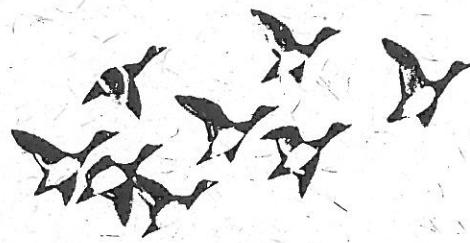


The Ardeid

Research & Resource Management at Cypress Grove Preserve



Beneath the surface: Waterbirds on Tomales Bay

John Kelly and Sarah Tappen

Winter conditions on Tomales Bay spin a magic that compels an amazing profusion of waterbirds to converge here each year. In contrast to other shallower Pacific Coast estuaries and lagoons, this fault-rift valley is flooded by vast expanses of open water even at low tide, providing suitable habitat for waterbirds throughout the tidal cycle. In addition to these, up to 50 million Pacific herring arrive each winter to spawn in the eelgrass, becoming prey for large concentrations of loons, large grebes, and cormorants, while herring eggs provide as much as 0.5 kg/m² of food for fishes, crabs, and particularly, waterbirds. It is surprising that, until now, patterns of habitat use by waterbirds in Tomales Bay have been virtually unknown to science.

Recently, we completed the first thorough baywide analysis of waterbird populations on Tomales Bay. Since 1989, Audubon Canyon Ranch (ACR) field observers have boarded observation boats several times each winter to count waterbirds on the bay. On each count, three boats travel in formation, following parallel 12-mile transects along the length of the bay. We further divide the data along each transect into 4 standard sections (see map) corresponding to changes in estuarine conditions that might influence foraging conditions for waterbirds. Such conditions include differences in water turbidity and color, eelgrass distribution, bottom substrate texture, water temperature, freshwater inflow, and rates of ocean water exchange. An intense four-hour baywide census can be exhausting, but some observers describe a kind of euphoria that comes from a first-hand look at "the big picture."

Tomales Bay is probably of statewide significance for some waterbird species. Our data suggest that Tomales Bay

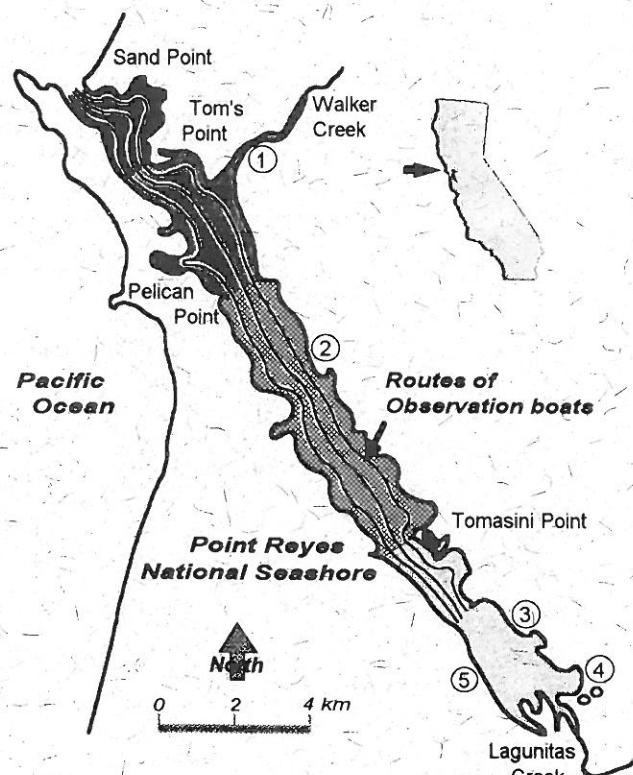
supports winter populations of Bufflehead, scoters, and Black Brant that are comparable to totals for estuaries and lagoons in Mendocino, Humboldt, and Del Norte Counties combined, and may be the single most important estuary south of the Columbia River for wintering Bufflehead, with the exception of San Francisco Bay. Tomales Bay also appears to be an especially important area for Red-throated and Common Loons, and Horned Grebes. We observed an average of 21,943 waterbirds per count (21 counts), not including up to 18,000 shorebirds and tens of thousands of gulls shown by other ACR studies to use Tomales Bay in winter.

We found significant seven-year population increases in Common Loon, Eared Grebe, Western Grebe, Black Brant, Common Goldeneye, Red-breasted Merganser, and American Coot. Comparisons with aerial surveys conducted from 1968-1970 by State Fish and Game and the Point Reyes Bird Observatory suggest that waterbird numbers on Tomales Bay may not have changed greatly over the last few decades. One wonders, however, about accounts of 19th-century travelers who noted waterbirds in "clouds great enough to darken the sun."

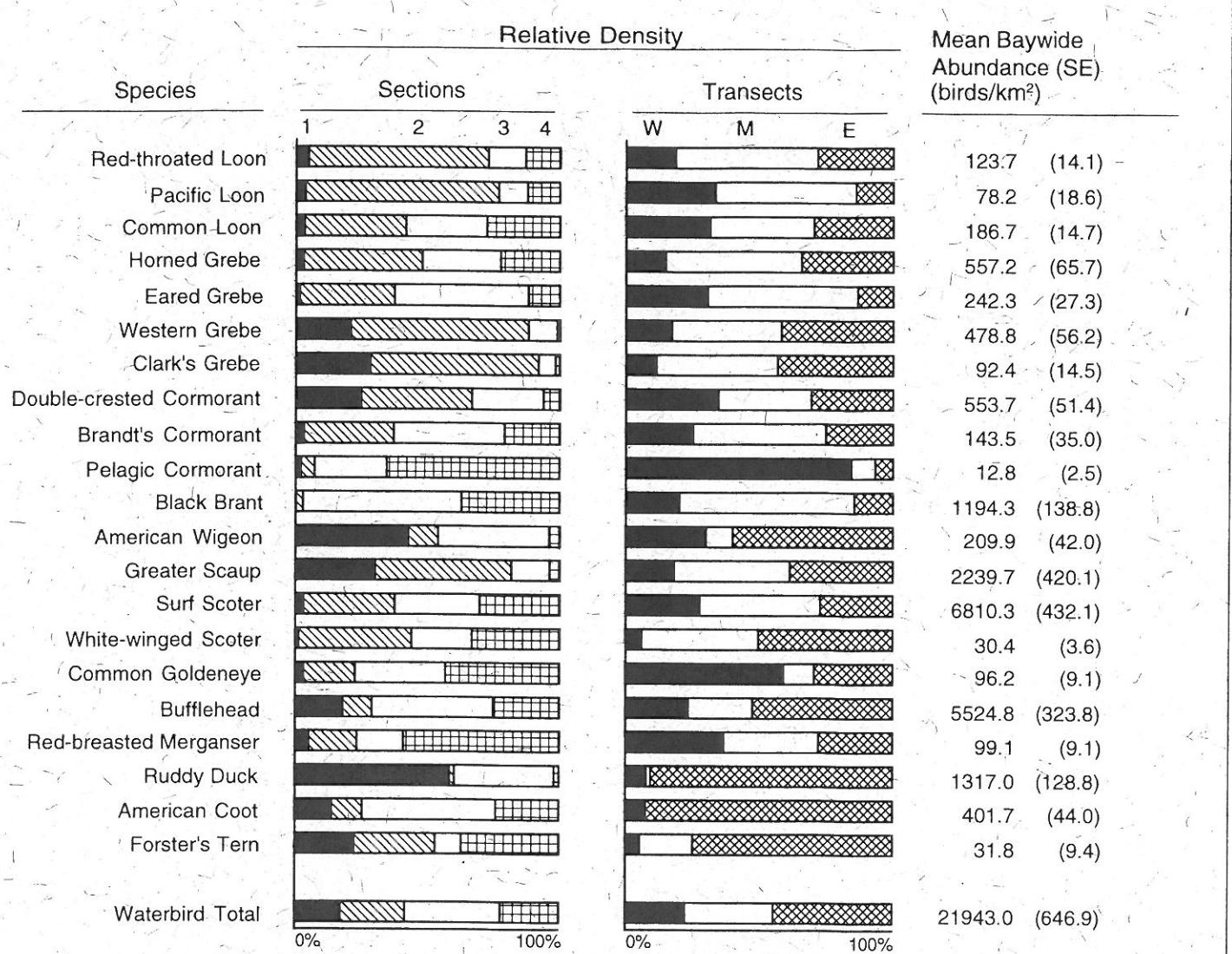
In general, the east shore of Tomales Bay, with shallow shoals and mudflats, headlands and protected coves, supports greater abundances and more species of waterbirds than either the midbay or west shore. However, many preferred habitats of various species occur throughout the bay (see table on page 2).

The most diverse and abundant concentrations of waterbirds in the bay occur between Pelican Point and Tom's Point. Here, eelgrass beds are the most concentrated and estuarine circulation is enriched by the tidal delivery of nutrients and plankton from the outer ocean, as well as by the inflow of freshwater and nutrients from Walker Creek.

(Please turn to page 2.)



Winter waterbird count areas (shaded) on Tomales Bay, and supplementary counting points (circled) at (1) Walker Creek, (2) Livermore Marsh, (3) Millerton Gulch to Bivalve, (4) Bivalve, and (5) Inverness.



Waterbird densities on Tomales Bay. Sections: 1 = south of Tomasini Point, 2 = Tomasini Point to Pelican Point, 3 = Pelican Point to Tom's Point, 4 = Tom's Point to Sand Point. Transects: W = west shore, M = midbay, E = east shore.

Implications for Conservation

Eelgrass provides crucial winter food for waterfowl such as Black Brant, and supports a rich estuarine fauna that provides additional food for other waterbirds. Because eelgrass habitats are sensitive to changes in salinity, turbidity, and temperature, they are vulnerable to reductions in the quality or quantity of freshwater supplied by Walker Creek. Fortunately, eelgrass distributions in Tomales Bay have been relatively stable and no immediate threats are apparent.

If some waterbirds depend on herring or herring roe in winter, overharvest could limit their populations. During recent years, the annual harvest quota for the commercial herring fishery on Tomales Bay has been around 10% of the predicted spawning biomass – a rate lower than in previous years. However, quotas are based on biomass estimates from the previous year, and can over- or under-estimate the proportion of herring harvested in the current year. High rates of piracy by gulls can limit the foraging activities of waterbirds feeding on herring eggs. Such disturbance is probably enhanced by the daily arrival at Walker Creek delta of several thousand gulls from a local landfill near Cotati, in Sonoma County. Well-informed ecosystem management will require focused research on the link between

Pacific herring and waterbirds, accurate forecasts of spawning biomass, and cautious harvest quotas to guide the commercial herring fishery.

Most diving ducks depend on benthic prey, which are vulnerable to steep declines in salinity and contamination from the watershed. Long water residence times of up to four months in the southern part of the bay during drought or summer can hold contaminants for long periods of time. This increases the potential for toxic materials derived from watershed runoff to enter food webs or become trapped in bay sediments. Common Loons and other fish-eating birds avoid highly turbid water, presumably because it interferes with prey detection. Thus, some waterbird populations could be limited by highly turbid waters generated from development or other activities in the watershed. Rafts of Western and Clark's grebes usually concentrate over the deepest areas of the bay, possibly to forage in pockets of clearer saline water near the bottom, although these groups may also reflect concentrations of prey fishes.

Commercial aquaculture operations for Pacific oysters and bay mussels modify waterbird habitats over a substantial portion of the bay. To our knowledge, scientific information on the effects of aquaculture on waterbirds does not exist.

(continued on page 3)

Disturbance Effects

Waterbirds in winter generally rely on flight as a response to predators or other disturbance. The energetic costs of flight are great enough that elevated levels of disturbance might affect energy balance and survival. Many wintering waterbirds must also accumulate fat and protein reserves in early winter to override periods of low food availability, such as during storms, and in late winter and spring to prepare for migration. Further, these wintering areas have a potentially crucial role in the deposition of fat stores used later as energy for reproduction. If waterbirds are close to their energy threshold, direct disturbance by humans could lead to abandonment of an area or starvation.

We have observed dramatic increases in sport fishing, kayaking, and other recreational boating on Tomales Bay, especially where waterbirds concentrate in the northern third of the Bay. Each boat is associated with a radius of disturbance determined by its speed of movement and the sensitivity of bird species. A few boats distributed across an eel grass bed can prevent most waterbirds from using the area. Unlike other recreational boats, kayaks tend to travel in loose groups and frequent the edges of shoreline marshes, coves, eel grass shallows, and sand bars where waterbirds feed and roost. Hunting disturbance can cause some waterbirds to avoid feeding in areas near the mouths of Lagunitas and Walker creeks. Because these are the only two large delta marshes, similar habitats are not available for refuge elsewhere on the Bay.

The distributions of waterbird populations on Tomales Bay reflect a dynamic array of habitat conditions and species preferences. Future work will focus on waterbird responses to specific change in habitat quality. It seems likely that protection of waterbird populations will require particular attention to the control of human disturbance, protection of eel grass beds, the possible effects of the herring fishery and aquaculture, and management of processes in the watershed.



IN PROGRESS

TOMALES BAY PLANT SPECIES DATABASE

Grant Fletcher has developed a database for monitoring rare plant populations and plant communities around Tomales Bay. He is also continuing baywide surveys of the rare salt marsh species *Cordylanthus maritimus* subsp. *palustris*, and a north-coast survey of *Castilleja ambigua* subsp. *humboldtensis*.

AQUACULTURE

John Kelly, Jules Evens, Rich Stallcup, and David Whimpfheimer published a paper on "Effects of aquaculture on habitat use by wintering shorebirds in Tomales Bay, California" in *California Fish and Game* (in press). The results show an overall decrease in shorebird use in areas developed for oyster farming.

HARBOR SEALS

Mary Ellen King is continuing to coordinate efforts to monitor the effects of human disturbance on harbor seals in Tomales Bay. In response to this information, The Gulf of the Farallones National Marine Sanctuary has developed a docent program to provide on-sight education regarding Harbor Seals in Tomales Bay.

SHOREBIRDS

ACR has completed its eighth year of monitoring shorebird populations on Tomales Bay. Each of eight baywide counts each year requires 15-20 qualified shorebird observers, most of whom have contributed to the project for several years. The project is generating valuable information on habitat use, population variation, and seasonal timing of shorebirds.

WINTER WATERBIRDS

John Kelly and Sarah Tappen have submitted a paper on the value of Tomales Bay to wintering waterbirds (see page 1). The paper summarizes seven years of monitoring data. We plan to continue with this monitoring program—experienced birders are needed to help census winter waterbirds by boat.

COMMON YELLOWTHROATS

John Kelly and Chris Wood published a paper on "Diurnal, intraseasonal, and intersexual variation in foraging behavior of the Common Yellowthroat" (*The Condor* 98:491-500). The paper is based on research conducted at ACR's Olema Marsh, and provides guidance for habitat management.

COASTAL PRAIRIE

We are restoring an experimental grassland area at Cypress Grove Preserve. As the introduced native perennial grasses grow larger, we are continuing to control exotic annual grasses by mowing in spring, to monitor plant species cover, and to index California vole population in restored and control areas.

PLANT WARS

We are continuing to remove African ice plant from ACR's Tom's Point, using black plastic sheeting (shading) for 4-6 month periods. Native plants such as Vancouver wild-rye and *Juncus* (rush) now dominate the treated areas.

NORTH BAY COUNTIES HERON/EGRET PROJECT

We are currently analyzing the sixth year of monitoring data for all known colony sites in the northern San Francisco Bay area. The number of active Snowy Egret nests on Red Rock Island declined from 80 in 1995 to only 30 in 1996. On Brook's Island numbers dropped from 89 nests in 1995 to zero in 1996. In contrast, the peak number of active Snowy nests on West Marin Island increased from 16 in 1995 to 72 in 1996 (although about half of these were unsuccessful), suggesting a continuing return of Snowy Egrets to West Marin Island.

The Ardeid

Ardeid (Ar-DEE-id), n., refers to any member of the family Ardeidae, which includes herons, egrets, and bitterns.

The Ardeid is published twice yearly by Audubon Canyon Ranch as an offering to Field Observers, volunteers, and supporters of Cypress Grove Preserve. To receive *The Ardeid*, please call or write to Cypress Grove Preserve. Subscriptions are available free of charge—however, contributions are gratefully accepted.

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THE WATCH

The following Field Observers have contributed to CGP projects since the last newsletter:

D = Harbor Seal study
 H = Heron/Egret Project
 I = TB Plant Species Inventory
 L = Library
 M = Marsh Monitoring Project
 S = TB Shorebird Project
 W = TB Waterbird Census

Debbie Ablin (H)
 Judith Allen (L)
 Sarah Allen (S)
 Susan Allen (D)
 Bob Baez (SW)
 Norah & Hugh Bain (S)
 Nancy Barbour (H)
 Sue Baty (L)
 Tom Baty (W)
 Rosalyn Bazurto (W)
 William Beal (MW)
 Betsy Berberian (D)
 Gay Bishop (S)
 Patti Blumin (H)
 Ellen Blustein (HS)
 Richard Bohnet (H)
 Janet Bosshard (H)
 Maureen Bourbin (H)
 John Boyd (H)
 Tom Bradner (H)
 Mary Brezner (H)
 Ken Burton (S)
 Phil Burton (H)
 Robert Cardwell (W)
 Hugh Cotter (W)
 Richard Crapuchettes (H)
 Rigdon Currie (HS)
 Ann Davis (S)
 Eric Davis (HS)
 Jim DeVore (H)
 Carolyn Dixon (H)

Dick Downing (H)
 Jenny Downing (H)
 Caroline Dutton (S)
 Lew Edmondson (S)
 Ted Elliot (H)
 Jules Evens (MS)
 Sheryl Fairchild (H)
 Katie Fehring (HMSW)
 Ken & Betty Fehring (H)
 Binny Fischer (H)
 Grant Fletcher (SHIO)
 Virginia Fletcher (S)
 Jim Fox (H)
 Carol Fraker (H)
 Dan Frolich (SW)
 Harry Fuller (W)
 Margaret Greene (H)
 Philip Greene (H)
 Madelon Halpern (H)
 David Hastings (W)
 Holly Heinzmann (W)
 Diane Hichwa (H)
 Edna Hickok (H)
 Terry Horrigan (SL)
 Darin Howe (D)
 Lisa Hug (S)
 Jeri Jacobsen (H)
 Lynnette Kahn (SH)
 Mary Ellen King (DHW)
 Richard Kirschman (S)
 Jim Knight (H)
 Carol Kuelper (S)
 Chris Lantman (D)
 Jim Larkin (D)
 Laura Leek (W)
 Robin Leong (H)
 Michele Liates (HW)
 Eileen Libby (H)
 Flora Maclide (HM)
 Jo Maillard (H)
 Roger Marlowe (W)
 Chris McAuliffe (H)
 Fred McCullum (H)
 John McDonagh (S)
 Ellen McKnight (W)
 Richard Merriss (H)

Jean Miller (H)
 Jan Moffet (W)
 Dan Murphy (W)
 Wally Neville (H)
 Terry Nordbye (HMS)
 Karen Paull (DW)
 Myrlee Potosnak (H)
 Grace Pratt (H)
 Helen Pratt (H)
 Matt Reese (D)
 Linda Reichel (H)
 Bob Richmond (H)
 Rolf Ridge (W)
 Jamie Ross (WH)
 Ellen Sabine (HS)
 Fran Scarlett (H)
 Dave Schurr (SW)
 Anne Sclare (H)
 Craig Scott (DSW)
 Kevin Shaw (D)
 Juliette Shin (D)
 Ann & Duane Smith (H)
 Joe H. Smith (HW)
 Anne Spencer (HS)
 Rich Stallcup (MS)
 Jean Starkweather (H)

Sarah Tappen (HW)
 Judy Temko (HS)
 Janet Thiessen (HSW)
 Gil Thomson (H)
 Don Tiernan (H)
 Bill Van Schaick (S)
 Brett Walker (SW)
 Tanis Walters (S)
 Katheryn Warner (W)
 Penny Watson (W)
 Ralph Webb (H)
 Rosalie Webb (H)
 Tom White (W)
 Adeline Whitmore (H)
 Diane Williams (S)
 Ken Wilson (H)
 David Wimpfheimer (WSH)
 Chris Wood (HM)

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 Jules Evens
 Grant Fletcher
 Philip Greene
 Mary Ellen King
 Flora Maclide
 Helen Pratt
 Rich Stallcup
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 David Greene
 Research Coordinator
 Sarah Tappen
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 John Kelly
 Sarah Tappen

Field Biologists
 Jules Evens
 Terry Nordbye
 Rich Stallcup
 David Wimpfheimer

IN THE FIELD

April	11-13	North Bay Heron Egret Project Regional Observation Period
	23	Tomales Bay Shorebird Spring Census
	26-27	"Reflections on Cypress Grove" Art Show artist inspiration weekend. Volunteers needed to host and guide visiting artists. Please call 415/663-8203 to sign up
May	10-12	North Bay Heron Egret Project Regional Observation Period
	20	Microtus runway index field day (field observers needed)
June	6-8	North Bay Heron Egret Project Regional Observation Period
	20-22	North Bay Heron Egret Project Regional Observation Period
October	4-5	"Reflections on Cypress Grove" Art Show

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