RC 36

ORGANIZED VILLAGE OF SAXMAN

SAXMAN I.R.A. COUNCIL

ROUTE 2, BOX 2 – SAXMAN, KETCHIKAN, ALASKA 99901 · FAX: (907) 247-2504 · PHONE (907) 247-2502

February 24, 2012

Boards Support Section
Alaska Department of Fish and Game
P.O. Box 115526
Juneau, Alaska 99811-5526

Dear Board of Fish Members,

The Organized Village of Saxman appreciates the opportunity to provide oral testimony and submit written comments on specific Board of Fisheries (BoF) proposals. The Organized Village of Saxman would like to go on record with its disapproval of 2012 Board of Fish Proposal 273.

The Saxman tribal government would like the BoF to know that herring eggs are a significant cultural food for the people of Saxman, and for all Southeast Alaska Villages. Our families used this food source way before we became colonized, and we are accustomed to partake of it for the valuable natural resource it is. Herring eggs will be found at potlatches, memorials, feasts, and any cultural setting with families gathering. We have concerns for stock levels because a once almost endless resource has drastically declined on the Pacific coast leaving us with the only sure herring subsistence fishery in Sitka Sound. If we fail to take heed what occurred with the 2011 Canada commercial herring fisheries and the 1958 Japanese commercial herring fisheries we will jeopardize any future Alaska herring stock fisheries. It is our understanding that the *Amount Necessary for Subsistence* (ANS) originally set by the Board of Fish was 105,000 – [illegible]5,000 pounds. And in 2009, the Board of Fish adjusted the *Amount Necessary for Subsistence* to 136,000 – 227,000 pounds. If overfishing occurs, it will be traumatic. It is threatening to stocks as they exist now.

The proposal to require a permit for subsistence herring eggs on branches in Sitka Sound or alter the harvest monitoring program to measure landed weights does create significant problems. There is uncertainty with this control strategy by the Board of Fish as a viable process in monitoring harvests. The present timeframe for Proposal 273 is on the cusp of a forthcoming herring fishery and will create turmoil for the subsistence herring harvester. The extra work placed upon a crew to take a harvest for weight places the subsistence herring harvester at a disadvantage, time-wise and money-wise. Any strong protection for the subsistence herring harvesters was underscored. We must remind the BoF that our subsistence take of the resources does not diminish the herring resources in Southeast Alaska, for as you know, the statistics indicate subsistence harvest in this industry is only 2% of the entire fisheries.

Our tribal community relies on the herring catch, and any present crisis with the herring fisheries will present frustration over further cultural loss and eroding against a practice we've been doing historically. Our children haven't gone away and the customary traditional harvest for our people is an assurance that we will have viable sources of herring for future generations.

It is economically sensible to stay the course with respect to how past herring fisheries commenced. We stand alongside Sitka Tribe of Alaska in the research data and conclusion they have declared. We agree that subsistence permits to protect commercial interest in a resource would be a major setback for subsistence state-wide.

Sincerely,

Lee Wallace
President

Copy/File: Saxman I.R.A. Council
Sitka Tribe of Alaska

RC 37

ORGANIZED VILLAGE OF SAXMAN
SAXMAN I.R.A. COUNCIL

ROUTE 2, BOX 2 – SAXMAN, KETCHIKAN, ALASKA 99901 · FAX: (907) 247-2504 · PHONE (907) 247-2502

February 24, 2012

Boards Support Section
Alaska Department of Fish and Game
P.O. Box 115526
Juneau, Alaska 99811-5526

Dear Board of Fish Members,

We, the Organized Village of Saxman are deeply troubled about the current management of Sitka Sound Herring, along with all Southeastern Alaska herring stocks. Historically, there were herring stocks up and down the entire west coast of North America. But today, the once robust Pacific herring stocks of Southeast Alaska hasdeclined to the point that the Sitka Sound stock is the last herring stronghold to support a subsistence and commercial fishery. In light of this, we request that the Board of Fisheries members representing all of Southeast Alaska support the following proposals to better manage Sitka Sound herring:

- Proposal 230
- Proposal 231
- Proposal 232
- Proposal 239

We hope that you will agree that these proposals will benefit all of Southeastern Alaskan Herring stocks, while improving the subsistence, commercial, and ecological value of Sitka Sound herring.

Thank you for strengthening and supporting conservation-minded and subsistence friendly proposals.

Sincerely,

Lee Wallace

Lee Wallace
President

Copy/File: Saxman I.R.A. Council
Sitka Tribe of Alaska

RC 38

Chairman Karl Johnstone
Alaska Board of Fisheries
February/March Finfish Meeting

RE: Proposal 216

Mr. Chairman, Board Members,

In your deliberations on proposal 216, I offer the following for consideration;

1) In the Department staff comments on proposal 249 there is a good explanation of when annual limits are normally applied to recreational fisheries. Proposal 249, staff comments;
"BACKGROUND: Annual limit provisions are utilized, in addition to bag and possession limits, to further constrain harvests, particularly if, after other measures are taken, harvest cannot be constrained to necessary levels. This can occur when bag limits have been reduced to very low levels, but angling success and effort lead to unsustainable harvests or the sport fishery exceeding its allocation." **There is no allocation of sablefish in the recreational fishery.**

2) Stock assessments showing a decline in abundance for NSEI, occur only in a relatively small portion of the waters open to commercial and recreational harvest of Blackcod, specifically Chatham Strait (NSEI Sablefish ABC Assessment 2011_7-14-11) All or almost all of the commercial harvest as well as over 80% of the guided recreational harvest takes place in Chatham Strait. **Does this limited amount of stock assessment accurately indicate an overall decline in abundance in all of NSEI or more of a localized depletion issue due to fishing pressure?**

3) The sportfish decrement for 2011 was determined using the average commercial weight of 8.91# from the commercial fishery; this weight differed from the Department test fish average weight of 7.14# (NESI Sablefish quota memo 7-14-11). The difference in average weights could be explained by high-grading in the commercial fishery due to price differentials based on size. It is unlikely this high-grading occurs in the sport fishery. Some of the sport take of Blackcod is incidental to other fisheries and not targeted. Even in the targeted sport fishery high-grading is much less likely due to the difficulty in accessing these fish. A sport fisher is not likely to return a smaller fish in hopes of catching a larger one due to the logistics of the fishery. **The sportfish decrement is likely biased high by using the commercial size average**. It is unclear as to if this same size average is applied to SSEI as well as the NSEO and SSEO areas.

4) The 2011 preliminary logbook data indicates over 80% of guided sport harvested Blackcod in 2011 were taken by a small number of businesses operating in NSEI (mostly Northern Chatham Strait).

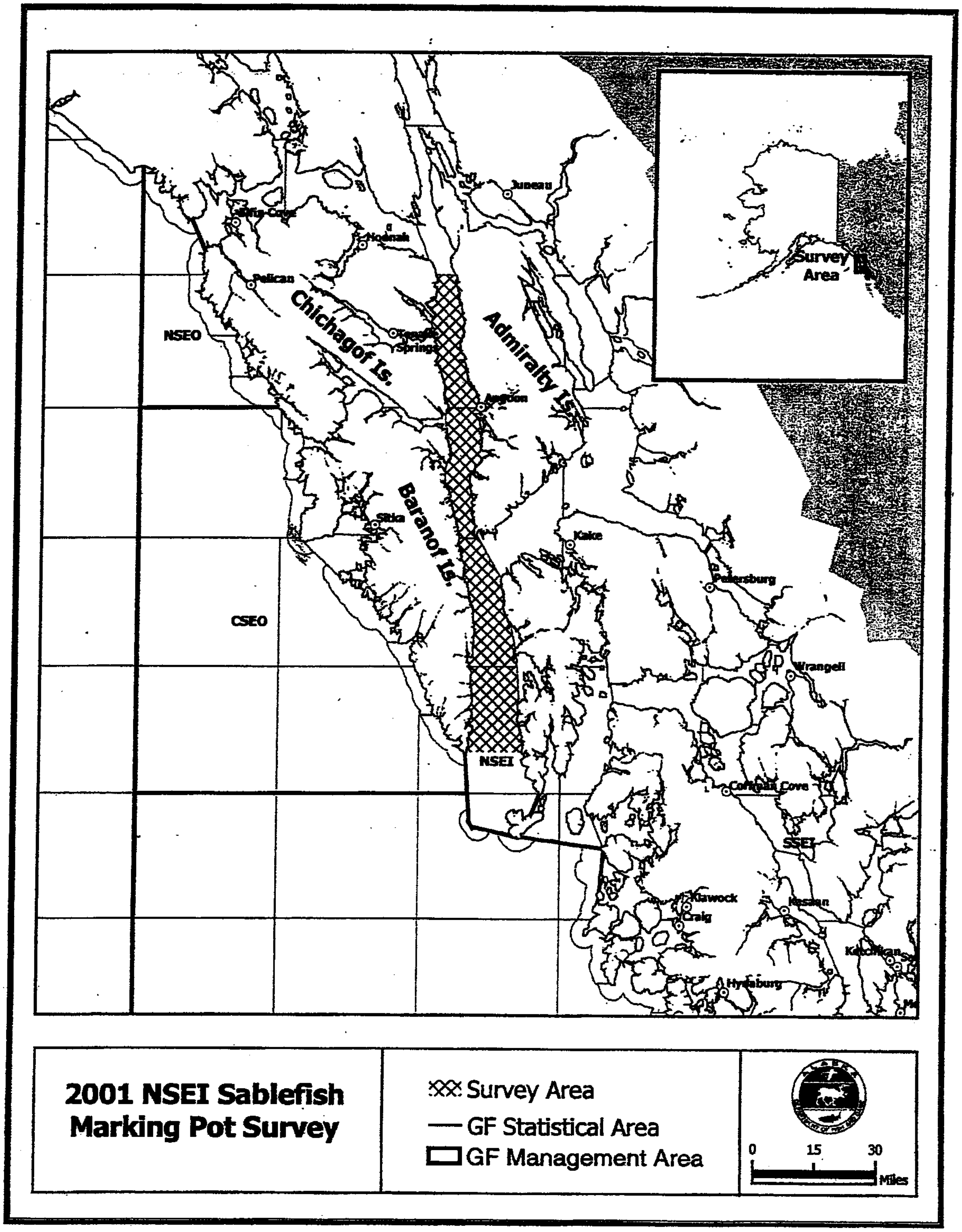
In 2011 guided nonresident anglers who were reported to have bottom fished, 96.6% harvested no Blackcod, 2.0% harvested less than the annual limit while only 1.4% caught their annual limit.
Given this low level of involvement by nonresident anglers harvesting Blackcod, an area wide annual limit is unnecessary and unwarranted.

5) There was no decrement for whale predation in 2011, nor in previous years despite repeated anecdotal information from commercial harvesters identifying this issue as becoming increasingly significant. It seems unreasonable to place the burden of conservation, through the application of annual limits, on nonresident sport fishers while disregarding an issue within the commercial fishery that may affect abundance.

Thank you for your consideration,

Stan Malcom

Stan Malcom



* Same area used for 2011 survey

Figure 1. Sablefish survey area.

RC 40

P.O. BOX 61
Sitka, Alaska 99835
Tel. No. 907-738-3509

February 23, 2012

Chairman Johnstone & Board of Fish Members
Ketchikan Board of Fish Meeting

Dear Chairman Johnstone,

Re: Response to Public Comment #144 by Mr. Wilson Proposal 230 Feb. 9, 2012

I would like to correct a number of errors in Public Comment #144 and supply additional data and references to support the corrections.

Page 1, paragraph , line 10 Classification of Pacific herring as forage fish – whether the State of Alaska classifies herring as a forage fish or not, the species is managed responsibly and sustainably. Please refer to PC #124. Forage fish such as Euchalon, Pollack, and smelt are harvested in Alaska without specific 'ecosystem' management.

Page 1, paragraph , line 19 Hatchery fry releases negatively affect herring – In 2002 ADF&G required a five year study of chum fry feeding behavior and stomach content analyses. NSRAA reports for 2002 and 2005 demonstrate the chum salmon fry diet consists of over 60% and 70% copepods and crustaceans, respectively. Herring larvae or fry were completely absent in most stomachs and rare in a small number of stomachs. Herring biomass and chum fry releases have grown in concert for over twenty years in Sitka Sound. (Reports attached)

Page 1, paragraph 1, line 24 Salmon smaller every year – this is simply not true. Average size of salmon varies annually, some it goes up and some years the fish are smaller (ADF&G & NSRAA data). There has been a trend in the past twenty year to slightly smaller Chinook but there are many factors, most significantly a decline in productivity of Columbia River and other Pacific NW systems that previously had large size fish. Pink salmon harvest to southeast in 2011 was 59 million and size was 3.5 lbs. which is average to above average.

Page 1, paragraph 1, last line subsistence needs not met – Reasonable opportunity is the threshold necessary, and it is met. Please see PC #124 herring egg branch reports and Subsistence Division report #343 December 2011.

Page 2, paragraph 1, line 3 & 4, incomplete data and immature herring – All species in Alaska are managed with less than the perfect data set. Data collection, management, and modeling for the Sitka Sound herring stock is a better data set than most. Biomass has increased 20-fold since the State began managing the stock. It is true that having a population estimate of one, two, & three year old herring would be nice and would increase our knowledge and management precision. However with a ten year plus age class structure there is ample opportunity to react if there is an age class failure by using existing annual fishery and field sampling protocols. Known egg deposition is currently estimated to calculate stock biomass; this is a good basis for understanding baseline productivity.

Page 2, paragraph 1, line 12, dump chemicals and fish waste in ocean – Hatcheries do not dump chemicals into the ocean or freshwater. On occasion hatchery use antibiotics for fish and treat eggs with minute quantities of formalin twice a week during two months of incubation, as do the mega Sport Fish hatcheries in Anchorage and Fairbanks. Process plants are permitted by the State to grind to <½ inch and discharge fish waste to the ocean; however there is less and less of this occurring due to the value of the byproducts for nutraceudicals, pet foods, and human consumption.

Attachment 1 PC #144 Alaska Daily News article – Non sequitur as it doesn't pertain to herring proposal. Article erroneously points the finger at Alaska for Pacific NW salmon problems. Please see attached graph of Alaska salmon catches. Article states $13 billion spent to restore endangered wild salmon, but there are no endangered salmon in Alaska. The majority of 5 billion fry released into ocean are from Japan and Russia.

Attachment 2 PC #144 Hypotheses article – This is not a study but a 2 page review with accompanying speculative hypotheses. Even so, they make a statement of general consensus from previous studies "*....1993 decline* (herring), *poor nutrition remains the most probably cause with disease a secondary response.*" In a published study by Heintz *et. al.* in 2010 the PWS herring population is prevented from recovering by nearly year around humpback whale predation, whereas the Sitka Sound herring population, besides being fundamentally more robust, has significantly lower predation due to minimum seasonal overlap of whale and herring populations. (Study attached)

Sincerely,

Steve Reifenstuhl
Executive Director SHCA

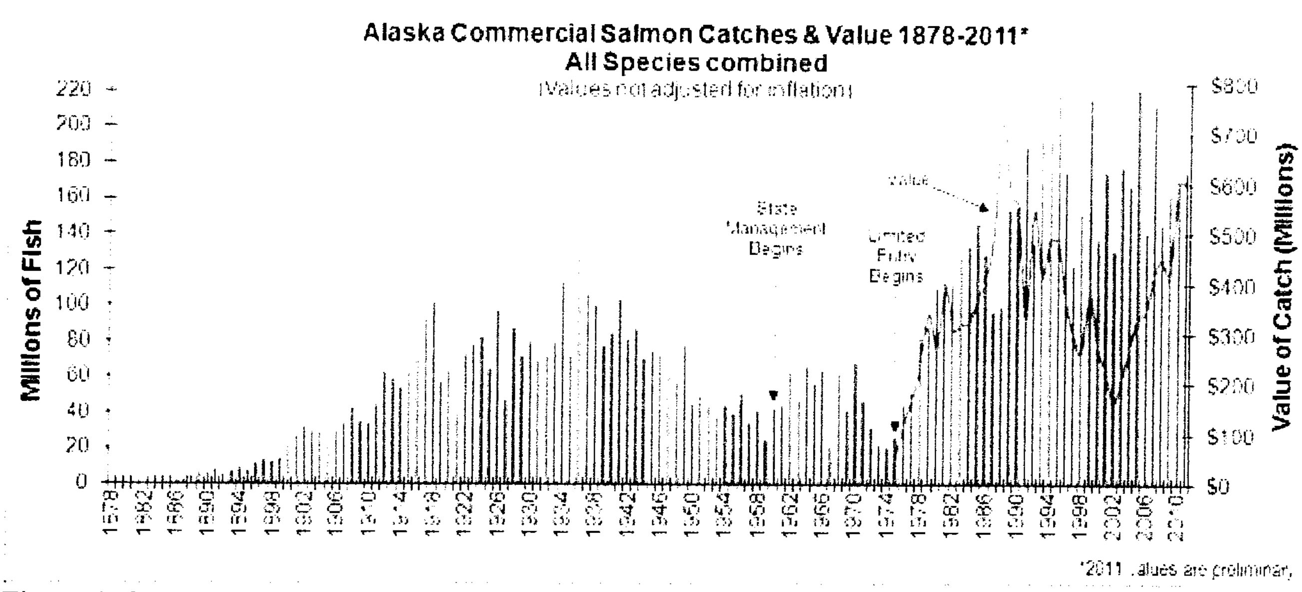


Figure 1. Source ADF&G. Salmon harvest in Alaska is at all time high. Habitat, management, and sustainability.

Humpback Whale Predation and the Case for Top-Down Control of Local Herring Populations in the Gulf of Alaska

by
Ron Heintz, John Moran, Johanna Vollenweider, Jan Straley, Kevin Boswell and Jeep Rice

During late winter in Lynn Canal Steller sea lions closely coordinate foraging dives with a humpback whale to capitalize on minor disruptions to the herring school caused by whales. Photo by John Moran.

Control over the production of highly fecund species such as Pacific herring (*Clupea pallasii*) has been attributed historically to bottom-up effects such as ocean conditions or food availability. In contrast, top-down control exists when predation limits population production. Recent observations of humpback whales (*Megaptera novaeangliae)* foraging on depressed herring populations suggests top-down control of herring may be underappreciated. Pacific herring populations are depressed in several locations in Alaska, and humpback whale populations are increasing. A 2004-06 census estimated the North Pacific humpback whale population at 18,000 to 20,000 and concluded that the population of whales wintering in Hawaiian waters (one half of the North Pacific population) is doubling approximately every 15 years. Humpback whales could potentially be a significant source of mortality on herring populations because they are large homeotherms that often consume herring, and they display a remarkable fidelity to their feeding grounds. If whales repeatedly return to locations to forage with increasing numbers, then production of their prey may become constrained. Anecdotal evidence of humpback whales foraging in locations where herring populations are depressed led to the hypothesis that humpback whale predation impedes the recovery of depressed herring populations, even when the commercial herring fisheries have been closed for decades.

It is important to understand the effect of humpback whales on herring because both species are conspicuous elements in the Gulf of Alaska ecosystem. Herring are ubiquitously distributed and play a key role in the ecosystem by making the energy bound in primary consumers available to apex predators. Humpback whales are voracious predators. A humpback whale weighs around 30 metric tons (t) and requires the equivalent of about 1,100 herring per day to meet its average daily metabolic cost. However, while it is evident that whales depend on herring to some degree, the impact of this dependence on herring is unknown.

If we are to evolve towards ecosystem-based management, we will need to begin quantifying the benefits whales gain from herring and the costs of whale predation to herring. Understanding the relationship between herring and humpback whales is a goal of the Auke Bay Laboratories' (ABL) Nutritional Ecology Lab. Beginning in 2001, we began documenting seasonal changes in the energy content of herring as winter progresses in the local population in Lynn Canal, a fjord adjacent to the ABL facility. Winter is an overlooked time of year critical to the survival and production of many marine species, and our location near a significant herring biomass facilitates our ability to understand these processes. In 2007, our studies expanded when we began comparing the effects of whales on three different herring populations. Our approach was to estimate the biomass of herring consumed by whales in each location and observe herring behavior in response to whale predation.

Herring and whale studies in the Gulf of Alaska

The location of greatest concern for the impacts of whale predation on herring stocks has been Prince William Sound. In 1993 the Prince William Sound herring stock, which had been fished commercially for decades, suddenly collapsed due to an

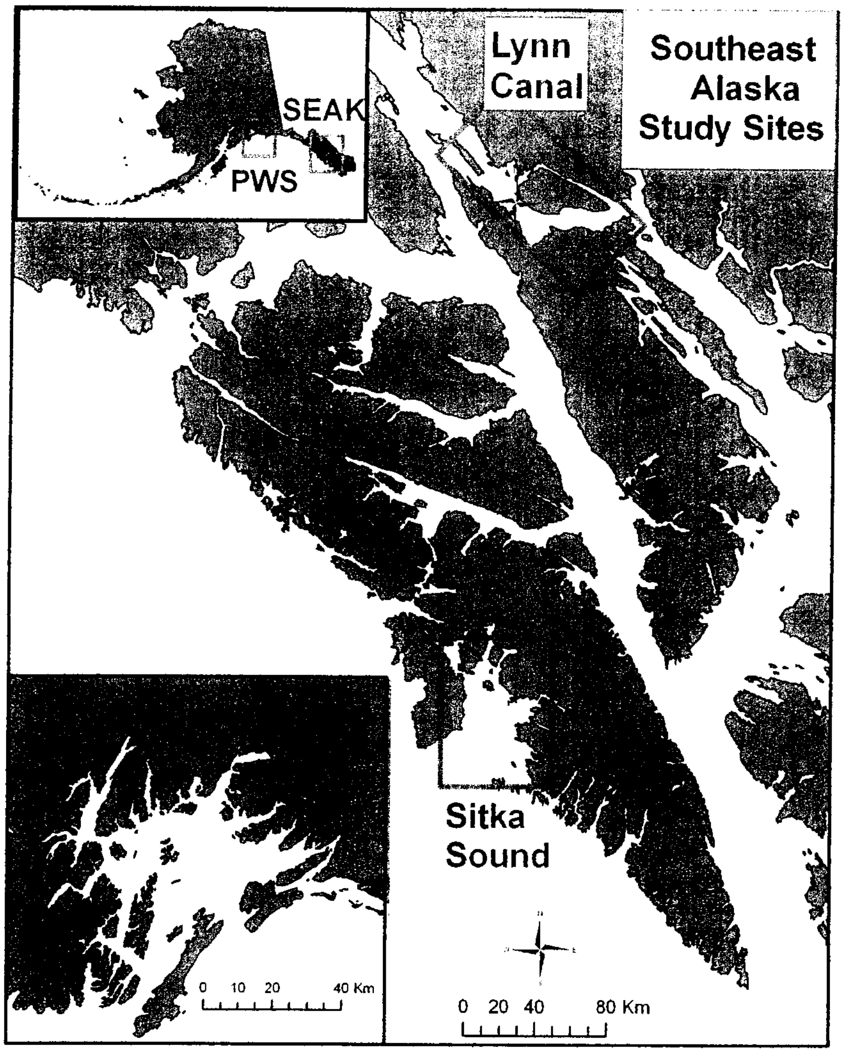


Figure 1. Location of the Prince William Sound (PWS), Lynn Canal, and Sitka Sound study areas in Southeast Alaska (SEAK).

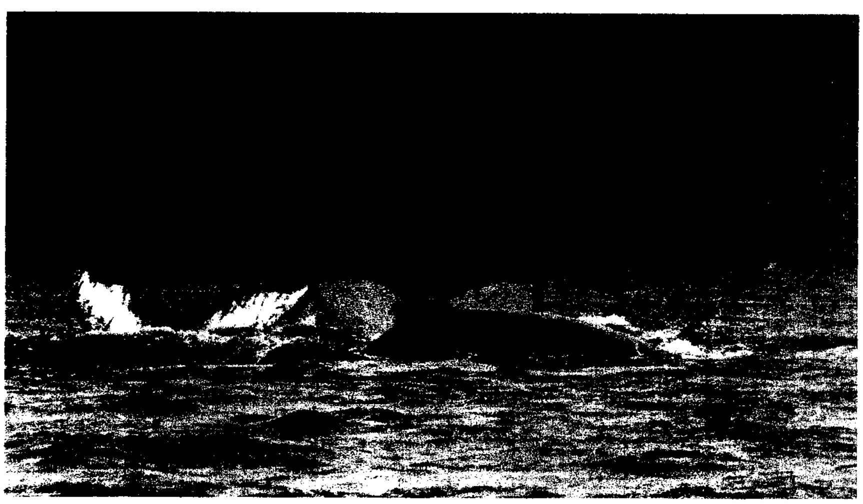


Figure 2. The unique patterns on the flukes of humpback whales identify individuals allowing the use of mark-recapture models to estimate whale abundance. Photo by John Moran.

outbreak of viral hemorrhagic septicemia. The fishery was closed and has essentially remained so to this day. Whale predation has been cited as one possible explanation for the failed recovery. This hypothesis derived from reports of humpback whales foraging in Prince William Sound all winter in locations where herring were known to congregate.

We began examining this question in detail in Prince William Sound in fall 2007 and included Sitka Sound and Lynn Canal (Fig. 1) as reference sites. We included Sitka Sound because it supports a commercially viable herring population with a total biomass currently near 85,000 t. Whales have been observed foraging on herring in Sitka Sound since the early 1980s. We included Lynn Canal because the herring population has failed to support a commercial fishery after being closed to commercial fishing for more than a quarter of a century. Though the cause for the depression of the Lynn Canal population is unknown, humpback whale populations there have been increasing. We focused on these three areas in winter, a time when herring congregate in each location. These concentrations of herring made it easier for us to observe whale foraging behaviors.

While there were reports of whales foraging in winter in Alaskan waters it was unlikely that whales foraged on herring all winter. Humpback whales make transoceanic migrations from their feeding grounds in the North Pacific to calving grounds near Hawaii in winter. It is known that whales stagger their departure from their feeding grounds, suggesting they also stagger their return. This could create the impression that whales were present throughout the entire winter. Only by identifying individual whales and enumerating them would it be possible to establish the extent of winter foraging. Individual identification of humpback whales is done by photographing and cataloging the unique markings on the undersides of their flukes (Fig. 2).

We used these individual markings in mark-recapture studies to estimate the number of whales present throughout the winter in each of the three locations. We developed monthly estimates of whale abundance for the winters of 2007-08 and 2008-09. We concurrently identified the types of prey consumed by whales through fatty acid analysis, direct observation, and acoustic observation (Fig. 3). Combining our observations of whale abundance and the proportion of whales consuming herring with bioenergetic models, we estimated the biomass of herring consumed by whales over winter in each location. We compared these estimates to the estimated total biomass of herring present after spawning for the three populations to determine what proportion of the total biomass the whales were likely consuming. The herring population numbers were obtained from age-structured stock assessments for Sitka and Prince William Sounds and estimates of spawning stock biomass for Lynn Canal. All of these herring estimates were produced by the Alaska Department of Fish and Game (ADF&G).

Our previous work with Lynn Canal herring indicated comparisons between whale consumption and spawning stock biomass would overestimate the whale impact because there are significantly more herring present in winter than are observed during spawning. Consequently, we conducted monthly acoustic surveys in Lynn Canal during winter to estimate herring abundance and estimate the potential predation rate on a monthly basis. One of the benefits of simultaneously conducting the acoustic and whale abundance surveys was that we could examine the effects of whales on herring by mapping the distribution of whales and herring and comparing the abundance of whales with the depth and location of herring schools in the water column.

Estimates of whale predation on wintering herring

Humpback whales consumed herring at each location, but their direct impact on herring varied considerably among locations. All three whale populations declined seasonally at the end of winter, but the trends in seasonal abundance and the effort they expended on foraging for herring differed among locations. Seasonal trends in whale abundance were similar between Lynn Canal and Sitka Sound peaking earlier in the fall. But when whales were abundant in Sitka Sound they foraged on krill, while Lynn Canal whales foraged on herring (Table 1). In Prince William Sound whale numbers remained high into mid-winter (Fig. 4), and they foraged primarily on herring throughout the winter. The timing of peak whale abundance in all locations corresponded to the time when herring have their highest energy content.

In Sitka Sound, the lack of feeding in the early fall on herring was directly related to the absence of herring and abundance of krill. In winter, the number of whales observed eating herring increased after herring arrived in Sitka Sound. However, as winter progressed herring began staging for spawning at the same time whales departed for their breeding grounds. Therefore, even though herring were abundant, there were few whales present and consumption rates were low.

In Lynn Canal we observed the opposite pattern: whales consumed herring in October and November when whales were abundant and herring densities were just beginning to increase. However, by mid-December when herring density was very high we could no longer determine what whales were eating and their numbers were in steep decline.

In contrast to Sitka Sound and Lynn Canal, whales in Prince William Sound almost always consumed herring and stayed until January. Krill appeared to be relatively rare in the area.

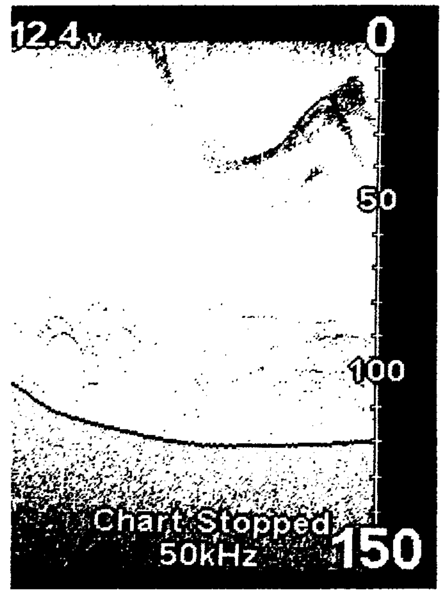


Figure 3. In this echogram recorded at 50 kHz a humpback whale can be seen attacking a small herring school near the surface. Depth intervals are displayed in meters. In January, when this echogram was recorded, herring schools were dispersed by whales and scattered throughout the water column in Prince William Sound.

The differences in whale abundance and apparent preference for herring led to very different estimates of herring consumption in each location (Table 2). In Sitka Sound, whales consumed an estimated 800-1,000 t of herring in late winter. However the estimated biomass of herring the previous spring was about 100,000 t, so whale consumption amounted to less than 1% of the herring biomass. In contrast, whales in Prince William Sound consumed 2,600–4,300 t of herring over winter, which translated to 20%-25% of the total herring biomass. Lynn Canal whales ate 500-700 t of herring over winter or almost all of the local spawning stock. But, recall herring abundance in Lynn Canal during winter exceeds the spawning stock biomass. In November, whales consumed 1%-2% of the biomass present. After November consumption dropped to less than 1% because whales departed and herring continued to arrive.

It is important to put the impact of the humpback whales on the Prince William Sound herring into perspective. The pro-

Table 1. The proportion of whales observed foraging on herring during monthly surveys in Lynn Canal, Prince William and Sitka Sounds over the winters of 2007-08 and 2008-09.

Period	Lynn Canal	Prince William Sound	Sitka Sound
Sep. 15 – Oct. 15	1.0	0.86	0
Oct. 16 – Nov. 15	1.0	0.90	0.17
Nov. 16 – Dec. 15	0.63	0.94	0.58
Dec. 16 – Jan. 15	0	1.0	0.57
Jan. 16 – Feb. 15	0	1.0	1.0
Feb. 15 – Mar. 15	0	1.0	1.0

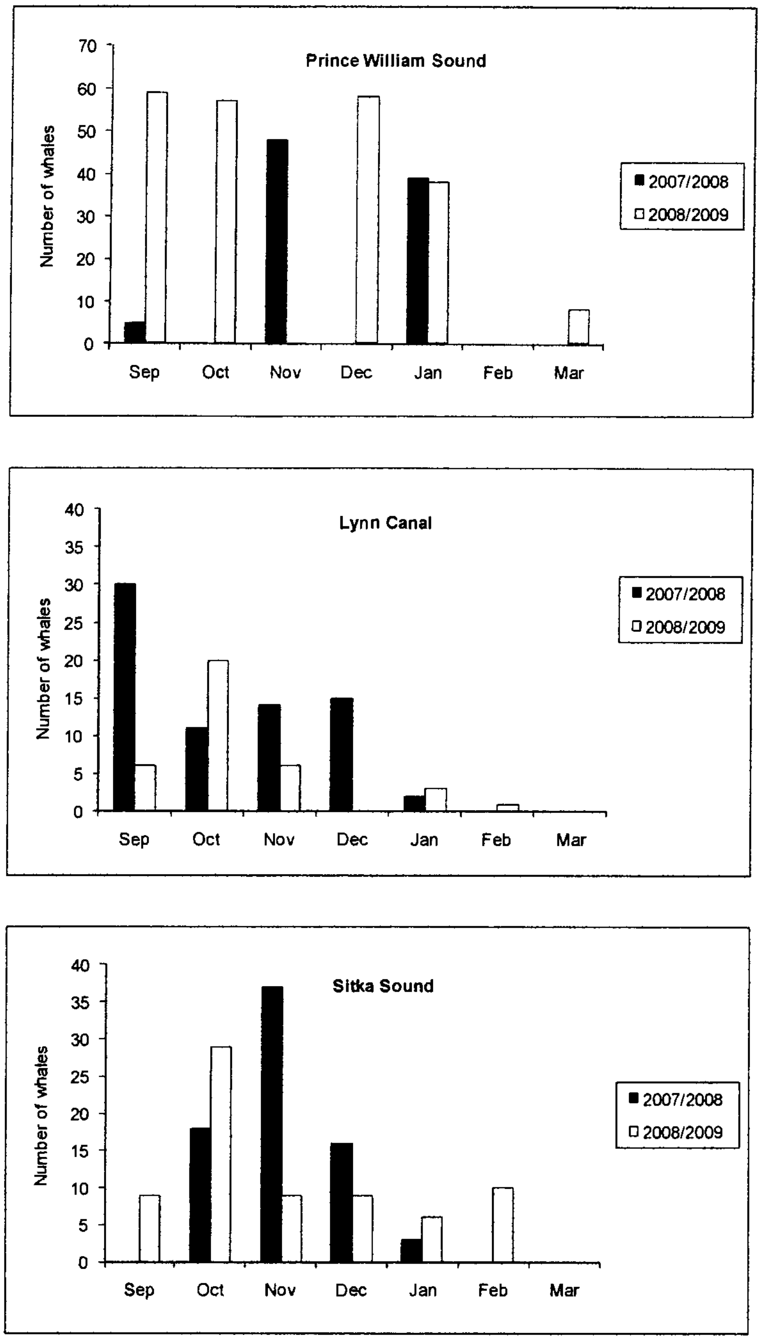


Figure 4. The number of individual humpback whales identified each month from fluke photographs in Prince William Sound, Lynn Canal, and Sitka Sound during the fall and winter months for 2007-08 and 2008-09. These values were expanded in the bioenergetic model to account for mark-recapture estimates of the total number of whales present.

portion of herring consumed is approximately equal to the number that would be removed if a commercial fishery were to take place. The guideline harvest level for herring in Prince William Sound varies between 15% and 20% of the total biomass, depending on the size of that biomass. The effect of the whales is therefore consistent with that of a sustainable commercial fishery, but the whales can remove herring even if the stock biomass is less than 22,000 t, the statutory threshold for commercial fishing. Another way to look at the impact is to compare the biomass consumed with the estimated biomass lost to natural mortality according to the age-structured stock assessments. These latter estimates range between 1,800 and 5,500 t lost per winter, suggesting whales might well account for nearly all of the natural mortality. Consequently, the true impact of humpback whales on Prince William Sound herring depends on the proportion of natural mortality that can be ascribed to whale predation.

Response of herring to whale predation

An important result of our combined whale and herring acoustic surveys in Lynn Canal was that we were able to describe the behavior of wintering herring and determine how humpback whales influence that behavior. Herring display a characteristic set of behaviors in winter, but we do not yet fully understand the impact of these behaviors on herring productivity. In the course of our surveys we were able to establish a correlation between the abundance of whales and herring schooling behavior, which suggests whales exert indirect effects on herring behavior that make them susceptible to predation by other surface-oriented predators.

Herring wintering behavior includes aggregating in predictable locations

During the fall and winter months Pacific herring exhibit a behavioral change; switching from smaller, dispersed, mobile, foraging schools found throughout the water column to forming large, dense shoals in the deeper trenches of bays and fjords where little feeding takes place. More than 30,000 t of herring move into Lynn Canal between October and March, where there are only 1,000 t during the rest of the year. The arriving herring demonstrate three important characteristics of wintering herring: 1) aggregation in a predictable location, 2) reduced foraging, and 3) formation of massive schools at depth. In Lynn Canal these schools can be more than 20 km long and 30 m thick. Similar behavior occurs in Atlantic herring. For example, over 10 million t of the Norwegian spring-spawning herring, the entire population, winter in only two fjords on the northwest coast of Norway.

Of these three characteristics, aggregation in a predictable location is the least understood. Reduced foraging is likely due to diminished food supplies in winter, and formation of massive schools at depth probably is an effort to avoid predation from surface-oriented predators. Site selection is less clear, but likely involves efforts to minimize predation from predaceous fish and minimize energy costs. As herring move into nearshore fjords in winter, piscivorous fish, such as halibut, arrowtooth flounder, sablefish, gadids, and rockfish move offshore. At the same time, herring begin maturing, an energetically demanding process. For example, Lynn Canal herring lose about 44% of their body mass and about 58% of their energy content over winter while the energy content of their gonads increases by approximately 600%. Cold water temperatures and slow water currents in deep trenches occupied by herring may reduce their metabolic costs and provide an energetic refuge. The formation of large schools in these refugia may offer some additional energetic advantage by increasing swimming efficiency.

While movement into nearshore fjords may protect herring from piscivorous fish, it places them in close proximity to a variety of surface-oriented predators. By forming massive schools at depth, individual herring can reduce their exposure to pinnipeds and diving seabirds. However, formation of such schools at depth may serve to increase their vulnerability to humpback whales. Humpback whales routinely forage at depths consistent with the location of these schools and can ingest hundreds of fish at a time. Hence there is likely a trade-off between formation of deepwater schools and the risk of predation by humpback whales.

Whales delay the formation of large deep schools

During early winter when whales were abundant, herring were distributed over a relatively large spatial area (Fig. 5) and located higher in the water column (Fig. 6). After the whales departed, the herring coalesced into one large school and moved deeper in the water. This correlation suggests a functional relationship in which whale foraging delays formation of the large deep school. Fin whales have been shown to disrupt schools of migrating herring in Norway, and that seems to be the case here with humpback whales. Schooling is thought to be adaptive for individuals because joining with a large number of fish reduces the probability of being predated, so the benefit increases with school size. While this may be true when predators consume a single fish at a time, humpback whales can ingest up to 60,000 liters of water and presumably hundreds of herring in one swallow. Certainly a large school in a predictable location would be relatively easy for a whale to locate, while smaller dispersed schools would be more difficult. Formation of large schools may reduce whale searching costs and makes herring a more attractive prey. Alternatively, the repeated disruption of the large school by foraging whales may simply prevent the school from coalescing. Sorting out these alternatives is important because the presence of small herring schools in winter might be used to index predation intensity.

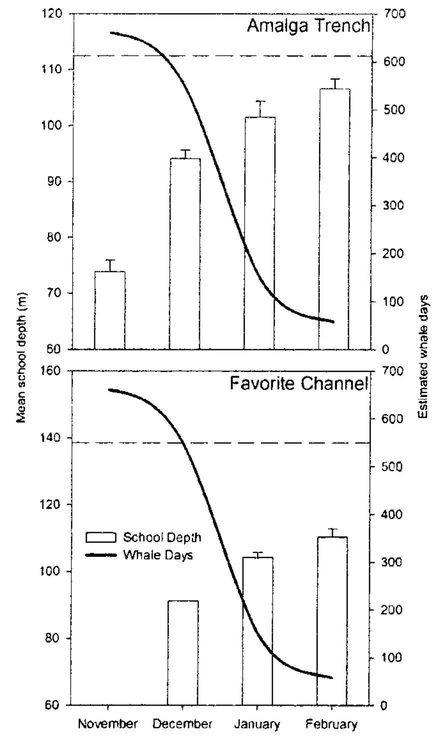


Figure 5. Monthly vertical distribution of Pacific herring schools in two locations in Lynn Canal and the estimated whale days for all of Lynn Canal during 2007-08 and 2008-09 winter months (Nov-Feb). Broken line on each plot represents mean water depth where herring schools were observed in both substrata. Error bars represent standard error.

Regardless of how the whales delay formation of large schools, the location of the schools higher in the water column increases herring vulnerability to other predators. The large deepwater school formed in late winter is found at depths below 100 m. Humpback whales routinely forage at that depth. But the metabolic returns and risk of predation favor dives to shallower water for Steller sea lions and diving seabirds. In fall and early winter when the deepwater school had not coalesced, herring occupied depths between 50 and 100 m, well within sea lion and seabird diving range. Coincidentally, we have observed a 64% decrease in the average mass of herring in sea lion scats between December and February in Lynn Canal even though her-

Table 2. Estimates of herring biomass removed from Lynn Canal, Sitka and Prince William Sounds. Consumption estimates are based on a bioenergetic model incorporating whale abundance, the proportion consuming herring and an allometric relationship between whale size and average daily metabolic rate. Total herring biomass is the estimated biomass of herring present in the spring prior to the winter in question as determined from stock assessments conducted by the Alaska Department of Fish and Game. Relative to spawning biomass, estimates of herring consumed in Lynn Canal very large in 2007-08 and exceeds the spawning stock biomass in 2008-09. As Lynn Canal is an overwintering location for herring, biomass increases significantly during the winter when consumption estimates are less than 2%.

Location	Winter	Herring consumed (t)	Total herring biomass[1] (t)	Percentage of total biomass consumed
Lynn Canal	2007-08	732	1,461	50%
	2008-09	501	499	100%
Sitka Sound	2007-08	1,018	101,209	1%
	2008-09	813	108,192	1%
Prince William Sound	2007-08	2,639	9,650	27%
	2008-09	4,388	20,737	21%

[1] Alaska Department of Fish and Game

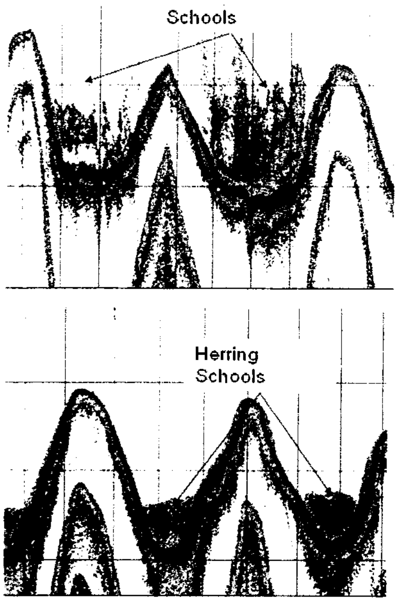


Figure 6. Example echograms of herring distributions observed at 38 kHz during November (A) and February (B) in Lynn Canal, Alaska. Depth intervals are displayed at 50-m increments, and horizontal cells are separated by 0.1 nmi. Herring schools are clearly more dispersed and shallower in November, whereas herring form dense schools in the deep trenches during February. The green thin line represents the seafloor.

·ing were the most frequently occurring rey in both collections. Surface-oriented predators also benefit from whale foraging because whales are relatively sloppy predators, leaving many stunned fish near the surface (Fig. 7).

If whales interfere with the formation of deepwater herring schools in Lynn Canal, then we would expect an even greater delay among herring in Prince William Sound where whale predation was sustained over a longer time period. Acoustic surveys of Prince William Sound conducted by the ADF&G did find large deepwater schools in November. However, these schools were near the spawning grounds. In Sawmill Bay where there was heavy whale predation on herring, herring were dispersed throughout the water column. If herring need to overwinter in areas that minimize their metabolic demand and formation of deepwater schools provide some energetic benefit, then whale predation in Prince William Sound may be influencing the energetics of herring reproduction. We plan to test this hypothesis with samples of adult herring we collected in 2007-08 and 2008-09. In another study, we have observed accelerated energy loss among overwintering juveniles from Prince William Sound relative to those in Sitka Sound or Lynn Canal. Humpback whale foraging may account for this discrepancy, but we do not know the extent to which whales forage on juvenile herring.

Conclusion

It is clear from our data that whales are affected by herring and herring are affected by whales. A significant number of whales rely on herring as prey and remove relatively large amounts of herring from the ecosystem. In turn, the amount of herring whales remove from some populations can represent a significant source of mortality, as in Prince William Sound. However, the extent to which whale-induced mortality exceeds current estimates of natural mortality, if at all, is unknown. We have also shown that whales can increase mortality by making herring more accessible to other predators. It is unlikely that these predators impact herring populations on the same scale as whales. But they directly benefit from the relationship between whales and wintering herring as a result in increased access to energy-rich prey during a critical time of year. The degree to which these species benefit from this prey indicates the importance of this function whales provide. We have little appreciation for the ecological role humpback whales play because we have yet to witness a marine ecosystem with whales at known pre-exploitation population levels. However, the ecological literature is replete with examples of the far reaching and unanticipated effects as apex predators re-enter ecosystems. Our work has revealed that as humpback whales impact one resource they improve conditions for others. While the significance of these effects are not currently understood, their valuation is likely to change as humpback whales become more abundant. Currently the Exxon Valdez Oil Spill Trustee Council is contemplating several restoration options for Prince William Sound herring. Predation by humpback whales presents a daunting obstacle to these efforts. Moreover, enhancing bottom-up processes may have little effect on herring production if the top-down effects exerted by whales continue to be a dominating force.

Figure 7. Gulls feeding on hundreds of stunned herring brought to the surface by a humpback whale. By disrupting herring aggregations at depth, whales make herring available to other air breathing predators with limited diving abilities. Photo by John Moran.

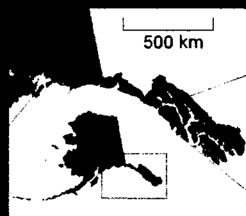
Alaska Fisheries Science Center
NATIONAL MARINE FISHERIES SERVICE - NOAA FISHERIES

Pacific Herring Reproductive Investment (*Clupea pallasii*): A Factor in Their Decline?

JJ Vollenweider*, Ron Heintz, Keith Cox
Auke Bay Laboratories, Juneau, AK
*Johanna.Vollenweider@noaa.gov

Introduction

Problem:
Herring populations in Prince William Sound (PWS) and Lynn Canal (LC) have been depressed since the 1980's while the population in Sitka Sound (SS) is robust and sustaining record harvest levels. Causes underlying the population declines are unknown.



Background:
Depressed recruitment may limit recovery of PWS herring. Potential agents for depressed recruitment remain unknown (disease, predation...?), but it is likely their combined effects are reflected in herring energy dynamics. We postulate that adult herring facing environmental stress will have higher energy expenditures over winter, resulting in decreased energy available for reproduction, consequently effecting offspring survival rates.

Objectives

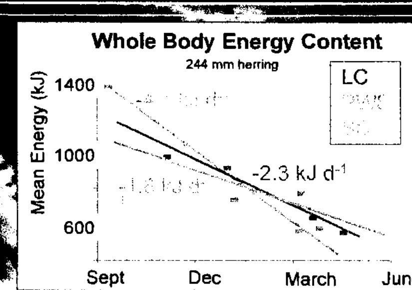
1. Compare overwinter energy expenditure of adult herring in 3 Gulf of Alaska stocks, Prince William Sound and Lynn Canal (depressed stocks), and Sitka Sound (robust stock).
2. Compare gonad composition (fat and protein content) of pre-spawning herring from the three herring stocks.

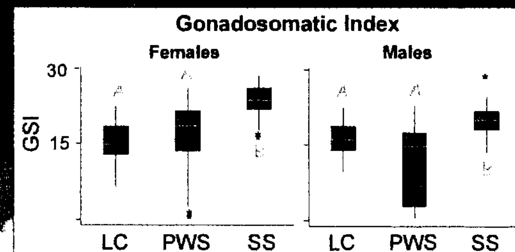
Methods

1. Collect adult (age 3+) herring before and after winter (pre-spawning) from each of the 3 stocks
2. Measure energy content and proximate composition (lipid, protein, water, ash) of whole fish and gonads

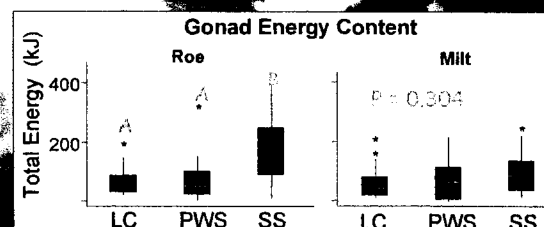
Results

1. PWS herring incur the greatest overwinter energy expenditures, nearly twice the rate of herring in Southeast AK stocks. Though PWS herring begin winter with greater energy stores than fish in Southeast AK, their high rate of energy expenditure caused all stocks to be in relatively similar condition at winter's end.





2. Gonadosomatic Indices (GSI) of pre-spawning herring were higher in the robust stock (SS) than the depressed stocks (PWS & LC).



3. Relative composition of gonads did not vary amongst stocks (energy density, %lipid and %protein). Thus, spawning herring in SS had larger gonads conferring more energy, lipid and protein.

4. Herring in PWS and LC forage more frequently than in SS, perhaps to compensate for increased energy expenditures.

% of Stomachs With Prey Remains

PWS	SS	LC
67%	27%	62%

Identifiable Prey:
Euphausiids
Copepods
Pteropods

Summary

Adult herring in PWS (and to a lesser degree LC) incur high overwinter energy expenditures at the expense of gonad condition. In contrast, fish in SS have the lowest rate of energy expenditure over winter, resulting in the largest, best provisioned gonads prior to spawning. Frequency of winter foraging is highest in the declining populations, perhaps to offset energy loss. Causes for the differential energy expenditures amongst herring stocks are unknown (disease, predation...?), but are likely factors in the population declines.

Acknowledgements
This work (project # PJ090806) was funded by the Exxon Valdez Oil Spill Trustee Council. We thank Jeep Rice (NOAA Fisheries, Auke Bay Labs) for his instrumental help in project design and logistics. We also thank many people for their collaborative efforts in collecting herring samples, including Steve Moffitt and Rich Brenner (Alaska Department of Fish and Game, Cordova), [illegible] (Prince William Sound Science Center), John Moran (NOAA Fisheries, Auke Bay Labs), Dave Gordon (Alaska Department of Fish and Game, [illegible]), Courtney Grady and Jake Gregg (US Geological Survey, Marrowstone Marine Field Station), and Heather [illegible] of Alaska. We also thank those who helped catch, process and analyze countless herring samples, including [illegible] Lawrence Schaufler, John Hudson, Matt Dietrick, Wyatt Fournier, Benita Nelson, Clay Werthheimer, Kevin [illegible] Stark (NOAA Fisheries, Auke Bay Labs).

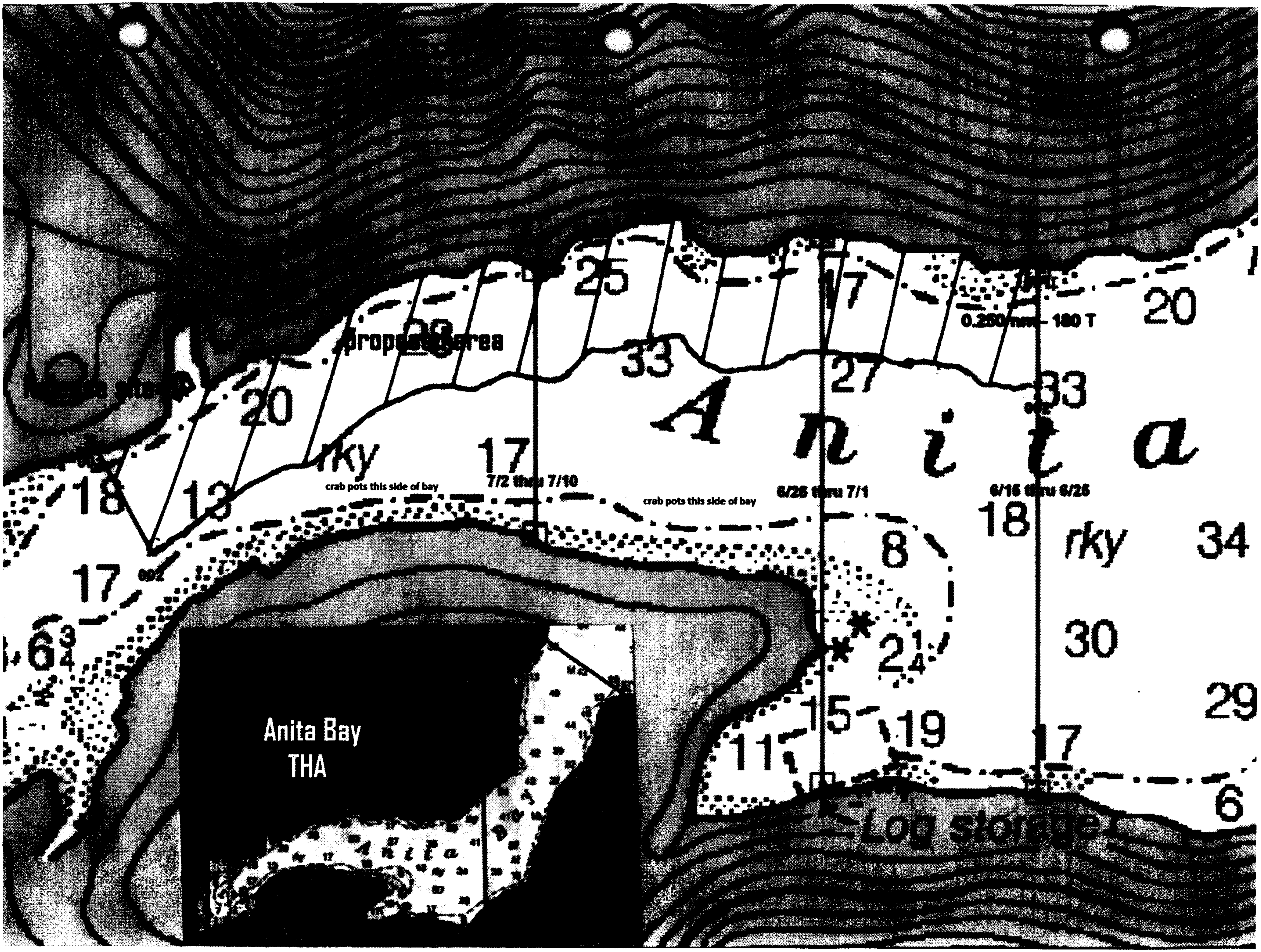
RC 41

Proposal 340:

I would like to comment on proposal 340, the Anita bay THA proposal to amend the open fishing area from June 15th thru July tenth. When the Anita Bay THA was created it was of utmost importance to protect the crab fleets traditional fishing area, and still is. After returns of salmon have come back to the bay their migration patterns are better understood, as are the fishing grounds of the crab fleet. The crab fleet fishes the gradual muddy southern side of the bay, while salmon return on the northern deep rocky side of the bay. The northern side of the bay is where the net pens are located, consequently where returning salmon gather. This proposal will increase the quality of the salmon from this THA, consequently increasing the overall value to all users. It also will allow Dungeness crab fishermen to fish as they traditionally have. I worked closely with the Dungeness crab fishermen that fish in Anita bay in forming the proposed new boundaries, and was told by them that the new proposed area would not infringe upon their traditional crab grounds.

I have included a chart that outlines the current lines, and the new proposed area within the bay. Current lines are north, south, moving towards the head of the bay as the season progresses. The proposed area to be added from June 15th thru July 10th is marked in blue.

Chris Guggenbickler


Anita Bay
THA
Anita
crab pots this side of bay
crab pots this side of bay
7/2 thru 7/10
6/26 thru 7/1
6/16 thru 6/26
0.250 nm - 180 T
Log storage
rky
rky

RC42

ALASKA GLACIER SEAFOODS INC
"Alaska's Finest"

February 23, 2012

Alaska Board of Fisheries
P.O. Box 115526
Juneau, AK 99811-5526

Dear members of the Alaska Board of Fisheries,

As the owner of Alaska Glacier Seafoods in Juneau, I fully support the regulation change proposed by Justin Peeler to allow a 2200 mesh net by emergency order. As a buyer of longline fish and crab, my fishermen are in need of a source for quality bait. The bait herring fishery is a perfect local resource for this need, and I fully believe that with the proper net size bait herring fisherman will be able to provide a much needed bait source.

This is a great opportunity to keep bait dollars in our local economy that would have no negative impact on the resource.

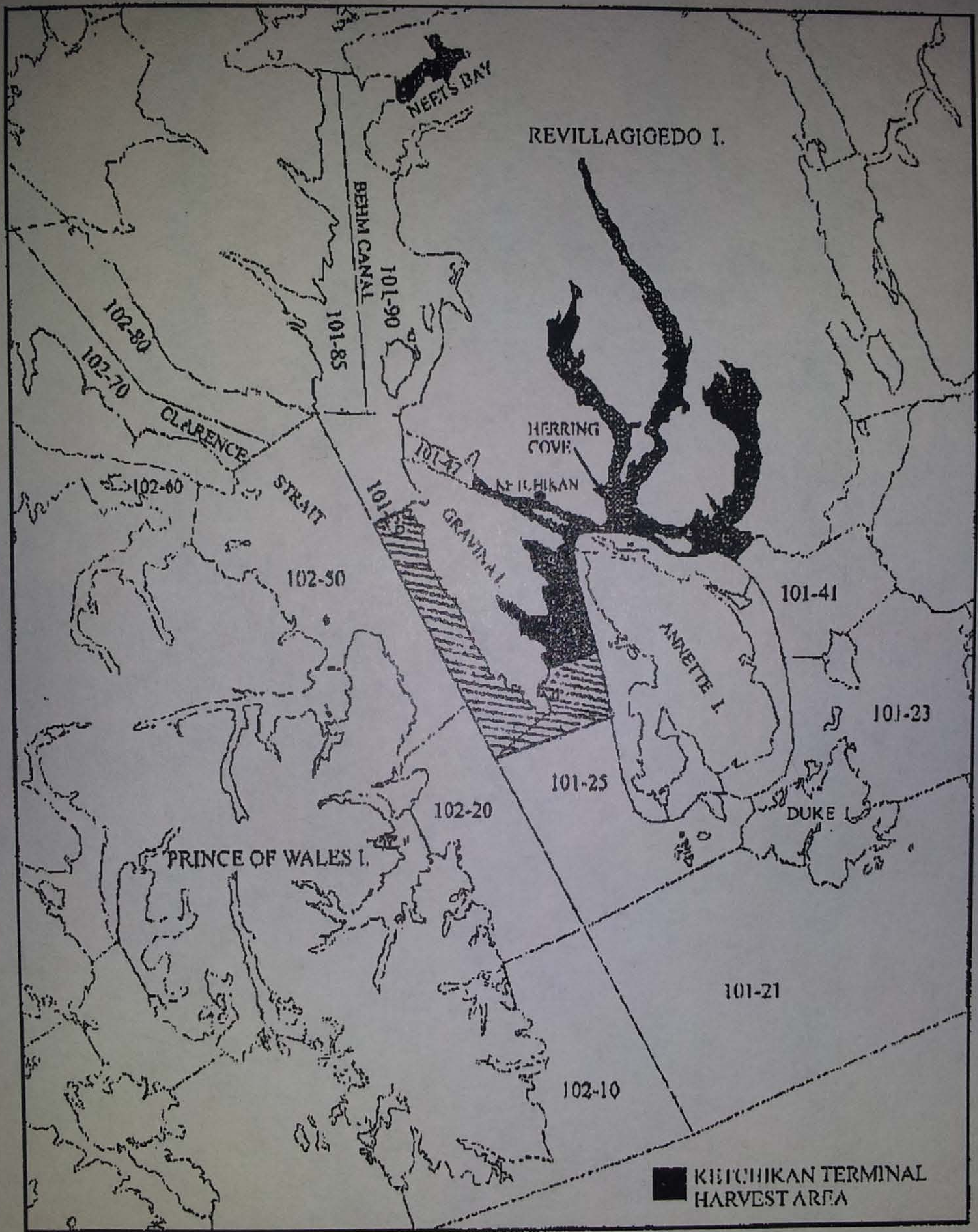
Sincerely,

Michael J. Erickson Sr.
President
Alaska Glacier Seafoods

Cc: Petersburg Vessel Owners Association

P.O. BOX 34363 • JUNEAU, ALASKA 99803 • (907) 790-3590 • Fax: (907) 790-4286

RC43


NEETS BAY
REVILLAGIGEDO I.
BEHM CANAL
101-90
101-85
102-80
102-70
CLARENCE
STRAIT
102-60
101-47
HERRING COVE
KETCHIKAN
101-45
GRAVINA I.
102-50
101-41
ANNETTE I.
101-23
101-25
102-20
DUKE I.
PRINCE OF WALES I.
101-21
102-10
KETCHIKAN TERMINAL HARVEST AREA

PAGE 2