

Discoveries

News and Views from Discovery Southeast Fall 2004

Nexus: Estuaries of Southeast Alaska

Richard Carstensen

Twenty-four years ago I found myself caretaker of an estuary – a square mile of goosetongue and sand flat at the joint mouths of the Herbert and Eagle Rivers. This was extraordinary luck for a budding naturalist, to spend a decade at the ultimate outpouring of two enormous glaciated watersheds.

I could tell at first glance that Eagle River estuary was a special place. But I was new to Southeast Alaska, and had seen little to which this complex of sloughs and marshes might be compared. It took many seasons, collecting experiences and readings, building conceptual frameworks, for the richness of my adopted home to fully sink in. Slowly I noticed that—contrary to my job description—Eagle Beach was taking care of *me*. It fed, sheltered and inspired. After I'd lived there for several years, an ecologist friend visited, and later sent a thank-you note addressed to "the center of the universe." I accepted that as scientific confirmation. If my watershed was a house, Eagle Beach was the power outlet.

Estuaries conduct a lot of juice. Once, as I jogged the perimeter of Eagle Beach on a high tide, a pod of orcas pulled in so close beside me that I swerved reflexively several steps away from the waterline. Those whales surfed directly over sands where I'd previously tracked wolves. From the trajectories of such animals I derive my definition of a wild estuary – a place where pinnacle predators of land and sea can hunt on the same shifting sand. To a swan, an estuary is the lowest, wealthiest point in a terrestrial watershed. To returning pink salmon, it's the last portal – the place to beat failing flesh against stream bottom in honor of renewal, repaying a loan the land gave the sea.

Such conclusions emerge from casual observation. But others are accessible only via science and measurement. Estuaries are the most fertilized natural habitats in the world by several orders of magnitude. Sediment delivered into estuaries as suspended load in rivers becomes temporarily entrapped at "turbidity maxima" – nodes of roiled, opaque current at the interface of fresh and salt water. Bottom-oriented zooplankton rise into this entrained debris to forage, and in the eddies can sometimes avoid being flushed out of the estuary. "Drift invertebrates"—the

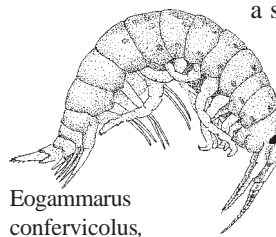
¹Simenstad, C., M. Dethier, C. Levings and D. Hay, *The Terrestrial/Marine Ecotone*, in *The Rain Forests of Home*. Schoonmaker, P., B. von Hagen, and E. Wolf, eds, 1997, Island Press.

²Willson, M. and A. Baldwin, 2003. *Invertebrate surveys on the Mendenhall Wetlands*. Report to the USFWS.

collected aphids, spiders and riverside brush fauna of entire stream networks—are also concentrated along tidal fronts, and juvenile salmonids collect in schools to target them¹. Naturalists toss wobbling Pixies through the mesmerizing silt plumes, teasing dollies and humpies whose stomachs are packed with estuarine sand lance.

Anyone willing to kneel in the mud with a hand lens can learn amazing stuff about estuaries that I managed to overlook during my 12-year Eagle River sojourn. Those barren-looking flats are treasure troves, if only you adjust your sense of scale. Corophiid amphipods build tubes of sand grains to live in. To the untrained eye the tube colonies appear as a fuzzy flocculent on the bottom of low-salinity sloughs. Submerged, these "sandfleas" feed salmon smolts. Exposed, they help to fuel the millions of shorebirds that biannually trace the dotted line of estuaries north and south across hemispheres.

Mary Willson and Aaron Baldwin recently studied the invertebrate life of the Mendenhall Wetlands². Straining sediment samples through a sieve, they counted tiny



Eogammarus confervicolus, abundant amphipod on the Mendenhall Refuge

worms, bivalves and crustaceans. Baby macoma clams the size of lentils can occur in thousands per square meter, close enough to the surface to be easily

continued on page 4

In this issue

Estuaries	1
Discovery news	3
Field journal	8
Kid's page	9
Contributors	10
Members Honor Roll	11

Masthead: Surfbird (rear) and Dunlin

From the director

Larry West

Things are changing at Discovery Southeast! For starters, the view from our office has changed—and not merely because summer has slipped quietly into fall. We've moved! Our new view is exactly the opposite of the old, a 180-degree shift. So our eyes are no longer drawn to the waterfalls of Mt. Juneau's precipitous southwestern face (a view we'll miss!). Instead, Mt. Jumbo looms in the distance over downtown rooftops.

Where are we now? Just across the hall, in a roomier space on the sunny side of the building. When long-time DSE supporter Mark Kelley moved his photo studio to roomier digs down the hall, we moved into his old space—rooms 207 and 208.

But that's not all. The building itself is changing. Formerly the Arcticorps Building (home of the Juneau Community Charter School and the Montessori Adolescent Program), it's now the Barrett Professional Building, recently acquired by local real estate attorney James Barrett and his mother. The Barretts are undertaking an ambitious effort to improve the property and its management. We already notice very positive results, and we're grateful to the Barretts for joining the ranks of DSE supporters!

The DSE staff has changed, too. As we often do this time of year, we say good-bye to naturalists who have moved on over the summer, and we welcome new naturalists who have joined us. Nonna Shtipelman and Kristine Martin are now immersed in full-time studies at the University of Alaska (Nonna here in Juneau, Kristine in Fairbanks), and Ami Reifenstein is pursuing other professional paths. We thank all three for their extraordinary service; they'll be missed—by us and by scores of students!

We welcome Scott Burton, who will assist Walt Chapman at Gastineau and Harborview Elementary Schools; Cheryl Van Dyke, who will work with Steve Merli at Glacier Valley; Ellen Naughtner, who joins Gareth Hummel at Mendenhall River and Auke Bay; and Joanne Rieselbach, who will help out at Riverbend.

Two additional changes should be mentioned. First, Jan Carlile has stepped up to new responsibilities as Program Coordinator. In her new role, she will oversee our elementary and middle school programs here in Juneau (Nature Studies, Discovery Days, and Creek Stewards), our distant programs in Haines and Gustavus, and our summer programs (Outdoor Explorers and the Admiralty Teacher Expedition). We're especially grateful to the Alaska Conservation Foundation and the Hugh and Jane Ferguson Foundation for their contributions to help build Discovery Southeast's administrative capacity. Jan's work will enable the executive director to focus more on fundraising, grant writing, and other administrative needs.

Finally, the Association of Alaska School Boards has made me an offer I'd be foolish to refuse, and so I announce my own departure from Discovery Southeast. While I'm excited about my new work, I'll miss my daily associations with dear friends here. I leave with tremendous respect for the people of Discovery Southeast and their extraordinary efforts to connect Southeast Alaskans with their natural surroundings. I remain committed to working alongside them—and you!—now as a member and volunteer.

Board of Directors

President: Mike Stanley
Vice President: Barb Sheinberg
Secretary: Alex Wertheimer
Treasurer: Jenifer Shapland
Sue Baxter
Dave Haas
Joyce Sarles
Cathy Connor
Nancy Douglas

Naturalists

Scott Burton, Richard Carstensen, Walt Chapman, Kathy Hocker, Gareth Hummel, Hank Lentfer, Steve Merli, Ellen Naughtner, Joanne Rieselbach, Terry Schwarz, Megan Sherman, Tim Shields, Darren Snyder, Cheryl Van Dyke

Summer 2004 Outdoor

Explorers Naturalists

Walter Chapman, Pam Cure, Laura Milligan (ACF-sponsored intern)

Administrative Staff

Executive Director: Dana Owen
Program Coordinator: Jan Carlile
Bookkeeper: Vickie Williams
Membership Volunteer: Susan Phillips

Discoveries is published by *Discovery Southeast*, Southeast Alaska's leading source for natural history and conservation education. Founded in 1989 in Juneau and serving communities throughout Southeast Alaska, *Discovery Southeast* is a nonprofit organization that promotes direct, hands-on learning from nature through natural science and outdoor education programs for youth, adults, and teachers. By engaging youth and adults in the study of nature, *Discovery Southeast* naturalists deepen and enrich the connections between the people of Southeast Alaska and nature.

Editor: Richard Carstensen
Writers: Richard Carstensen, Kathy Hocker, Larry West, Jan Carlile
Illustrations and photos: Richard Carstensen, Kathy Hocker, Bob Armstrong

Discovery Southeast

PO Box 21867, Juneau AK 99802
907/463-1500 phone • 463-1587 fax
e-mail: info@discoverysoutheast.org
website: www.discoverysoutheast.org

Discovery News

Discovery hires new ED!

As we (finally!) go to press with this long-incubated newsletter, we are pleased to announce that long-time Juneau resident and Discovery member Dana Owen has just been hired as DSE Executive Director. We'll have a profile of Dana in our next newsletter. Meantime, you can meet him and help extend our thanks to outgoing director Larry West at our . . .

Members Celebration

This will be on Thursday November 18th. Place and time to be announced.

New Streamwalker booklet.

The latest addition to Discovery's great suite of publications is this 60-page booklet. It was written by Kathy Hocker and Terry Schwarz, with extensive help from agency biologists and DSE staff. There are many good guides to stream ecology and stream survey methods, but none so lovingly "customized" for the unique aquatic habitats of Southeast Alaska. You can order it at www.discoverysoutheast.org, or call 463-1500.

Special Thanks to our major donors!

Discovery Southeast is deeply grateful to two companies for their extraordinary support during

the past year.

In September, Captain Bowland and the officers and crew of **Royal Caribbean International's** *Radiance of the Seas* presented Discovery Southeast with a check in the amount of \$12,500. RCI's Safety and Environment Department annually honors the ship with the fleet's best environmental record a cash award of \$25,000 to pass along to recipients chosen by the ship's personnel. Discovery Southeast shared the award with an organization in the Caribbean. Last year, **Celebrity Cruise Line** presented Discovery Southeast with a similar award.

Last spring, **Goldbelt Tours** donated a 23-passenger minibus to Discovery Southeast. Previously used to transfer Goldbelt guests between Gustavus and Bartlett Cove, the vehicle was barged to Juneau courtesy of Sea Level Transport, and is stored when not in use courtesy of Western Auto/Radio Shack.

RCI's contribution will provide essential support for Nature Studies and for general operations, while Goldbelt Tours' donation will support all Discovery Southeast programs that depend on transportation.

Our deepest gratitude also goes to the following companies who have made major contributions to Discovery Southeast over the past year:

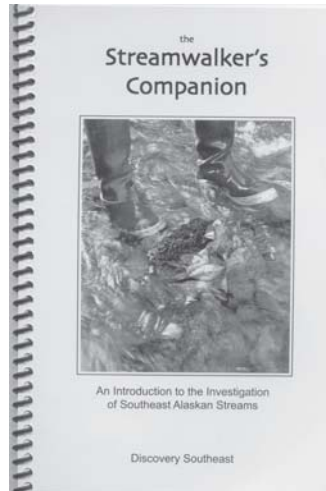
Cellular One • For a major in-kind contribution to the safety of all participants in Discovery Southeast programs.

Alaska Discovery • For a major in-kind contribution to our annual Bears of Admiralty Teacher Expedition, and for a large cash contribution to Creek Stewards and general operating support.

Barrett Professional Building • For in-kind support of general operations.

Faulkner Banfield PC • For a major in-kind contribution to our office systems.

A full listing of all our supporters and members is on pages 9 and 10.



Captain Bowland presents Discovery with a check from Royal Caribbean International.



Goldbelt Tours donated this 23-passenger minibus to Discovery Southeast.

continued from page 1

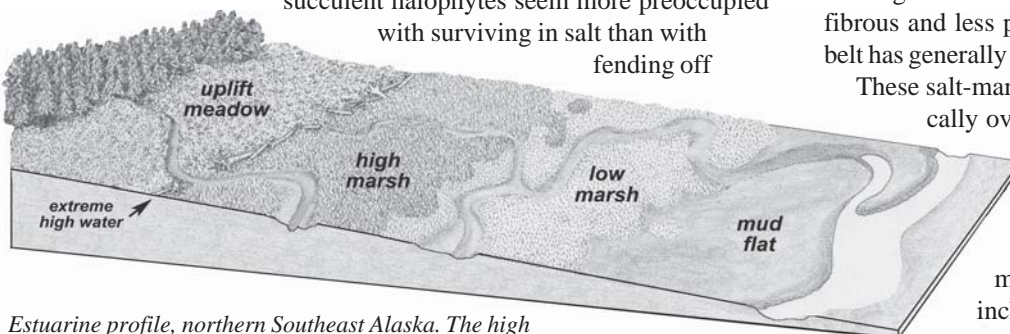
reached by probing bird bills.

When I began to study Eagle River estuary in the early 1980s, I visited the office of John Thilenius, a plant ecologist who at the time was conducting surveys on the Copper River mouth. I still remember John filling a piece of scrap paper with beach profile sketches and ecological nuggets such as “halophyte \neq halophile.” A halophyte is a plant of the brackish estuary. We tend to assume that plants gravitating to certain conditions must “like” them. Salt, however, is poison to vascular land plants, not loved but *endured* by halophytes seeking niches free of competition from less tolerant species. John pointed out that in salty estuaries, seed reproduction is nearly impossible. Instead, most halophytes spread by clonal advance.

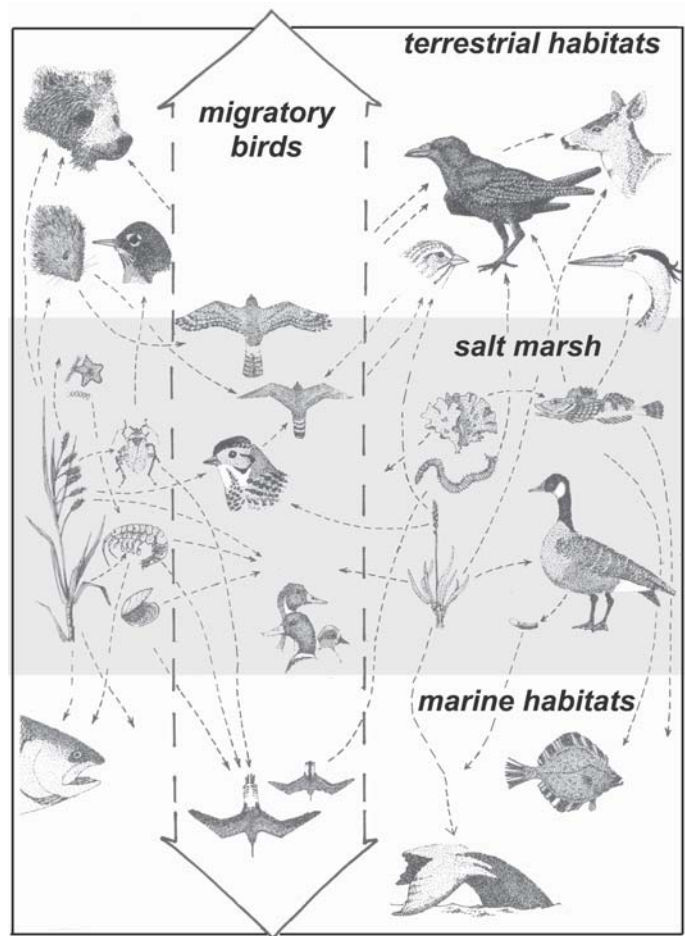
John Thilenius also advised me that researchers should not fall in love with their study areas. No doubt such attachments do lead to unscientific biases, but I failed to heed John’s guidance. Estuaries, after all, are about linkages and attachments. Estuaries are lavish and surprising and vulnerable. Even battered estuaries like the Mendenhall Flats can be achingly lovely on a warm spring morning when the larks and longspurs are sweeping through the milkwort.

The Mendenhall Wetlands State Game Refuge encompasses the combined estuaries of Mendenhall River, Lemon, Salmon and Peterson Creeks, and many smaller streams. From April 2002 to May 2003, *Discovery Southeast* studied bird concentrations on the refuge for the US Fish and Wildlife Service. Bob Armstrong, Mary Willson and I conducted the surveys. We noted “hotspots” of bird activity, places that repeatedly attracted feeding or resting bird congregations. Although our study plan did not originally address the “why” of such phenomena, our curiosity spurred us into deeper investigations. Mary probed the sand and mudflats and the barnacle/mussel/rockweed beds, trying to figure out what was attracting turnstones and gulls and dowitchers. Bob looked into the fish that feed terns and mergansers and kingfishers. And I began to map the plants that explain the shifting distributions of grazers like geese, and of seed-gleaners like teal and shovelers.

The low marsh community of tidal sedges, goosetongue and arrowgrass (not a true grass) is Southeast Alaska’s salad bowl. Its succulent halophytes seem more preoccupied with surviving in salt than with fending off



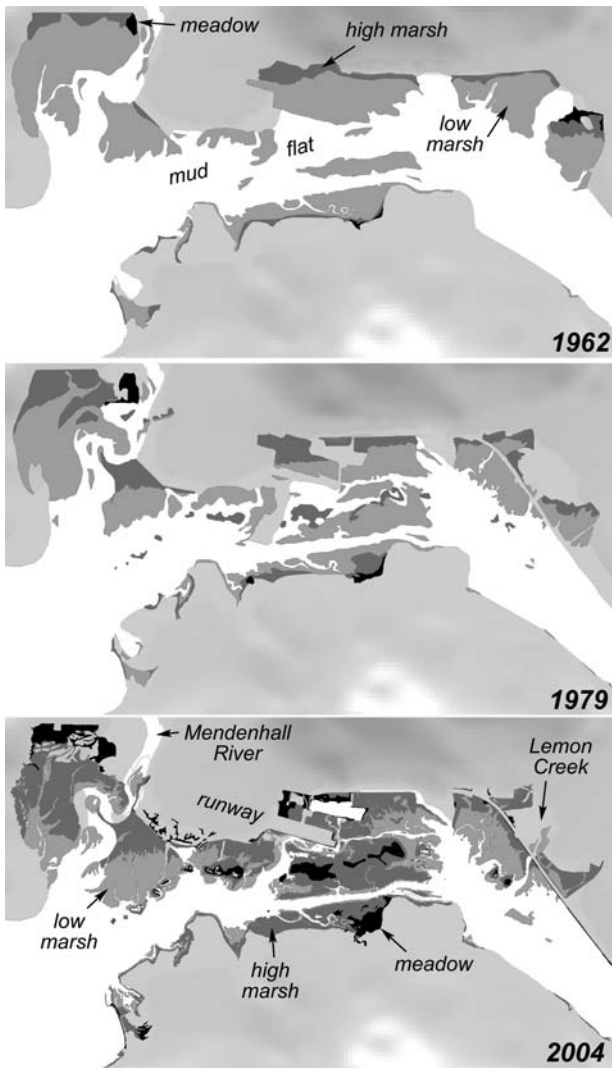
Estuarine profile, northern Southeast Alaska. The high and low marsh together comprise the salt marsh. Uplift meadow colonizes former tideland.



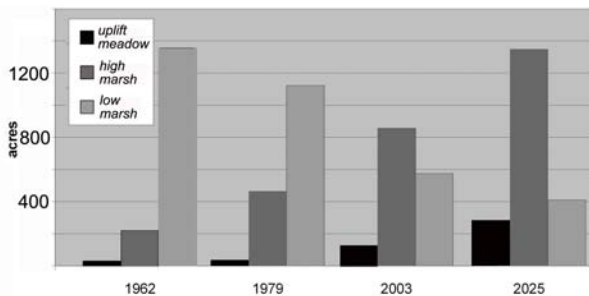
Salt marsh food web. Arrows showing who feeds whom trend outwards from the salt marsh to marine and terrestrial habitats. The salt marsh is a “giveaway” system. For an annotated version of this diagram see p. 59, *The Nature of Southeast Alaska*, O’Claire, Armstrong and Carstensen, 1997, Alaska Northwest Books.

herbivores. In every other terrestrial plant community of our region, toxins, thorns and woodiness serve to discourage choosy grazers like bears who, whenever possible, forsake the uplands to spend hours mowing the low tidal marsh. (On most of the Mendenhall, access for bear and deer is impeded by roads and houses.) The high marsh is dominated by grasses—more fibrous and less palatable than sedges—and this belt has generally lower wildlife value.

These salt-marsh zones have shifted dramatically over recent decades. Throughout northern Southeast Alaska, glacial rebound is elevating tidal marshes. On the Mendenhall Wetlands, mudflats rising at about half an inch per year are colonized by low-marsh sedges that in turn are



Changes in salt marsh during 4 decades on the Mendenhall Wetlands. Land rose 2 feet, and tidal flushing was weakened due to human barriers to flow. There was much more open mudflat in Gastineau Channel 40 years ago. Chart below shows loss of low marsh and gain in high marsh and uplift meadow, including a prediction for the year 2025.



colonized by high-marsh grasses. As the high marsh is finally raised above extreme high water, these salt-tolerant grasses are replaced by a diverse supratidal community we refer to as uplift meadow. These

Estuarine studies by Discovery Staff

Hotspots; bird survey of Mendenhall Wetlands. Armstrong, Carstensen and Willson. 2004. Our report has been published by the Juneau Audubon Society and Taku Conservation Society. We think *Hotspots* is the best current overview of the natural history of the Mendenhall Refuge. Copies of the 75-page color report are available in public and school libraries and can be downloaded from www.juneau-audubon-society.org. For color printing, a higher resolution CD version can be obtained from the authors.

GIS Mapping for Mendenhall Wetland State Game Refuge. Carstensen, Schwartz, Christensen and Van Dyke, 2004. Report by Discovery Southeast to SEALTrust (contact SEALTrust or Carstensen).

globally unique meadows of lupine, fireweed and nagoonberry are ephemeral stages on the way to spruce forest. Development on the margins of the Mendenhall Wetlands before creation of the refuge quickly eliminated nearly all of the original uplift meadow.

Depending on species, wildlife may either gain or lose from the complex interplay of glacial rebound with human alterations like runway construction and spoil-island deposition (from the 1960s dredging of Gastineau Channel). On the Mendenhall and at Eagle River, rapid loss of the low marsh is a substantial impact to geese, dabbling ducks, and salt-marsh-rearing fishes like coho, herring and sculpin. On the other hand, at the upper limits of the Mendenhall Wetlands, grassy high marsh is succeeding to uplift meadow. Much of this lush meadow is now off-limits to development where it lies within refuge boundaries. The net effect of successional change on Mendenhall Wetlands is bad news for most waterbirds and fish, and good news for meadow lovers like savannah sparrows and mammalian herbivores—more so if we can improve access to the wetlands for animals like deer, bear and porcupine.

Another *Discovery Southeast* estuarine research project in 2003-2004 began on a request from the Southeast Alaska Land Trust (SEALTrust), for whom we had previously studied wildlife habitats in the Amalga/Eagle River area (Hocker, *Risen Valleys*, Discoveries, Summer 2003). The Land Trust asked us to create a GIS (geographic information system) project for the Mendenhall Wetlands State Game Refuge. SEALTrust is particularly interested in the question of potential accretion of private properties into the refuge. The mean high water mark (15.4 feet above sea level) that defines some property lines is migrating relentlessly toward Gastineau Channel as land rises.

Thanks to many hours of guidance from Bob Christensen* and Cheryl Van Dyke of SEAWAAD (Southeast Alaska Wilderness Exploration, Analysis and Discovery), *Discovery Southeast* is now capable of sophisticated computerized mapping and spatial analysis. After making maps with pen and ink for a quarter century, I feel like a caveman who's been handed a high-powered rifle.

Discovery naturalist Terry Schwarz and I walked the Mendenhall Wetlands in late summer, 2003, with GPS (global positioning system) units. We took hundreds of waypoints—latitude/longitude positions with 10- to 30-foot accuracy—deter-

* Bob is also Discovery's webmaster. If you haven't yet admired his work, check out www.discoverysoutheast.org.



Bear trails in estuarine sedges, Traitors Cove, Revillagigedo Island.

mined from satellite triangulation. At each point we recorded plant community type, dominant species, and often included comments on succession, wildlife sign, etc. At home, we “downloaded” these points onto exquisitely detailed air photos, and labelled them with their known community types. Using these ground-truthed points, we could confidently draw polygons around vegetation of similar color and texture on the photos, producing what is now the best available vegetation map for the refuge.

But on uplifting estuaries like the Mendenhall, a habitat map is just a snapshot in time. The trick, as naturalist Greg Streveler would say, is to “turn on the projector” and watch vegetation change as a moving picture. From old historical photos, aligned and scaled to modern maps in GIS, I created similar, if cruder, vegetation maps for 1962 and 1979. Using some known tidal elevations and the uplift rate of 0.6 inches per year, I also carried the successional process ahead in time, creating a vegetation map for the year 2025. As expected, the prognosis for retention of the valuable sedge low marsh communities is not encouraging. Although the rate of loss may taper off somewhat, our current 600 acres of low marsh sedges should be reduced to about 400 acres over the next quarter century.

As we wrapped up the *Discovery* research projects on hotspots and accretion, I wanted to learn more about the larger picture of estuaries across Southeast Alaska. Shorebird stopover sites, for example, are poorly documented in our region. The most commonly cited are the Stikine River mouth, Yakutat Forelands, and Mendenhall Flats. With the exception of the Stikine, these are far from the largest river systems in Southeast Alaska. Is there truly something special for shorebirds about these three areas, or are they simply the only places we have studied?

The larger one’s study area, the greater the advantages conferred by GIS analysis. The most comprehensive dataset for estuaries in Southeast Alaska was compiled by the National Wetlands Inventory (NWI). The US Fish and Wildlife Service, with help from the Forest Service, recently completed the enormous task of mapping the fresh and saltwater wetland habitats from Ketchikan to Skagway. The NWI map for all of



Buck skull in glasswort tidal marsh, Heceta Island.

Southeast totals about 150,000 “polygons,” or individual wetland units.

For estuaries, the NWI maps delineate the extent of 3 key habitats: vegetated salt marsh, bare tidal flats, and another less extensive but important community—the “algal bed” of rockweed, barnacles and mussels. My table of habitat acreages lists the ten largest estuaries of Southeast, based on the total of all 3 intertidal habitats. Relative proportions of the 3 types differs considerably. The Mendenhall Wetlands have the 3rd largest acreage of salt marsh in Southeast, but rank only 9th in total estuary size.

Several interesting patterns emerge from the GIS mapping:

1) Estuary size is not closely correlated with watershed size. The 5th and 6th largest watersheds of the SE Alaska/BC borderlands—the Unuk and Whiting Rivers—do not even rank in the top 25 for estuary size. And 3 of the 5 largest estuaries—Dangerous River, Duncan Canal and Rocky Pass—have watersheds that are orders of magnitude smaller than those of the great transboundary rivers.

2) Southern Southeast has few large estuaries.

3) Six of the 10 largest estuaries are fed by glacial streams, but a surprising number of very large glacial systems, although heavily sediment-laden, have negligible estuaries.

4) Topographical complexities such as island clusters, convoluted shorelines and undulating bathymetry lead to increased sediment deposition. In such locations even small streams can have

	salt marsh	tideflat	algal bed	total
stikine	2926	18496	315	21737
dangerous	2577	11282	0	13859
duncan	606	7500	1340	9446
dry bay	919	5859	33	6811
rocky	480	5123	220	5823
gustavus	862	3800	0	4662
chilkat	95	4423	0	4518
taku	714	3365	0	4079
mendenhall	1450	1987	195	3632
gambier	672	2337	0	3009

Habitat acreage for the 10 largest estuaries of SE AK.

large estuaries.

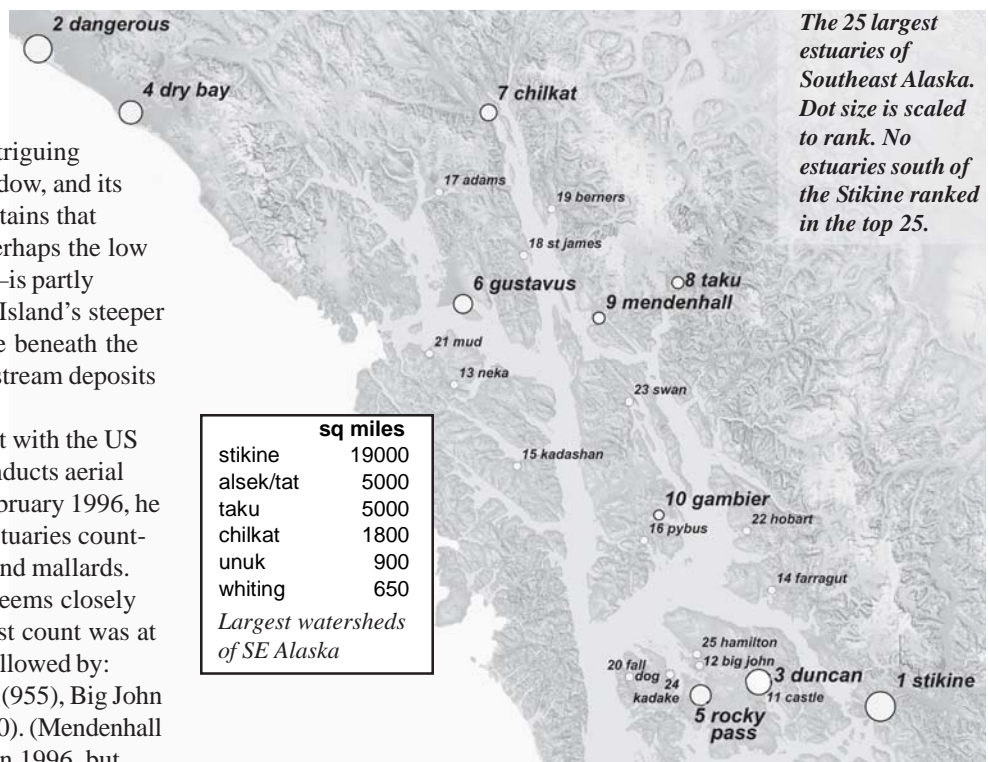
5) Of all Southeast communities, Kake is richest in large estuaries. Five of the biggest are within a short skiff ride. This is intriguing since Kake is in a relative rainshadow, and its nearby watersheds lack tall mountains that spawn stout, snowfed streams. Perhaps the low relief—extending also underwater—is partly responsible. In contrast, Baranof Island’s steeper mountainsides continue to plunge beneath the waterline, leaving few places for stream deposits to collect.

Jack Hodges is a pilot/biologist with the US Fish and Wildlife service who conducts aerial censuses for waterfowl. In late February 1996, he flew over nearly 200 Southeast estuaries counting overwintering Canada geese and mallards. The number of geese supported seems closely related to estuary size. The highest count was at the Stikine mouth (1965 geese), followed by: Duncan Canal (1322), Rocky Pass (955), Big John Bay (475) and Hamilton Creek (390). (Mendenhall Wetlands had a low goose count in 1996, but would normally rank in the top 5.) Again, the country around Kake stands out as remarkably productive. Jack says that for wintering waterfowl, freezing of salt marshes during cold snaps can be a serious problem. Large creeks may spread extensive, freeze-prone freshwater lenses over their estuaries. Perhaps a small creek with a large estuary such as Big John is a safer combination for geese and mallards.

The ecological importance of estuaries depends on more than size alone. The postage-stamp mudflats of Prince of Wales Island—like Crab Bay near Craig—sizzle with transient shorebirds in late April. And in nearly every watershed on both mainland and archipelago, a host of resident creatures from shrews to sculpins pay their seasonal respects to the nexus.

Conservation issues in estuaries near Southeast towns include airport development, pollution from sewage, landfills or roads, and displacement of wildlife by recreational activities. More remote estuaries are vulnerable to oil spills, invasive plants and invertebrates, swamping of native salmon runs by hatchery strays, and increasingly dispersed tourism. Natural changes such as loss

View northeast to Southeast Alaska’s largest estuary at the mouth of Stikine River. Generated in ArcScene by “draping” a vertical air photo over a digital elevation model. Extent of salt marsh and bare mudflat is from the National Wetlands Inventory database.



of low marsh sedges to glacial rebound also need to be better mapped and understood.

We are blessed to have so many intact wild estuaries in Southeast, but history warns that complacency is ill-advised. Wolves and orcas no longer overlap at the stream mouths of the lower 48 states. Those apex predators sat on the shoulders of a once-sturdy-but-vanished food pyramid of spawning smelt, overwintering ducks, subtidal crabs, barndoor halibut, driftlog sandfleas, and globetrotting turnstones. The whole trophic masterpiece still exists here on the northern coast—wobbling perhaps, but standing.

Estuaries have been our caretakers. It’s time to return the favor.



Sketches from a field notebook Kathy Hocker

Muskeg Ants

I spend an hour investigating the world of the mysterious

I've seen these ants before, but never so many this summer. Is weather? The they occupy smooth, small flow, I've

as there are it the dry microhabitats are mounds of sphagnum. On occa- found what I assume to be a nest, broken up by what I assume to have been a bear's ayle claws. Sometimes a few scattered pupae remain.

I put a few ants in the freezer to slow them... they do not withstand...

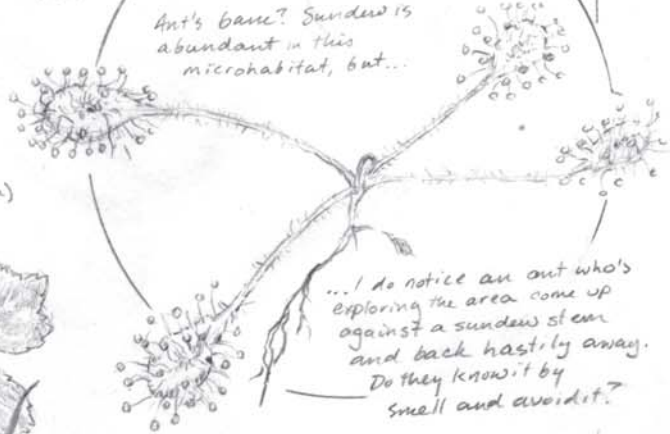
Under the dissecting scope (20x), this little critter is beautiful. It's made of hinges and segments. Its thorax, head are indented with a pattern of strange channels & pits, but abdomen is glossy smooth, with many pale hairs.



It has a sting!

Proocera rotundifolia

Ant's base? Sundew is abundant in this microhabitat, but...



...I do notice an ant who's exploring the area come up against a sundew stem and back hastily away. Do they know it by smell and avoid it?

Some typical plants of the ant-hummocks:

Crowberry (*Empetrum nigrum*)

Trifoliate goldthread (*Coptis trifoliata*)

Cloudberry (*Rubus chamaemorus*)

Dogwood (*Corvus canadensis*) don't seem to bloom well on these hummocks. Most are small.

Typical moss of this microhabitat is this sphagnum (drawn life size) - tight top, pale salmon/rusty color, packed very tightly together to present a dense smooth surface but loose and open underneath.



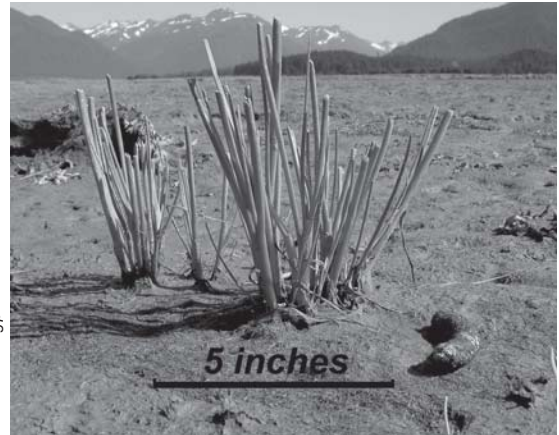
A plant I'm unfamiliar with; grows quite abundantly packed in the sphagnum layer with only the upper tips of its leaves protruding. Is it just a young butterwort?

Estuary puzzlers

All of these photos were taken in estuaries. Can you figure out who left the sign? Answers are at the bottom.



1) A wide-bodied animal mashed down these sedges recently.

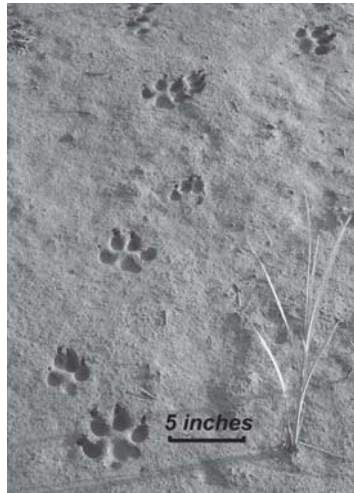


Bob Armstrong photo

2) The same animal that bit off this arrowgrass left a dropping in the foreground.



3) Birds with webbed feet could be either gulls or ducks. This one was a waddling seed-eater, quite small. Notice that its entire stride was scarcely longer than the 6-inch pencil.



4) This 4-toed trotting animal left tracks in a *really* wild estuary in Glacier Bay.



6) A tiny animal hopped through the fresh snow of the beach meadow last night, sometimes slipping entirely beneath it.



5) A whole family of 5-toed, slick-furred critters loped over the riverside sandflat.

1) Brown bear (black bear trails would be a bit narrower); 2) Canada Goose; 3) the green-winged teal is the smallest of our dabbling ducks; 4) wolf (hard to tell from dog—but no dogs in Glacier Bay); 5) river otter (mink tracks are similar but much smaller); 6) long-tailed vole.

Many thanks to our great supporters!

Grants and contracts

Discovery Southeast thanks the following foundations and organizations for their generous support in the past year.

Alaska Conservation Foundation • Bear Expedition, Summer Internship, Administrative Capacity

Alaska Department of Community and Economic Development, Coastal Impact Assistance Program • Creek Stewards Project

Alaska Department of Fish and Game • Habitat Use of Amphibians in Southeast Alaska

Chatham School District • Nature Studies in Gustavus

City and Borough of Juneau • Outdoor Explorers, Bear Education, JPD Pond

Hugh and Jane Ferguson Foundation • Administrative Capacity

Leighty Foundation • Operating Support

Mt. Roberts Stewards • Mt. Roberts Trail Signs

National Audubon Society • Terrestrial Ecosystems

SB Foundation • Operating Support

SEALTrust • Accretion study

US Fish and Wildlife Service • Avian & Invertebrate Research in the Mendenhall Wetlands

US Forest Service • Teacher Bear Expedition, Repeat Photography Project

Business/organization sponsors

We're grateful to the following businesses for their contributions

Discovery Circle (\$2,500 and above)

Alaska Discovery
Barrett Professional Building, LLC
Celebrity Cruises
Cellular One

Falkner Banfield PC
Goldbelt Tours
Royal Caribbean International

Naturalists Circle (\$1,000 to \$2,499)
Juneau Emergency Medical Associates
Mt. Roberts Tramway

Honors Circle (\$500-\$999)
Alaska Fly 'n' Fish Charters
Anchor Electric
Cha's Gallery
Coast Guard Women's Association
Gustavus Inn
Lynn Canal Conservation, Inc.
Mark Kelley Books and Calendars
NorthStar Trekking
Wm. Spear Design
Tongass Maritime LLC/"Tongacell"

Contributors Circle (\$250-\$499)
Alaska Ship Chandlers
Alaska Sport Shop
Auke Bay Landing Craft Services
Coeur Alaska
Cross Sound Express – M/V Taz
Foggy Mountain Shop
Glacier Pediatrics
Gustavus Inn
Howser's IGA Supermarket
Kennecott Greens Creek Mining Co.
The McDowell Group
Rainbow Foods
Rent-A-Wreck
Sockeye Cycle Company
Wells Fargo Bank
Wings of Alaska

Friends of Discovery (up to \$250)
Admiralty Island Wilderness
Homestead
Air Excursions
AJ Mine-Gastineau Mill Enterprises
Alaska Marine Highway System
Alaska Natural History Association
Alaska Nature Tours, Haines
Association for the Education of Young Children
Bear Creek Outfitters
Captain's Choice Hotel, Haines

Chilkat Cruises, Haines
Chilkat Guides, Haines
Dejon Delights
Driftwood Lodge
Endurance Outdoors
Fjord Air Flying Service
Gastineau Guiding Company/Mt. Roberts Nature Center
The Hangar at the Wharf
Heritage Coffee
JRC/The Alaska Club
Juneau Artists Gallery
Juneau Lions Club
Juneauphotos.com/Pat Costello
Kennecott Greens Creek Mining Co.
Laura Lucas Designs
PEO Sisterhood
Princeton Hall, Ltd.
Rainbow Foods
Simpson Tillinghast
Sorensen&Longenbaugh
Tlingit-Haida Central Council
Wee Fishie Shoppe
Wostmann and Associates

Volunteers and gifts

Discovery Southeast also wishes to thank all who have volunteered time and personal resources for our fundraising events: our annual Dinner and Auction in April and Quick Draw in June, as well as our sales booth at Pubic Market. Special thanks to Karen Mayer and Pete Snyder and Mendenhall Visitor Center naturalists Paulina Russel, Dave Cox and Ryan Brown for enhancing this past summer's Outdoor Explorers program; and to John Horn, Michelle Kissling and Steve Lewis for interpreting our cruise to Tracy Arm last May. Thanks, too, to Susan Phillips, Marge Hermans, Cindy LaVigne, and Julie DeLong for their many hours of administrative assistance, and to Paul Kinslow for donating rollaway racks for storage of our material resources.

Members honor roll

Our thanks to all the great folk who are current members of Discovery Southeast. Your support is fundamental to our capacity to provide the finest nature education programs for Southeast Alaskans. Not represented here are anonymous gifts and the many additional gifts made above and beyond membership dues by so many of you. These extra contributions are essential and we greatly appreciate your commitment. We couldn't do it without you!

Benefactor (\$500-\$1500): John Day and Tessa Muehlehner • Michael and Dee Ann Grummett • Dave Haas and Mary Ellen Arvold • Nate and Liz Johnson • Bill Shattenberg • Barbara Sheinberg and Norman Cohen

Sustaining (\$250-\$500): J Michael Blackwell • Laura L. Carstensen • Cathy Connor and Rod Flynn • Margorie C. Hermans • Lynn Humphrey and Peter Van Tamelen • Glenda and Bob Hutton • Marie Larsen and Larry Holland • Hank Lentfer and Anya Maier • John and Judy Neary • Julie and Edward Sinclair • Mike Stanley and Natalee Rothaus • Greg Streveler and Judy Brakel • Scot and Alice Tiernan • Alex and Peggy Wertheimer

Sponsoring (\$100-\$250): Aaron Angel • Bob Armstrong • Jack and Margie Beedle • Kara Berg and Michael Nigro • Laurie Berg and John Connally • Elizabeth M. Bishop • Nathan Borson • Ken and Sherri Brown • Scott Brylinsky • Annie Calkins and Dave Hunsaker • Greg and Tamara Cook • Peggy Cowan and Dick Wood • Bob Cross • Margaret Dowling and Jim Thompson • Maria Gladziszewski and Eric Kueffner • Clay Good and Claire Fordyce • Paul Grant and Susan Phillips • John Greely and Marla Berg • Kathy and Tom Hanna • Mary Claire Harris • Debbie Hart • Beverly Haywood • Stephanie Hoag and John Staub • Phil and Gail Hocker • Patricia Hull and Skip Gray • Connie Keithahn and Mike Rawson • Tina Kobayashi and Dick Monkman • Kurt and Christine Kondzela • Geoffrey and Marcelle Larson • Marshall and Lois Lind • Sharron and Cliff Lobaugh • Bobbie Lowden • KJ and Peggy Metcalf • Mark and Esther Millea • Jonathan Mollick • Roman J. Motyka • Peter and Julie Neyhart • Eric Olsen M.D and Vicki Bassett • Reto Strehler & Peggy Murphy • Paul Peyton • Catherine Pohl and Richard Carstensen • Joe and Grace Powers • James Protz • David and Paula Rak • Joyce Sarles • Bob and Elaine Schroeder • Katherine Shaw • Michael and Flora Sigler • Jeff and Susan Sloss • William W. and Janet Smoker • Dick and Jane Stokes • Paul Suchanek • Van Sundberg and Tracey Miller • Mary-Claire Tarlow-Bernstein • Christine and Donald Thomas • Sandy Warner • Jetta Whittaker and Rob Steedle

Contributing (\$50-\$100): David and Cindy Audet • Bob N. Bartholomew and Kaye Kanne • Rai and Susan Behnert • Gretchen Bishop • Tom and Eva Bornstein • E.O and Laura Bracken • Becca Braun and John Caouette • Jim and Terri Calvin • Shirley Campbell • Butch Carber • Annie and Bud Carpeneti • Janice Caulfield and Tom Paul • Judy and Nathaniel Cole • Cristine Crooks and Dean Guaneli • Pam Cure • Logan and Frances Dameron • Connie Desouza • Janene Driscoll and Rusty Yerxa • Pat and Anna Eberhardt • Gregg Erickson • Kenyon Fields • Charles and Marilyn Freymueller • Donald and Marion Gotschall • MJ Grande and Michael Stark • Carol and Michael Griffin • Mary Hakala Ord • Pat Harris • Frank and Jane Homan • David Job and Marinke Van Gelder • Barbara Kelly • Kim Kiefer • James and Mary Lou King • Mark Kjerstad • Theresa Lauterbach • Lisa Lindeman • Craig and Barbara Lindh • Jenny and Pat Malecha • Ronald and Susan Marvin • Mary McDowell and Gordy Williams • Marna and Patrick McGonegal • Mary Alice McKeen and David Ottoson • Dick McKinney • Michael E. McKrill and Lisa Rollin • Jan and Steve McPhetres • Gerald and Linda Miller • Gary Moeller and Mary Bedore • Tim Moore and Nancy Cooperrider • Ruth Mulligan • Jim and Dotty Nelson • Kris and Dave Nemeth • Marie Olson • Tina Pasteris and Arthur Petersen • Nancy Ratner • George and Jean Rogers • Kristen Romanoff and Andy Romanoff • Bill Roodenburg • Linda Rosenthal • Ed Schoenfeld and Betsy Longenbaugh • Bea Shepard • John Sisk and Mary Pat Schilly • Carin Smolin and Jon Heifetz • Ritchie Sonner and Greg Pease • Reed Stoops and Betsy Brenneman • Saralyn Tabachnick and Peggy Brown • Debbie and Jon Tillinghast • Linda Whitman • Dick and Lynn Williams • Mark Wipfli • Rick and Wanda Wright •

Member (\$30-\$50): Becky Achten • Henry Akiyama • Stephanie Allison • Kara Altman and Martin Palmer • Lupita Alvarez and Bruce Botelho • Eleanor Anderson • Mary Ellen Anderson • Alex Andrews • Diane and Ron Antaya • Bruce and June Baker • Suzanne Baker • Kristie and Scott Balovich • Paul Barnes • Kymm Benson • Paul Berry • Lisa Blacher • Karen Blejwas • Joyanne Bloom • Koren and Robert Bosworth • Cathy Botelho and John Clark • Cydney Boyer • Karen Brian • Lorinda Brotherton • Tracy Buck • Richelle and Grant Burns • Ellen Carey-Starr and Scott Carey • Marylee Cassell • Diane Cathcart and Jamison Paul • Eleanor W Chapman • Brown/ Conerton Family • Jeannie Conneen • Sioux and Paul Douglas • Sheila Dyer • Cherry Eckland • Kathy Fagerstrom • George and Bobbi Figdor • Jean Findley • Sharon Fisher • Michael F. and Gail Ford • Christopher and Jeanette Francis • Anne Fuller and Mike Sakarias • Marcy and Al Gillie • Jane and Jay Ginter • Susan and Jim Goes • Richard Gordon • Suzy Greeley • Sudie Hargis • Sarah A. Isto and Gordon Harrison • Anissa and Michael Jackson • Bob Janes and Dawn Wolfe • Pam Johansen • Gennifer Johnson • Anjela Johnston • Suzanne Johnston • Chuck and Alice Johnstone • Gretchen Keiser • Molly Kemp and Nick Olmsted • William T Kenyon • Mun Chin Killeen • Anne Kincheloe • Wayne and Barbara Kinnen • Steve Krall and Cindy Boesser • Steven & Tonia Kramp • Cindi Lagoudakis • Elizabeth Landen • Patrick and Edna Leamer • Jamie Letterman • Brandon Loomis • Cheryl Loudermilk • Jon and Lesley Lyman • Rich and Joy Lyon • Liz Marantz and Mike Falvey • Rebecca Mass • Jill Matheson • Tracey Maxwell • Kathrin McCarthy • Tom and Ali McKenna • Ted and Doreen Merrell • Valerie Mertz • Raandi Miller • Jeannie Monk and Tim Blust • Terri Myskowski • Barbara Neal • John and Julie Norton • Kathy Obersinner • Kay Parker • Corey Pavitt • Tina Peckham • Beth and Grey Pendleton • Bill Platte and Mary Bardone • Susan Pollard • Stacy Poulson • Alice Jane Rarig • Catherine Reardon • Jan A. Rutherford and Jeffrey Bush • Jill Sandleben • Jay Satterfield and Lisa Oberle • Philip Schempf and Janet Hall Schempf • Jerry and Laurie Schoenberger • Mark Schwan and Debi Ballam • Stephanie K. Scott • Betty Seguin • Ellie and Lewis Sharman • Mary Anne Slemmons and Jim Baldwin • Marsha and Steve Squires • Cinda Stanek and Fred Hiltner • Rachel Stauffer • Philip & Jackie Stewart • Mary Sweeney • Chuck Taylor • Curt Terrall • Linda Vallie • Rene and David Walker • Patty Ware • Kristina Welzin • Freda Westman • Jeff White • Dottie Whitehead • Valerie Williams • Sara Willson • Marjorie Wyland-Schmiege

Friend (Up to \$30): Elias Antaya • Norman and Patricia Blank • Kristi and Eric Buerger • Marlene Clarke • Jai Crapella • Jim Douglas and Dixie Alms • John Hudson and Kim Frangos • Laura and Kenneth Imamura • Joyce Levine • Mary C. MacNaughton and Susan Haymes • Mary and Jack Manning • Ke Mell • Tony and Linda Newman • Bobbie Rice • Herman and Paula Savikko • Sally Smith • Tony Soltys • Ron and Linda Torgerson

Discovery Southeast
PO Box 21867
Juneau AK 99802

Non-Profit Org.
U.S. Postage
PAID
Juneau, AK 99801
Permit No. 91



Printed on recycled paper

Save this date:
*Thursday November 18, 2004
Discovery Members Celebration
Place and time to be announced*

<p>Help support hands-on nature education in Southeast Alaska with your special contribution</p> <p><i>Our mission is to deepen and enrich the connections between people and nature.</i></p> <p><i>Discovery Southeast members receive our quarterly newsletter, Discoveries, discounts on adult-education workshops, and notification of special events.</i></p>	<h2>Contribution and Membership Form</h2> <p><input type="checkbox"/> Yes, I want to support Discovery Southeast. Enclosed is my gift of:</p> <p><input type="checkbox"/> \$30* <input type="checkbox"/> \$50 <input type="checkbox"/> \$100 <input type="checkbox"/> \$250 <input type="checkbox"/> \$500 <input type="checkbox"/> \$1000 <input type="checkbox"/> Other \$</p> <p>* This amount or more entitles you to all of your membership benefits</p> <p>Name: _____</p> <p>Address: _____</p> <p>City/State/zip: _____</p> <p>Telephone: _____ E-mail: _____</p> <p><input type="checkbox"/> My check is enclosed (payable to Discovery Southeast) <input type="checkbox"/> Please bill my <input type="checkbox"/> Visa <input type="checkbox"/> Mastercard</p> <p>Account Number: _____</p> <p>Expiration Date: _____ Sig: _____</p> <p><i>Return to Discovery Southeast, PO Box 21867, Juneau, AK 99802</i></p>
---	---