



The Tributary

The Newsletter of the Western Division of the American Fisheries Society

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President's Hook

By Cleve Steward

"I accept!"

I can't tell you how moved I was to hear these words from Dr. Fred Allendorf, long-time AFS member and recently retired from the faculty at the University of Montana. I've kept tabs on Fred since taking his genetics class in the late 70s (yes, almost 40 years ago), and was delighted when he accepted (with gusto!) our invitation to deliver a keynote address at next year's Western Division meeting in Missoula. As many of you know, Fred suffered a personal tragedy a few years ago when a freakish snow slide destroyed his home and took the life of his beloved wife. I didn't know what to expect when I contacted him recently, but after hearing "I accept!" I knew Fred is doing well, and his friends and colleagues would be happy and inspired. I know I was.

All of us seek inspiration and affirmation that we are "doing the right thing" with our lives. We want to believe that the personal and professional choices we've made and the things we've accomplished have had (or will have) a positive and lasting impact. How you define that impact and how you go about affecting it varies from person to person, but I would guess that it has something to do



with improving the quality of life of the people around us and ensuring that the generations to come are able to enjoy similar benefits. We admire people like Fred, who have overcome so many challenges and accomplished so much in their careers, but we are equally grateful for the contributions of all who have chosen some form of fisheries-related work as a vocation. We all contribute in our own way.

In the two short years I have served as a Western Division officer, I have been inspired by the many individuals who have given so freely of their time and ability to help run this organization. I am humbled by the accomplishments of Jim Bowker, my predecessor as Western Division President, and Hilda Sexauer, who preceded him. I'm also grateful that Brian Missildine, our President-Elect, and Jackie Watson, who was recently elected Vice-President of the Western Division, will follow in our footsteps. Travis Neebling has been our stalwart Secretary-Treasurer these past three years. Travis is dedicated to AFS and incredibly good at what he does, so I expect to see him ascend to the Presidency in the not-too-distant future. I predict a similar trajectory for Tracy Wendt, the editor of this newsletter. Of course, I see [HOOK continued on page 2]

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incredible promise in all our younger AFS members – rising stars all – but I want to single out Jane Sullivan and Zach Klein, the past and current Student Representatives on the Western Division’s Executive Committee. Looking down the road, I am certain that AFS will be in good hands.

Many of you serve or have served in some capacity at the Chapter or Student Subunit level. You are the backbone of the Society. You have not only earned the respect of your peers, but also their gratitude. For the rest of you – if you have time, if you desire to “give back” to your profession, and if you want to have a “positive and lasting” impact, please consider volunteering; AFS needs creative, talented, and dedicated individuals to lead us into the future.

Looking back over what I’ve written, I’m afraid it comes across as a paean to Western Division officers and a plea for your support. I suppose it is. My intent in this article, the first of several Presidents’ Hooks I’ll be writing, is to give you a feel for the passion and vision I share with my fellow officers and fisheries colleagues. In future articles, I will focus on the particulars of my Plan of Work, which hopefully will not only reflect the priorities and initiatives of those that went before me, but also the input I’ve received from many of you. As always, I welcome your feedback and encourage you to reach out to others. AFS is not a static, top-down organization; it is a continually changing professional society comprising diverse backgrounds and points of view. Since it is a direct extension of its members, the Western Division would benefit from your active involvement.

If you contact us, either directly or through your Chapter/Sub-Unit representatives, I promise that your ideas and concerns will be heard by the Western Division leadership and given full consideration as we set a course for the future. One of the ways you can have an immediate impact is to volunteer to sit on one of the standing committees of the Western Division. Please visit the Western Division website (<http://wdafs.org/>) to learn more. There is work to be done, and we count on you for guidance and help.

New WDAFS Student Representative

By Zach Klein



Dear WDAFS members,

I was recently elected the new WDAFS Student Representative, so please let me take this opportunity to introduce myself. My name is Zach Klein and I am currently a PhD student in the laboratory of Dr. Michael Quist at the University of Idaho. My graduate project focuses on addressing a number of knowledge gaps associated with the ecology and management of kokanee. Specifically, my research addresses uncertainty in sampling techniques used for kokanee, interspecific competition between Opossum Shrimp and kokanee, and recruitment dynamics of kokanee in large lentic systems.

I certainly love fisheries research, but I also think involvement in AFS is essential for successful fisheries professionals. To that end, I have served as the Treasurer and Vice-President of the Palouse Unit of AFS. Additionally, I am the co-chair of the Native Fish Committee in the Idaho Chapter of AFS. I strongly believe in the mission of AFS and am eager to act as a liaison between student members of WDAFS and the ExCom.

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One of my primary tasks as WDAFS Student Representative is to help organize the 2017 Student Colloquium. Annual Student Colloquiums are incredibly important and benefit students through networking, workshops, and feedback on research and presentations. I am still in the nascent stages of planning the 2017 Student Colloquium, but hope to include workshops focused on population dynamics and using the R statistical package. Additionally, I would very much like to include some of the new student sub-units to welcome them to our organization. I have some big shoes to fill and hope that I can serve WDAFS and its members well. Please do not hesitate to contact me with any questions, concerns, or suggestions and thank you again for electing me as the 2017 WDAFS Student Representative.

Sincerely,
Zach Klein (klei768@vandals.uidaho.edu)

Did you know AFS offers reduced membership fees for students and early professionals?

Student Member (Max. 7 years)

Must be a student enrolled full-time in an approved educational institution. The maximum allowed time is 7 years, after which membership is automatically changed to Young Professional.

Dues: \$20.00

Young Professional (valid for 5 years after graduation)

If you are a recent graduate, this category is for you! It is valid for five years after graduation. It was designed to give early career professionals Professional membership at a discounted rate. After five years, the membership automatically changes to Professional membership.

Dues: \$40.00

More details available at:
<http://fisheries.org/membership/types-of-membership/#student>

Student Subunit Highlight

Santa-Cruz-Monterey Bay Subunit (SCMBAS)



The Santa Cruz-Monterey Bay Area Subunit (SCMBAS) was founded in October of 2015 by President Katie McElroy and Vice President Dave Fryxell with support from UC Santa Cruz faculty members Joe Merz and Eric Palkovacs. An initial mixer at the Long Marine Lab at UC Santa Cruz recruited 38 members from the university, Southwest Fisheries Science Center, and other local fisheries-oriented groups. In our first year, we held multiple business meetings with guest speakers, fundraised at local businesses, attended the Western Division/California-Nevada Chapter Meeting in Reno, and implemented restoration and education programs. Katie Kobayashi, chair of the SCMBAS restoration committee, sponsored a reach of our major Santa Cruz River, the San Lorenzo, for ongoing stewardship. Outreach Chair, Hayley Nuetzel, won a Western Division small grant for work with local high schools to create awareness on fisheries issues, such as mislabeling of seafood species. We are looking forward to continuing our restoration and education programs and starting a monthly invasive species removal program at Loch Lomond Reservoir in our second year.

The Western Division welcomes four new student subunits this year!

- Brigham Young University – Idaho Subunit
- Eastern Washington University Salish Subunit
- Santa-Cruz-Monterey Bay Subunit
- University of Alaska Fairbanks-Juneau Subunit

Student Focus: How to Get Involved in AFS

By Tracy Wendt and Andrew Carlson

Reprinted from American Fisheries Society Student Subsection of the Education Section

The American Fisheries Society (AFS) is the world's largest and oldest organization dedicated to conserving fisheries resources, advancing fisheries science, and strengthening the fisheries profession. Becoming involved in the AFS is a critical step in fisheries education. It empowers students to develop professional competencies and cultivate relationships with scientists, managers, biologists, and policy makers throughout the world. Involvement in AFS also improves a student's eligibility when applying for AFS-sponsored awards and scholarships.

We encourage AFS students to get actively involved in their professional society, making meaningful contributions to prepare for a rewarding career.

Here's how:

Join the Student Subsection of the Education Section

The Student Subsection of the Education Section (Subsection) is an association of AFS students and young professionals throughout the United States, Canada, and Mexico. Members work closely with the Education Section to improve fisheries education and foster communication among fisheries educators, employers, students, and the public. Joining the Subsection is an important step in fisheries education and employment. Not only will you connect with students and professional throughout the world, you will build leadership skills that will empower you to secure the job of your dreams. Join the Subsection today!

Join a Student Subunit

Many universities with fisheries programs have Student Subunits of the American Fisheries Society. Subunits work to promote fisheries conservation, professional development of members, and public education. In addition, subunits are led by student officers (e.g., President, Vice President, Secretary, Treasurer) – getting involved as a student officer provides an excellent opportunity to develop

leadership skills and to learn about AFS operations and procedures. Talk with your faculty advisor and fellow students about getting involved. As with the Subsection, joining a Subunit will enable you to network with students and professionals and develop critical skills for future employment.



Connect with your state chapter

Many states have an AFS chapter: Check here to find yours: <http://fisheries.org/chapters>. State chapters hold annual meetings at which students can give professional talks and poster presentations, or organize raffles and silent auctions. In addition, students can run for officer positions and join committees. Some state chapters have student-specific positions, such as student liaison or student representative, providing a direct link between subunits and chapters. Students are also often encouraged to write articles for the state chapter newsletter or website, or participate in social media posts. Talk with your university advisor or state chapter representative about getting involved. Engaging in state chapters will benefit all aspiring fisheries professionals.

Connect with your division

Divisions are groupings of state chapters based on geographic region. Divisions also hold annual meetings students can present and participate in. These larger meetings often have student-specific activities such as socials or mentoring sessions which [STUDENT *continued on page 5*]

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may provide opportunities for students to interact directly with fisheries professionals. Divisions may have committees or offices that students can participate in, affording them the opportunity to get to know officers and professionals not just in their state, but throughout their region.

Write

Whether it's original research, popular literature, or a "Student Angle" article in Fisheries, publishing your writing is a phenomenal way to get involved in the AFS. Publications are the currency of science and a gateway to employment. Talk with your faculty advisor and fellow students about ways to get your writing published. And be sure you're subscribed to the Fisheries newsletter for the latest updates in fisheries science and AFS activities:

<http://fisheries.org/newsletter>.

Volunteer

At Annual Meetings of the AFS, including your regional and state meetings, students can assist with registration, event planning, professional presentation judging, and other tasks. And volunteers are generally compensated for their services! Check the AFS website and look for emails from the Student Activities Committee prior to the Annual Meeting for more information.

Other opportunities for involvement

There are many other ways to get involved in AFS:

- Attend AFS, division, and state meetings!
- Start a student subunit!
- Organize subunit events!
- Join a committee at the state, division, or AFS level!
- Run for an officer position!
- Read and write for newsletters!
- Become a reviewer!

Don't forget to send your student subunit updates to westerndivnewsletter@gmail.com by December 8 for inclusion in the next Tributary newsletter!

Subunit Highlight

BYU-Idaho Student Subunit



Darcy McCarrick and Devin Skidmore working on a project comparing diet overlap between brook trout and rainbow trout for student Kayleigh Smith (not shown).

Our Subunit has officially taken off and has enjoyed great success in achieving the goals of the Subunit and the Society. We have appreciated the overwhelming support we have received from the Idaho Chapter, both the Ex-Com and the members of the Chapter. These folks have made the process of getting off the ground easy and enjoyable.

Our current officers are Darcy McCarrick as president, Jason Spillett as vice president, Drew Scott as secretary/treasurer, and Devin Skidmore as program committee chair. Dr. Eric Billman is our faculty advisor.

Over the past quarter, student members have participated in a variety of volunteer opportunities with Idaho Fish and Game Upper Snake Region fish biologists. In addition, a group attended the USFS Fish Identification Training held by Bart Gamett in Mackay, Idaho. To promote both student and community awareness, we hosted a clean-up of a campsite along the banks of Henry's Fork. As we head into the fall semester, we are anxious to keep the momentum going with similar activities and hopefully some guest speakers to keep the excitement for fisheries high.

WDAFS Small Grant Update

Promoting Investment in Fisheries Resources Through Education: Practicing Science-based Fisheries Management in the Classroom

By Haley Nuetzel, University of California, Santa Cruz

As human populations continue to increase, pressure on natural resources has intensified. Fisheries are one highly impacted example, where excessive demand has led to the overexploitation of many wild stocks. While ongoing fisheries research has greatly informed our understanding of stock connectivity and abundance, leading to more effective conservation strategies, this information rarely reaches individuals outside the scientific or fisheries management communities. If the seafood industry is to witness any measurable improvement in the near future, this information needs to become more readily accessible to all seafood consumers. Secondary school classrooms provide an excellent forum to actualize such changes; by utilizing the naturally inquisitive nature of the students to promote scientific dialogues, we can increase awareness and encourage informed decisions that support sustainably sourced seafood.

To this end, we have established a collaboration between our subunit and a local Santa Cruz high school, Harbor High, to bring fisheries science to the classroom. During the school year we performed a series of three activities with both the AP Biology and Biology classes (involving ~200 students), including: 1) an investigation of DNA barcoding and seafood fraud, 2) a comparative anatomy dissection with a focus on determining reproductive state to assess sustainability, and 3) an interactive exploration of life history and artificial selection due to fishing pressure. All of the activities were designed to be cohesive with the course curriculum, and related topics recently discussed in the classroom to fisheries science.

Additionally, we performed a seafood fraud study with the AP Biology and ROP Biotechnology students, building upon the first DNA barcoding activity. The AP Biology students visited markets and restaurants in the Santa Cruz area and collected various seafood samples. The ROP Biotechnology students then



Students in the AP Biology and Biology classes practice DNA sequence alignment principles to identify unknown samples as part of the DNA Barcoding activity.

extracted DNA from these samples and amplified the CO1 gene region. Successfully amplified samples were sent to the UC Berkeley Sequencing Core Facility for sequencing. Students from both classes then used NCBI BLAST to identify the species and assess labeling accuracy for each sample. Although our sample size for this pilot study was small and somewhat biased towards “imitation crab,” the markets and restaurants in Santa Cruz performed remarkably well. We found no mislabeled samples; however, one sample labeled as “tuna” was identified as Southern bluefin tuna, which is concerning given that Southern bluefin tuna is listed as critically endangered by the ICUN.

Our presence at Harbor High, as representatives of UC Santa Cruz and the American Fisheries Society, would not have been possible without the support of the WDAFS Small Project Grants Opportunity. This project allowed us to increase accessibility and interest in fisheries science within our local community and led to stimulating discussions of existing regulatory frameworks, as well as individual and community-driven actions that will increase seafood sustainability. We are already planning a [SMALL GRANT *continued on page 7*]

[SMALL GRANT *continued from page 6*]
seafood fraud study with Harbor High for the upcoming school year, increasing the scale to reflect a greater diversity of species and seafood venues. Furthermore, news of our collaboration has reached many other teachers at Harbor High and additional local high schools, leading to plans to expand our project. Ultimately, this project helped us realize our overall goal of utilizing science to promote stewardship for marine and freshwater resources.



Students, acting as NOAA affiliates and fisheries scientists, report on the number of fish remaining after each fishing season. The scientists also used size-fecundity relationships to estimate how many eggs could be produced by the remaining stock, extrapolating effects of fishing pressure to future productivity



Students race to “catch” as many fish as possible at the opening of the season as part of the Life History activity.



INTERNATIONAL
TROUT CONGRESS

**Emerson Center for the Arts and
Culture
October 2-6, 2016
Bozeman Montana.**

**REGISTRATION IS
OPEN!**

<http://troutcongress.org/>

Want to help?

There are a number of ways you can help to make the Congress a success. Consider volunteering to help with the event. We'll need lots of help pulling together the various parts of the Congress before and during the meeting. Contact us at troutcongress@gmail.com and we'll send you a link to some of the things where we need your help.



Robert T. Lackey Named Fellow of the American Fisheries Society



Dr. Robert T. Lackey was named a Fellow of the American Fisheries Society (AFS) at the society's 146th Annual Meeting in Kansas City, Missouri. Fellows of the American Fisheries Society are individuals who have made outstanding

contributions to the diversity of fields that are included in the American Fisheries Society. Career contributions may include, but are not restricted to, accomplishments in leadership, research, teaching and mentoring, fisheries resource management and/or conservation, and outreach or interaction with the public.

Lackey, currently a fisheries professor at Oregon State University and a 52 year AFS member has

worked on an assortment of natural resource issues from various positions in government and academia. Most recently, he retired after 27 years with the Environmental Protection Agency's national research laboratory in Corvallis, Oregon, where he served as Deputy Director, Associate Director for Science, and in other senior leadership positions.

Throughout his career, his professional assignments involved diverse aspects of natural resource management, but mostly he has operated at the interface between science and policy. He has published over 100 articles in scientific and professional journals. Dr. Lackey has long been an educator, having taught at five North American universities and currently teaches a graduate course in ecological and natural resource policy at Oregon State University.

Scott Bonar Elected AFS Second-Vice President



Dr. Scott Bonar's election as second vice president of AFS was officially announced at the AFS Annual meeting in Kansas City. Dr. Bonar served as WDAFS president in 2008-2009, president of the Introduced Fish Section, and chair of the Standard Sampling Committee in the Fisheries Management Section. Bonar has been a Western fisheries biologist or fisheries student for over 30 years. He received his Ph.D. at the Washington Cooperative Fish and Wildlife Research Unit at the University of Washington and was employed by the Washington Department of Fish and Wildlife for almost 10 years. Following that, he moved to Arizona to study the unique fishes of the Southwest. Bonar will be AFS president in 2020-2021.

"I look forward to working with fisheries biologists in the Society to share our ideas and science to help conserve the wonderful fish communities found across North America."

The WDAFS Tributary needs YOU!

If you have accomplishments, chapter updates, research news, or other information to share with the Division, please email westerndivnewsletter@gmail.com. The Tributary is the quarterly newsletter of the Western Division of the American Fisheries Society.



The 2017 WDAFS Annual meeting will be held in Missoula in conjunction with the Montana Chapter's 50th anniversary. SAVE THE DATE and keep checking the meeting website for updated information: <http://wdmtg.fisheries.org/>

Here's a sneak peek at some of the field trips planned for the 2017 WDAFS meeting in Missoula:

RAFT THE LOCHSA RIVER with Zootown Surfers!

The Lochsa River (Idaho) is one of the best white water rivers in the world. The Lochsa is a designated National Wild and Scenic River, originating on the western slope of The Bitterroot Mountains, far into the wilds of the Clearwater National Forest. Every trip down the Lochsa is a true whitewater experience with many class IV rapids. Zoo Town Surfers have river professionals who will enhance your white-water experience while maintaining the overall safety of your trip.



Tour the ICONIC BLACKFOOT VALLEY

In the past 40 years, the Blackfoot Watershed has become a pioneer landscape, demonstrating the success of collaborative conservation. Join us for a tour starting at the site of the Milltown Dam removal and visit stream restoration projects across various scales and ownerships and private lands protected by conservation easements. We will be joined by representatives from local nonprofit organizations, state agencies and private landowners, all working together to preserve the valley and the Blackfoot River and its tributaries.

FISH Rock Creek

Rock Creek is one of the finest trout streams in Western Montana and contains different species of trout, including cutthroat, rainbow, brown, brook, and bull trout. But it's the legendary salmon fly hatches that make Rock Creek a top-notch fishery, with solid hatches of mayfly and caddis occurring consistently throughout the year. Join an AFS buddy guide on the river for a day of fishing.

Flathead Lake Biological Station Facility, SCIENCE AND BOAT TOUR

The Flathead Lake Biological Station at the University of Montana is an ecological research and education center on Flathead lake in the Rocky Mountains. For over 100 years, they have conducted courses and led limnological research focused on the Crown of the Continent ecosystem. This trip includes a tour of the biological station and a boat ride on Flathead Lake.

BISON RANGE Tour and Wildlife Viewing

The National Bison Range is one of the oldest wildlife refuges in the nation and is a great place to enjoy wildlife

observations. Wildlife in the Range include bison, elk, white-tail and mule deer, antelope, bighorn sheep, black bear, coyote, and over 200 species of birds, including eagles, hawks, meadowlarks, bluebirds, ducks and geese.

Jocko River Restoration on the FLATHEAD INDIAN RESERVATION AND MISSION TRIBAL WILDERNESS

The Confederated Salish and Kootenai Tribes (CSKT) govern and manage Flathead Indian Reservation resources including water, air, fish, wildlife, and roads. This full-day field trip includes tours and field talks by CSKT Natural Resource staff. Stops will include cutting-edge highway mitigation projects/wildlife crossing structures, river restoration projects, and a discussion on the Mission Mountains Tribal Wilderness.

GLACIAL LAKE Missoula

About 12,000 years ago, the valleys of western Montana lay beneath a lake nearly 2,000 feet deep. Glacial Lake Missoula formed as the Cordilleran Ice Sheet dammed the Clark Fork River just as it entered Idaho. The rising water behind the glacial dam weakened it until water burst through in a catastrophic flood that raced across Idaho, Oregon, and Washington. Over the course of centuries, Glacial Lake Missoula filled and emptied in repeated cycles, leaving its story embedded in the land which will be revealed by in this ½ day field trip.

Digging into a Dilemma – Cook Inlet Razor Clams

By Carol Kerkvliet and Michael Booz

Reprinted from *Oncorhynchus: Newsletter of the Alaska Chapter of AFS, Spring 2016*

centimeters of substrate and are more exposed to

In sandy intertidal beaches of Cook Inlet, Pacific razor clams (*Siliqua patula*) are found in large concentrations along eastern Cook Inlet between the Kasilof and Anchor rivers and along western Cook Inlet from Polly Creek to Crescent River. Cook Inlet's eastern beaches have supported Alaska's largest sport and personal use razor clam fishery, whereas western beaches have supported the state's largest commercial razor clam fishery. But in recent years, razor clams in eastern Cook Inlet have declined substantially, with the razor clam sport and personal use fisheries closed since 2015 from the Kenai River to the tip of the Homer Spit. So what has driven these declines?



To begin, one must first consider general razor clam biology. Razor clams are dioecious with both sexes first maturing at ~80 mm shell length in eastern Cook Inlet. Maximum age in Alaska is 18 years. Growth varies by location with size-at-maturity occurring at age -3 or -4 at Ninilchik compared to age -2 at Clam Gulch. Spawning in eastern Cook Inlet occurs in late July and August with the broadcast of 6–10 million eggs/female clam coinciding with sperm broadcast from males; large females are more fecund. Razor clams in eastern Cook Inlet spawn over multiple years, but might not spawn annually (*McKellar 2014*). Larvae drift from six weeks to over two months before settling to the substrate as juveniles. Juvenile razor clams live in the top few

heavy wave action and changes in temperature and salinity than adults. Mechanisms of razor clam recruitment to eastern Cook Inlet beaches are unknown.

Regulations for east side fisheries have remained fairly consistent since the 1960s. For most years, gear was limited to shovels, rakes, clam guns, or hand digging, and the bag limit was the first 60 razor clams dug. This limit was considered so liberal that many diggers were incapable of achieving the limit (D. Nelson, ADF&G, unpublished report). Razor clams can be dug year round; however, most effort occurs from May through August on tides lower than -2.0 ft.

MONITORING

The Alaska Department of Fish and Game Division of Sport Fish (ADF&G) began managing the razor sport fishery on the east side of Cook Inlet after the 1964 earthquake caused subsidence of Cook Inlet

beaches. Eastern beaches were delineated into six major areas based on beach characteristics and their major access points. Within each area, specific beaches were identified. Razor clam studies focused on fishery management and stock monitoring. Several long term data sets used to monitor fishery and razor clam population trends include: 1) harvest and effort (digger-days) since 1969 for specific beaches in eastern Cook Inlet; 2) the distribution of diggers among specific beaches, assessed through aerial surveys since 1970; 3) since 1969, harvest success (clams per digger-day; CPUE); 4) since 1977, age and length composition of the harvest for most beaches; and 5) since 1989, periodic surveys of the abundances of the estimated mature (≥ 80 mm shell length) and juvenile (< 80 mm) clams on beaches in the Clam Gulch, Oil Pad Access, and Ninilchik areas.



Biologists survey razor clams along eastern Cook Inlet.
Photo from ADF&G.

HARVEST, EFFORT, AND POPULATION TRENDS, 1969–2008

Fisheries on eastern beaches were historically managed in unison with blanket regulations for all beaches. Total harvest and effort peaked in the mid-1990s, before steadily declining. Harvest success, was relatively stable during 1969–2001, averaging 29 clams/digger-day, then declined to 18 clams/digger-day during 2002–2008. During 1969–2008, the fishery focused on the Clam Gulch and Ninilchik areas. Clam Gulch accounted for 46% of harvest and 54% of effort from east side beaches during 1969–1984. But due to availability of larger clams and more abundant large clams, harvest and effort shifted in the 1980s to Ninilchik, which accounted for 54% of harvest and 49% of effort during 1985–2008. In general, a broad range of ages was present in the areas. The annual razor clam harvest was comprised of 8–12 age classes (broods) among areas. Annual age-length compositions for beaches within areas suggested the fisheries were supported by strong recruitment classes (*Szarzi and Hansen 2009*). Both the average and the most prevalent age classes differed among areas, but were in the range of 4–6 years for most areas.

Following the harvest and effort shift from Clam gulch to Ninilchik, periodic abundance surveys were implemented in 1989 to inform better management. Surveys were designed to estimate the abundance of mature and juvenile razor clams for the beaches with the highest harvest so exploitation could be assessed. Abundance surveys were conducted concurrently with the fishery from May through August. Because a clam smaller than 20-mm in shell length is difficult to detect during these surveys, juvenile razor clams were considered to be underestimated. For the Clam Gulch area, annual abundance ranged from 2.9 to 10.0 million mature razor clams with a harvest rate $\leq 10\%$ based on four surveys conducted during 1989–2008. For the Ninilchik area, abundance ranged from 750,000 to 3.6 million mature razor clams for the seven surveys conducted during 1990–2005. For some years, exploitation exceeded 25%, which caused concern because it exceeded the harvest rate

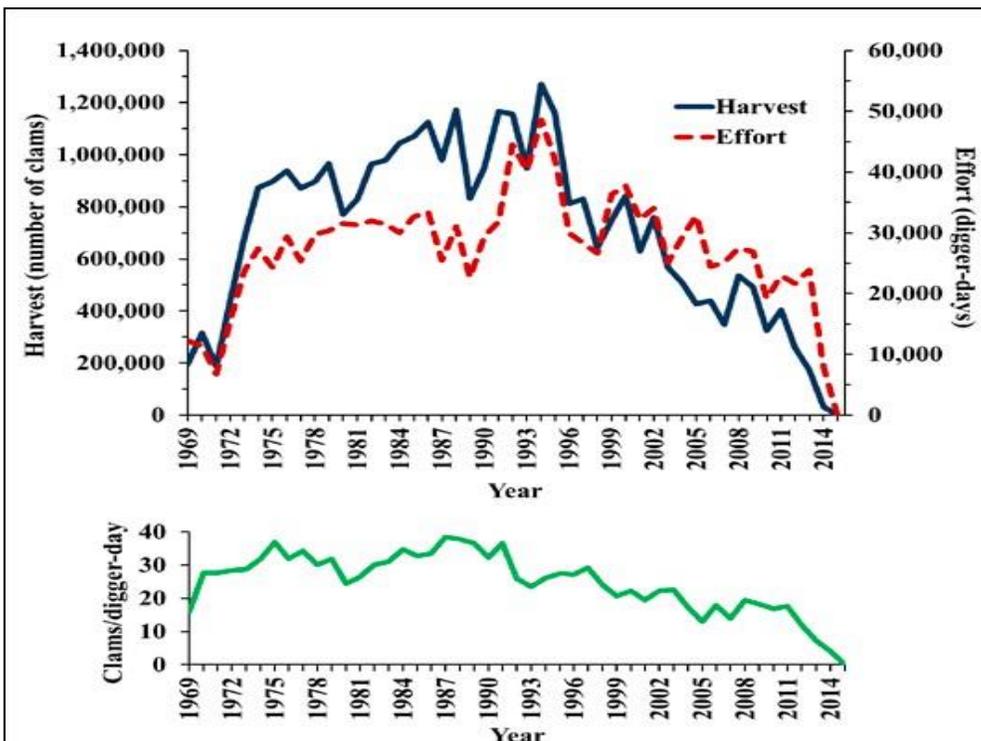
estimated as “sustainable for Washington State razor clam fisheries (Szarzi et al. 2010).

HARVEST, EFFORT AND POPULATION TRENDS, 2009-PRESENT

The strategy of managing east side fisheries in unison continued through 2012, but was refined when declines in productivity were observed. East side harvest and effort continued to decline from 2009 to 2014, and the fishery has been closed since 2015. While the fishery was open during 2009-2014, CPUE averaged 13 razor clams/digger-day, but reached a low of four razor clams/digger-day in 2014. During 2009-2013, digging continued to focus on Ninilchik, which accounted for 64% of the harvest and 51% of the effort. Closure of the Ninilchik beaches in 2014 resulted in a shift of harvest to other areas, with Deep Creek supporting the greatest percentage (33%) of the annual harvest and effort.

conducted in 2009 or 2010, but resumed in 2011 after a large die-off of razor clams was observed in November 2010 on the Ninilchik beaches. The die-off likely resulted when surf from a large storm displaced clams from the substrate. Razor clams observed in the die-off were primarily age-2 and had likely reached maturity and spawned the previous summer.

The 2011 abundance survey, involving collaboration among ADF&G and Alaska Pacific University (APU) marine biology researchers, occurred in April and May prior to months when most harvesting occurs. This survey produced separate abundance estimates for the Ninilchik North and South beaches. To facilitate comparisons among data sets, historical abundance estimates were reanalyzed and standardized to produce separate estimates for the Ninilchik North and South beaches instead of simply by the Ninilchik



Annual harvest and effort in the recreational/personal use razor clam fishery (top figure) and CPUE (bottom) between the Kasilof and Anchor rivers, 1969–2015. Figure from ADF&G.

Age and length compositions from the six major areas indicated fewer age classes with a shift toward younger clams. Abundance surveys were not

area. This reanalysis involved using more refined digger distribution data from the aerial survey to estimate exploitation by beach section. Results from the 2011 abundance survey revealed high abundances of mature razor clams on both beaches despite the die-off. The abundance of 1.2 million mature clams at Ninilchik North was the third highest on record with a harvest rate of 16%. The abundance of 1.6 million mature clams on Ninilchik South was a record high with a low 6% exploitation. However, most of the clams were represented by a single age class. This concern triggered continued

collaboration with APU to survey Ninilchik South annually and continue surveys of Clam Gulch South and North (surveyed in 2014 and 2015), Ninilchik North (2015), and Oil Pad Access North (2015).

In 2012, to better assess the status of east side Cook Inlet razor clams, we focused on Ninilchik South. Surveys were refined to estimate abundance by age class so natural mortality and recruitment could be better assessed. The 2012 abundance estimate was 600,000 mature clams, representing 1.1 million fewer mature razor clams than in 2011, and harvest accounted for 98,000 clams (16% exploitation), but the survey and harvest were again comprised primarily of a single age class with little recruitment evident. Concerns continued during 2013–2015 when mature razor clam abundances reached historic lows of 66,000–90,000. Natural mortality varied annually by brood year, was generally highest for older clams, but was consistently high at 45%–80%.

Reduced abundances of mature-sized razor clams were also observed at Clam Gulch North and South in 2014 and 2015, Ninilchik North in 2015, and Oil Pad Access North in 2015. During these years, abundances were 90% below historical averages. From 2014 to 2015, preliminary estimates of natural mortality of mature razor clams at Clam Gulch ranged between 68% and 78%.

Reanalyzing historical abundance data to assess recruitment had limitations, but highlighted that recruitment is highly variable among beaches and years. Generally, Clam Gulch beaches had more consistent recruitment while Ninilchik beaches were more variable. Periodic and imprecise assessments limited detection of major recruitment events to Ninilchik beaches despite observations of select age classes in the harvest age composition as cohorts recruited to the fishery. To assess recruitment to the beach and fishery, a brood year was assigned to age composition samples and then applied to the corresponding harvest for each Ninilchik beach. Results highlighted that annual harvests at Ninilchik beaches were supported by broods that recruited to the fishery every 2–4 years. This pattern continued from the early 1980s through the mid-2000s.

In 2013, an EO reduced the bag and possession limit for all east side beaches. Despite the limit reduction, exploitation reached a record 57% on Ninilchik South. Since 2014, the east side razor clams fishery has been progressively restricted, with all beaches closed by EO in 2015. The causes for poor recruitment to the beaches are unknown, but are thought to be related to poor spawning and/or settling success. The causes for the high rate of natural mortality may include winter storms like the one observed in 2010, predation, and other unknown factors. The department will continue to track razor clam population trends annually on east side beaches by collecting age-length data on beaches within the six areas and estimating abundances on selected beaches.

The authors work for the Alaska Department of Fish and Game Division of Sport Fish in Homer managing Lower Cook Inlet Area sport fisheries. Carol Kerkvliet is the Assistant Area Biologist and Mike Booz is a fisheries biologist.

Important Dates and Deadlines

2016

October 2-6

1st International Trout Congress, Bozeman, MT
Conversations to Promote a Global Trout Conservation Network. Volunteers needed! For more information, visit www.troutcongress.org.

2017

May 22-25

WDAFS Annual Meeting – Missoula, MT

Save the date! More information is available at <http://wdmtg.fisheries.org/>

August 20-24

AFS Annual Meeting – Tampa, FL

Details to come – watch www.fisheries.org for updates.