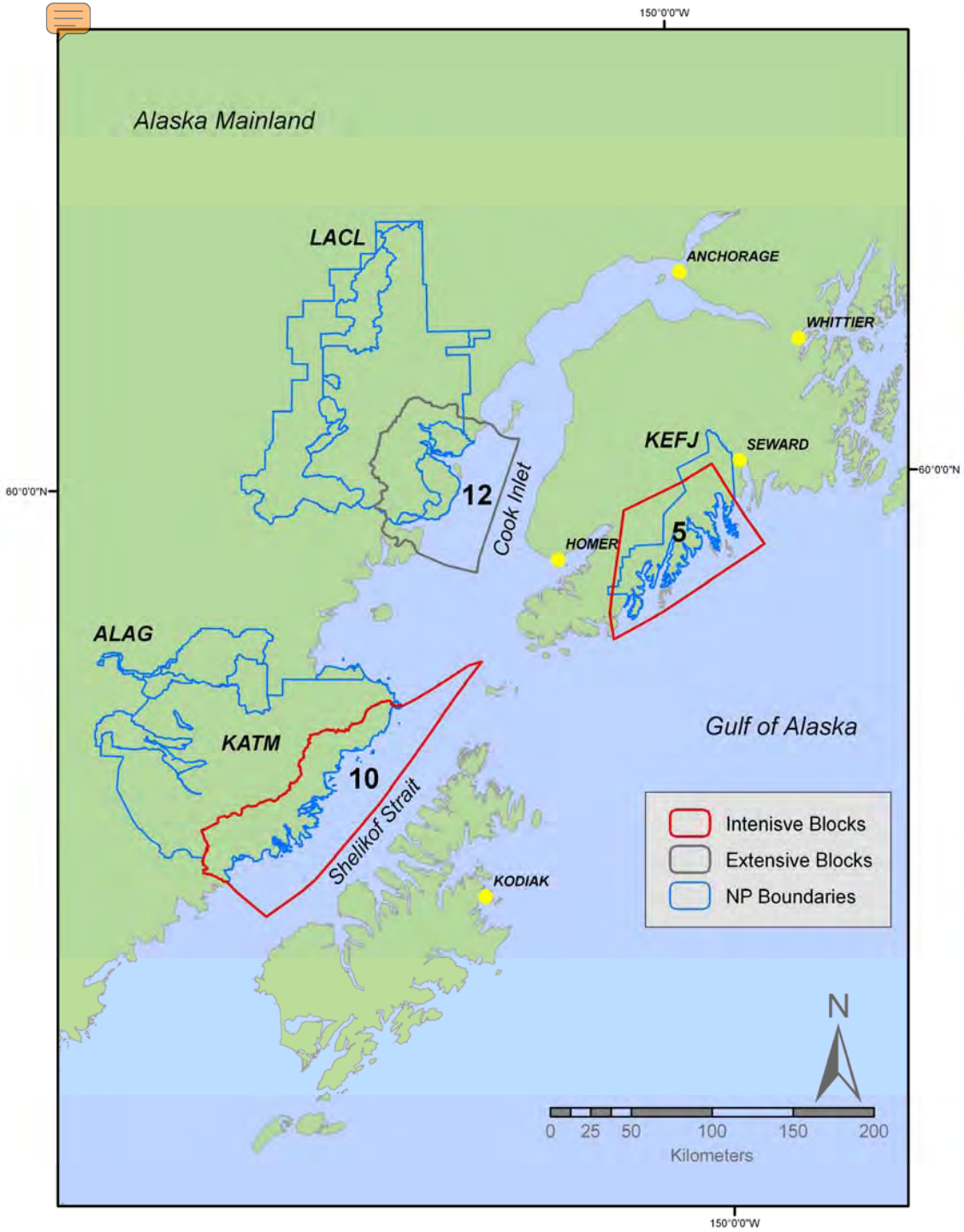
Nearshore Web

Offshore

Linkages

Watersheds





Where?

- KATM & KEFJ
  - Sampling all VS
- LACL
  - Only sampling soft sediment for intertidal invertebrates

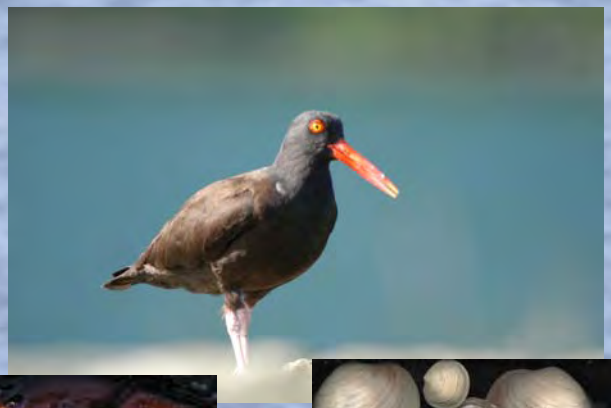
What?

NPS Vital Signs

- Marine Water Chemistry
- Kelps and Seagrasses
- Intertidal Invertebrates
- Marine Birds
- Black Oystercatcher
- Sea Otter

USGS
science for a changing world

Nearshore Vital Signs



Marine Water Chemistry

- Temperature
- Contaminants

USGS
science for a changing world

Kelps and Sea Grasses

- Species composition
- Distribution
- Abundance

USGS
science for a changing world

Intertidal Invertebrates

Rocky and Soft Sediment habitats

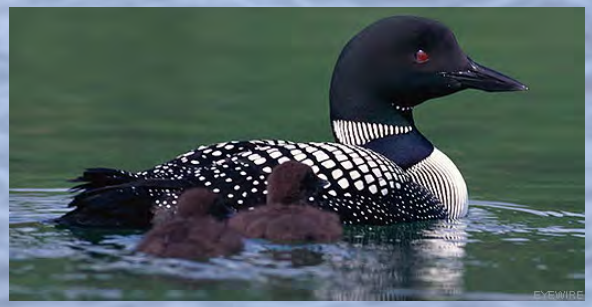
- Species composition
- Abundance/Density
- Sizes
- Trend

Focal Species

- Mussels
- Clams
- Limpets

Marine Birds (and mammals)

- Species composition
- Distribution
- Density
- Trend



Black Oystercatchers

- Density/Abundance (adults and nests)
- Nest occupancy and productivity
- Diet (chick provisioning)

USGS
science for a changing world

Sea Otter

- Density/Distribution/Abundance
- Mortality
- Diet

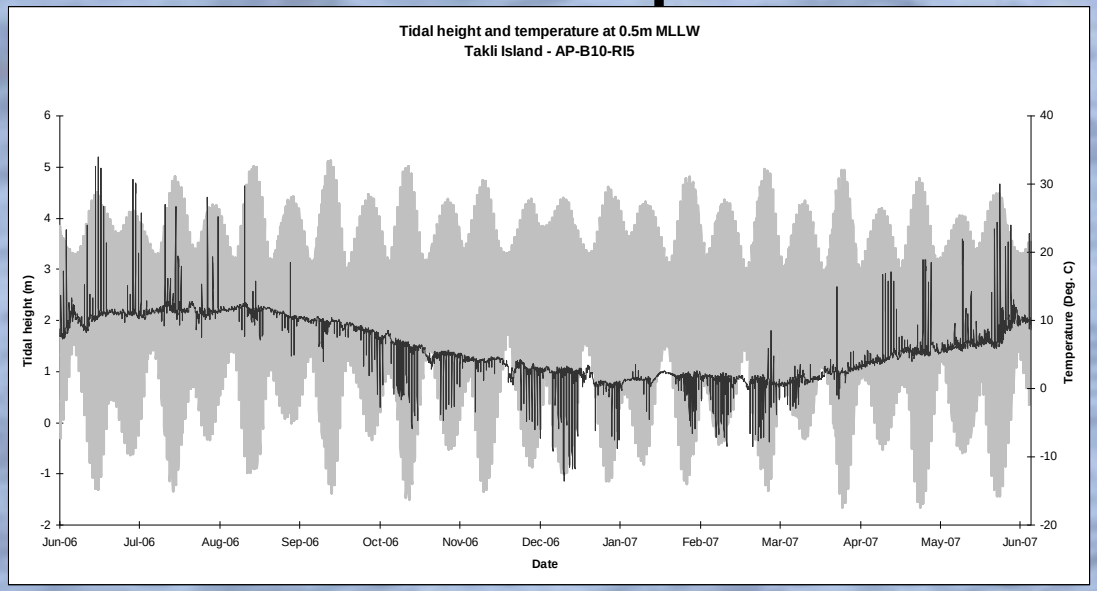
How??

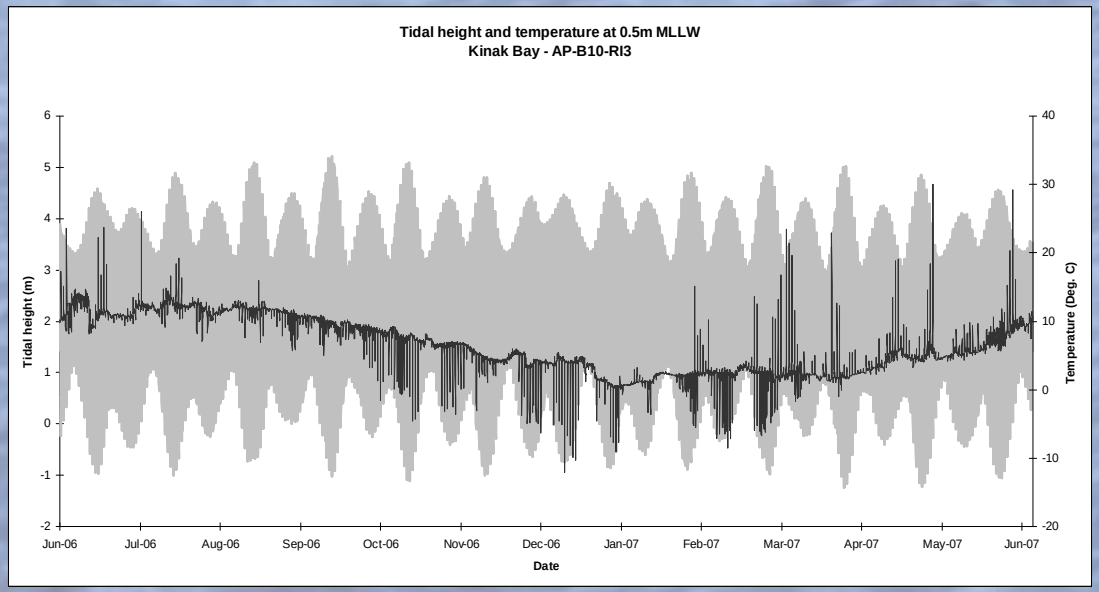
Marine Water Chemistry

- Collecting mussels for contaminants analysis

- Using Hobo temperature loggers to examine temperature trends over time

Temperature Results





- Only 2 of the five Hobos deployed in 2006 were recovered in 2007 from the KATM coast
- There was a wide range of temperatures observed at both sites, with the maximum yearly range of over 40C (from less than -10C to greater than 30 C), and ranges of greater than 20C occurring on some days
- Might not need to have the spatial coverage that we currently have

Kelps

- Methods
  - Counting surface bulbs along a given shoreline distance
  - Counting surface bulbs along a given transect
  - Using an underwater video camera to assess kelp abundance
- Results
  - Highly doubt the accuracy or precision of the estimates
- Recommendations
  - no further effort be spent on developing techniques for evaluation of smaller-scale distributions of kelp at this time

Seagrasses

- Methods
  - Perimeters mapped using a GPS
  - Underwater video camera was utilized to delineate the edge of beds
  - Presence or absence was recorded on transects placed systematically through a bed

Seagrass Results

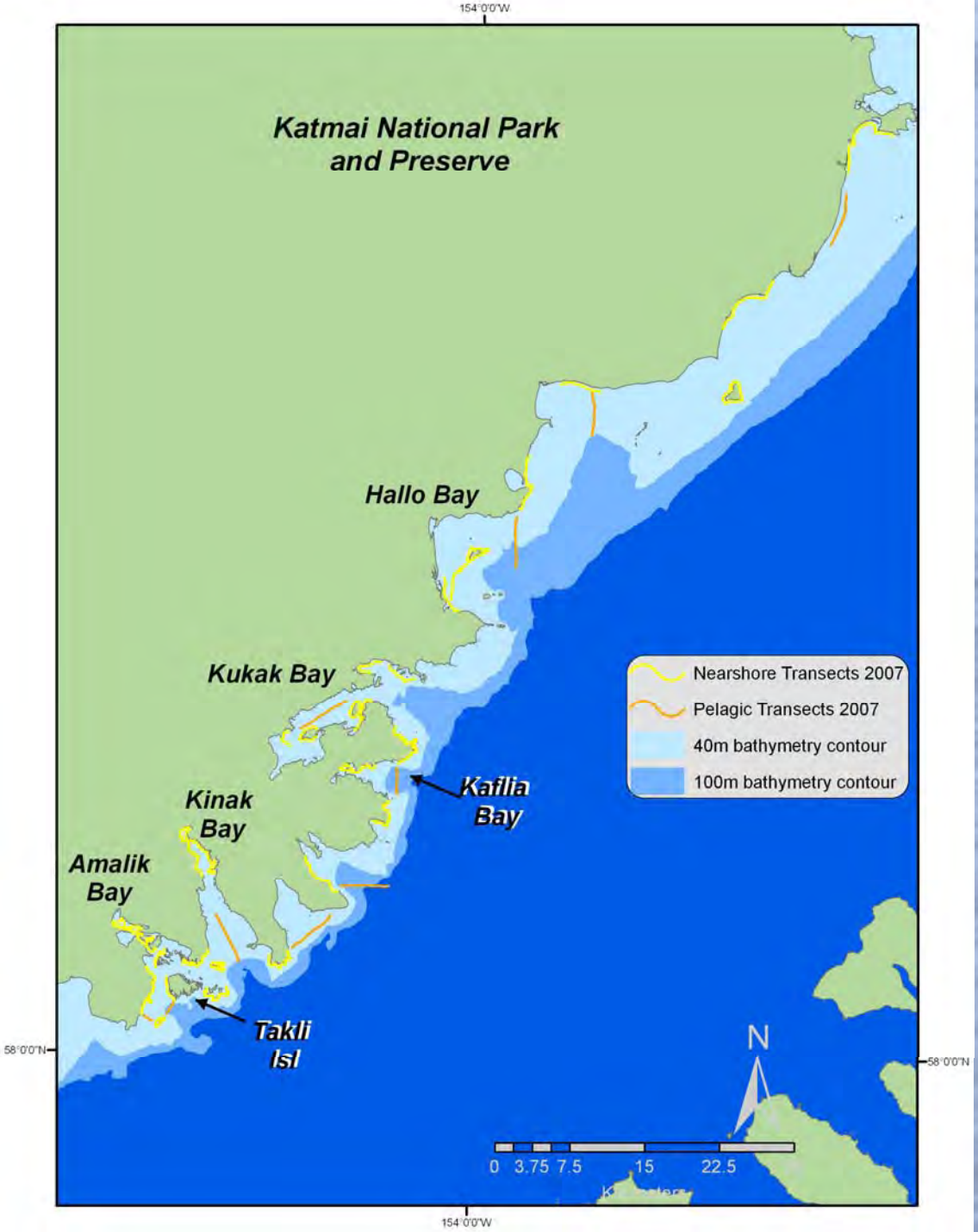
- Established five beds in KATM and 4 in KEFJ for long-term monitoring
- Continue to refine sampling methods for 2008

Intertidal Invertebrates

- Two methods
  - Rocky sediment sampling
    - Large motile invertebrate density
    - Small motile invertebrate density
    - Algae percent cover
    - Limpet size distribution
  - Soft sediment sampling
    - Excavate quads to collect clams (as well as crabs, mussels, and urchins at most sites)
    - Identified to the lowest possible taxa, counted, and measured to the nearest millimeter
    - Sediment samples taken for grain size analysis

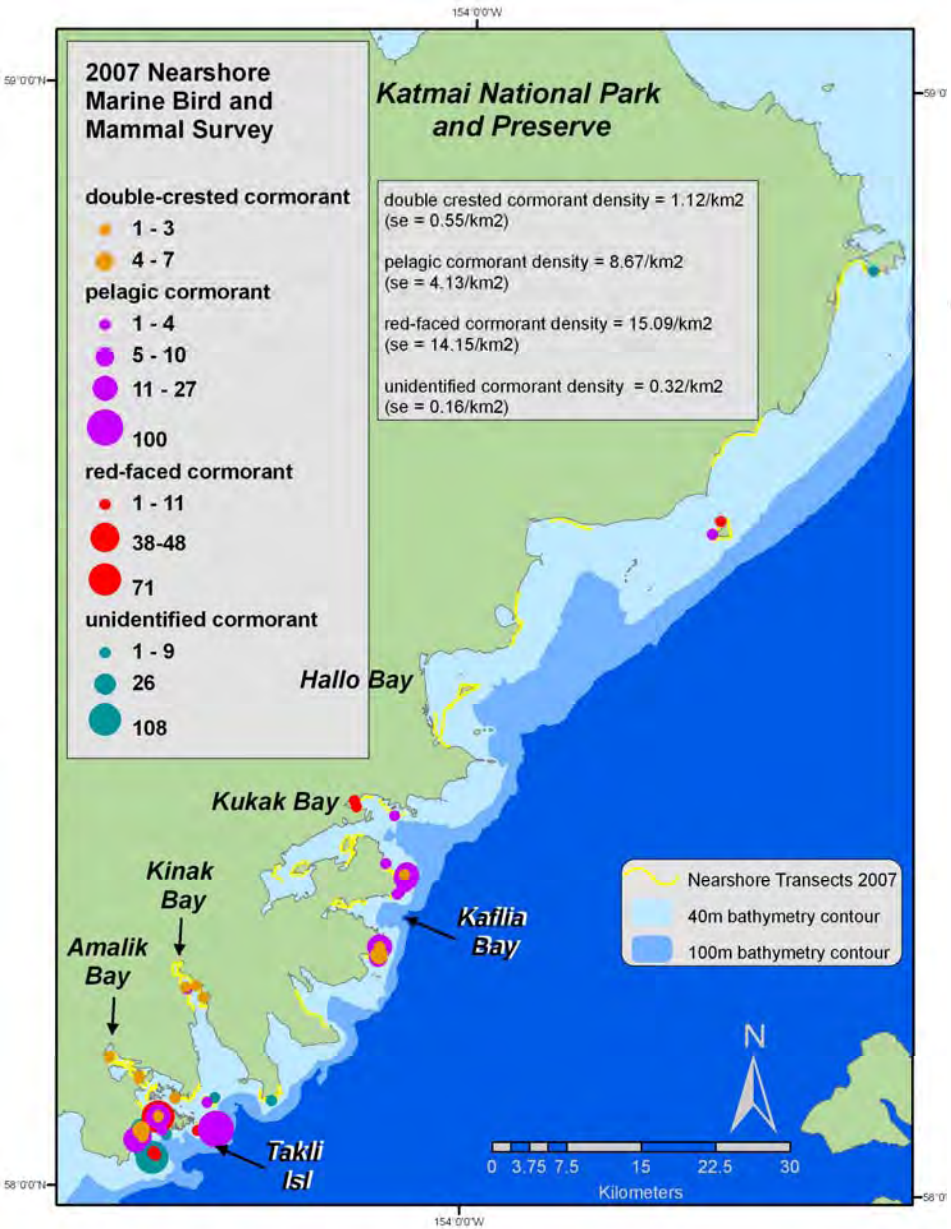
Marine Bird Density and Abundance

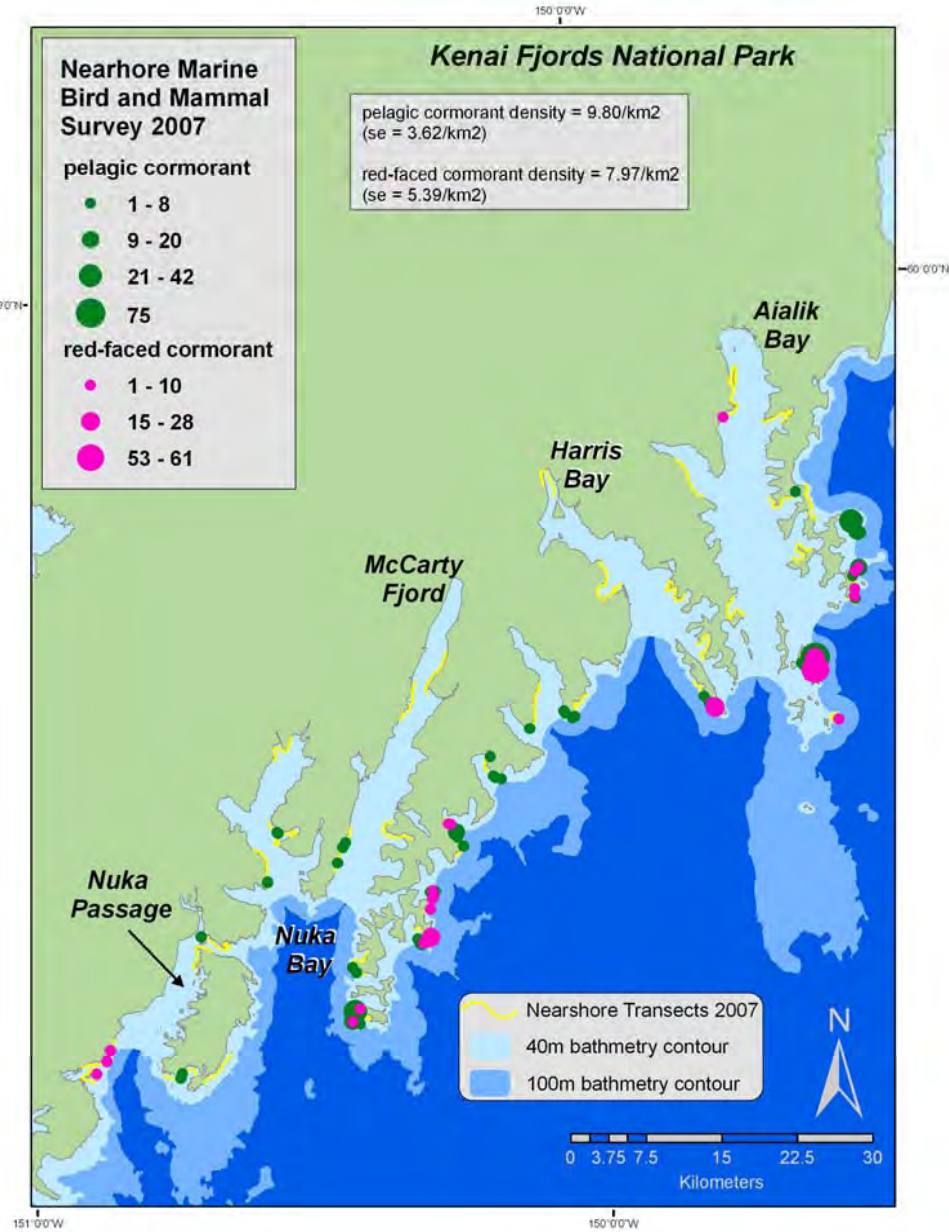
- Boat-based surveys of all birds and mammals detected within a 200m swath of the survey vessel are recorded
- Survey design likely has biases associated with sampling transects adjacent to shorelines, and underestimates species that generally occupy offshore habitats
- Established ten offshore transects to address this bias in KATM, however, sampling intensity is too low to estimate offshore abundance with any confidence



KATM MBM Transects

Example of MBM Results

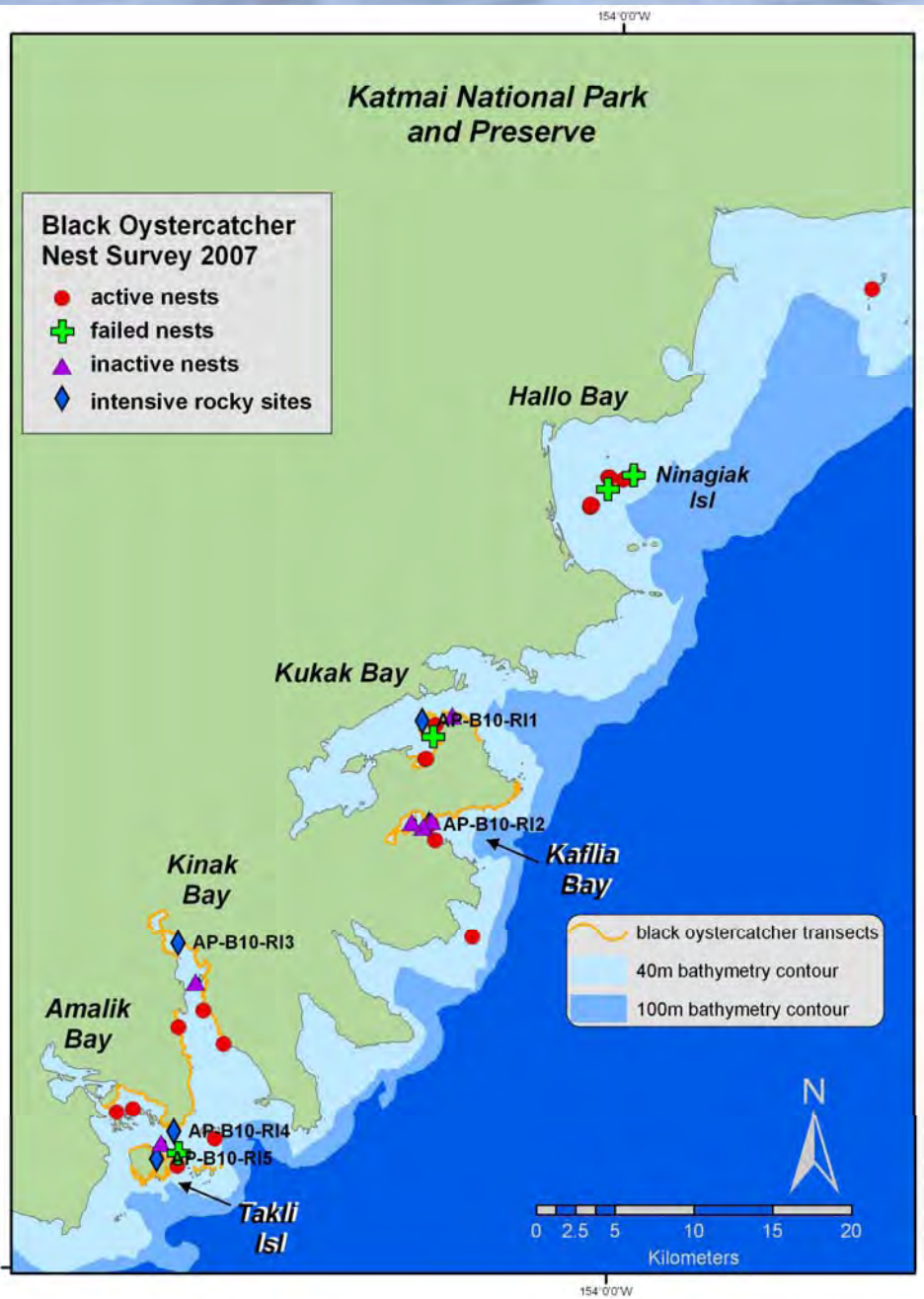




Black Oystercatcher

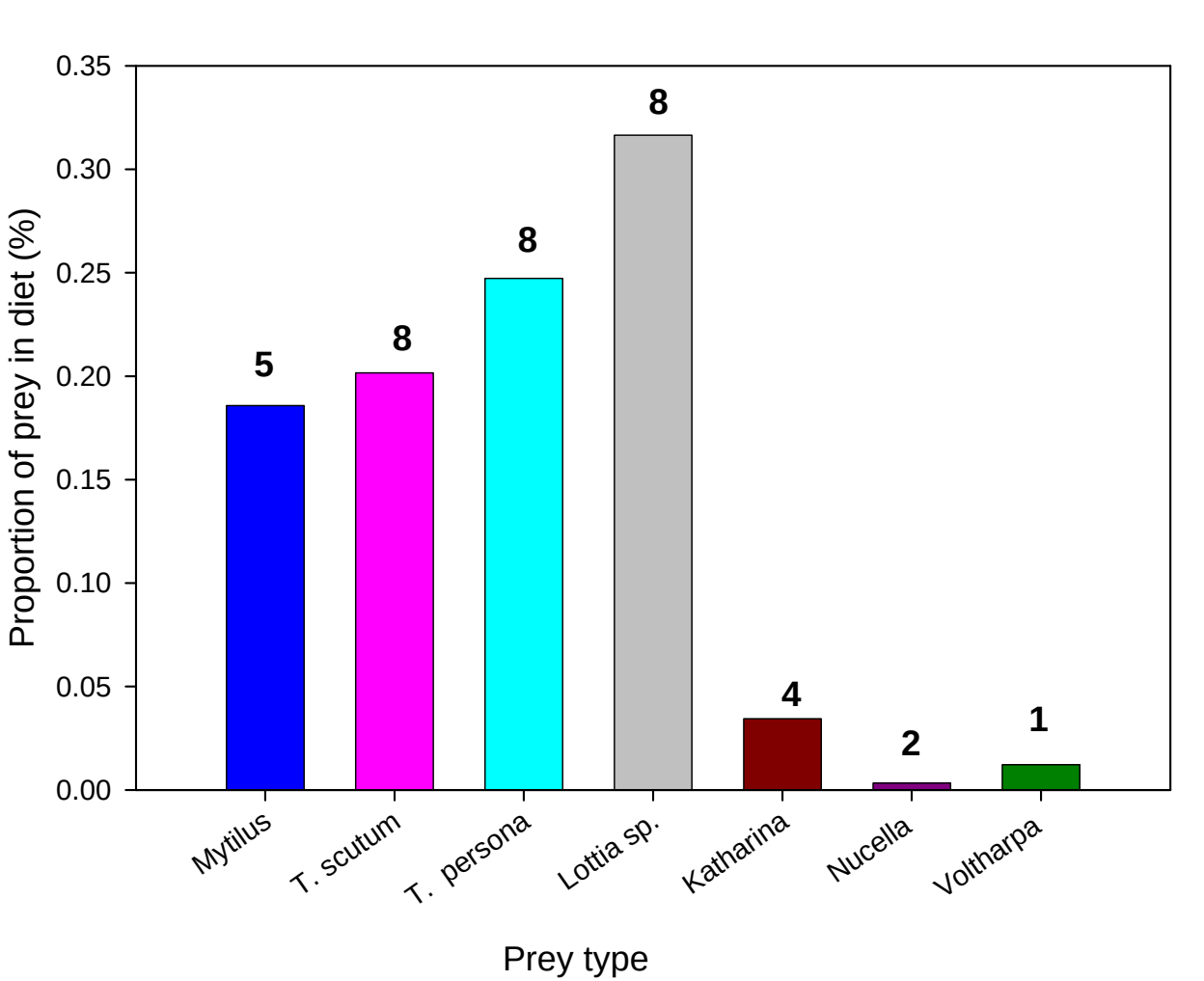
- Estimation of breeding pair density and nest occupancy
  - Boat based surveys of breeding pairs detected along a 20km transect centered on each established rocky site
- Estimation of species composition and size distributions of prey returned to provision chicks
  - Prey collected at the nest site, identified and measured
- Estimation of density of breeding and non-breeding black oystercatchers observed during the marine bird and mammal surveys
  - See marine bird and mammal survey methods

Black Oystercatcher



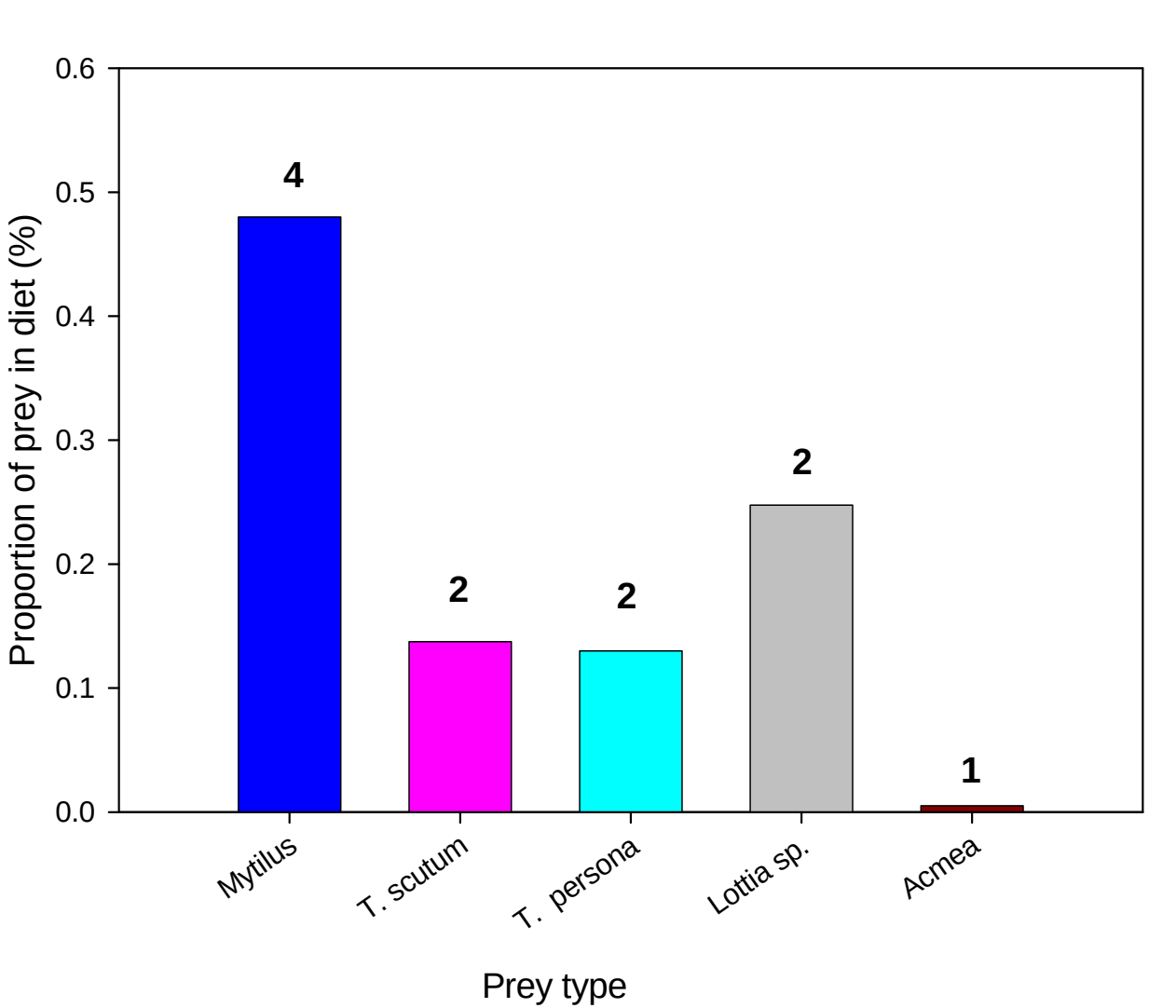
- 22 active nests
- 4 failed nests
- 6 inactive nests (from previously active 2006 nests)

Nest Provisioning KATM 2007



- Cumulative diet among nine black oystercatcher nests where prey were collected in 2007
- Numbers above bars indicate frequency of prey type in sample of eight nests

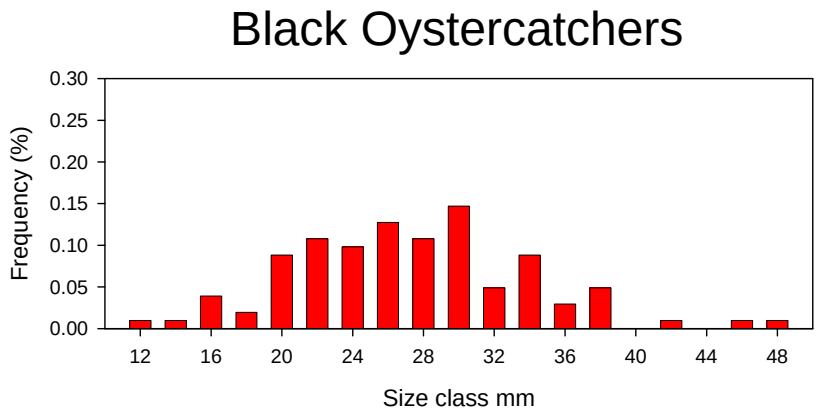
Nest Provisioning KEFJ 2007

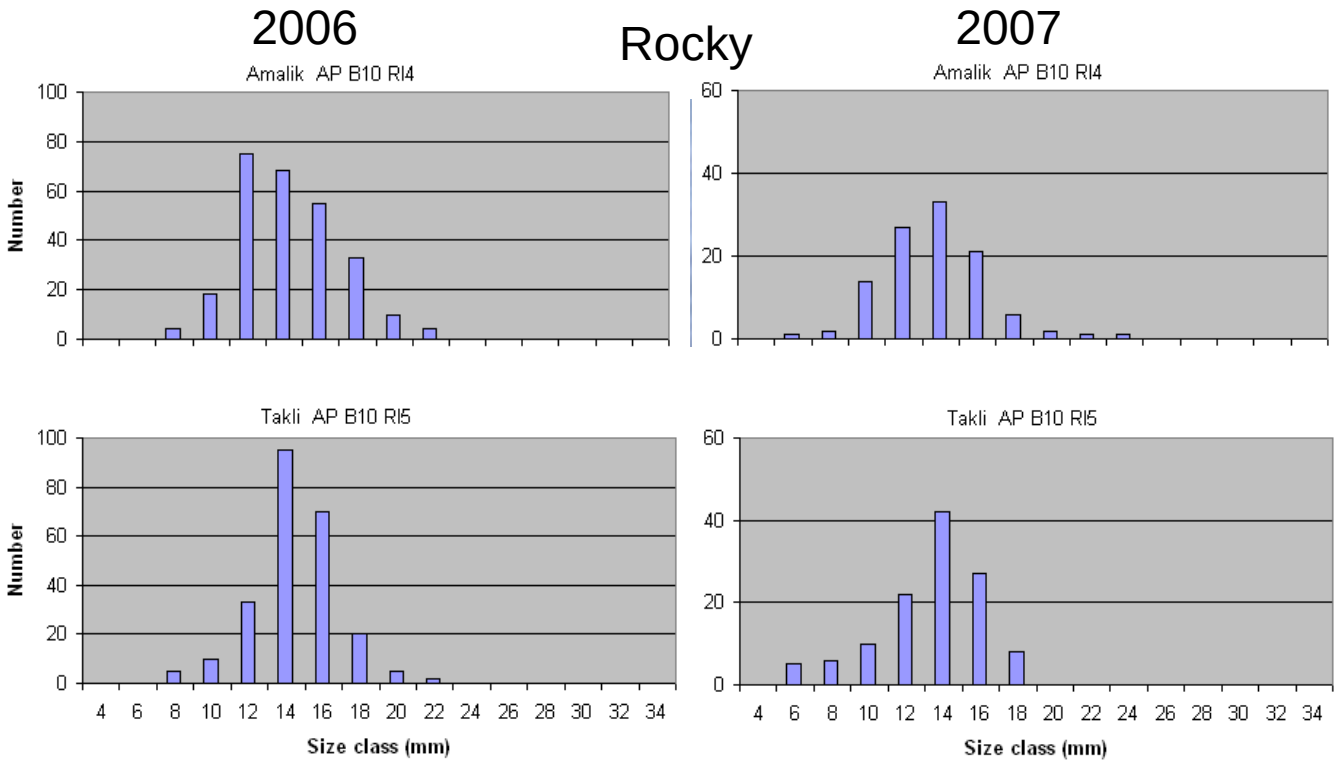


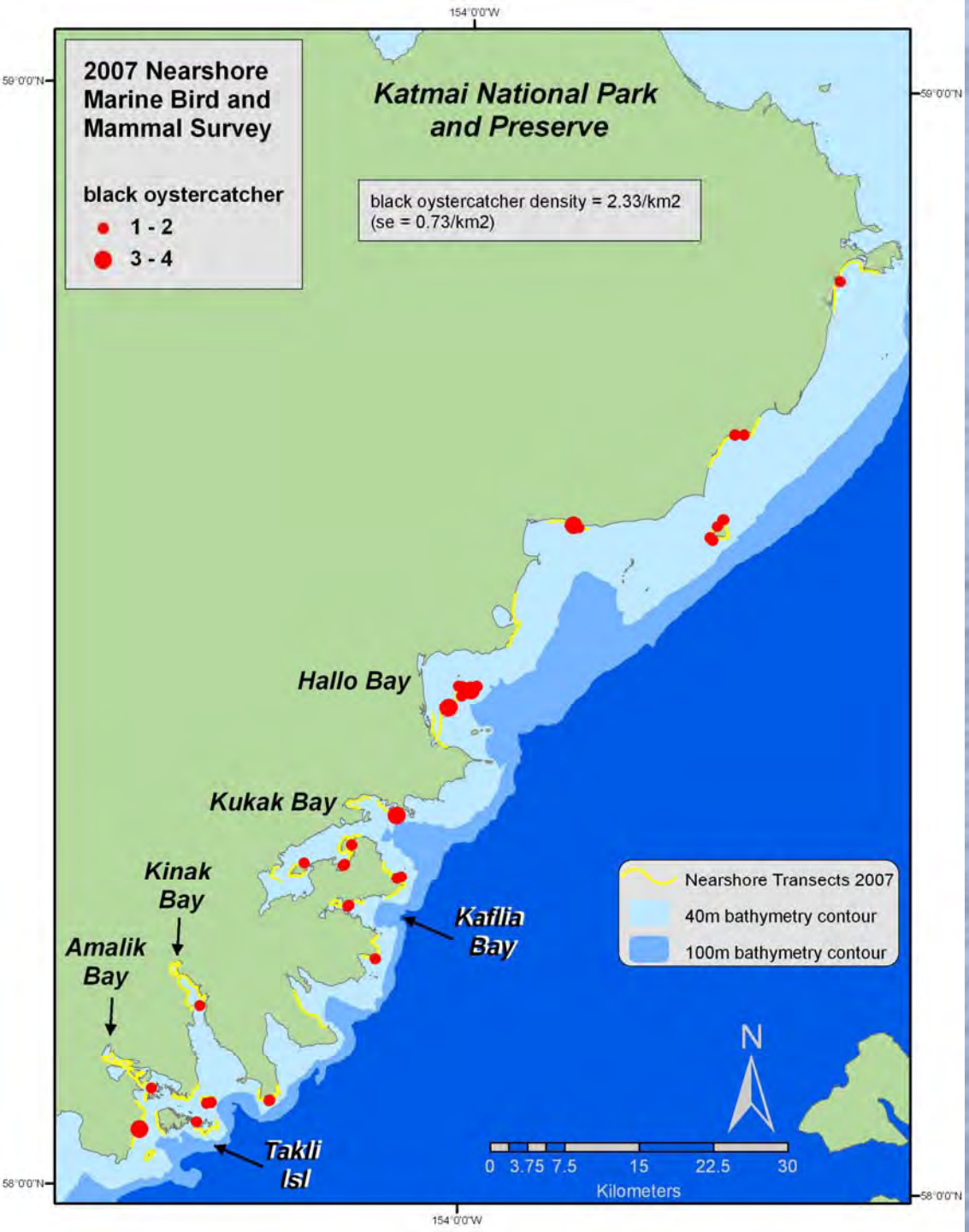
- Cumulative diet among four black oystercatcher nests in KEFJ where prey were collected in 2007
- Numbers above bars indicate frequency of prey type in sample of four nests

Black Oystercatcher vs. Rocky Sampling

Tectura persona







KATM MBM Results

- Black Oystercatcher density and distribution

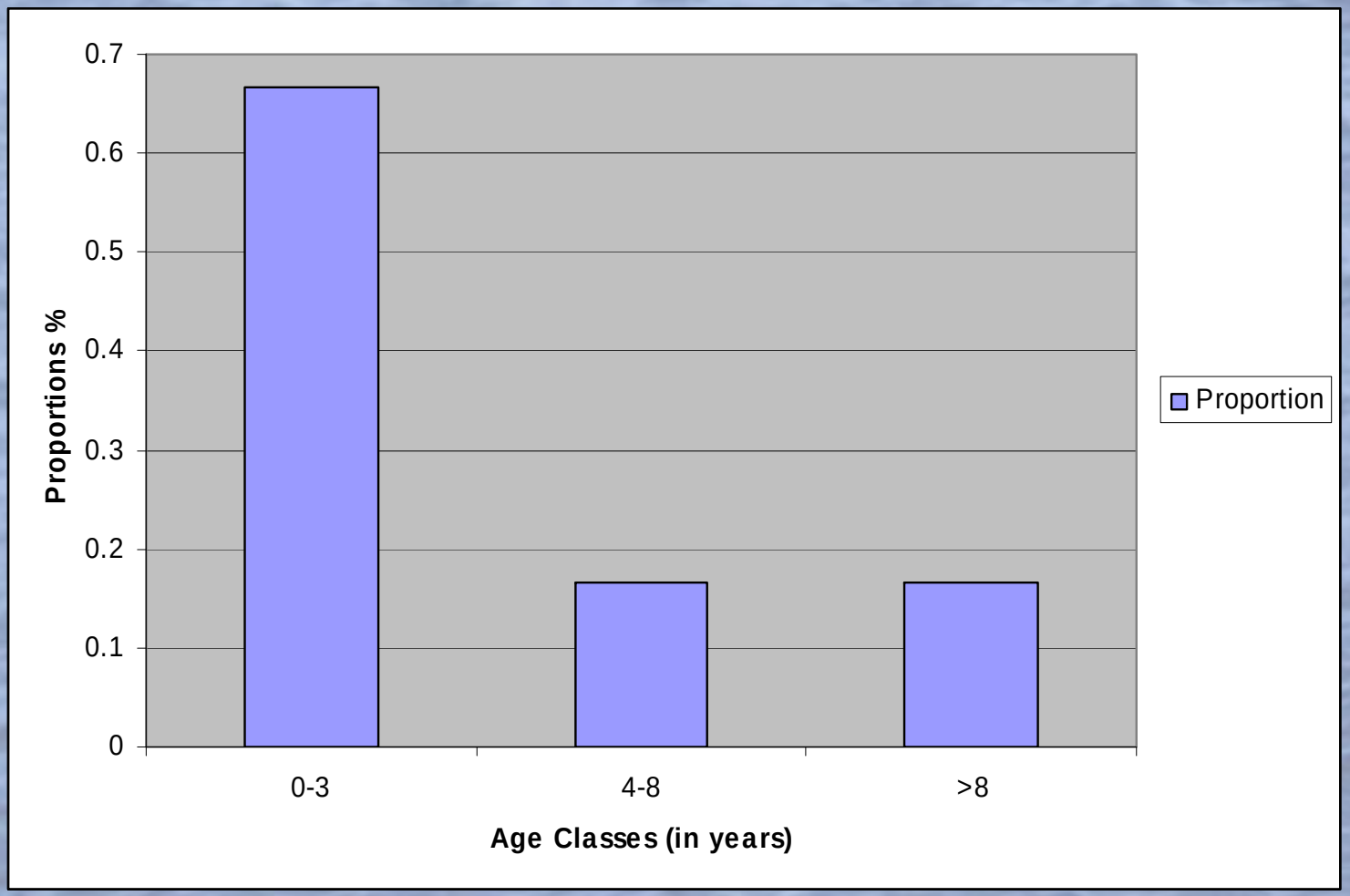
In summary of 2007 bloys…

- Densities of black oystercatchers on marine bird and mammal transects was about four times greater at KATM (2.3/km) than at KEFJ (0.74/km)
- Densities of nesting pairs of black oystercatchers were about twice as great within the five randomly located transects at KATM (0.13/km), compared 0.07/km at KEFJ
- Productivity of nests, estimated as eggs or chicks per nest was similar between the two Parks (1.8 at KATM and 1.7 at KEFJ)

Sea Otters

- Age-at-death data
  - Collection of beach cast carcasses
  - Data are used in demographic models that examine changes in the age distribution of dead otters over time
- Food habits, foraging success and efficiency
  - Derived from shore-based observations using high-powered telescopes
- Abundance
  - Aerial survey with methods for calculating detection and a correction factor
  - Will be conducted in KATM during the summer of 2008
- Density and Distribution
  - Marine bird and mammal surveys

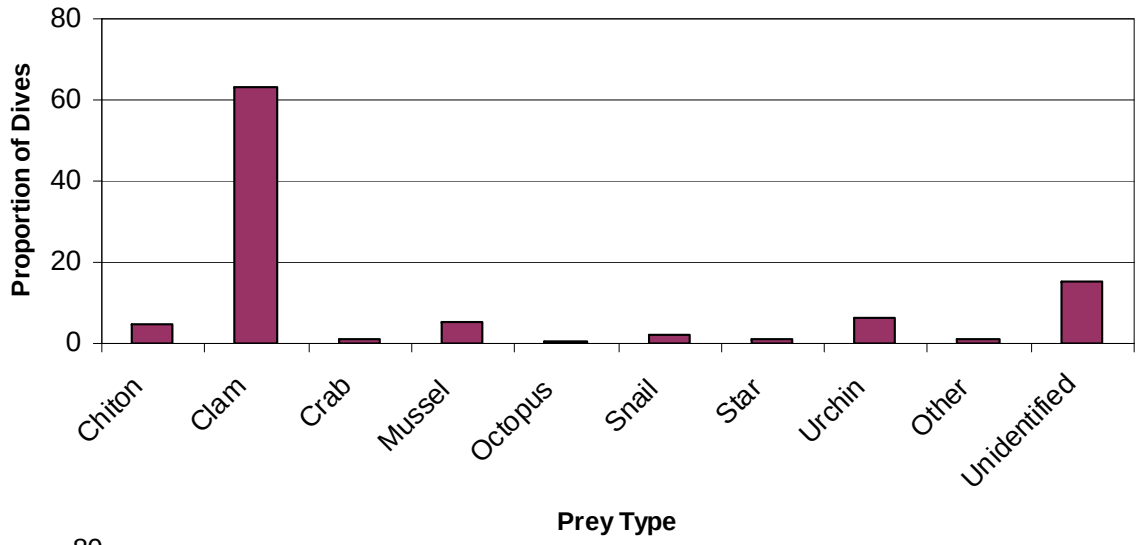
Sea Otter Age-at-Death Results



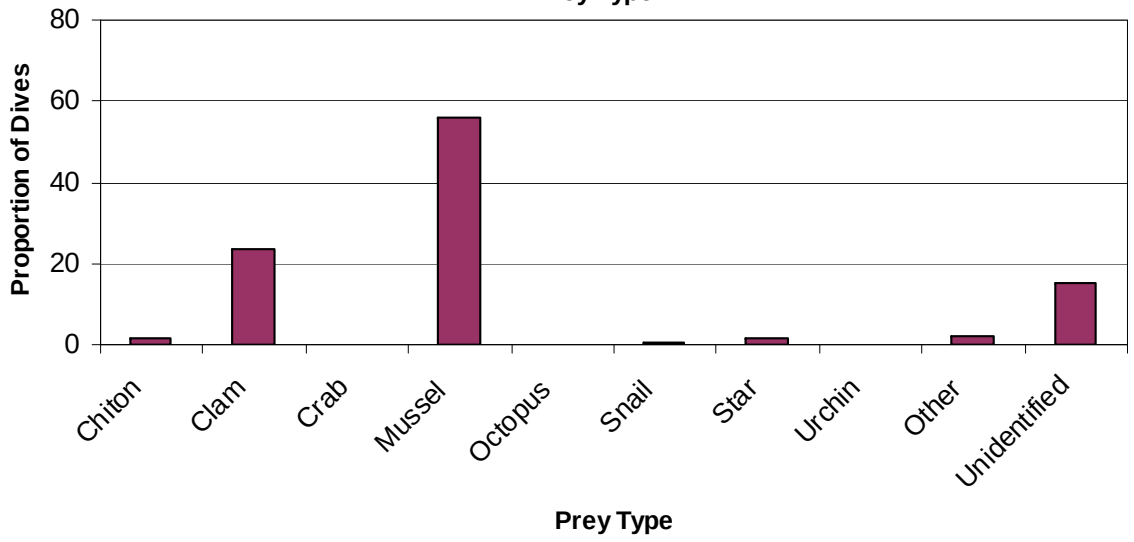
2006

Foraging Results

KATM

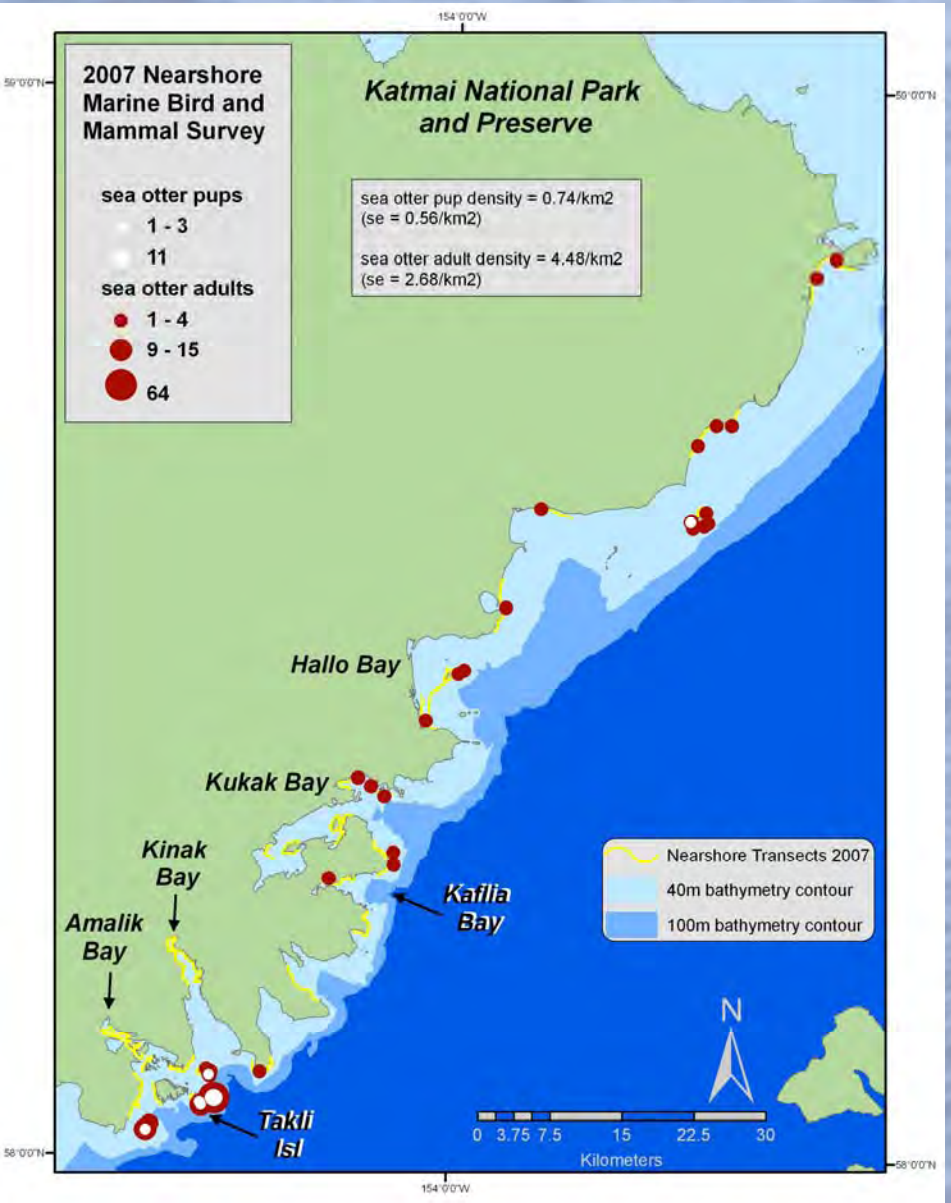


KEFJ

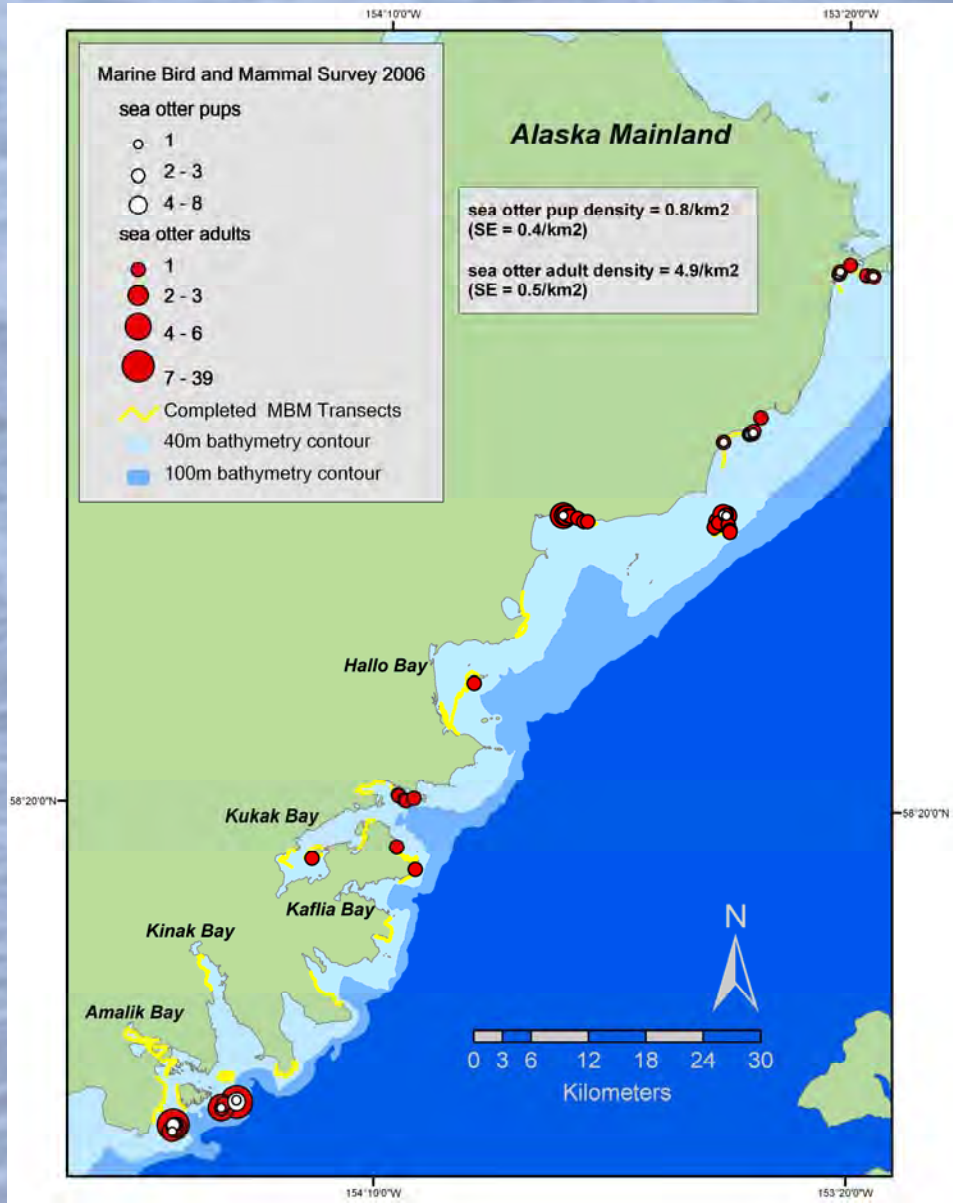


Sea Otter MBM Results

2007



2006



Tasks completed in 2007

SOP	KEFJ	KATM
Rocky intertidal sampling	set up only	X
Soft sediment sampling	X	X
Water chemistry and quality	-Hobo temp. loggers deployed -mussels collected for contaminants	-Hobo temp. loggers collected & deployed -mussels collected for contaminants
Black oystercatcher nest density and diet	X	X
Sea otter foraging	X	X
Sea otter aerial survey	X	unable to complete due to aircraft availability
Summer marine bird and mammal survey	X	X
Kelp and eelgrass SOP testing	X	X
Carcass collection	X	X

USGS
science for a changing world

Schedule

	2007	2008	2009	2010	2011	2012	2013	2014
Annual sampling * KEFJ / KATM	X	X	X	X	X	X	X	X
Sea otter aerial surveys	X	X		X			X	
Winter marine bird and mammal surveys		X			X		X	
Contaminants	X		X					X
LACL sampling**			X		X		X	
Mussel growth		X				X		

*Annual sampling includes: black oystercatcher nest density and diet, sea otter foraging, summer marine bird and mammal surveys, carcass collection, rocky intertidal sampling and kelp and eelgrass extent

** Lake Clark NP sampling consists of soft-sediment intertidal sampling

USGS
science for a changing world

Future Plans

- Complete Protocol Revision
- Continue revision and testing of “Vital Sign” SOPs’
- Complete and test the data management plan
- Continue implementation in Katmai NPP and Kenai Fjords NP
- Explore expansion of Nearshore Monitoring to PWS, Kodiak, SE Alaska (SEAN)

And Thanks to SWAN and Park staff: A. Bennett, M. Shephard, B. Thompson, D. Mortenson, S. Kim, M. Hahr, C. Moore and D. Noon as well as A. Fukuyama, C. Ehrler, K. Kloecker, G. Esslinger and J. Coffey

USGS
science for a changing world