

EVALUATION OF TIME-LAPSE PHOTOGRAPHIC SERIES OF
HARBOR SEALS HAULED OUT IN DRAKES ESTERO,
CALIFORNIA, FOR DETECTING AND ASSESSING
DISTURBANCE EVENTS

submitted to

UNITED STATES DEPARTMENT OF THE INTERIOR
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by

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Introduction:

The objective of this effort was to review a series of time-lapse photographs of harbor seals hauled out in Drakes Estero, California, to determine if those photographs could be useful for understanding the relationships between harbor seals and human activities in there during an impact assessment by the U.S. National Park Service and the U.S. Geological Service. The specific goals were to:

- 1) Describe specific behaviors of harbor seals that could be detected in time-lapse photographic records to indicate whether seals have been disturbed;
- 2) Examine a subset of time-lapse photographic series provided by the USGS and classify them as indicative of disturbance, non-disturbance or not determinable and suggest if causation could distinguished from simple correlation when apparent disturbance responses by seals occurred when potential disturbing stimuli were also observed; and
- 3) Suggest ways to improve photographic methods for documenting interactions between human activities and harbor seals in Drakes Estero using remote monitoring by cameras.

Analysis:

The work initiated after a conference call with project representatives of the USGS on 9 April 2012. USGS provided subsets of time-lapse photographic records collected from 26 March through 5 June 2008 from a camera installed overlooking a tidal harbor seal haul-out site in Drakes. That data set included 3442 photos from 83 event sequences on 46 of the 81 days during that period (Appendix 1, Excel Workbook). I evaluated each of those photos and photo sequences to determine if there were disturbances to harbor seals and if there were correlative potential human related stimuli recorded in the photographs.

The camera monitoring method that was used in 2008 appears generally capable of gross detection of human activity within the field of view of the camera and also capable of coarse detection of disturbance, as measured by flushing of seals from resting areas towards or into the water. But the camera focus was generally poor to very poor and the image resolution too low to allow accurate counting of seals that were hauled out or to determine more subtle responses (i.e., a heads-up alert or other postural responses) to potentially disturbing stimuli. The method and equipment used does not allow discrimination between visual and auditory elements of potentially disturbing stimuli and consequently appears to have limited potential to discriminate causation from correlation for most disturbance responses of seals that might be associated with visual stimuli that were documented in the photos. A wide-angle camera system with better attention to depth of field and focus and higher image resolution capabilities or a network of linked high-resolution camera components coupled with audio recording systems might be able to help determine whether movements or subtle changes in behavior or posture or harbor seals might be directly caused by human presence and activity. They would also

provide better opportunities for recording normal haulout patterns and behaviors. Direct monitoring by on-site observers might allow better documentation and evaluation of seal behaviors and variables that influence them but that could also create additional potential for disturbing seals particularly if birds roosting near the observation site reacted to the entry to, exit from, or presence at observation sites. Any consequent increase in frequency of disturbance to seals would likely substantially influence assessments of the affects of apparent very low disturbance rates owing to other disturbing stimuli of concern (e.g., oyster farm operators, kayakers). A video and audio surveillance system that could broadcast continuously by radio frequency, cellular telephone equipment, or perhaps satellite to a remote monitoring site would reduce the chances that servicing of photographic equipment could confound the observations. That system would need to resolve the same issues of focus, field of view, and resolution that have limited the utility of the time-lapse camera system that was used in 2008. The first order limitation of all these methods is that they would only document the brief responses or non-response of harbor seals to single correlative stimuli. Larger scale questions of whether changes in the number of seals hauled out each day or the locations used by seals to haul out in the Drakes Estero area would need to systematically and rigorously document as many human related, biotic, and abiotic explanatory variables as possible to support testing of an hypothesis that any changes in patterns of behavior of seals in the area might be caused or explained by any particular factor. If hypothesis testing and discrimination of causation from correlation is the intent of further effort then development of a more rigorous and comprehensive study design to incorporate several behavioral and environmental surveillance methods seems appropriate and necessary.

There were potentially disturbing human-related stimuli (working skiffs, camera servicing, kayak) on 40 of the 46 days of time-lapse photo series examined, accounting for 57 separate potential disturbing stimuli (43 skiff presence events, 14 camera servicing events, 1 kayak event.. Using flushing movements of seals as an indicator of disturbance, I identified 7 disturbance events. Four of those disturbance events corresponded with potential stimuli nearby, once when a kayak was present and three times when a skiff was present. The disturbance event associated with the kayak appears to have been directly caused by the close presence of the kayak and the seals' detection of it. One disturbance reaction of seals correlative with the presence of a skiff beached on mud flats several hundred meters away can not be causally linked to human presence as no humans were in the field of view of the camera when the seals' movements occurred. Another movement of seals toward the water (but where none entered the water) occurred several minutes before a skiff was observed in the area and could not be determined have been caused by skiff's presence in the area. The third disturbance event occurred when a skiff and people associated it were within the field of view of the camera and several hundred meters away from the seals; that event was difficult to attribute directly to human presence because the seals appeared to respond to birds that had evidently flushed from an area near the camera site rather than near the persons working near the skiff. There was no identifiable stimulus source for each of the other three disturbance events.