Special Publication No. 15-14

Summary of the 2013 Interagency Crab Research Meeting Held December 11–12, 2013

by

Joel Webb

April 2015

Alaska Department of Fish and Game **Divisions of Sport Fish and Commercial Fisheries**

Symbols and Abbreviations

The following symbols and abbreviations, and others approved for the Système International d'Unités (SI), are used without definition in the following reports by the Divisions of Sport Fish and of Commercial Fisheries: Fishery Manuscripts, Fishery Data Series Reports, Fishery Management Reports, and Special Publications. All others, including deviations from definitions listed below, are noted in the text at first mention, as well as in the titles or footnotes of tables, and in figure or figure captions.

Weights and measures (metric)

centimeter	cm
deciliter	dL
gram	g
hectare	ha
kilogram	kg
kilometer	km
liter	L
meter	m
milliliter	mL
millimeter	mm

Weights and measures (English)

cubic feet per second	ft^3/s
foot	ft
gallon	gal
inch	in
mile	mi
nautical mile	nmi
ounce	oz
pound	lb
quart	qt
yard	yd

Time and temperature

day	d
degrees Celsius	°C
degrees Fahrenheit	°F
degrees kelvin	K
hour	h
minute	min
second	s

Physics and chemistry

all atomic symbols	
alternating current	AC
ampere	A
calorie	cal
direct current	DC
hertz	Hz
horsepower	hp
hydrogen ion activity (negative log of)	pH
parts per million	ppm
parts per thousand	ppt, ‰
volts	V
watts	W

General

Alaska Administrative Code	AAC
all commonly accepted abbreviations	e.g., Mr., Mrs., AM, PM, etc.
all commonly accepted professional titles	e.g., Dr., Ph.D., R.N., etc.
at	@
compass directions:	
east	E
north	N
south	S
west	W
copyright	©
corporate suffixes:	
Company	Co.
Corporation	Corp.
Incorporated	Inc.
Limited	Ltd.
District of Columbia	D.C.
et alii (and others)	et al.
et cetera (and so forth)	etc.
exempli gratia (for example)	e.g.
Federal Information Code	FIC
id est (that is)	i.e.
latitude or longitude	lat. or long.
monetary symbols (U.S.)	$, ¢
months (tables and figures): first three letters	Jan,...,Dec
registered trademark	®
trademark	™
United States (adjective)	U.S.
United States of America (noun)	USA
U.S.C.	United States Code
U.S. state	use two-letter abbreviations (e.g., AK, WA)

Measures (fisheries)

fork length	FL
mideye-to-fork	MEF
mideye-to-tail-fork	METF
standard length	SL
total length	TL

Mathematics, statistics

all standard mathematical signs, symbols and abbreviations	
alternate hypothesis	H_A
base of natural logarithm	e
catch per unit effort	CPUE
coefficient of variation	CV
common test statistics	(F, t, χ^2, etc.)
confidence interval	CI
correlation coefficient (multiple)	R
correlation coefficient (simple)	r
covariance	cov
degree (angular)	°
degrees of freedom	df
expected value	E
greater than	>
greater than or equal to	≥
harvest per unit effort	HPUE
less than	<
less than or equal to	≤
logarithm (natural)	ln
logarithm (base 10)	log
logarithm (specify base)	$\log_2$, etc.
minute (angular)	'
not significant	NS
null hypothesis	H_O
percent	%
probability	P
probability of a type I error (rejection of the null hypothesis when true)	α
probability of a type II error (acceptance of the null hypothesis when false)	β
second (angular)	"
standard deviation	SD
standard error	SE
variance	
population	Var
sample	var

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April 2015

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PURPOSE

This report summarizes the 18th annual interagency crab research meeting, held December 11 and 12, 2013, in Anchorage, Alaska at the Dena'ina Center. The interagency crab meetings began in 1993 and are held annually as prescribed in the *State/Federal Action Plan for Management of Commercial King and Tanner Crab Fisheries* (Revised March, 2006, and available from the authors) an agreement between the National Marine Fisheries Service and the Alaska Department of Fish and Game. One objective of the interagency crab research meeting is the review, development, and prioritization of research priorities. The special topic of the 2013 meeting was direct determination of age in decapod crustaceans. This meeting continued the tradition of providing an informal opportunity for researchers from each of the active crab research centers to present their work on Alaskan crab species among peers.

Key words: Alaska crab research, red king crab, blue king crab, golden king crab, Tanner crab, snow crab, Dungeness crab, spot shrimp, age determination

PARTICIPANTS

The 2013 meeting was attended by approximately 60 participants representing the Alaska Department of Fish and Game (ADF&G), the National Marine Fisheries Service (NMFS), Norton Sound Economic Development Corporation, and the School of Fisheries and Ocean Sciences of the University of Alaska Fairbanks (UAF), and the University of Alaska Southeast (UAS). A list of participants and contact information is included in Appendix 1.

PRELIMINARIES

The meeting was jointly chaired by Chris Siddon and Bob Foy and audiovisual operations were run by Joel Webb. Following introductions and welcoming remarks, the draft agenda (Appendix 2) was adopted without change.

ACKNOWLEDGEMENTS

The authors thank the presenters for providing us with electronic copies of their slide presentations, allowing us to faithfully summarize the material presented. The author of this report accepts responsibility for errors in interpretation.

SUMMARY OF PRESENTATIONS

The order of presentations followed the agenda (Appendix 2) which was organized by the topic session and affiliation of presenters (University of Alaska, ADF&G, and NMFS).

SPECIAL TOPIC: CRUSTACEAN AGE DETERMINATION

Direct age determination in crustaceans is now possible: a novel technique

Raouf Kilada, Biology Department, University of New Brunswick (St. John), Canada

The detection and measurement of annual growth bands preserved in calcified structures underlies the assessment and management of exploited fish and invertebrates populations around the world. However, the estimation of growth, mortality, and other age-structured processes in crustaceans has been severely limited by the apparent absence of permanent growth structures. Here, I review the application of the novel technique for direct age determination in crustaceans. In addition to the study involving northern shrimp and snow crab, the method was applied successfully on other species, such as squat lobster and nylon shrimp in Chile and crayfish in Louisiana. The method has proved applicable in all species that were investigated. In the method, the detection of annual growth bands in calcified regions of two body structures in crustaceans was confirmed, thus providing a direct method of age determination. Comparison of growth band counts with reliable, independent measures of age indicates that the bands form annually and provide an accurate indicator of age in all of the species examined. Chemically labeled growth bands were retained through successive molts, as was one of the two body structures containing the growth bands. Growth band formation was not associated with molting or previously documented lamellae in the endocuticle. Sex-specific growth curves were readily developed from growth band examination in multiple species, suggesting that routine measurement of growth and mortality in decapod crustaceans should now be possible.

CONTRIBUTED TALKS

Sea otter impacts on shellfish in southern Southeast Alaska

Ginny Eckert[1], Sean Larson[1], Zac Hoyt[1], Verena Gill[2], Sunny Rice[1]

[1] School of Fisheries and Ocean Sciences, University of Alaska Fairbanks, Juneau, Alaska
[2] U.S. Fish and Wildlife Service, Anchorage, Alaska

Fisheries for Dungeness crab, red sea urchin, geoduck clam, and California sea urchin in Southeast Alaska are worth in excess of $15 million annually. Sea otter populations disappeared from Southeast Alaska by the early 1900s due to fur harvest but were reintroduced to Southeast Alaska in the 1960s. Range expansion and dramatic increases in abundance of sea otters since the 1980s may be associated with declines in the abundance and harvest of other commercially valuable species. Sea otter impacts were evaluated using time-series data on sea cucumber density, Dungeness crab commercial catch, and by direct observations of sea otter foraging. Sea cucumber density in Southeast Alaska was higher before than after occupation by sea otters, and there was a dramatic decrease in cucumber density with increasing time of sea otter occupation. Commercial harvests of Dungeness crab by district decreased conincident with occupation by sea otters. Foraging data showed higher consumption rates of Dungeness crab and red sea urchins in areas recently occupied by sea otters versus those that have been occupied for longer periods of time, suggesting that sea otters may preferentially target these species. Tagging and tracking movement of male and female otters suggested that movements were largely localized but that several otters also moved longer distances to new locations to forage a pattern which may facilitate range expansion. Increased legal harvest of sea otters by native Alaskans since 2010 may help decrease the population growth rate and mitigate impacts of sea otter predation on commercially valuable invertebrates.

Variability in settlement timing and abundance of juvenile red king crab (*Paralithodes camtschaticus*)

Christy Howard, School of Fisheries and Ocean Sciences, University of Alaska Fairbanks, Juneau, Alaska

Harvest of red king crab in Southeast Alaska has remained at low levels despite repeated fishery closures. High levels of mortality during the early life history stages are a potential bottleneck, limiting the ability of populations to increase in abundance. This hypothesis was investigated by quantifying juvenile abundance and habitat by transects in the intertidal area and examining variability in settlement timing and numbers of settled juveniles using larval collectors deployed in the water column. At two sites in Auke Bay most juvenile red king crab were found in heterogenous rocky substrates and juvenile abundance was much higher in 2010 than 2013. The timing of settlement by postlarvae was similar but interannual differences in settler abundance were observed among the three years sampled. Interannual variability in settler and juvenile abundance indicate that recruitment variability may have play a role fluctuations in stock abundance.

Updates from the Tamone Crab Lab: from Bering Sea snow crabs to Southeast Alaska spot prawns

Sherry Tamone, University of Alaska Southeast, Biology Department, Juneau, Alaska

Projects in the Tamone lab included further work on terminal molt in the *Chionoecetes*, male *Chionoecetes* reproductive biology, and growth and reproduction of spot prawns. Adolescent male Tanner crab were held through moltin; some completed the terminal molt while others molted to but remained adolescent. Hormone characterization indicated that while ecdysone levels were similar between groups, methyl farnesoate likely functions as a juvenile hormone with decreased levels associated with terminal molt. Patterns of genetic stock identification (GSI) show a linear decrease in GSI from small to large body size for adult male snow crab and much higher GSI at size for oldshell versus newshell male snow crab at small but not at large body size. These patterns may have implications for male mating dynamics and maturity. There is lack of knowledge of the reproductive biology of spot prawns, *Pandalus platyceros*, a commercially important species with a protandric sequential hermaphrodite life history in Southeast Alaska. Male and female spot prawns were held captive through molting and larval release. Embryos hatched at night and approximately 10 days was required to complete hatching. High circulating vitellogenin levels were measured for transitional (male to female) and female shrimp, indicating that ovaries were maturing in both of these groups (i.e., lack of semelparity). All shrimp identified as transitional molted to females.

Temperature and zombie crabs: temperatures effects on the larval development of a king crab parasite

Leah Sloan and Sarah Hardy, School of Fisheries and Ocean Sciences, University of Alaska Fairbanks, Fairbanks, Alaska

The rhizocephalan barnacle, *Briarosaccus callosus*, parasitizes all the king crab species in Alaska resulting in their castration. The prevalence of parasitization is higher among king crab stocks in the Gulf of Alaska than the eastern Bering Sea, a pattern that may be associated with differences and temperatures necessary for successful larval development of the parasite. To investigate the relationship between larval development of *Briarosaccus* and temperature, parasitized female red king crab were collected in Southeast Alaska and held in the lab until larval release by the parasite. Larvae (naupliae) were reared at five discrete temperatures ranging from 0 to 16 °C. Preliminary results suggested that

larval survival increased with decreasing temperature. Larval rearing experiments will continue with the further objective of producing the cyprid larvae to investigate how the parasite infects king crab.

Interannual variability in modeled larval transport and environmental conditions for eastern Bering Sea Tanner crab

Jon Richar and G. H. Kruse, School of Fisheries and Ocean Sciences, University of Alaska Fairbanks, Juneau, AK; E. Curchitser, Institute of Marine and Coastal Sciences, Rutgers University, New Brunswick, NJ; and A. J. Hermann, Joint Institute for the Study of the Atmosphere and the Oceans, University of Washington, Seattle, WA

The eastern Bering Sea Tanner crab stock has undergone large fluctuation in abundance likely due to factors affecting survival during the early life history stages. A hydrodynamic model was used to investigate patterns of larval transport and population connectivity for eastern Bering Sea Tanner crab in relation to environmental variability, groundfish abundance, interspecific cannibalism, and benthic habitat. Model results suggested that the probability of larval retention was high in most areas, transport patterns were predominately in a north to northwesterly direction, and that Bristol Bay is unlikely to receive larval subsidies from other areas. Recruitment variability showed little relationship with environmental variability but settlement points were associated with cold near-bottom temperatures. Limited connectivity via larval transport suggests that the current policy of managing the Tanner crab separately as eastern and western stocks is appropriate. Patterns of connectivity and juvenile distribution also suggest that the southern portion of the middle domain of the eastern Bering Sea is a key region for stock productivity.

Spiny king crab in the Bering Strait and Norton Sound

Wes Jones and Kevin Keith, Norton Sound Economic Development Corporation, Nome, Alaska

Spiny king crab (*Paralithodes brevipes*) were first observed in the subsistence crab harvest off Little Diomede Island in 2003 and subsequently at Saint Lawrence Island in 2007. Several additional specimens were observed in commercial and subsistence crab fisheries around Norton Sound in 2011 and 2012. Numerous juvenile and mature male and females were observed at St. Lawrence Island in 2013. These observations indicate that their abundance and distribution may be expanding but there is limited data to evaluate this pattern. The presence of spiny king crab in this region raises a number of questions including the impact of this species on other king crabs, their range expansion, and the need for planning/development regarding knowledge and management of this new species.

Video based habitat examination: how to make a GoPro useful for more than inflating one's ego

Quinn Smith, Alaska Department of Fish and Game, Douglas, Alaska

The fishery for spot shrimp in Tenakee Inlet, Southeast Alaska, declined, but factors contributing to this decline are unknown, and unknown movement or habitat variables could influence the ability of the fishery-independent pot survey to detect changes in the population. A system to gather video of habitat at surveyed locations was constructed on a minimal budget of less than $1000. The video system consisted of a Go Pro©[1] video camera and waterproof housing combined with paired high intensity dive lamps, and was placed in a Dungeness crab pot. Adjustments to improve performance included placing milk jugs over the dive lights for greater light diffusion. Video was successfully collected at over 70 sites stratified by historic survey shrimp catches into high, moderate, and low categories. Preliminary

[1] Product names used are included for completeness and do not constitute product endorsement.

results suggest that bottom types identified by the echo sounder as *soft* are actually *harder* than thought and are present in these habitats.

Tanner crab fisheries in Prince William Sound: history and status

Maria Wessel, Alaska Department of Fish and Game, Cordova, Alaska

Tanner crab harvests peaked in 1973 prior to the implementation of management measures, and harvest—and presumably abundance—dropped to very low levels in the early 1980s. Subsequent fishery openings in the late 1980s had low yields, and the commercial fishery for Tanner crab in Prince William Sound has remained closed since 1989. A subsistence fishery for Tanner crab remains open with measures to reduce both effort and harvest relative to historical regulations. Subsistence harvests increased sharply in 2012/13 with most of the harvest taken in waters near Cordova. Tanner crab stocks in Prince William Sound are monitored by a biennial trawl survey. The trawl survey estimate of total male abundance increased nearly fourfold in 2013 relative to 2011 and is the highest estimate observed since the survey was implemented in 1990. The survey indicated high abundance of crab with a current carapace width of less than 50 mm, which may indicate strong recruitment to the stock in recent years. A fishery management need is to establish threshold abundance levels for opening the commercial fishery.

Kodiak lab update: survey and ocean acidification

Robert Foy, National Marine Fisheries Service, Kodiak Laboratory, Kodiak, AK

The eastern Bering Sea trawl survey was conducted from June to August 2013. Bottom temperature conditions were warmer on average relative to 2012. This survey is the primary data source for the abundance and distribution of commercially important crabs and data were collected for each species. Cooperative research for eastern Bering Sea crab stocks included trawl survey selectivity experiments, trawling of nearshore stations to form a recruitment index, and estimation of handling mortality for snow crab. The impact of varying pH levels on the cuticle and on embryo hatching success was also evaluated experimentally. Both hatching success and cuticle calcium content decreased significantly under the most acidified conditions tested (pH 7.5). Additional collaborative experiments also assessed the effect of ocean acidification on cuticle hardness and cellular calcium processes for red and blue king crab.

Kodiak lab research update: species interactions, aquaculture, and proposals

Ben Daly, National Marine Fisheries Service, Kodiak, AK

The effect of habitat on predation of juvenile red and blue king crab by larger juvenile red king and blue king was evaluated experimentally. Shell, versus sandy habitat, was optimal for blue king crab survival but less so for red king crab. Blue king crab are cannibalistic but less so than red king crab and availability of shell habitats may be important for survival of juvenile blue king crab in the eastern Bering Sea. An experimental pilot study release of hatchery-produced juvenile red king crab into the wild was also conducted to examine survival rates. Five thousand juvenile crab were released by divers but the government shutdown interrupted postrelease monitoring. At four weeks postrelease no juvenile king crab were detected by divers at the release site.

Population assessment of snow crab in the Chukchi and Beaufort Seas, first results

Bodil Bluhm, Katrin Iken, and Lauren Divine, University of Alaska Fairbanks, School of Fisheries and Ocean Sciences, Fairbanks, Alaska

Snow crab were collected during multiple surveys between 2008 and 2012 in the Chukchi and Beaufort seas to examine population structure and other parameters. Larger male and female crab were associated

with deeper, warmer water—a pattern that may be due to ontogenetic movement or varying growth rates with prevailing temperature. Very few male snow crab achieved the legal body size used for harvest in the Bering Sea. Female fecundity was qualitatively similar to that observed in the eastern Bering Sea. Trophic analysis via stomach content and stable isotope analyses showed that prey items and trophic position vary among locations and between sexes in the surveyed areas.

Sperm reserves of female snow and Tanner crabs in the eastern Bering Sea: status update and preliminary conclusions

Laura Stichert, Alaska Department of Fish and Game, Division of Commercial Fisheries, Kodiak, Alaska

Snow and Tanner crabs have been collected annually since 2007 to characterize female sperm reserves as a direct indicator of female reproductive success for these stocks, which are managed with large, male-only harvest rules. Spatial trends in spermathecal load (SL; wet weight of the contents of the sperm storage organ) were evaluated between areas determined by ontogenetic migration patterns for snow crab and management for Tanner crab. Trends in SL were evaluated from 2007 to 2012 for snow crab, but only in 2012 for Tanner crab. For snow crab, SL decreased with increasing latitude across three areas in the eastern Bering Sea, and females that completed more than one reproductive cycle (multipara) had greater sperm reserves than those that reproduced only once (primipara). Female size appeared to confound spatial trends as female size also decreased with increasing latitude, and SL increased with increasing female body size. There were high proportions of viable eggs in the clutches of both primiparous and multiparous females, indicating high levels of mating success. However, remaining sperm reserves (after fertilization of the existing clutch) for primiparous crab were low and most snow crab would require remating prior to the successful fertilization of subsequent clutches. For Tanner crab evaluated between areas east and west of 166°W longitude based on the harvest strategy, multiparous females had greater SL than primiparous females. Spatial trends for primiparous females showed greater SL in the west than the east in 2012, although size was greater in the east than the west. Multiparous female SL and size were similar between the two areas. The increased SL between primipara and multipara indicates that most snow and Tanner in the eastern Bering Sea remated prior to fertilizing a subsequent clutch. The differences observed in SL between areas underscore the importance of understanding how spatial processes affect snow and Tanner crabs in the eastern Bering Sea, especially regarding male availability and sperm demand.

Demographic effects on female reproductive potential and implications for recruitment of eastern Bering Sea snow crab

Joel Webb, Alaska Department of Fish and Game, Juneau, Alaska

Snow crab, *Chionoecetes opilio*, in the eastern Bering Sea support an important commercial fishery managed with large-male-only harvest and biological reference points determined from mature male biomass. However, mature male biomass may be a poor proxy for female reproductive potential and stock productivity. We developed egg (embryo) production indices that incorporate information on female demography and fecundity into estimates of stock egg production to better inform management decisions. Both male and female indices of abundance were positively correlated with egg production, but stronger association was observed with female versus male indices. Estimates of annual egg production also decreased with the incorporation of detailed demographic and size-fecundity information, inferring up to approximately 50% lower annual egg production than a simple index based on average fecundity. First-time reproducing (primiparous) females frequently occupied waters with bottom temperatures less than 0° C, while females reproducing for the second or more (multiparous)

were primarily found in warmer waters. Efforts to infer the fraction of biennially reproducing females from average conditions based on near-bottom temperatures and fluctuations in abundance were hindered by high variability in the underlying data. A positive relationship between reproductive potential and recruitment, defined as instar vii juveniles (25–33 mm CW), was evident at a lag of 4 yr. This relationship was primarily driven by brood years in the late 1980s and was more robust for indices based on mature females and egg production than those based on males. A decline in stock productivity, ln(R/S), in the early 1990s preceded the dramatic decline in eastern Bering Sea snow crab abundance in the mid to late 1990s with an increasing trend in in stock productivity thereafter.

Choosing an appropriate error model for the GLM: an example from Aleutian Islands golden king crab observer CPUE data

Shareef Siddeek, Alaska Department of Fish and Game, Juneau, Alaska

The generalized linear model was used to standardize observer CPUE data for the Aleutian Islands golden king crab fishery, which is managed as two stocks in the eastern and western Aleutian Islands. Two noninteracting sets of explanatory variables were identified to standardize CPUE data for both stocks using the generalized linear model. The negative binomial model was chosen over the delta model to define the error structure in these data. Observer CPUE postrationalization may be hyperstable and this possibility will be included in stock assessment model scenarios.

Accounting for massive die-offs during the early 1980s in the Bristol Bay red king crab stock assessment model

Jie Zheng, Alaska Department of Fish and Game, Juneau, Alaska

Abundance of the Bristol Bay stock of red king crab decreased dramatically in the early 1980s but the proximate causes of this decline are poorly understood. A length-based synthesis model was used to evaluate alternatively hypotheses for the decline. Hypotheses included directed harvest in the pot fishery, bycatch on nontarget males and females, cannibalism and predation of molting crab, high mortality due to high average age, and disease. A constant natural mortality rate caused the model to fit the data poorly, while higher mortality rates for all sizes and both sexes in the early 1980s improved the fit. Overall, likely causes for the sharp decline in abundance are a combination of factors which are difficult to disentangle with the data currently available.

Examining molt timing and condition of red king crab in Norton Sound using a fall pot survey

Jenefer Bell, Alaska Department of Fish and Game, Nome, Alaska

The timing of male molting is poorly documented for male red king crab in Norton Sound but is thought to occur from August to October. During the summer 2013 commercial fishery molting males were first reported in August with reports continuing into September. A pot survey was implemented in September 2013 to gather further data on male molting to clarify timing relative to the fishing season and potential impacts. A high proportion of sublegal male crab captured during the survey were soft-shell indicating recent molting. Knuckle color and shell hardness appear to have limited utility for assessing molt status.

Westward Region roundup: 2013

Doug Pengilly, Alaska Department of Fish and Game, Kodiak, AK

Two trawl surveys, small- and large-mesh, were conducted by regional staff in 2013. Small Tanner crab were caught in large numbers along the west side of Kodiak Islands during the 2013 large-mesh trawl survey and may indicate formation of a strong year class. Progress continued on a project to characterize

Tanner crab habitat using multibeam sonar and a benthic camera sled. Ultimately this information may be used to stratify trawl survey stations by habitat to improve estimates of Tanner crab abundance. Fishery observers from the ADF&G shellfish observer program deployed 77 times on commercial fishing vessels and collected data from 815 crab fishery landings. Observers also collected data on crab bycatch mortality in cooperation with NMFS. New seawater space was brought online in support of Bering Sea snow and Tanner crab research.

PLANS FOR 2014

The annual Alaskan crab research meetings continue to be productive and valuable for free exchange of scientific results, ideas, and perspectives. A 19th annual meeting is expected to be scheduled for the approximate dates of December 10–12, 2014, in Kodiak, Alaska.

PROPOSALS FOR NEXT YEAR'S SPECIAL TOPIC

1. Effectiveness of slot limits for management of crustacean fisheries
2. Effects of size-selective harvest on crab reproduction and recruitment
3. Ecosystem-based management and application to crab fisheries
4. New developments in harvest strategies for crustacean fisheries

APPENDICES

Appendix A.–List of participants at the 2013 Interagency Crab Research Meeting.

Last Name	First Name	Affiliation	E-mail
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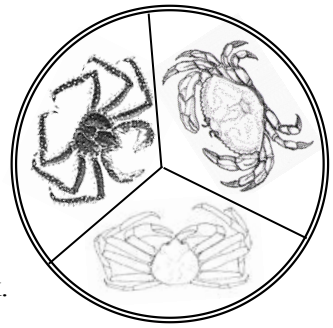
Interagency Crab Research Meeting
December 11th -12th, 2013



All sessions will be held in Tubughnenq' (Tyonek) Room 3 on the second floor of the Dena'ina Center. All talks are scheduled for 20 minutes unless otherwise noted. Affiliations are provided for the presenting author (listed first) of each contributed talk.

WEDNESDAY, DECEMBER 11

Afternoon Session 1:00 PM – 5:00 PM

I. Introductions
II. Opening Remarks: Chris Siddon, Bob Foy
III. Meeting Agenda: Modify and Adopt
IV. Research Review
    A. University of Alaska
        1. Sea otter impacts on shellfish in southern Southeast Alaska – Ginny Eckert, Z. Hoyt, V. Gill, S. Larson, and A. Rice. University of Alaska Fairbanks, Juneau, Alaska
        2. Variability in settlement timing and abundance of juvenile red king crab (*Paralithodes camtschaticus*) – Christy Howard and Ginny Eckert, University of Alaska Fairbanks, Juneau, Alaska
        3. Updates from the Tamone Crab Lab: from Bering Sea snow crabs to Southeast Alaska spot prawns – Sherry Tamone, University of Alaska Southeast, Juneau, Alaska
        4. Temperature and zombie crabs: temperature effects on the larval development of a king crab parasite – Leah Sloan and S. Hardy, University of Alaska Fairbanks, Fairbanks, Alaska

Mid-afternoon Coffee (15 Minutes)

        5. Interannual variability in modeled larval transport and environmental conditions for eastern Bering Sea Tanner crab – Jon Richar, Gordon Kruse, Enrique Curchitser, and Al Hermann, University of Alaska Fairbanks, Juneau, Alaska
    B. Norton Sound Economic Development Corporation
        1. Spiny king crab in the Bering Strait/Norton Sound region – Wes Jones and Kevin Keith, Norton Sound Economic Development Corporation, Unakleet, Alaska
    C. Alaska Department of Fish and Game
        1. Video based habitat examination: how to make a GoPro useful for more than inflating one's ego – Quinn Smith, Alaska Department of Fish and Game, Douglas, Alaska
        2. Tanner crab fisheries in Prince William Sound: history and status – Maria Wessel, Alaska Department of Fish and Game, Cordova, Alaska

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THURSDAY, DECEMBER 12

Morning Coffee 8:00 – 8:30 AM
Morning Session 8:30 AM – 12:00 PM

D. Special Topic Session – Age determination in decapod crustaceans
    1. Direct determination of age in shrimp, lobsters, and crab – Raouf Kilada, University of New Brunswick, St. John, New Brunswick, Canada (45 minutes)
    2. Discussion (15 minutes)

Mid-Morning Coffee (15 minutes)

E. National Marine Fisheries Service (NMFS)
    1. Kodiak lab update: EBS survey and ocean acidification – Bob Foy, NMFS, Alaska Fisheries Science Center, Kodiak Laboratory, Kodiak, Alaska
    2. Kodiak lab research update: species interactions, aquaculture, proposals – Ben Daly, NMFS, Alaska Fisheries Science Center, Kodiak Laboratory, Kodiak, Alaska

F. University of Alaska (Continued)
    1. Population assessment of snow crab, *Chionoecetes opilio*, in the Chukchi and Beaufort seas, first results – Bodil Bluhm, Katrin Iken, and Lauren Divine, University of Alaska Fairbanks, Fairbanks, Alaska

G. Alaska Department of Fish and Game (Continued)
    1. Sperm reserves of female snow (*Chionoecetes opilio*) and Tanner (*C. bairdi*) crabs in the eastern Bering Sea: status update and preliminary conclusions – Laura Stichert, Alaska Department of Fish and Game, Kodiak, Alaska
    2. Investigating the influence of demography and biennial reproduction on reproductive potential and recruitment of eastern Bering Sea snow crab – Joel Webb, Alaska Department of Fish and Game, Juneau, Alaska (25 minutes)

Lunch: 12:00 PM – 1:30 PM

Afternoon Session: 1:30 PM – 5:00 PM

H. Alaska Department of Fish and Game (Continued)
    1. Choosing an appropriate error model for GLM: an example from Aleutian Islands gold king crab observer CPUE data – Shareef Siddeek, Alaska Department of Fish and Game, Juneau, Alaska
    2. Accounting for massive die-offs during the early 1980s in Bristol Bay red king crab assessment model – Jie Zheng, Alaska Department of Fish and Game, Juneau, Alaska (*25 min*.)
    3. Examining molt condition and timing in Norton Sound red king crab using a fall pot survey – Jenefer Bell and Scott Kent, Alaska Department of Fish and Game, Nome, Alaska
    4. 2013 St. Matthew Island blue king crab survey – Overview and preliminary results – Vicki Vanek, Alaska Department of Fish and Game, Kodiak, Alaska

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5. Westward Region update – Doug Pengilly, Alaska Department of Fish and Game, Kodiak, Alaska

V. Crab Research Priorities: Chris Siddon
VI. Next Year's Meeting and Special Topic Suggestions
VII. Other Business

5:00, 5:15, and 5:30 PM – Reservations in groups of ten for dinner at the Glacier Brewhouse.