

ALASKA LEGISLATURE SPECIAL COMMITTEE/SUBJECT FILES 8672

2895 SCOMM 126: HOUSE SPECIAL COMMITTEE ON FISHERIES, 2001-02



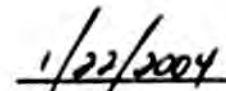
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SCOMM 126: HOUSE SPECIAL COMMITTEE ON FISHERIES, 2001-2002

MEMBERS:

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REPRESENTATIVE JOHN COGHILL
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Established by House Resolve No. 2, 2001.

Contents: 6" of files. 31 tapes are also available of meetings held 1/22/01 - 4/15/02.

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SCOMM

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What is a commercial fishing permit?

In Alaska, a limited entry or interim-use permit entitles the holder to operate a unit of gear in a specific commercial fishery. The term "fishery" refers to a unique combination of fishery resource, gear type and area. For instance, halibut longlining, salmon trolling and salmon seining are distinct fisheries, requiring separate permits. Permits for some species are issued on a statewide basis, while others are valid only for certain areas of the state, for instance Cook Inlet or Bristol Bay. This somewhat intangible "right to fish" is embodied in a plastic permit card which is issued annually.

Are there other types of permits?

During 1996, the Alaska State Legislature directed the commission to issue annual "vessel permits" for the Korean hair crab fishery (occurring beyond 5 miles from shore in the Bering Sea) which was being placed under a moratorium. "Vessel permits" are completely different than limited entry or interim-use permits as they are vessel-specific. The vessel permit, which authorizes use of the vessel in the fishery, must be kept on board the qualifying vessel, in addition to the regular commercial vessel license. There must also be a person on board who holds a valid interim-use permit for the fishery. The vessel permit is an 8-1/2" x 11" document similar to a limited entry certificate, rather than a plastic card. There are also special types of permits that may be issued to private non-profit hatcheries and accredited educational institutions for commercial fisheries training programs.

How is the limited entry or interim-use permit card used?

The fisherman is required to have the permit card, and a photo ID, in possession at all times while engaged in commercial fishing activities. When fish are delivered for sale, the permit card is imprinted on the fish ticket which records the species, number of fish, pounds delivered, area caught, etc..

What information is printed on the permit cards?

The top line of the permit card indicates the holder's residency status and the name of the vessel designated on

the permit application. The next line is the fishery description. Third line is the person's name, fourth is the permit number, followed by the vessel ADF&G number. The bottom line is a sequence number used to track the time period for which the card is valid, followed by the holder's social security number and year of birth.

How long do permits remain valid?

There are four basic types of permits issued by the commission; they are limited entry, interim-entry, interim-use and vessel permits. Limited entry permits are the permanent permits issued for certain fisheries to applicants who received enough points on their applications. Interim-entry permits are the "temporary" permits issued on an annual basis to persons waiting to find out if they qualify for permanent permits. Interim-use permits are issued annually for all commercial fisheries which are not under entry limitation. Vessel permits are issued annually to vessels qualified to participate in the Bering Sea Korean hair crab or weathervane scallop fisheries which are under moratoria. (See the leaflet which explains the entry limitation process for additional information.)

Don't some permits cost thousands of dollars?

Yes. In order to enter a fishery which is under limited entry, a permit must be obtained by transfer from a current permit holder. Many of these transfers involve sales and the prices may range from about \$6,000 for a salmon hand troll permit to about \$300,000 for a False Pass salmon drift permit. These prices fluctuate with the market and are not regulated by the Entry Commission.

Do you have to fish a limited entry permit every year in order to keep it?

No. Limited entry permits do not have to be fished every year, however, the renewal fee must be paid each year in order to keep the permit valid (unless the fishery remains closed for the entire year). If renewal fees are not paid for two years, the permit may be forfeited to the State. Since interim-entry and interim-use permits are issued on an annual basis, applications do not have to be submitted at all unless the applicant actually intends to participate in the fishery during the year.

What happens to permits which are forfeited because fees are not paid?

Forfeited limited entry permits are simply removed from the fisheries. They are not reissued to other fishermen. The permit holder may request reinstatement of the forfeited permit if good cause can be demonstrated for the failure to renew.

Can permit fees be refunded if the permit isn't used during the year?

Permit fees are not refundable, except in the event of a season-long closure of the fishery or if some other circumstance, (applicable to all permit holders in the fishery,) prevents a substantial number from participating. The Exxon Valdez oil spill in Prince William Sound provides a good example of the type of situation in which refunds may be authorized.

If a person holds a permit for one fishery, does s/he have to buy a crewmember license to participate as a deckhand in another fishery?

No. Any valid limited entry, interim-entry or interim-use permit may also serve as a crew license for the holder to participate in other commercial fisheries. (The one exception may be in fisheries with superexclusive registration requirements - ADF&G regulations should be consulted for details.)

Can the permit holder use the permit on any boat?

In most fisheries, the permit holder may fish the permit on any vessel which is licensed, but ADF&G regulations for the specific fishery should be consulted. On the permit application the ADF&G number of the vessel to be fished must be provided and the designated vessel must be licensed for that year in order for the permit card to be issued. (One exception to this general rule involves fisheries which have "superexclusive area registration" requirements, i.e. the vessel may be used in only one area.)

What agency issues vessel licenses?

Vessel licenses are also issued by the Entry Commission. In 1996, the annual fee for a vessel license changed from a flat \$20 per vessel to 6 fee categories ranging from \$20 to \$750, depending upon the overall length of the vessel. Once licensed, the vessel may be used in any commercial fishery, provided it is in compliance with applicable Alaska Department of Fish and Game regulations.

Can a partnership or corporation hold a permit?

No. Entry and interim-use permits must be held by an individual person and the person named on the permit must be actively involved in the fishing operation. The permit holder must be able to present personal identification, including a photo ID, if so requested by authorities. "Vessel permits" issued to owners of qualifying vessels (such as in the Korean hair crab and weathervane scallop fisheries) may be held by business entities or individuals.

What may be done if the permit holder is NOT able to participate in the fishery for some reason?

The regulations include provisions for permits to be transferred in certain situations. The permit holder may permanently transfer the permit to someone else upon sale or as a gift or, if unable to participate in the fishery due to a problem temporary in nature, s/he may be able to transfer the permit for the season on an emergency basis, subject to the commission's approval. (See the leaflet dealing with permit transfers for additional information.)

Is it legal for a permit to be leased out, or fished by someone else, if the permit holder doesn't want to fish?

No, permits cannot be leased simply because the permit holder does not want to fish; leasing is prohibited by the Limited Entry Statutes. However, if the permit holder has a legitimate reason for requesting an emergency transfer of the permit, and the transfer is approved, the permit holder may legally

receive a payment for the use of the permit.
Why is it illegal to lease permits?

The legislature made it illegal to lease permits to ensure that fishermen would maintain control of their own livelihoods, and that permits would be controlled by active participants in the fisheries who would have a stake in conservation of fishery resources. The concern with leasing was that permits would be bought up by large companies or speculators and fishermen would be subject to their demands.

Can aliens obtain permits?

Aliens lawfully admitted to the United States may hold permits. Proof of lawful admission may consist of:

- 1) a "green card" (Alien Registration card); or
- 2) a Naturalization Certificate; or
- 3) a Certificate of Citizenship

An alien applying for an interim use permit or limited entry permit, or, seeking to obtain one through permanent or emergency transfer, must show proof of being lawfully admitted to the United States for employment purposes. AS 16.05.905 prohibits alien persons not lawfully admitted to the United States from engaging in commercial fishing activities. If you have questions about your status, call CFEC for more information.

(rev. 04/00)

State of Alaska

COMMERCIAL FISHING PERMITS

Summary information for commercial fishermen
presented courtesy of the licensing section of the:

Commercial Fisheries Entry Commission
8800 Glacier Hwy, #109
Juneau, AK 99801

(907) 789-6150



Bruce Twonley, Chairman
Marlene Johnson, Commissioner
Mary McDowell, Commissioner

This pamphlet is not intended to replace the agency's governing statutes (AS 16.43) and regulations (Title 20 Alaska Administrative Code)

What is the Commercial Fisheries Entry Commission?

The CFEC (aka Limited Entry Commission) is one agency involved in regulation of Alaska's commercial fisheries. Its purpose is to promote the conservation and sustained yield management of fisheries resources and the economic health and stability of the industry by regulating entry into the fisheries in the public interest.

Why and how does the Commission "limit entry" in a fishery?

The limited entry process is usually initiated when CFEC receives a petition from participants in a fishery who believe the number of gear operators must be limited in order to preserve the resource and/or economic health of the fishery. If research indicates that there is a problem which would be mitigated by limiting entry, the Commission establishes the maximum number of permits for the fishery, based upon historic participation levels. The next step is to develop a point system to rank eligible applicants according to the relative degree of hardship they would suffer if not awarded an entry permit.

Are there different types of limited entry programs?

The original Limited Entry Act only provided for one type of program, primarily designed with the salmon fisheries in mind, but that program is not ideal for all other fisheries. At this time, no other permanent entry limitation programs have been implemented in the state. However, in 1996 a temporary moratorium on vessels (rather than gear operators) participating in the Bering Sea Korean hair crab fishery was approved by the Legislature and the Commission is studying this, and other, types of limitation. Also, 1991 legislation authorized temporary moratoria to be established to cap growth in fisheries while research is undertaken to evaluate the need for permanent entry limitation. In 1995, legislation was enacted which gave the Commission authority to further restrict the fishing capacity of an entry permit, (for example, permits for 100, 200 or 300 pots may be issued in a crab fishery).

What are the point systems based upon?

The basic criteria used to evaluate hardship are: (1) economic dependence upon the fishery, which may include percentage of income from the fishery, availability of (and reliance on) alternative occupations and investment in vessels and gear; and (2) past participation in the fishery,

which may include the number of years and consistency of participation.

Who is eligible to apply for a limited entry permit?

A person must have participated in the fishery legally, e.g., held the required permits and/or licenses, and made at least one landing of fish prior to the established qualification date. The qualification date is usually January 1 of the year in which the CFEC adopts limited entry for the fishery.

When can a person apply for a limited entry permit?

A specific application period, usually a few months, is established for each limited fishery. All persons who are eligible to apply must submit their applications during the specified time period. Sometimes lawsuits result in the reopening of an application period. An example of this was the Wassilie class action which involved a group of Alaska Natives that claimed the Commission had not done enough initial public outreach to explain the limited entry program. Due to their lack of understanding they had failed to submit timely applications. The settlement provided them another opportunity to apply.

How long does it take for the Commission to decide who qualifies for limited entry permits?

The time period can vary in individual cases from a couple months to several years. The first step is for CFEC staff to review the evidence submitted with the application to verify the points that have been claimed; they then make an initial determination as to the number of points awarded. Permits may be issued fairly quickly to applicants who are classified at the high end of the point range.

Applicants who wish to contest their point determinations may request hearings and submit additional testimony and evidence. Permits are issued first to applicants with the highest number of points, and then on down through the range of point levels until the established maximum number of permits has been issued. It is actually a bit more complicated than this, since a block of permits must be held in reserve for applicants who are going through the appeal process and may eventually be found to qualify for permits. The Southeast herring gillnet fishery may be a good example. There are 3 permits left to be issued before the maximum number is reached. However, there are 7

applications classified at the next lower point level and 8 more still in the hearing process. The Commission must await the final decisions in those hearings to see how many permits may be left to issue. Permits may then be issued to all applicants at the next point level, if the maximum number would not be exceeded by more than 5% or 10 permits, (whichever is greater), otherwise the permits would be issued by lottery.

Are people allowed to fish while they are waiting to find out if they qualify for a limited entry permit?

In most cases the answer is "yes". From the time that the Commission adopts limited entry for a fishery, until limited entry permits are actually issued, applicants who may eventually qualify for a permit are allowed to fish using interim-entry permits which are issued annually.

Does the Commission ever issue special permits in "hardship" cases?

No. There are no special provisions for awarding limited entry permits in hardship situations. In order to qualify for a permit, an applicant must meet the standard requirements for eligibility and have sufficient points verified on the application.

If someone wants to fish, but doesn't qualify to apply for a limited entry permit, how can s/he get into the fishery?

Most of the limited entry permits may be freely transferred once issued. In other words, if the permit holder no longer wishes to fish the permit, s/he may permanently transfer it to another person. A transfer may take place as the result of a sale, gift, inheritance, trade, or other type of transaction. All requests for permanent transfers of permits must be approved by the Commission. (See the leaflet on permit transfers.)

Which fisheries in Alaska have been put under limited entry?

The salmon fisheries in all areas of the state and most of the roe herring fisheries have been limited. A partial list of other fisheries which are under limitation or moratoria, by area, follows:

Southeast Alaska: King, Tanner and Dungeness crab, shrimp pot gear and beam trawl, sablefish longline and pot gear, herring spawn on kelp pounding, dive fisheries for abalone, geoduck, sea cucumbers and sea urchins
Prince William Sound: herring roe on kelp pounding, sablefish fixed gear and net gear
Cook Inlet: Dungeness crab pots and ring nets
Bristol Bay: herring spawn on kelp

Fisheries which are not under limited entry include: King, Tanner and Dungeness crab in some areas, halibut, ling cod, sablefish in some areas, miscellaneous finfish, rockfish, shrimp in some areas, food/bait herring, roe herring in a few areas, clams other than geoducks, snails, octopi and other miscellaneous species. As of July 1996, the Korean hair crab fishery in the Bering Sea (beyond 5 miles from shore) is under a moratorium restricting vessels which may participate, and requiring issuance of "vessel permits." A similar vessel permit moratorium was enacted during 1997 for the weathervane scallop fishery. (Some fisheries are subject to federal limitation programs (i.e. halibut and sablefish IFQ's,) or moratoria which may restrict eligibility to participate in fisheries. Fishers are advised to review state and federal requirements before engaging in fishing activities.)

What else does the CFEC do besides put fisheries under limited entry?

The Commission has four major sections: (1) adjudications, which deals with limited entry applications, point verification and hearings; (2) licensing, which deals with the annual issuance of all commercial fishing permits and vessel licenses for Alaska, as well as permit transfers; (3) data processing, which responds to ad hoc requests for data and maintains the computer system which enables the agency to operate efficiently; and (4) research, which monitors the development of fisheries and produces economic data utilized by a variety of management agencies. There is a Chairman and two additional commissioners, who perform a quasi-judicial function, hearing and voting upon decisions in disputed cases. In addition, the agency has a small administrative staff. Approximately 35 persons are currently employed.

(rev 11/97)

**COMMERCIAL
FISHERIES
ENTRY
COMMISSION**

(aka "Limited Entry")

What It Is



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Limited Entry Facts

- The overall interests of Alaskans have been far better served under limited entry than they would have been without it. Without the constitutional amendment allowing for limited entry, and implementation of the program, there would have been a rush into Alaska's fisheries by non-residents as fisheries elsewhere collapsed or became subject to such impacts as the Boldt decision, which displaced non-Alaskan fishermen from their own fisheries. Even with all of these potential external pressures on our fisheries over the years, the percentages of residents in Alaska's various fisheries have remained roughly consistent with historic (pre-limited entry) levels.
- There are currently about 14,300 limited entry permits in existence. Of those, over 11,000 (about 77%) are held by Alaska residents.
- It is true that some permits held at one time by resident Alaskans, later come to be held by non-residents. However, *migration of permit holders*, rather than transfer of permits, has had the greater cumulative effect on the resident/nonresident balance. That is, between 1975 and 1999, the number of permits held by non-residents increased by only 140 due to the net result of transfers of permits, while resident Alaskan permit holders moving out of state (and continuing to hold their permits) resulted in a net increase of 483 in the number of nonresident permits. (In fact, during most recent three year period, 1997 through 1999, 106 *more* permits were transferred *from* non-residents *to* Alaskans than the other way around).
- Commercial fisheries are subject to federal constitutional provisions and laws pertaining to *interstate commerce*. Therefore, access to this commercial enterprise by all residents of the United States is protected by the federal privileges and immunities clause.
- Alaska's Limited Entry program has survived constitutional challenges while serving to protect the place of Alaskans in the state's fisheries. Without creating a "closed class," the program's system of "freely transferable" permits has been effective in keeping permits within families and communities. Over the last 20 years, between 30 and 40 percent of all permit transfers have been by GIFT rather than by SALE. These are primarily transfers between family members.

ALASKA'S LIMITED ENTRY PROGRAM

Overall, limited entry has worked well for Alaska residents:

- ☐ The program grandfathers into each fishery Alaskans who most depend upon the fishery.
- ☐ Limited entry is a critical component of Alaska's fishery management as it stabilizes one major variable, the number of participants, in a given fishery.
- ☐ Transferability of permits (the ability of permit holders to choose who to give or sell their permits to) provides the mechanism for keeping permits within Alaskan families and communities.
- ☐ More than half of the permits transferred to rural Alaskans are transferred by gift, rather than by sale.
- ☐ The courts have repeatedly ruled that the limited entry program meets constitutional requirements regarding equal access, interstate commerce, and prohibition against creation of a "closed class."
- ☐ Today, 77% (more than 10,000) of all limited entry permits are held by Alaska residents. It is reported that in 1962, well before limited entry, only about two-thirds of commercial fishers licensed in Alaska fisheries were Alaska residents.
- ☐ More than one-half of permits held by Alaskan residents are held by rural Alaskans.
- ☐ In the absence of limited entry, a rush into our fisheries by thousands of displaced fishermen from outside of Alaska would certainly have occurred, placing our fishery resources and commercial, sport and subsistence fishers under tremendous additional pressure.
- ☐ There are currently available mechanisms that can help to retain and even increase the number of permits in the hands of residents.

Further elaboration on these points and on the history and structure of the limited entry program can be found in a July, 1998 report to the Governor by the Commercial Fisheries Entry Commission, entitled "Alaska's Limited Entry Program: Is it Working for Alaskans?"

**ALASKA'S LIMITED ENTRY PROGRAM:
IS IT WORKING FOR ALASKANS?**

**A Report to Governor Knowles
by the Commercial Fisheries Entry Commission**

July, 1998

ALASKA'S LIMITED ENTRY PROGRAM: IS IT WORKING FOR ALASKANS?

I. Overview & History of Alaska's Limited Entry Program

Why and how was the program created? Why is it structured as it is?

Alaska's limited entry system is the product of years of effort by the State beginning in 1961. Two early attempts to limit entry into Alaska's fisheries were struck down by courts.

The Alaska legislature persisted, however, because Alaska's salmon fisheries were experiencing a long and threatening overall decline, which began in the 1930's under federal management and continued into the early 1970's. Despite this decline, the number of participants continued to increase substantially, which resulted in more and more fishing pressure on a diminishing resource. A limited entry system was the only means by which the State could control a critical variable in the management of its fishery resources: the number of fishers participating in a given fishery.

Following action by the legislature to put the issue on the ballot, Alaska voters, in 1972, approved an amendment to Article VIII, Section 15 of the Alaska Constitution, which authorized the state to:

limit entry into any fishery for purposes of resource conservation, to prevent economic distress among fishermen and those dependent upon them for a livelihood and to promote the efficient development of aquaculture in the State.

Building upon this constitutional foundation, in 1973, the Alaska legislature adopted the Limited Entry Act, which has resulted in the largest limited entry program of its kind in the United States. Limitation of entry into all twenty-six of Alaska's salmon fisheries followed shortly. During 1976, by referendum, the voters of Alaska again supported limited entry by a margin of almost two-to-one. Today, nearly sixty of Alaska's fisheries are under limitation.

Alaska's fisheries employ a substantial segment of the state's population, and many remote communities rely upon commercial fishing as their primary economic base. Therefore, sound fisheries management is crucial to the State of Alaska, and limited entry is an important part of the state's management system.

Extensive biological, economic, historic, and cultural data and analyses have been generated to aid the development, enactment, and review of entry limitation in Alaska. Thousands of hours of hearings throughout the state and before the legislature have informed the choices made in shaping Alaska's limited entry system. Alaska's courts have carefully scrutinized the program and developed a body of law governing limited entry in Alaska that is both extensive and unique.

Under AS 16.43.140, no commercial fisher may operate fishing gear in a limited fishery without a valid fishing permit. The Alaska Commercial Fisheries Entry Commission (CFEC) issues entry permits and administers the program. The entry permit is the critical element of the system and, to Alaska fishers, a legally required tool of their trade. In establishing limited entry and considering the needs of the State and Alaska fishers, the Alaska legislature gave careful consideration to the nature of an entry permit and the privileges that a permit would extend to its holder.

If the legislature had been committed only to simplicity and economy, it could have authorized conducting of a lottery or auctioning of a limited number of fishing rights. The legislature rejected these approaches because they would not have been consistent with the State's most important objectives in establishing a limited entry system. The legislature believed that, in view of the substantial reliance on their fisheries by fishers and those dependent upon them, privileges should be initially extended only to qualified, individual fishers who could demonstrate their dependence. At the same time, the legislature wished to restrain the growth of state bureaucracy.

Although, under state law, entry permits do not constitute property belonging to their holders, the legislature authorized holders to transfer their permits subject to control and approval by CFEC. Doing so advanced several of the State's objectives. Because the law provides holders with uninterrupted use of their entry permits and authorizes fishers to transfer their permits, fishers hold the means to continue their access to the fishery and their livelihood. This transfer system allows permit holders the option of transferring their permits to other family members who are physically able to fish, and thereby maintain permits within families over time. Additionally, by not cutting off the interest of fishers or their heirs (as could be the case through a lottery or a system of reversion and reissue), the holders are granted a sufficiently long-term privilege in the fishery so as to be encouraged to both conserve and enhance the fishery resource. Finally, to avoid generating additional state bureaucracy, the legislature did not require the State to select who would be a subsequent recipient of the privilege. (The task of initially awarding permits has been sufficiently burdensome in itself.)

Generally, AS 16.43.150(g) prohibits involuntary transfer requiring that an entry permit may not be "attached, distrained, or sold on execution of judgment or under any other process or order of any court." Additionally, a fisher may not pledge his or her entry permit as security for a debt. [The legislature recognized that the absence of a property right might impair a fisher's ability to obtain financing for the purchase of a permit and fishing operation, and, therefore, established two state authorized loan programs: the Commercial Fishing Loan Program and Commercial Fishing and Agriculture Bank (CFAB)]. Just as fishers cannot, contrary to state law, create a security interest in their fishing privileges, neither can a creditor.

The legislature recognized the earnings of fishers are seasonal and subject to many variables from year-to-year beyond their control (for example, weather, ex-vessel fish prices, survival rates, predation, and interception). If creditors were allowed to seize and force the sale of an entry permit, fishers without other means of earning a living, together with those

dependent upon them, could well be left destitute. In Alaska, where many communities in remote areas of the state depend upon commercial fishing as the primary basis for their cash economy, this is a very real possibility. [The Social Security Administration has acknowledged the wisdom of Alaska's approach by recognizing that an entry permit is essential to self-support, and, therefore, by not considering the market value of a permit as an alternative resource in determining an individual's eligibility for Supplemental Security Income benefits. 20 C.F.R. § 416.1222(b); 50 Fed. Reg. 42683, 42685 (1985).]

To avoid intemperate transfers, a permit holder may permanently transfer a permit only after a 60-day waiting period during which the holder can withdraw from any agreement to transfer. Permits can be transferred only to a living individual who can demonstrate his or her present ability to participate actively in the fishery. They may not be transferred to a corporation or a partnership. Furthermore, an individual may not own more than one permit in any given fishery. These provisions keep fishers from becoming "share croppers," and prevent absentee ownership of fishing privileges and displacement of fishers through the consolidation or vertical integration that might otherwise occur.

Finally, because only a limited number of privileges would be extended, the legislature wished to ensure that the State would be reasonably compensated by regular permit fees. CFEC charges fishers fees for its licensing functions, including fees for the required annual renewal of limited entry permits, interim use permits, and vessel licenses. Fees vary according to permit value and vessel size. Today these fees generate revenues equaling more than two times the operating budget of CFEC and thus contribute a net of over 2.5 million dollars annually to the state General Fund.

The open access alternative: What might Alaska's commercial fisheries look like today without Limited Entry?

While shortcomings of the limited entry program can be identified, in analyzing its effectiveness, it is important to consider the alternatives. How would Alaska's fisheries evolve in the absence of limited entry? As mentioned, even with Alaska's salmon fisheries in decline in the nineteen-sixties and seventies, participation levels continued to rise. One can imagine how much participation would have grown as Alaska's salmon stocks rebounded in subsequent decades (assuming the rebound would have occurred without the limitation of participation).

In addition to the increase in Alaskan salmon harvests, there would have been other likely sources of pressure. The construction of the Alaska pipeline during the 1970's drew a large work force into Alaska. Upon completion of the pipeline, displaced former pipeline workers could well have sought to enter Alaska's salmon fisheries.

Of more significance, the troubles that have befallen west coast salmon fisheries over the last two decades could well have spawned additional pressure from displaced west coast salmon fishers entering Alaska's salmon fisheries. Alaska's system of limitation was barely in

place when the Boldt decision came down in 1974. Among other things, the Boldt decision required that a substantial portion of the salmon harvests in the northwestern United States be reserved for certain Native American tribes. That decision dislocated large numbers of northwest salmon fishers, who would likely have looked to Alaska to offset their losses. In more recent years, many U.S. fisheries have crashed and been closed. Without limitation, many of those out of work fishers would likely have entered Alaska's fisheries. In short, had Alaska's license limitation system not stood as a bulwark, these various pressures likely would have caused additional growth in the numbers of participants in its fisheries and even greater pressure upon the resource itself as well as commercial, sport, personal use, and subsistence users.

It is especially difficult to envision how Alaska's fisheries would have evolved over time without limited entry, or to predict how they would be affected by a return to open access, because the limited entry system does not operate by itself. While limited entry stabilizes one major variable in a fishery (the number of participants), the State Board of Fisheries consistently provides gear and vessel restrictions applicable to commercial fishers. These restrictions, when coupled with license limitation, result in a limitation of overall fishing capacity and further allow fishery managers to calculate with some assurance the amount of fishing power to be managed. Without license limitation, state fishery managers would face a much more complicated and difficult task. Indeed, in the absence of license limitation, in a situation where managers believe there is a risk of more participation than the resource could withstand, a fishery would likely not be opened at all.

II. How has limited entry worked for Alaskans, and, specifically, rural Alaskans?

Levels of Alaska residency among permit holders

The purpose of limited entry, under AS 16.43.010, is "to promote the conservation and the sustained yield management of Alaska's fishery resource and the economic health and stability of commercial fishing in Alaska in the public interest and without unjust discrimination."

Directing benefits to Alaska fishers is not a purpose of the limited entry program and *cannot be* under the state and federal constitution. However, grandfathering in participants through the limited entry program and giving those participants the power to transfer their limited entry permits tends to *maintain historic levels of Alaskan participation in most limited fisheries*. While the Limited Entry Act is neutral with respect to residency, overall, Alaskans hold a substantial portion of the permits. In 1962, well before limited entry, Alaska residents constituted about two-thirds of the licensed commercial fishers in the state. Brown v. Anderson, 202 F. Supp. 96, 99 (1962). According to CFEC data, as of the end of 1996, 77% (more than 10,000) of Alaska's limited entry permits are held by Alaskan residents. More than one-half of the Alaskans holding entry permits are rural residents living

in areas where other sources of cash income are very limited. Some limited fisheries like the Lower Yukon and Lower Kuskokwim salmon fisheries have 99% Alaskan participation.

Again, while we can take satisfaction from these historic results, under the state and federal constitutions, the state cannot as a matter of law or policy discriminate unjustly against nonresident fishers.

Permit transferability: How does it affect levels of Alaska resident participation?

An entry permit secures a fisher's access to his or her fishery. Limited entry empowers fishers by giving them control of that access. The various protections that apply to entry permits help to insulate fishers from control and exploitation by others. In turn, fishers are free to transfer their entry permits to family members or to any other individuals with the ability to participate in the fishery. This "transferability" of permits, the ability of permit holders to transfer their permit to another person by gift, inheritance, or sale (with values determined by the private sector market) is a controversial aspect of Alaska's limited entry system. Yet, it is this free transferability that has allowed permits to remain in families, transferring between generations or from one family member to another, rather than having to revert back to the state at the end of one person's use of the permit, for reissuance. Transferability of permits is the aspect of the limited entry program probably most responsible for maintaining such high percentages of residents in Alaska's fisheries while meeting constitutional requirements of equal access.

In some rural areas of the state, because of the choices fishers have made regarding transfer of their permits, more permits have departed from the area by transfer than have been received by transfer. This is the case in Bristol Bay. This net drain of entry permits in areas where economic alternatives to commercial fishing are limited is a very serious concern.

The situation, however, varies from place-to-place and from fishery-to-fishery. This is true even within Bristol Bay, where, for example (again using CFEC data as of the end of 1996), in five of the last ten years, more salmon set net entry permits have transferred to local Bristol Bay residents than from them. Additionally, residents of Port Heiden held 13 entry permits in 1975, but held 18 by the end of 1996. Similarly, during the same time period, the number of Togiak residents holding salmon limited entry permits increased from 92 to 129. And, near Bristol Bay, the number of permits held by the residents of Chignik communities has increased.

The power to transfer has helped many Alaskan families, including those of Bristol Bay. Over time, there have been more than 1,200 transfers of entry permits to local Bristol Bay residents. More than 60% of these transfers have been by gift.

Overall, among permits transferred to rural Alaskans living near their fisheries, more than 50% of the transfers have been by gift. When permits have transferred from rural areas of the state, they have tended to transfer to other Alaskans (as opposed to nonresidents).

What has been done, or could be done, to minimize negatives and maximize positives of limited entry for Alaskans?

No system, whether open access or license limitation, is without drawbacks for some people. While Alaska's policy-makers have adopted a form of limited entry believed to be the "best" overall for the state and its fisheries, the state recognizes the need to help local Alaskans work within this system to maintain their place in their traditional fisheries.

The expense of obtaining a vessel, gear, and a limited entry permit can make entering a fishery difficult for those without ready access to financing. Traditionally, young people in many areas of the state have gotten their start in fishing by working as crew to obtain the experience needed to be successful and to save up the capital necessary to enter the fishery. Others have gotten their start by participating at little cost in "entry level" fisheries. Where such local "small boat" fisheries have come under limitation, the added expense of purchasing a permit has sometimes created an obstacle to this avenue to entering the fisheries.

The State has sought to assist Alaska residents in maintaining access to their fisheries by providing a loan program through the State Department of Commerce and Economic Development. This Commercial Fishing Revolving Loan Fund provides loans only to resident Alaskans. One of the authorized purposes of the program is financing of limited entry permits. Within this loan program, the state developed a special loan program for the benefit of Rural Alaskan residents. As of the end of 1996, the state's revolving loan program had loaned over \$148 million to Alaskans for the purchase of 2238 limited entry permits.

The state loan program presents opportunities for additional special cooperative efforts. For example, the Lower Yukon CDQ Corporation is participating with the Commercial Fishing Loan Program to help Lower Yukon residents obtain limited entry permits.

The Alaska Commercial Fishing and Agriculture Bank (CFAB), another state-authorized lending program, also finances limited entry permits for Alaskans. CFEC helped CFAB amend their statute to provide a new opportunity for local village residents to transfer permits to each other. Several Alaska Native villages are participating in this program.

These two programs are the only lending institutions allowed by state law to use the permits themselves as collateral for loans. The availability of these financing options for Alaska residents, and the ability of the two programs to use the permits as security, give Alaskans an edge in obtaining permits not available to non-residents.

At two AFN conventions in recent years, the Commission conducted workshops to help local people get and keep limited entry permits. CFEC has observed some groups become very successful at getting and keeping limited entry permits for the benefit of their

families and local communities. At an Economic Summit of all Southeast ANCSA Corporations, CFEC conducted a similar workshop. CFEC has made an effort to share information about how to use the limited entry system effectively with all interested Alaskan communities and Alaska Natives.

One idea sometimes proposed as a solution to the desire for more access to permits is to expand the program to allow additional permits to be acquired. Salmon fisheries in particular are under great stress right now because of some run failures and because of depressed worldwide salmon market conditions. Nonetheless, the Commission does have statutory authority to create more permits if it can satisfy the legal requirements. However, the state would not have the power under either the state or federal constitutions to direct permits exclusively to local village residents or any other exclusive group. Alaska residents and nonresidents alike would have to be allowed to compete for any additional limited entry permits created.

Another idea aimed at maintaining high numbers of permits in rural Alaska would be to assign permits to Alaska Native village councils or other local entities which would have the authority to transfer permits only among village members or local residents. Under the state and federal constitutions, the state would not have power to create a "closed class" of permit holders. Additionally, the state would not have the power to directly assign benefits exclusively to local Native villages (as opposed to other communities in other areas which might wish to compete for fishing privileges). All citizens must be equally free to come and go from commercial fisheries in order for the program to pass constitutional muster.

It is illustrative to note that Alaska's own State Supreme Court struck down the state's statutory rural preference for subsistence use. Additionally, under federal constitutional standards, the state Supreme Court struck down a 50% local hire requirement in financially disadvantaged rural areas. As we have noted, in contrast to this modest 50%, the limited entry program (which treats all applicants alike) has yielded 77% Alaskan participation in limited fisheries with some fisheries running as high as 99%. Despite the substantial percentage of Alaskan beneficiaries, limited entry has withstood numerous court challenges.

The Limited Entry Commission participated in the Bristol Bay Native Association (BBNA) Commission on Limited Entry which led to the creation by BBNA and the Bristol Bay Economic Development Corporation (BBEDC, the Bristol Bay CDQ Corporation) of the Bristol Bay Permit Brokerage based in Dillingham. The function of a local permit brokerage (as CFEC has advocated for years) is to protect permit holders from the IRS and to help local individuals obtain and retain limited entry permits.

Taking action to limit a fishery is another way CFEC can often help rural Alaskans maintain their position in fisheries, since permits are initially issued based upon participation in the fishery and economic dependence upon it. For example, in order to protect their places in Western Alaska herring fisheries, 537 Alaska Natives from villages

up and down the coast of Western Alaska petitioned the Entry Commission to limit entry into their herring fisheries. The Commission responded to this request and limited Western Alaska herring fisheries.

CFEC participates on the Alaska Federation of Natives Task Force concerning the Internal Revenue Service and Alaska Native fishers. The Task Force was instrumental in persuading the Alaska Legislature to create (within the state's Commercial Fishing Loan Program) the Tax Obligation Loan Program, which has helped many rural and Native fishers come into voluntary compliance with the IRS.

In 1996, CFEC issued the Carle decision which denied a request by the IRS to force transfer of an entry permit held by an elderly Alaska Native living in a coastal village. CFEC has worked aggressively with Governor Knowles, the Congressional delegation, AFN, the Bristol Bay Native Association, the Commercial Fishing Loan Program, and the Bristol Bay Permit Brokerage to avoid IRS seizure and forced sale of entry permits. As the result of these efforts, so far, no Alaskan has lost commercial fishing privileges due to an IRS forced sale.

CFEC and the state settled the Wassillie class action in 1988, authorizing Alaska Native class members to file very late applications for salmon limited entry permits. CFEC made Wassillie cases the highest priority and moved them ahead of other pending cases in the Commission's workload. The Wassillie settlement has allowed the Commission to issue many new limited entry permits to Alaska Natives. Additionally, CFEC has taken special measures to reduce pressure on the older Wassillie permit holders to sell their permits. CFEC wished to allow them sufficient time to consider transferring their permits to family and other community members.

The Limited Entry Act, as originally passed, was designed with the state's salmon fisheries in mind. Its provisions have proven less well-suited to some other fisheries which may lack long term participation track records upon which to base eligibility criteria or have very different patterns of participation or gear or vessel use. CFEC has worked very hard, within its statutory authority, to develop point systems to best meet the needs in each fishery. In addition, the legislature has passed several revisions to the limited entry statutes over the years, such as authorizing the use of capacity restrictions when appropriate, to address specific needs or problems.

Still, several other shortcomings of the limited entry law have yet to be addressed. For example, some developing fisheries are very different from the individual owner/operator model presented by Alaska's salmon fisheries. At the direction of the legislature, the commission is working to draft legislation to allow for license limitation based on vessels, rather than operators, for such fisheries. In addition, the existing statutory provisions for fishery moratoriums have proven to be unusable. The ability to efficiently impose a moratorium to protect a resource and participants when a fishery is growing very quickly is critical. A bill correcting this shortcoming in the law came very

close to final passage during the 1998 legislative session. The commission will seek its introduction and passage again in 1999.

Additionally, in response to the continuing salmon industry crisis and in cooperation with Governor Knowles' Salmon Forum, the Commercial Fisheries Entry Commission is developing an outline of possible options for reducing fleet size and improving cost effectiveness in salmon harvests. The outline will include discussion of legal and practical problems as well as potential benefits of the options. It will further suggest the practical steps required to pursue each option: for example, whether an option can be achieved right now under existing statutes or would require a change of law by the Legislature. The Commission hopes this outline will facilitate discussion of remedies on a fishery-by-fishery basis.

In short, while the limited entry law is not perfect, limited entry has, we believe, served Alaska's fishers and fisheries well overall. Despite having largely benefited Alaskans, limited entry has withstood constitutional challenges all the way to the U.S. Supreme Court. Any proposed changes to the law must be carefully considered so that limited entry can continue to survive court challenges. A change in the law resulting in a court finding limited entry unconstitutional could lead to opening Alaska's fisheries to fishers everywhere. Given the unfortunate state of salmon and other fisheries in Washington, Oregon, and California, one can easily imagine the potential influx of fishers from outside Alaska if limited entry were overturned by the courts.

The Commercial Fisheries Entry Commission stands ready to work with the Governor, Legislature, fishers and Alaskan organizations and communities to ensure that Alaska's limited entry system works well for the people and resources it is intended to serve.

SCOMM

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**The North Pacific Universities
Marine Mammal Research
Consortium**

**Annual Report
1999-2000**

The University of Alaska
The University of British Columbia
The University of Washington
Oregon State University



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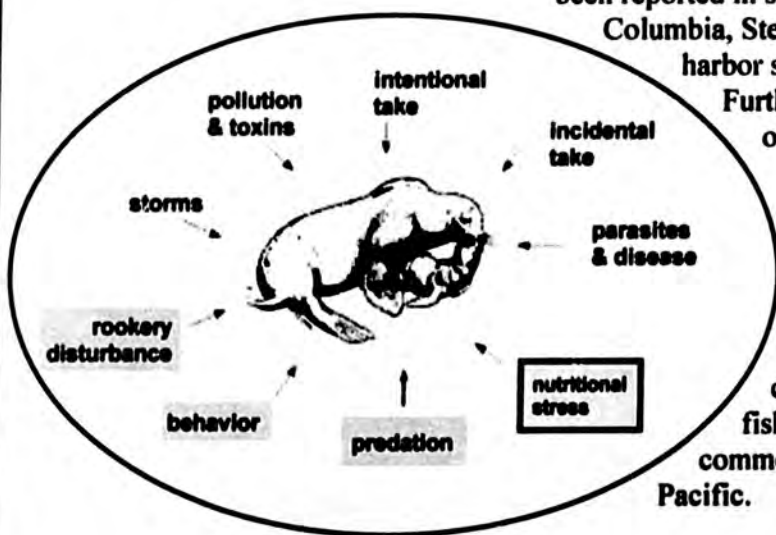
THE CONSORTIUM

In the summer of 1992, John Roos, Vice President of the Pacific Seafood Processors Association, on behalf of a group of representatives of the fishing industry, requested universities of the Pacific northwest to submit proposals for research on the impacts of fisheries on Steller sea lions. From that request, the *North Pacific Universities Marine Mammal Research Consortium* was formed with four participating institutions: the University of Alaska, the University of British Columbia, the University of Washington and Oregon State University.

The mission of the Consortium is to *undertake a long-term program of research on the relation between fisheries and marine mammals in the North Pacific Ocean and Eastern Bering Sea. Studies will focus initially on Steller sea lion biology and could include research on the effects of species interactions and oceanographic conditions on changes in sea lion abundance. The scope could subsequently be broadened to include other marine mammals and possibly sea birds.*

THE PROBLEM

Over the past few decades, the North Pacific has seen major changes in the abundance of seals, whales and seabirds. In Alaska, harbor seal numbers are greatly reduced, northern fur seals are *depleted*, while Steller sea lions have been declared *endangered* in parts of their range. Similar declines have been reported in some seabird breeding colonies. In British Columbia, Steller sea lion numbers appear stable, while harbor seal populations have increased rapidly. Further south, striking increases are being observed in the range and abundance of elephant seals and California sea lions.



Such large-scale changes may be a natural phenomenon or may be connected with similar changes occurring concomitantly in a number of commercial fisheries. All told, they stand to affect commercial fisheries throughout the North Pacific.



BACKGROUND

In 1990, the Steller sea lion was listed as a *threatened* species under the *U.S. Endangered Species Act*. In 1997, the Steller sea lion was listed as two distinct populations, maintaining those east of Prince William Sound as *threatened*, while those to the west were re-listed as *endangered*. Such listings forbid commercial or industrial activity that could further imperil the species.

The question of why Steller sea lions have declined in western Alaska continues to puzzle biologists. Possible causes include increased incidence of parasites and disease, predation by killer whales, nutritional stress resulting from competition with man or other species for food, or nutritional stress caused by natural and/or human-induced changes in the abundance, quality and distribution of prey. Pollution and toxic substances, entanglement in marine debris, and incidental and intentional take by man may also play significant roles.

Whether the decline is caused by a single factor or a combination of all of the above is a matter of scientific debate. The data necessary to resolve the question have been limited. However, research into the nutritional stress hypothesis is receiving increasing amount of attention and funding in recent years.

Sound management policies governing human activities require a better understanding of the relationship between such activities and the ecosystem in which sea lions live. The North Pacific Marine Science Foundation, which funds the research program of the Consortium, was

formed specifically for that purpose. Contributions to the Foundation have come from other foundations, federal grants, coastal communities and a wide spectrum of donors representative of the fishing industry.

The research program is overseen by a Scientific Advisory Committee with representatives of universities, industry, and government agencies. A Research Committee, composed of the research leaders at the four universities, is responsible for preparing a proposal for research each year and for reporting on progress to the Scientific Advisory Committee.

The Consortium has been greatly aided in its work by the guidance and assistance provided by the United States National Marine Fisheries Service, the Alaska Department of Fish and Game, Fisheries and Oceans Canada, the National Fish and Wildlife Foundation and the Vancouver Aquarium Marine Science Centre.

The Marine Mammal Research Unit of the Fisheries Centre at the University of British Columbia administers the Consortium. Core staff consists of a Research Director (Dr. A.W. Trites) and an Administrative Manager (P. Rosenbaum).

The interactions of fisheries and marine mammals are the subject of intensive research in many parts of the world, and will be a major focus of research in the North Pacific for many years. The Consortium coordinates university resources to help resolve the issues that arise.

Consortium researchers have completed their seventh full year of research. This report reviews the accomplishments from April 1999 to March 2000, and briefly sketches the work being undertaken for the 2000-2001 fiscal period.

RESEARCH PLAN

The Consortium's research program contains three components:

- field studies
- captive studies
- data analysis and laboratory studies.

The essence of the field studies is to contrast healthy sea lion populations in Southeast Alaska with declining populations in the Gulf of Alaska. Captive studies on Steller sea lions held at the Vancouver Aquarium Marine Science Centre are providing data about the animals' nutritional requirements and how they use the energy they derive from their food. Such information cannot be established in the wild. Captive studies also allow for the testing and development of new techniques for studying sea lions in the wild. Analysis of historical data sets and development of new laboratory techniques for processing biological samples comprise the third group of studies. The research plan balances short-term and long-term studies designed

to test the various hypotheses that have been put forward to explain the decline of Steller sea lions. The projects are integrated and draw on the expertise and talents of university-based physiologists, ecologists, marine mammalogists, fisheries specialists and oceanographers. Only a concerted effort and a commitment to long-term research will determine the causes of changes in the North Pacific.

RESEARCH UNDERTAKEN

FIELD STUDIES

Behavioral Ecology

Observations of Steller sea lions in their natural habitat and analysis of these data continue to comprise significant portions of Consortium research efforts. Studies at Timbered Island in Southeast Alaska during the winter of 1996 recorded the time Steller sea lions and their young spent on shore and at sea during the late stages of nursing when the young were expected to move from milk to independent foraging. Behavioral data analyses completed in 1999 by Boyd Porter (Alaska Department of Fish and Game) and Dr. Andrew Trites (UBC) indicate that pups (7-9 months) and dependent yearlings (19-21 months old) tended to stay on or near the haulout while their mothers were away and showed no signs of weaning or consuming solid food during winter.

Average trips to sea by young sea lions were 50% shorter than lactating females, suggesting that pups and yearlings make independent trips away from the haulout while their mothers forage. The winter attendance cycle of lactating females (consisting of one trip to sea and one visit on land) averaged almost 3 days, with the mother spending about 19 hours of this time onshore with her offspring. The winter attendance cycle of pups and yearlings averaged just over 2 days, of which 25 hours was spent on shore. Lactating females spent more time at sea during winter than during summer.

Changes in Body Size

Lengths and weights of Steller sea lions shot in the 1970s and 1980s indicate that Steller sea lions were physically smaller in the 1980s than they were in the past. Body size is thought to be a sensitive indicator of feeding conditions and is likely a good measure to assess the nutritional stress hypothesis. The problem in continuing the existing time series is that the traditional methods of measuring sea lions requires capturing or killing individuals.



Xavier de la Bernardie and Dr. Trites (UBC) have been developing a new method of measuring body length using image processing that causes no disturbance and yields large sample sizes to accurately quantify body size. The technique requires taking digital photographs of animals lying on haulouts or rookeries. The photographs are transferred to a computer, which can measure the distance between any two fixed points.

The software to measure body lengths was written in 1999 and tested on plastic seal models. Tests are underway on captive Steller sea lions at the Vancouver Aquarium Marine Science Centre and are expected to be completed in 2001. Assuming that length can be measured with an acceptable degree of accuracy, the technique will be used in the field in 2001.

Changes in Diet and Foraging Success

Identifying the types of bones (by species of fish) found in scats (feces) of Steller sea lions is the best nondestructive means presently available to determine what they eat. Since 1993, more than 2,000 scat sample have been collected in a collaborative project with ADF&G in Southeast Alaska. Preliminary results indicate that this large and apparently healthy population of Steller sea lions has the most diverse diet of all populations studied to date. In comparison, the least diverse diet occurs in the Aleutian Islands, where the sharpest population declines have been reported. Species consumed in high abundance in Southeast Alaska include cod, herring, sandlance, salmon, pollock and arrowtooth flounder. Other studies are comparing diets of male and female sea lions, and using statistical (Monte Carlo) simulations to determine the optimum number of samples that need to be collected each year to accurately quantify diet.

There is considerable speculation about whether the declining population of Steller sea lions is nutritionally stressed. There is also uncertainty over what portion of the Steller sea lion population is at greatest risk and what is the most critical time of the year for them. In response, Drs. Kathleen Hunt (UW), Andrew Trites (UBC) and Samuel Wasser (UW) proposed to measure the concentration of stress hormones contained in Steller sea lion feces from different age classes and from different regions of Alaska. Scats were collected in Southeast Alaska in July 1999 and February 2000 for this analysis. This non-invasive technique for assessing physiological stress has been used on a number of species to gather information on physiological responses to various environmental stressors. It has yet to be applied to Steller sea lions and may provide new insights into the effects of seasonal and environmental stresses on Steller sea lions.

Telemetry

As part of the search for evidence of a link between Steller sea lion decline and reduced prey availability, Dr. Russ Andrews (UBC) and a team of researchers from Alaska, Washington, Texas and British Columbia used new datalogging equipment to compare foraging activity in healthy and declining populations. By fitting dataloggers to five sea lions from Southeast Alaska and three from the Aleutian islands, the team was able to record the dive behavior, prey ingestion and energetics of the animals while they searched for food. The results proved surprising and challenged the notion that total prey availability alone determines foraging effort.

The sea lions from the relatively healthy population in Southeast Alaska spent more than twice as much time away from their rookeries on foraging trips than members of the declining population in the Aleutian Islands. It also took the Southeast Alaska sea lions five times longer to find their first fish. In addition, the Aleutian sea lions made shorter, shallower dives than their Southeast Alaska counterparts. Analysis of trawl surveys of prey in both areas and scat samples for diet analysis show that while juvenile groundfish were more abundant in the Aleutians, prey diversity was higher in Southeast Alaska. It may be that despite access to a single abundant prey species, Aleutian sea lions are suffering from a lack of a diverse diet.

Changes in the Forage Base

Although the total number of sea lions in the Gulf of Alaska and Bering Sea has decreased over the past two decades, not all sea lion rookeries have been affected to the same degree. Irregularities between the rookeries could have resulted from differences in seasonal densities of fish or relative amounts of human disturbance.

In 1995, Dr. David Sampson (OSU) completed his analysis of groundfish fishing activities near Steller sea lion rookeries in Alaska. The study found that large winter catches of pollock occurred near sea lion rookeries that suffered large declines in the early 1980s. However, sharp sea lion declines were also reported in the late 1980s in areas where no winter catches of pollock occurred. There was no relationship between the declines and the amount of fishing effort, total catches of groundfish, or catches of Pacific cod and Atka mackerel. It may be that the only way to determine if there is a relationship between commercial fishing activities and sea lion numbers is to conduct a carefully monitored experiment that heavily fishes in one area while restricting fisheries in another.

Such an experiment has yet to be carried out. However, a comparison of forage fish abundance and distribution in Southeast Alaska with the results of previous surveys in the Aleutian and Pribilof Islands



discovered significant differences between the two regions.

- *Forage fish abundance and distribution at Forrester Island, Alaska.* Norcross et al. 2000. Final contract report, NOAA Award No. NA66FX0455. Institute of Marine Science, University of Alaska Fairbanks.

This analysis of trawls, conducted by Dr. Brenda Norcross (UAF) and colleagues, found higher species diversity but lower numbers of forage fish in Southeast Alaska than in the western regions. The topography and environmental conditions of the two regions of Alaska also showed marked differences.

Another possible explanation for the decline of Steller sea lions is that an ecosystem shift changed the food base in the North Pacific in the mid 1970s. For example, removals of whales, along with the collapse of Pacific Ocean perch, herring and yellowfin sole stocks during the same interval in the eastern Bering Sea and Gulf of Alaska (1950s-1960s), resulted in the rapid loss of several million tons of biomass from this region. Such an abrupt change may have had cascading effects that led to new patterns of energy flow through food webs of relevance to other species at higher trophic levels, and could have been the cause of recent declines of sea lions, harbor seals, fur seals and certain seabirds. Another hypothesis under consideration is that ecosystem change resulted primarily from variability in patterns of weather and climate, particularly as related to the Aleutian Low pressure system.

A team of researchers headed by Dr. Trites (UBC) constructed a mathematical model of the Eastern Bering Sea ecosystem. The model was used to test the hypothesized cascading effects on Steller sea lions of commercial whaling, overfishing and climate change. The team employed an integrated software package (Ecopath with Ecosim) to quantitatively compare the eastern Bering Sea ecosystem during the 1950s, before large-scale commercial fisheries were underway, with conditions during the 1980s, after many marine mammal populations had declined.

- *Ecosystem change and the decline of marine mammals in the Eastern Bering Sea. Testing the ecosystem shift and commercial whaling hypotheses.* Trites, A.W., et al. 1999. Fisheries Centre Research Reports 1999, Vol. 7.

The mass-balance ecosystem models showed that most of the top predators (those at trophic level IV, including Steller sea lions, seals, sperm whales, deep-water fish and other demersal fishes) declined from the 1950s to the 1980s. The only top predators to increase were arrowtooth flounder and other large flatfish. At the mid-trophic level (III), baleen whales and pelagic fishes declined, while small flatfish, pollock, walrus and bearded seals increased. Based on the model's assumptions, pollock contributed more than 50% of the total flow of

energy at the mid-trophic levels during the 1980s compared with only 10% in the 1950s model. In contrast, pelagic fishes contributed nearly 50% of the flow in the 1950s. At the top trophic level (IV), no one species dominated the flow of energy during the 1950s. However, large flatfish contributed over 60% of the total energy flow in the 1980s model. Large flatfish and adult pollock that dominated the Bering Sea in the 1980s appear to be significant competitors of seals. Large flatfish are also competitors of Steller sea lions and there are large overlaps in the diets of pollock and baleen whales.

Removing whales from the 1950s ecosystem had a positive effect on pollock by reducing competition for food. However, whaling alone does not explain the 400% increase in pollock biomass that may have occurred between the 1950s and the 1980s. Nor do commercial fisheries account for these observed changes. In fact, the magnitude of changes that occurred in the biomass of all the major groups in the eastern Bering Sea cannot be explained solely through trophic interactions. Other environmental factors associated with a regime shift, such as water temperature or ocean currents, may have been at play.

According to a recent forecast, the northeast Pacific climate will cool through the coming decade and enter a "cold" regime by about the year 2005, characterized by conditions that prevailed in the 1950s through the 1970s. Biological correlates of atmospheric regime shifts continue to be discovered over a wide part of the North Pacific and Bering Sea. These include broad-scale changes in primary and secondary production, recruitment of several species of salmon and forage fishes, and the production and abundance of certain species of seabirds and marine mammals. Thus, the ecosystem structure and function may respond to the change in atmospheric forcing.

To shed light on those historic changes, Dr. Alan Springer (UAF) is continuing to collaborate with other investigators who are extracting core samples from anoxic basins in the Bering Sea and Gulf of Alaska. The samples record long-term (100+ year) records of variability of forage fish populations preserved in sediments. A one-meter core from Skan Bay, Alaska, for example, revealed a dramatic decline in the abundance of forage fishes coincident with the regime shift of the mid-1970s. A three-meter core has since been acquired that should allow an evaluation of the magnitude of variability in forage fish abundance over an interval of about the past 200 years. Mounting evidence suggests that climate change has a major effect on the structure of marine communities and the productivity of a variety of species from phytoplankton to seabirds and marine mammals.

Disease Pathology

While infectious diseases can degrade general health, reproductive capacity, and survival of Steller sea lions, the impact on population



dynamics is not clear. Drs. Kathy Burek (Alaska Veterinary Pathology Services), Terry Spraker (Veterinary Diagnostics Lab, Colorado), Durrell Kapan (UBC) and Andrew Trites are exploring the possibility that disease is causing the decline. The study has two parts: a modeling exercise that tests whether the patterns of decline are consistent with the transmission of an infectious agent, and a serological survey of exposure of declining and control populations of Steller sea lions to various pathogens, including caliciviruses, *Brucella* species, influenza A, morbilliviruses, phocine herpes virus, *Leptospira interrogans*, canine parvovirus and *Chlamydia psittaci*. Results to date suggest diseases are not a primary cause of the decline because they are either not present, or are present in both declining and thriving populations. However, endemic agents may be more pathogenic in stressed animals. Further research is necessary to compare the immune responses of different populations to pathogens that are present.

CAPTIVE STUDIES

Overview

A number of hypotheses have been proposed to explain the drastic decline in Steller sea lions in the North Pacific over the last 20-25 years. An array of biological and physical changes in the environment have been suggested as possible reasons for the population decline, but the extent and manner in which these variables might adversely affect sea lions has been difficult to ascertain due to a lack of understanding of sea lion physiology and bioenergetics (the manner in which energy is utilized by an animal).

Physiological and bioenergetic data can only be obtained from empirical experiments conducted under controlled conditions. The research program with our captive Steller sea lions carries out studies that are designed to measure several key parameters of a sea lion's energy budget. This will enable scientists to determine how changes in behavior, environment and life history affect a sea lion's energy needs and, ultimately, its health and survival. With the aid of a newly developed computer simulation model of Steller sea lion bioenergetics, the results of these studies help scientists to evaluate specific hypotheses and to formulate new predictions.

Basic Energy Use

The captive Steller sea lion research project uses an array of studies to routinely measure key parameters that make up a sea lion's energy budget. The most central of these studies measure the energetic costs of growth and resting metabolic rate.

■ Resting metabolism

Resting metabolic rate reflects an animal's basic energy use. It influences and forms the basis of most other bioenergetic parameters, serving as a key

comparative measure. Since they were pups, the metabolism of the captive sea lions at the Vancouver Marine Aquarium Marine Science Centre has been monitored using indirect calorimetry, a technique that measures oxygen consumption while the animals rest in a dry metabolic chamber. We have developed an unparalleled database that can trace changes in resting metabolic rate due to sea lion age, condition and the time of year.

Preliminary analysis indicates that sea lions undergo developmental and seasonal changes in metabolism. The sea lions exhibit an initial decrease in metabolism within the first 18 months of life. Metabolism then decreases at a much lower rate over the next several years. Overlaid on these developmental patterns is an emerging seasonal pattern of metabolic changes that increase in magnitude as the sea lion matures. There appears to be a peak in metabolism associated with the spring "fattening" period, and a period of low metabolism in the early winter. In addition to providing information on changes in the basic energy use of sea lions, these data have also been incorporated into concurrent bioenergetic studies, and serve as the backbone of a Steller sea lion computer model.

■ Body Morphology and Growth

Changes in nutrition can permanently affect the size or condition of individual animals, ultimately determining life history parameters such as reproductive success and survival. Quantifying the cost of tissue growth and the degree to which "normal" growth can be maintained under conditions of variable energy intake are central to understanding the impact of changes in prey availability, quantity or type on Steller sea lion populations. Understanding changes in body size, shape, and condition is critical to recognizing and evaluating the health of wild populations. In addition to obtaining data on individual parameters such as length, weight, and body girth, Consortium researchers have also used the primary data to construct and evaluate several indices of body condition. Previous studies highlighted the need for extensive longitudinal data sets to construct a reliable morphological measure of body condition that can be applied to animals in the wild.

The body mass of our captive sea lions has been measured daily since they were pups by training them to hold position on a platform scale. In addition, twice-weekly measurements of body length and body girth at three or four positions have also been obtained. Estimates of blubber depth at several key points have been obtained with the aid of a portable ultrasound machine.

The results of these studies provide an overview of how body size and shape change on a developmental and seasonal basis, and these data have been used to help construct a bioenergetic computer model of Steller sea lions. The data have also been used in a number of other studies, such as those which have quantified how body size, shape and condition change when energy or food intake is restricted. The construction and testing of species-specific condition indices that can be used to evaluate the condition of Steller sea lions in the wild also make use of this information.





The Effects of a Pollock Diet

Research continued into the possible role that switching diet from fatty fish (such as herring) to lean fish (such as pollock) may have played in the decline of Alaskan Steller sea lions. The captive sea lions were used in a number of experiments that examined the effect of several short-term diet switches between herring and pollock on body mass and metabolism, and also measured the amount of energy derived from different fish species. The results of these experiments were released in two scientific papers:

- *Digestive efficiency and dry-matter digestibility of Steller sea lions fed herring, pollock, squid, and salmon.* Rosen and Trites. 2000. *Canadian Journal of Zoology* 78:234-239.
- *Pollock and the decline of Steller sea lions: testing the junk food hypothesis.* Rosen and Trites. 2000. *Canadian Journal of Zoology* 78:1243-1250.

However, as with most scientific investigations, the experiments generated a number of additional questions. Another round of experiments was designed to test the effect of herring/pollock diet switches on sea lion growth and metabolism. Unlike the previous short-term experiments, in which the sea lions determined their own food intake, the sea lions were given diets of an equal energy value, and each trial was substantially longer (6 weeks). The food was distributed under two different conditions. It was either fed evenly throughout the week, or the majority was given on alternating days (which may more realistically mimic natural feeding patterns). Given that other studies have suggested pinnipeds may maintain body mass when eating a leaner diet, but at the expense of reduced body fat, the body condition of the sea lions was also measured using a deuterium dilution technique.

During the experiment, changes in body mass, morphology and condition, and overall activity have been monitored. Blood samples were also taken to measure the clinical effects of the diet on serological profiles (such as anemia, vitamin deficiency, etc.). Blood samples were also provided for collaborative studies examining the possible effects of diet on oxidative stress (Dr. David Kitts, UBC) and immune function (Dr. Kimberlee Beckmen, UAF). Results are expected in 2001.

Thermal/feeding Trials

Most parameters of an animal's energy budget are measured one at a time. For example, previous studies with the captive Steller sea lions have measured the additional energy expended by the animals to keep warm at different water temperatures (thermoregulation). However, documenting and understanding the interactions between bioenergetic parameters is important for a realistic interpretation of the energetic consequences of changes in an animal's energy budget.

One recent experiment examined the interaction between the heat generated from digesting a meal (known as the heat increment of feeding, or HIF) and the cost of thermoregulation. This question is critical to determining whether the heat increment of feeding is lost as a waste product or whether it can be used to offset thermoregulatory costs. The end result can significantly impact an animal's overall energy needs.

In this study, the apparent HIF was measured in the swim flume where water temperature was regulated between 2 and 10 degrees C by means of a water-chiller unit. The metabolism of the sea lions was measured by having the sea lion hold steady in the respiratory dome of the swim flume. The tests were run after an overnight fast to ensure the effects of digestion from the previous meal was complete. Another measurement was made under identical conditions 2 hours after eating a meal. Comparing the differences in these fed and fasted metabolic rates across different water temperatures should reveal whether HIF was substituted for thermoregulatory costs below the animals' thermoneutral zone. In addition, the experiments also measured the oxygen consumption of the sea lions while they were active within the swim flume. This will allow us to estimate the degree to which the sea lions use activity to offset the costs of thermoregulation, and how this interacts with the process of digestion.

The results from these tests suggest that, contrary to predictions, juvenile Steller sea lions do not use heat generated through digestion to offset the increased thermoregulatory costs of decreasing water temperature. The findings were presented by Dr. David Rosen (UBC) at the International Congress of Comparative Physiology and Biochemistry.

Heart Rate

Current techniques can only measure the energy expended by Steller sea lions in the wild as a gross average calculated over an extended time period. Measuring heart rate can be used to calculate the energy expenditure of Steller sea lions in the wild performing specific behaviours over short time periods. A project led by Jan McPhee (UBC) has established a linear relationship between heart rate and oxygen consumption across various levels of activity in four captive Steller sea lions.

To find the relationship, the sea lions were outfitted with two subcutaneous electrodes and a harness housing a computerized data-logger for monitoring and recording heart rate. Oxygen consumption data were collected simultaneously with heart rate data while an animal was at rest in the metabolic chamber or swimming against different water current speeds in the swim mill. From this relationship, recorded heart rate may be used to estimate metabolism and, thus, energy expenditure in wild Steller sea lions. However, further



research is needed into how the relationship may change in a more natural environment before this monitoring method is used in the field.

Hydrodynamic Forces

A team of researchers has been studying the hydrodynamic forces encountered by Steller sea lions as part of the effort to estimate the energy requirements the animals face in their aquatic environment. Such information is vital if we are to understand the dietary choices of the species, and the possible effects of changes in diet associated with changing habitats and climate. Lei Lani Stelle videotaped six sea lions at the Vancouver Aquarium as they glided past an observation window. Measurements of the change in velocity as the animals decelerated, along with each animal's size, shape and mass, produced estimates of the drag coefficient for Steller sea lions.

The published results of the experiments showed that drag coefficients for Steller sea lions lie within the typical range expected for marine animals – greater than that of a Gentoo penguin, but less than values associated with bottlenose dolphins. In general, it appears that Steller sea lions experience relatively low levels of drag, resulting in a swimming performance that is similar to other otariids, including the California sea lion. They also appear to swim at close to an optimum speed, based on calculations for a minimum cost of transport. The next step is the development of models that can estimate the energetic costs of swimming and the contribution of swimming costs to their overall energy requirements.

- *Hydrodynamic drag in Steller sea lions (Eumetopias jubatus)*. Lei Lani Stelle, Robert W. Blake and Andrew W. Trites. 2000. *Journal of Experimental Biology* 203: 1915–1923.

Fasting Mechanisms

Given that changes in nutrition may be contributing to the decline of Steller sea lions in the wild, it is important to understand the physiological mechanisms they use to cope with periods of poor nutrition and to develop methods of detecting this condition in the wild. To that end, the Consortium undertook a joint research project with Dr. Lorrie Rea (University of Central Florida) to examine the effects of undernutrition on blood chemistry.

The recently completed study investigated whether sea lions are able to cope with food limitation equally well during all times of the year. Data from previous fasting trials suggested that sea lions experience faster rates of mass loss during the non-breeding seasons. Differences in blood chemistry also suggested that sea lions, which voluntarily fast during the breeding season, do not readily enter a fasting-adapted metabolic state when forced to fast outside of the breeding season.

Paired fasting trials (breeding season and non-breeding season) conducted on four sea lions held at the Vancouver Aquarium during 1999 supported the findings of this study.

DATA ANALYSIS & LABORATORY STUDIES

A Bioenergetics Model

Foraging activity records only tell part of the story of the relationship between fish stock and predator population trends. A complete explanation of the impact of predation on fish stocks requires a detailed understanding of the food requirements of the predators. Traditionally, researchers have relied on analysis of stomach contents from wild sea lions and studies of captive animals. The former suffers from considerable logistical and economic hurdles, while captive studies are often limited by small sample sizes and the difficulty in approximating conditions in the wild. A third option is the development of a bioenergetics model. Such a model for Steller sea lions in Alaska constituted a major portion of a study conducted by Arliss Winship (UBC). Using existing physiological, diet and population data from a variety of sources, including captive sea lion studies, Winship constructed a model of how much food the sea lions needed at each stage of their lives and what those requirements imply for populations of prey.

Winship was able to provide estimates of the amount and type of fish necessary to support each population, in effect evaluating the nutritional stress hypothesis. The model showed that changes in the energy density of a sea lion's diet leads to significant changes in the amount of fish the animal needs to eat. Sea lion populations from Southeast Alaska consumed fewer fish per individual during the breeding season than sea lions in the Aleutians. The trend is associated with the relatively low energy density of the main prey species in the western region compared with the high-energy prey in the east. On average, sea lions in the central Aleutian Islands had to eat 12 per cent more fish than did sea lions in Southeast Alaska.

The model predicts that a 10-year-old male needs between 20 and 32 kg of herring or other small schooling fish, which are high in energy content, each day. To get a comparable amount of energy from a diet comprised of pollock, cod or other gadids typically low in energy content, the same animal would have to consume between 32 and 48 kg of fish. Those differences may be even greater when digestive efficiency of each prey type is taken into account. A comparison of the amount of energy required to digest different types of fish was undertaken by Dr. Rosen (UBC), who concluded sea lions use more energy digesting pollock compared with herring and squid due to the high proportion of bony material in pollock. Winship also analysed the sensitivity of the model to uncertainty in the data. He found that, while uncertainties associated with estimating diet and population can affect



the model's predictions, they are not as important as variation in metabolism estimates. This suggests that the largest improvements in the model's accuracy will come from studies of sea lion metabolic processes and activity rates.

Steller Sea Lions Sample Catalog

A new web-based catalog of biological samples and specimens from Steller sea lions stored at the National Marine Mammal Laboratory was unveiled in 2000. The laboratory, a division of the Alaska Fisheries Science Center but located in Seattle, houses a diverse collection of hard and soft anatomy samples currently of great potential value in evaluating population trends and trophic interactions. The samples include soft tissues (muscle, stomach, kidney, heart, liver, brain, blubber, skin), blood, vibrissae, teeth, skulls, bacula and other bones. In the past, much of the information about these samples was stored in numerous types of electronic files, making comparative analysis a logistical challenge.

In order to organize the information into an easily accessible format, Laura Litzky (UW) consulted staff from museums and other institutions, including the University of Alaska Fairbanks, the University of Washington (Burke Museum), the University of California at Berkeley (Museum of Vertebrate Zoology), the Santa Barbara Museum of Natural History and the Alaska Department of Fish and Game. The resulting database includes all information from the specimen data record (i.e., date of collection and measurements recorded) along with housing location, type of storage, analyses previously or currently being done on the sample, reference to results of analyses, and availability of the sample for loan. It is available at www.nmml.afsc.noaa.gov/pinniped.htm.



OTHER ACTIVITIES

Consortium researchers undertook a number of studies in 1999-2000 that fell within our mission statement, but were either not formally proposed in the Research Plan or were completed with outside funding. The Consortium participated in Seattle's Fish Expo. In addition, Dr. Trites made presentations to the Marine Mammal Commission and the North Pacific Fisheries Management Council describing of the Consortium's work. Dr. Trites also presented a number of papers to symposia and conferences, including:

- *Ecosystem change: Unraveling the effects of fisheries from natural oceanographic changes* (American Association for the Advancement of Science)
- *Ecosystem change and the decline of marine mammals in the eastern Bering Sea: testing the ecosystem shift and commercial whaling hypotheses* (13th Biennial Conference on the Biology of Marine Mammals)
- *Ecosystem effects of fishing in the eastern Bering Sea: insights from trophic mass balance assessments* (ICES Symposium on Ecosystem Effects of Fishing).

Talks and posters were also presented at the 13th Biennial Conference on the Biology of Marine Mammals by:

- Dr. Russ Andrews (*A comparison of the foraging ecology of Steller sea lions from declining and stable populations*)
- Jan McPhee (*Heart rates as an indicator of metabolic rates in captive Steller sea lions*)
- Linda Milette (*Behaviour of lactating Steller sea lions in Alaska: are they nutritionally stressed?*)
- Dr. David Rosen (*Hold the hot sauce: heat increment of feeding does not contribute to thermoneutrality in juvenile Steller sea lions*)
- Laura Williams (*Maximizing meals: digestive and assimilation efficiency in yearling Steller sea lions*)
- Arliss Winship (*A bioenergetics model for Steller sea lions: effects of diet and growth on food requirements*).

Dr. Rosen made several other presentations in 1999-2000, including:

- *The bioenergetic interactions of thermoregulation, activity, and digestion in juvenile Steller sea lions* (5th International Congress of Comparative Physiology and Biochemistry 1999).

Further presentations are planned in 2000-2001.



CONTINUING AND FUTURE RESEARCH

Energy Consumption Patterns

To understand the ecological impact of sea lions and other marine mammal predators at the top of the trophic pyramid, reliable estimates of just how much energy these animals consume are required. Ecopath, a computer model developed at the UBC Fisheries Center, is designed to aid ecosystem management and policy design, but requires accurate consumption rates to predict the effects of competition between marine mammals and fisheries for shared prey and primary production.

At present, limited basal metabolic and consumption rates are available for marine mammals, and such information is of little value when developing detailed models. Andrea Hunter (UBC) is collecting data from published and non-published studies of metabolic and consumption rates conducted at aquariums and research facilities around the world. Over the next year, she will create a database from the information and generate a mathematical model that will predict consumption rates of all species of marine mammals based on diet, season, activity level, morphology and demography, and other variables.

Dietary Quality

As the nutritional stress theory proposed to explain the decline of Steller sea lions attracts increasing attention, researchers are demanding more sophisticated explanations of how changes in diet can affect a marine mammal. Recent studies of sea lion stomach contents show that small schooling fish such as herring have been largely replaced over the last few decades with pollock and other gadid species. It is over this same period that Steller sea lion populations have fallen so dramatically in the Gulf of Alaska. This change in diet and the resulting reductions in growth rates, fur quality and pup survival, has given rise to what is colloquially known as the "junk-food hypothesis."

Testing the metabolic effects of a switch in diet from herring to pollock is relatively straightforward, and Dr. Rosen continues to explore this question with the sea lions at the Vancouver Aquarium. Testing for reproductive effects, however, is more problematic, because of the difficulty and length of time associated with breeding sea lions in captivity. Such effects are much more readily observed in small terrestrial mammals, and Carolyn Donnelly (UBC) is doing just that with rats. She is feeding her subjects meals consisting of a variety of mixes of Alaskan pollock and herring, and measuring the resulting growth and reproductive parameters. By early next year, it is expected she will have enough data on the effects of the dietary mixes on metabolism to compare with Rosen's data on captive sea lions. If the data are comparable, it may be possible to extrapolate the nutritional effects of pollock and herring from the rats to the sea lions.



Foraging Strategies

Nutritional quality may not be the only factor affecting sea lion prey choice. Olivier Cheneval (UBC) is exploring the possibility that prey behavior and foraging strategies employed to catch and consume prey also determine the energetic value of different species. Sea lions may expend more energy foraging for pollock and consume fewer fish per dive than they do foraging for herring.

To estimate the costs of foraging, the number of fish that can be caught per dive and the amount of time spent handling each species, Cheneval is videotaping three adult Steller sea lions as they forage for fish in a covered pool. The cover allows for gas exchange rates to be measured through a single breathing hole topped with a respiratory dome. The cover limits trainer-animal interactions and supplies a dim environment comparable to the aquatic conditions in which sea lions forage.

In addition to supplying vital data on the energetics of foraging, the project is designed to shed light on the physical details of foraging. Frame-by-frame analysis will be used to study capture, handling, swallowing and other events.

SUMMARY

The Consortium was formed to address issues related to marine mammal/fishery interactions in the North Pacific. We have undertaken a solid field program, a strong captive research program, and a major analytical research initiative. Research in 2000-2001 will continue with a balance of short-term and long-term projects designed to address and draw conclusions about changes occurring in the North Pacific and the role that commercial fisheries may have played in causing them. We have mounted a multidisciplinary research program to elucidate the factors responsible for the decline of Steller sea lions in Alaska. Our studies also take into account issues related to harbor seals, northern fur seals and whales that will attract greater attention in the years to come. Understanding the causes of change in the North Pacific requires a commitment to long-term research. Solutions are unlikely to come quickly and need a concerted effort.

ACKNOWLEDGEMENTS

The Consortium has been greatly aided in its work by the guidance and assistance provided by the U.S. National Marine Fisheries Service, the Alaska Department of Fish and Game, and Fisheries and Oceans Canada. We are particularly grateful for the field support provided by the Alaska Department of Fish and Game.

We extend our thanks to the Vancouver Aquarium Marine Science Centre and its staff, who provide us with research space and expertise



in training and caring for our Steller sea lions. We are particularly grateful to the subsistence hunters from the Pribilof Islands and Aleutians East Borough for collecting and providing scientific data from subsistence hunts. We are also grateful to the members of the Research and Scientific Advisory Committees for the many hours they have spent preparing and reviewing the Consortium research plans.

We wish to thank our volunteers and the many and varied donors for their support and continued interest. We would particularly like to acknowledge the At Sea Processors Association for donating pollock and the support of the National Fish and Wildlife Foundation, and the National Oceanic and Atmospheric Administration.

Finally, we would like to thank John Roos, who retired this year as President of the North Pacific Marine Science Foundation. We are indebted to him for his guidance and foresight, which were responsible for the creation and accomplishments of the Consortium.

CONTRIBUTORS AND FUNDING

Alaska Ocean Seas Fisheries Research Foundation
 Aleutian Pribilof Island Community Development Association
 Aleutians East Borough
 At Sea Processors Association
 City of Unalaska
 High Seas Catchers Cooperative
 National Bank of Alaska
 National Oceanic and Atmospheric Administration
 North Pacific Seafood Coalition
 Pacific Seafood Processors Association
 Pollock Conservation Cooperative
 Trident Seafoods
 University of British Columbia
 Vancouver Aquarium Marine Science Centre

The Consortium received start-up funding in the latter part of 1992 and full-year funding in 1993. The fiscal period was changed in 1994 from the calendar year to April 1 – March 31.

1992	(Sep. 1 – Dec. 31)	\$ 32,000
1993	(Jan. 1 – Dec. 31)	\$290,056
1994	(Jan. 1 – Mar. 31)	\$ 75,000
1994-95	(Apr. 1 – Mar. 31)	\$278,124
1995-96	(Apr. 1 – Mar. 31)	\$300,000
1996-97	(Apr. 1 – Mar. 31)	\$294,000
1997-98	(Apr. 1 – Mar. 31)	\$485,286
1998-99	(Apr. 1 – Mar. 31)	\$371,040
1999-00	(Apr. 1 – Mar. 31)	\$581,367

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**The North Pacific Universities
Marine Mammal Research Consortium
The University of British Columbia
6428 Biological Sciences Road
Vancouver, B.C. V6T 1Z4**

**Telephone: (604) 822-8181
Facsimile: (604) 822-8180**

**E-mail: consortium@zoology.ubc.ca
www.marinemammal.org**



UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE

ALASKA FISHERIES SCIENCE CENTER
7600 Sand Point Way N.E.
P.O. Box 15700 F/AKC
Seattle, WA 98115-0070

January 12, 2001

Dr. Bob Small
Alaska Department of Fish and Wildlife
Division of Wildlife Conservation
1255 West 8th Street
Juneau, AK 99802-5526

Dear Dr. Small:

You may be aware that the FY2001 NMFS appropriations language contains a large increase in funding for Steller sea lion protection and management, and includes a directive for the development of a comprehensive and coordinated research program with those funds. With very little lead time, we must frame a series of complex research questions to address a broad range of factors, both natural and anthropogenic, that may relate to the ongoing Steller sea lion decline. The scope of the projects, as well as their prioritization must be carefully determined in order to craft a research program that is scientifically sound, responsive to Congressional intent and consistent with the appropriations language. This new program will incorporate and expand the Steller sea lion investigations already underway. Additionally, we need to determine the most practical process for utilizing the residual, "no year" funds that are neither earmarked for a particular recipient nor required by the Alaska Region to meet groundfish management obligations precipitated by the 2000 Biological Opinion. Needless to say, this process and its results will receive considerable public and Congressional scrutiny.

To facilitate the construction of the requisite research program, the AFSC will host a planning meeting 24-25 January at our offices in Seattle (agenda attached). For these discussions, we hope to bring together representatives from each of the parties designated in the appropriations bill as well as scientists experienced in Steller sea lion research. Your participation is both welcomed and encouraged. Please refer to the agenda and the attached draft research framework for details. If you have questions regarding the meeting, do not hesitate to contact me (206-526-4000) or Doug DeMaster (206-526-4047) for assistance. I am looking forward to a frank and productive discussion, and thank you in advance for your contribution to this effort.

Sincerely,

James M. Coe
Acting Science & Research Director



Attachments(2)

Distribution:

OAR - Emory Anderson, Ron Baird, John Calder
OAR/PMEL - Eddie Bernard
NOS - Dave Johnson, Beth Turner
Sea Grant - Ron Dearborn, Louie Echols, Kate Wynne
NPFMC - Chris Oliver, Dave Witherell
ADF&G - Bob Small, Gordon Kruse
NPUMMRC - Andrew Trites
ASLC - Shannon Atkinson
SSL Recovery Team - Lloyd Lowry
F/AKR - Jim Balsiger, Mike Payne, Ron Berg, Peter Jones
F/NWC - John Stein
F/ST - Bill Fox
F/PR - Don Knowles
F/SF - Clarence Pautzke

cc: F/AKC - Doug DeMaster, Gary Stauffer, Rich Marasco, Rich Ferrero

Draft Framework for FY2001 Steller Sea Lion Research
(Alaska Fisheries Science Center)

The FY2001 appropriations language identifies a total of \$43.2 million in the NOAA budget for the implementation of Steller sea lion protective measures. This constitutes a very large increase of over \$36.8 million for Steller sea lion research and management. Recipients of the funding include NMFS, OAR, NOS, North Pacific Fisheries Management Council, State of Alaska, University of Alaska, Alaska Sea Life Center, and the North Pacific Universities Marine Mammal Research Consortium. The collective expertise of these organizations, supported by these new appropriations, provides an opportunity to significantly increase our knowledge of the Steller sea lion decline and to identify the most effective means of meeting conservation and management goals under both MSFCMA and ESA. However, the breadth of the Steller sea lion research questions, and the large number of research participants suggest that early and ongoing coordination of programs will be needed to effectively address the problem as specified by Congress. Recognizing that plans for the 2001 field season need to be developed immediately, and drawing upon the AFSC experience with Steller sea lion biology/management issues, we offer the following draft framework for potential research project development as a starting point for discussions among the endowed parties. This approach specifically incorporates all of the topics of interest expressed in the appropriations language (Secs. 209(a)(2) and 209(d)) in a format that will allow participants clarify the relationship between the primary research questions and the various component projects necessary to answer them.

The draft framework (Table 1) consists of 3 elements:

1. Identification of the principle hypotheses (causal factors) related to the Steller sea lion decline. These are extracted from the appropriations language.

Noting that the western population of Steller sea lions has declined substantially over the last 25 years, Congress has directed that a broad research program be conducted to examine "all possible factors relating to such decline, including the possible interactions between commercial fishing and Steller sea lions and the localized depletion hypothesis"(Sec. 209(a)(2)). The intended scope of this research effort is further specified in Section 209(d) where a collection of 12 topics are listed:

(d) SEA LION PROTECTION MEASURES. - \$20,000,000 is hereby appropriated to the Secretary of Commerce to remain available until expended to develop and implement a coordinated, comprehensive research and recovery program for the Steller sea lion, which shall be designated to study-

- (1) available prey species;*
- (2) predator/prey relationships;*
- (3) predation by other marine mammals;*
- (4) interactions between fisheries and Steller sea lions, including the localized depletion theory;*
- (5) regime shift, climate change, and other impacts associated with changing environmental conditions in the North Pacific and Bering Sea;*

- (6) disease;*
- (7) juvenile and pup survival rates;*
- (8) population counts;*
- (9) nutritional stress;*
- (10) foreign commercial harvest of sea lions outside the exclusive economic zone;*
- (11) the residual impacts of former government-authorized Steller sea lion eradication bounty programs; and*
- (12) the residual impacts of intentional lethal takes of Steller sea lions.*

Although these twelve items are specifically referenced to the \$20 million appropriated for sea lion protective measures, they identify topics that relate to the entire research effort. While the list points out various "things to study", it is also problematic in that it contains both categorical areas of research and individual topics that relate to one or more categories. For instance, a regime shift (5), could precipitate nutritional stress (9), manifested by changes in juvenile and pup survival rates (7). Nonetheless, with slight interpretation, the list provides the starting point for the research framework. Five principle hypotheses for the Steller sea lion decline were distilled from the 12 items in the appropriations language:

1. fisheries competition (item 4);
2. environmental change (item 5);
3. predation (item 3);
4. anthropogenic effects of disturbance/intentional mortality/harvests (items 10,11 and 12); and
5. disease (item 6);

A 6th principle, pollution, was also added to our list. Each of these are listed in the first column of the draft framework. The second column lists the various ways in which the general categories of causation expressed by the principle hypotheses might result in adverse impacts to steller sea lions (i.e. the vectors). We suggest that these vectors be discussed and carefully articulated because they constitute different research orientations and designs.

These six principle hypotheses then form the overall headings under which more specific research questions fall. Thus, the second step is:

2. Expansion of the general hypotheses into individual research questions that represent the vectors through which the interaction between the causal factor and the Steller sea lion may occur.

Each hypothesis contains multiple pathways or vectors by which impacts on Steller sea lions may manifest themselves. For instance, fisheries competition could effect Steller sea lion foraging success either by altering prey abundance (e.g. globally or locally) or by disturbance of prey fields (e.g. via redistribution or changes in density). This would be the appropriate context to address how such modifications of habitat (natural or anthropogenic) relate to other elements on the list such as nutritional stress or changes in survival or reproduction.

Articulation of the many research directions underlying each causal element category is a prerequisite to their prioritization and consideration of feasibility. To help determine feasibility and to move closer to the development of proposals or spending plans, the third step in the framework is necessary:

3. List the research project elements that would be required to address each of the questions posed in the previous step.

The building blocks needed to fully address each pathway or vector are represented by the set of individual research elements supporting the projects. In nearly every case, all proposed studies will ultimately involve additional research on either Steller sea lion biology or the habitats (both physical and biological) that influence their recovery. It is likely that much of the work identified under one hypothesis could contribute to testing other hypotheses and this step will help to identify opportunities for research plan integration among the participants.

Overall, the development of a framework such as the one proposed will help participants identify aspects of an overall research program that their resources and expertises are most suited to address. Using this framework as a starting point, we hope to encourage the participants to contribute to the full development of a comprehensive and coordinated research program. Further, agreement on the overall context of the research effort will encourage cooperation and avoid duplication of effort.

Table 1. Draft Framework for FY2001 Steller Sea Lion Research (Alaska Fisheries Science Center)

		Research Project Elements
1. Fisheries Competition	V1 - Removals of prey by commercial fisheries reduce the abundance/availability of prey on the global scale (i.e., FMP area or ecosystem wide) V2 - Removals of prey by commercial fisheries reduce the abundance/availability of prey at local scales of relevance to foraging Steller sea lions V3 - Disturbance of prey fields by commercial fisheries reduce the availability of prey by reducing patch densities V4 - Disturbance of prey fields by commercial fisheries reduce the availability of prey by redistribution of prey patches	V1 Project Elements: Requires expanded knowledge of a) prey base, stock dynamics (i.e. spatial/temporal distributions, seasonal movement patterns, factors effecting predation, survival and productivity), b) effects of fisheries removals on the prey base (recognizing these dynamics) and Steller sea lion response to associated differences in prey availability. - Improve ability to assess Atka Mackerel, GOA Pollock, GOA Pacific cod - Develop an ability to assess forage species for the BSAI and GOA - Improve catch monitoring for groundfish vessels less than 125 feet - Develop methods for monitoring catch of forage fish at the species level species reference points - Develop and update ecosystem models indicators of the GOA and BSAI ecosystems - Expand studies of predator/prey interactions AND Update analysis of existing samples for predator/prey models - Improve knowledge of the role of oceanographic factors on large scale fish distribution - Improve knowledge of the role of oceanographic factors on fish production on fecundity and maturity of groundfish species

		- Develop multi-species biological reference points and evaluate impacts relative to single- - Improve knowledge of the impact of gear allocations on fish distribution and abundance - Improve knowledge of the impact of fisheries - Implement seasonal resource surveys - Design and implement tagging projects to improve knowledge of seasonal Pacific cod and Atka mackerel movements - Update and develop new multi-species seasonally explicit predator/prey models - Design and Implement seasonality studies in regions of contrasting Steller sea lion abundance trends V2 Project Elements: - Design and implement resource surveys to determine the impact of fisheries on local groundfish abundance and distribution - Conduct studies to examine the densities of fish utilized by commercial fishermen and Steller sea lions - Determine the role of oceanographic conditions availability at the local scale - Determine the availability and ecosystem utilization of fish-prey at the local scale - Improve, update and develop new spatially explicit multi- species models
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	<i>Table 1-5</i> <i>1981-1982</i>	V3 Project Elements -Conduct studies associated with commercial fishing that characterizes the prey field before, during and after fishing V4 Project Elements -Conduct studies associated with commercial fishing that characterizes the prey field before, during and after fishing
2. Environmental Change	Theme: changes in K V1. Changes in primary production have lead to conditions which effect Steller sea lion survival or reproductive capability V2 <i>Changes in the physical environment</i> have lead to conditions which effect Steller sea lion survival or reproductive capability V3 <i>Changes in species composition</i> have lead to conditions which effect Steller sea lion survival or reproductive capability	V1 Project Elements - Correlate changes in the life history of steller sea lions based on collections made in the 1970s and 1980s with features of the physical and biological marine environment from the same period <i>under the primary production</i> V2 Project Elements - Correlate changes in the life history of steller sea lions based on collections made in the 1970s and 1980s with features of the physical and biological marine environment from the same period V3 Project Elements - Correlate changes in the life history of steller sea lions based on collections made in the 1970s and 1980s with features of the physical and biological marine environment from the same period Notes: time series late 70's to present; requires Stellers branding project for contemporary vital rate data modeling: ECOSYM, ECOPATH moorings, drifters diet diversity trends (longitudinal across range of w. stock; re-analysis of diet diversity data

3. Predation	V1 Predation by <i>killer whales</i> has a) increased as a function of their increased populations or per capita predation rates and is contributing significantly to their decline or b) remained constant but has increasing effect at lower Stellers population levels. V2 .Predation by <i>sharks</i> (sleepers or salmon) has a) increased as a function of their increased populations or per capita predation rates and is contributing significantly to their decline or b) remained constant but has increasing effect at lower Stellers population levels.	V1 Project Elements Killer whale studies - population trends and abundance - diet (% Stellers) -free fatty acid signature (Stellers in killer whales) - direct observation - distribution and movements, especially with respect to activity near rookeries V2 Project Elements shark studies - population trends and abundance - stomach sampling (longline fishery for large sleeper sharks off sea lion rookeries Aug-Oct 01 and Mar-May 02) - direct observation? - live predation vs scavenging
4. Anthropogenic Effects of Disturbance/ Intentional Mortality/Harvests	V1 One or more sources of <i>anthropogenic disturbance</i> , including direct mortality, harvesting, incidental take and intentional killing lead to and continue to contribute to the ongoing Steller sea lion decline	V1 Project Elements -retrospective summary of removals from all sources by year, by area prior to the onset of the decline - modeling of population responses given combinations of sources - effects of disturbance as it translates to decreased reproductive capacity or increased mortality
5. Disease	V1 Disease has reduced the reproductive capacity of steller sea lions V2 Disease has increased the mortality of Steller sea lions	V1 and V2 Project Elements - antigen analyses of tissues (via 1 time biopsy or carcass sampling) - longitudinal studies of branded animals (blood, and biopsy) -contaminant pathways - risk analyses - contrast SE w/ GOA w/ BS
6. Pollution	V1 Pollutants have reduced the reproductive capacity of steller sea lions V2 Pollutants have increased the mortality of Steller sea lions	V1 and V2 Project Elements -contaminant analyses of tissues (via 1 time biopsy or carcass sampling) - longitudinal studies of branded animals (blood, and biopsy) -contaminant pathways - risk analyses - contrast SE w/ GOA

Steller Sea Lion Research Coordination Meeting
Building 3, Room 2104
NOAA Western Regional Center
7600 Sand Point Way NE, Seattle, WA
24 - 25 January 2001

Wednesday, 24 January

0900 ~ Opening Remarks (Jim Coe - AFSC)

- Welcome from the chair (Ron Dearborn - Alaska Sea Grant)
- Statement of purpose
- Review of the agenda
- Introductions

0940 ~ Perspectives on Steller sea lion research

- National Perspective (Ron Baird - Sea Grant)
- Regional Perspective (Jim Coe - AFSC)
- Industry Perspective (Dave Frasier - NPFMC Advisory Panel)

1010 ~ Background and issue orientation

- Summary of the events leading up to expansion of the Steller sea lion research program (Doug DeMaster - AFSC/NMML)
 - Steller sea lion trends and current status
 - ESA listing research based on Recovery Team recommendations
 - Current lines of research
 - Fisheries management connection: requirements under ESA, MSFCMA &

NEPA

- Litigation based on ESA and NEPA compliance
- Comprehensive Biological Opinion and responses to it

1055 ~ Break (20 min)

1115 ~ Congressional response to the Steller sea lion issue

Essence of the appropriations language:

- Senate Report
- Conference Report
- Senate debate

Thumbnail sketch of the gross operating budget

1130 ~ The need for applied management - NPFMC decisions and time lines

(Dave Witherell - NPFMC)

1145 ~ Physical oceanographic and climatic research as applied to the Steller sea lion case
(Eddie Bernard - PMEL)

1200 ~ Lunch Break (1hr 30 min)

1330 ~ The development of an integrated research plan

- Chair lead discussion of today's approach
 - Proposed use of AFSC or other framework
 - Identify hypothesis and operationally feasible research questions
 - Relating research needs to preferences and expertise of participants
- Identify potential and real overlapping expectations
 - Gross estimates of project costs

1500 ~ Break (20 min)

1520 ~ Continuation of integrated research plan discussions

1700 ~ Adjourn

Thursday, 25 January

0900 ~ Recap of progress toward research plan development

0915 ~ Continuation of integrated research plan discussions (as needed)

1040 ~ Break (20 min)

1100 ~ Fiscal and Logistical Considerations: Protocols for Research Plan Assembly, Reviews and Distribution of Funds

- Earmarked vs. unspecified funds
- Spending plans and RFPs
- Spending plan deadlines and format
- Executable plans vs. RFPs (Feb 15 deadline for spending plans)
- Format for spending plans
- Reviews - when and by whom
- Special considerations for grants process
- Consideration of an advisory group formation

1200 ~ Lunch Break (1 hr 30 min)

1330 ~ Continuation of the morning's discussions

1500 ~ *Break (20 min)*

1520 ~ Summary and Consideration of Future Actions

- Subsequent meetings
- Time line for research plans
- Assignments for the advisory group (?)

1700 ~ *Adjourn*



Alaska Marine Conservation Council

P.O. Box 101145 • Anchorage, Alaska 99510

(907) 277-5357 • (fax) 277-5975

amcc@akmarine.org • www.akmarine.org

Steller Sea Lions and Fisheries

Community Update #4

January 22, 2001

Background

November 30, 2000

The National Marine Fisheries Service (NMFS) released a Biological Opinion (BiOp) concluding that food stress continues to be the agency's leading hypothesis for why sea lions are not recovering. The agency found that the Bering Sea/Aleutian Island and Gulf of Alaska (GOA) pollock, Atka mackerel, and Pacific cod fisheries are jeopardizing the recovery of the Steller sea lion. An accompanying management measure called an RPA (Reasonable and Prudent Alternative--a legal term) restructures the fixed gear and trawl fisheries to reduce the rate and level of fishing, especially near rookeries and haulouts. Although the RPA may protect sea lion feeding grounds, the measures also severely limit fishing near many of Alaska's coastal communities in the 2001 fishery and potentially beyond.

December 5, 2000

The U.S. District Court acknowledged completion of the BiOp and dissolved the trawl prohibition that it put in place in July of 2000. The Court did not rule on the adequacy of the BiOp or the fairness of the RPA; it will only do that if the BiOp and/or RPA is appealed.

December 15, 2000

Congress passed a Steller sea lion "rider" (federal law) requiring that Steller sea lion conservation measures be phased in over 2001 to allow time for a scientific review of the BiOp and for input from the public and North Pacific Fishery Management Council (NPFMC).

January 11-12, 2001

The North Pacific Fishery Management Council met in Seattle to consult with NMFS about their draft emergency rule (part of the phase-in of sea lion conservation measures), which the Stevens rider requires NMFS to put into effect by January 20, 2001.

Upcoming Meetings

February 5-12, 2001 -- North Pacific Fishery Management Council meeting at the Anchorage Hilton

February 6, 2001, 1 p.m. -- Joint Board of Fish/North Pacific Fishery Management Council meeting at the Fourth Avenue Theater in Anchorage

Early February (Date to be Announced) -- Board of Fisheries meeting to address Steller sea lion issues in relation to the state water fisheries

For More Information

Check out these web sites for further information:

- North Pacific Fishery Management Council: www.fakr.noaa.gov/npfmc/
- National Marine Fisheries Service (Alaska Region): www.fakr.noaa.gov/
- Board of Fisheries: www.state.ak.us/local/akpages/FISH.GAME/boards/fishinfo/bofhome.htm

AMCC is a community-based organization working to minimize bycatch, protect habitat, prevent overfishing, and promote clean, community-based fishing opportunities.

What are the new rules regarding the federal groundfish fishery in 2001?

New measures to be implemented based on the November 30, 2000 biological opinion include:

- Prohibition on groundfish fishing by federally permitted vessels within 3 nautical miles of more than 75 important (currently used by sea lions) haulout sites. NMFS has stated that the current common practice of forfeiting federal permits to fish the state fishery, then reverting back to federal permits will soon no longer be allowed.
- Establishment of two fishing seasons for Pacific cod in both the Bering Sea/Aleutian Islands and Gulf of Alaska, January 1-June 10 (60% of allocation) and June 11-December 31 (40%).
- Reduction in the allowable catch of GOA pollock from the NPFMC's recommended 2001 level by 10%. This is less than the 20% reduction that would have been required by the BiOp, because Senator Stevens' rider limits the reduction in allowable catch to 10%.
- Capping of the 2001 Bering Sea pollock catch in the sea lion conservation area to no more than the amount authorized in 2000. The purpose of this measure is to require that the increase in 2001 pollock quota be caught outside critical habitat. This cap will remain in place until the BiOp RPA is fully implemented in 2002.
- Implementation of the closed areas in the BiOp ("red zones"), starting June 10, 2001 for pollock, Pacific cod and Atka mackerel fisheries. The NPFMC can recommend modifications to these closures for the 2nd half of 2001 as long as the changes meet the requirements of the BiOp, which are to close at least 50% of critical habitat to the three fisheries and maximize protection of Steller sea lion pups and juveniles. In 2002, the closed areas must also provide for the statistical design of a monitoring program to evaluate the effectiveness of protection measures.

Alphabet Soup

AMCC -- Alaska Marine Conservation Council

BSAI -- Bering Sea/Aleutian Islands

BiOp -- Biological Opinion

GOA -- Gulf of Alaska

NMFS -- National Marine Fisheries Service

NPFMC -- North Pacific Fishery Management Council

Prey Field -- the fish available to sea lions for food

RPA -- Reasonable and Prudent Alternative

What actions did the North Pacific Fishery Management Council take?

At its January meeting, the NPFMC made minor adjustments to the emergency rule that NMFS presented, including shifting some halibut bycatch caps among seasons. They also responded to the request of AMCC and others to direct NMFS (again) to analyze the effects of different gears on the availability of prey to sea lions. The NPFMC had directed National Marine Fisheries Service to do this last September, and raised the issue again in December, but NMFS has not to date incorporated differential gear impacts in their sea lion protection measures. The NPFMC also committed to forming a sea lion committee soon.

AMCC's Comments to the North Pacific Fishery Management Council

AMCC testified that while we recognize a variety of factors have caused the decline of Steller sea lions, sea lion conservation management measures should be driven by the need to protect the integrity of the "prey field," or the fish available to sea lions for food. We supported the BiOp's requirement to lower the allowable catch level when populations of prey species are low (called the global control rule). AMCC also called for the NPFMC to:

- Analyze gear-specific differences in fishery impacts on Steller sea lion prey fields. Differences in the impacts of various gear types is described in the BiOp: *"The various gear types used in these fisheries (trawl, pot, hook and line, jig) have differential effects on the environment. ...In terms of effects on Endangered Species Act-listed species, the slower and more dispersed nature of the hook and line and pot fisheries make localized depletion less likely than would be possible with trawl gear."* (p. 215, BiOp, November 30, 2000)

- Provide a clear schedule for how sea lion research currently being commissioned feeds into the development of future sea lion conservation measures.
- Use weekly delivery limits for vessels fishing in critical habitat as a way to slow down the rate of harvest and make it possible for small boats and fixed gear vessels to participate effectively.
- Vessels with substantial cod bycatch (such as trawlers in flatfish fisheries) should be allowed only 5% maximum retainable bycatch (instead of 20%, as currently allowed) when fishing in critical habitat. This will help protect the integrity of the prey field by everyone who catches cod. Increased monitoring of fishing through vessel monitoring systems and observer coverage should be increased on all vessels that fish in critical habitat.
- In 2002, regulations for fisheries that occur in sensitive habitats should encourage less selective gears to convert to more selective gears with slower rates of extraction (for example, conversion from cod trawling to pots).
- Consider findings of and coordinate with the various working groups analyzing the sea lion issue, including the State of Alaska Steller Sea Lion Recovery Team.

AMCC's Position on State Water Cod Fisheries

- AMCC supports preserving the status quo in the state waters fisheries because of the importance of these fisheries to local communities and because the gears fishing cod in state waters are the most selective and hold the most promise for long term sustainability of both sea lions and the ecological health of the fisheries.
- The differing impacts of various gear types on catch rates and levels and bycatch and habitat impacts should be the basis of any sea lion conservation measure.
- The State has more ability to control rates of removal (of fish) at a local level than federal managers do, and the State can use this to its advantage to work proactively to prevent localized depletions and slow down the fishery where warranted.
- AMCC supports establishing a state waters cod fishery in the Bering Sea around participating communities, in order to promote the use of less-impacting and more-selective gears.

A Call to Action

You can help communicate the importance of protecting Steller sea lions in a way that also enables appropriate levels of fishing to occur by writing the North Pacific Fishery Management Council and the Alaska Board of Fisheries. Make the points listed above or present your ideas on how the RPAs might be changed to better balance sea lion conservation objectives and fishing priorities. We encourage you to write TODAY to:

Federal Fisheries: Chairman David Benton, North Pacific Fishery Management Council, 605 W. 4th Ave, Suite 306, Anchorage, AK 99501-2252 Fax (907) 271-2817

State Waters Fisheries: Board of Fisheries Chair Dan Coffey and Groundfish Committee Chair Ed Dersham, c/o Diana Cote: ALASKA DEPARTMENT OF FISH AND GAME, Boards Support Section, P.O. Box 25526, Juneau, AK 99802-5526
ph: (907) 465-4110, fax: (907) 465-6094, email: Diana_Cote@fishgame.state.ak.us

Please contact AMCC if you would like more information on the sea lion issue, and please send us a copy of letters or e-mails you send out on this subject.

**FY01 Steller sea lion-Groundfish
Budget
\$43.15 million**



Studies Identified in Steven's Rider

- Available prey
- Predator/prey
- Predation by other marine mammals
- Fishery-SSL interactions
- Regime shift
- Disease
- Survival rates

- Population counts
- Nutritional stress
- Foreign harvests
- Residual impacts of former eradication programs
- Intentional lethal takes
- Non-lethal measures to protect SSL from predators

“Endowed Organizations”

<i>Organization</i>	<i>Funding Level in FY01</i>
NMFS	\$7.85 million
Alaska SeaLife Center	\$6.0 million
ADFG	\$2.5 million
Univ. of Alaska	\$1.0 million
NPUMMRC	\$0.8 million
OAR/PMEL	\$6.0 million
NOS	\$2.0 million
NPFMC	\$2.0 million
Commerce	\$15.0 million
Total	\$43.15 million

National Marine Fisheries Service

FY01 Budget-\$7.85 million

Study (<i>Preliminary</i>)	Cost (000s)
Localized depletion (cod, pollock, Atka mackerel)	1600
Satellite tagging SSL	400
Food habits/foraging behavior	350
Forage fish assessment	550
Regime shift- AI passes (with PMEL)	400
Implement Recovery Plan	2300
Predation studies	750
AKR Management Activities	1500

Alaska SeaLife Center

FY01 Budget-\$6 million

Study (<i>Preliminary</i>)	Cost (000s)
Feeding behavior	1000
Remote monitoring/branding	1500
Collection of pups-short term hold	1500
Endocrine and immune function	300
Chiswell Island prey study	500
Chiswell Island predation study	200
Disease and reproductive biology	500
Instrumentation (e.g., implants)	500

Alaska Dept. of Fish and Game

FY01 Budget- \$2.5 million

Study (<i>Preliminary</i>)	Cost (000s)
SSL body condition and life history	2000
Estimation of vital rates	300
Model response to incidental take	150
Survey of blood borne diseases	25
Measurement of contaminants	25

University of Alaska

FY01 Budget- \$1 million

Study (<i>Preliminary</i>)	Cost (000s)
Seasonal diets of SSL at Kodiak	200
Prey availability at Kodiak	300
Prey quality at Kodiak	100
Diet of SSL competitors	200
Killer whale/shark diets at Kodiak	200

North Pacific Universities Marine Mammal Research Consortium FY01 Budget- \$0.8 million

Study (<i>Preliminary</i>)	Cost (000s)
Bioenergetics of SSL	250
Bias in scat analysis	35
Telemetry (implants)	40
Amack food quality/SE scat collection	24
Bioenergetic modeling/timing of molt	31
KW predation model/subs. Harvest	120
Diet in Oregon/WA/forage fish abund.	22
SSL vital rates and condition indices ?	120

North Pacific Fisheries
Management Council
FY01 Budget- \$2 million

Study (<i>Preliminary</i>)	Cost (000s)
NAS Independent review	700
Management and legal compliance	1300

Oceanic and Atmospheric Research

FY01 Budget- \$6 million

Study (<i>Preliminary</i>)	Cost (000s)
Analysis of existing environmental data	500
2-yr field study and modeling-combination of PMEL and RFP (CIFAR)	5000
Coordination, communication, outreach	500

National Ocean Survey

FY01 Budget- \$2 million

Study (<i>Preliminary</i>)	Cost (000s)
Competitive process for directed research on predator/prey relationships (CIFAR)	2000

Dept. of Commerce
FY01 Budget- \$15 million

Study (<i>Preliminary</i>)	Cost (000s)
Competitive process for directed research on predator/prey relationships	15,000

**% of Funds in FY01 Budget to inhouse
research, contracts, management and reviews
\$43.15 million**

- 36% in-house research
- 56% contractual studies (research determined by competitive process)
- 6% management related to ESA/NEPA
- 2% external reviews
- Possible Problem- FY02 budget currently has \$7-10 million assigned to SSL-groundfish research and management
- Possible Problem- Contractual studies may not provide information in time for October 2001 review

A Review of the Effects of Regime Shifts on the Production Domains in the Eastern North Pacific Ocean

Ashleen J. Benson¹ and Andrew W. Trites²

¹ *Department of Earth and Ocean Sciences, Oceanography,
University of British Columbia, Vancouver B.C. V6T 1Z4 Canada.*

² *Marine Mammal Research Unit, Fisheries Centre,
University of British Columbia, Vancouver B.C. V6T 1Z4 Canada.*

November 27, 2000

The intent of this review is to identify the timing of regime shifts in the north Pacific Ocean and to characterize the nature of the biological responses, from primary producers through to the top predators in the food chain. The available data indicate that large-scale, low frequency variations occurred in climatic and oceanic conditions in 1925, 1947, 1977 and 1989. They also indicate that these changes occurred abruptly and were not random variations. Changes in atmospheric pressure can alter wind patterns that affect oceanic circulation and physical properties such as salinity and depth of the thermocline. This in turn affects primary and secondary production. Regime shifts can have opposite affects on species living in different domains, or can affect different species living within a single domain in opposite ways. The effects of climatic forcing on fish and marine mammals are not easy to predict, and may indirectly affect these populations through changes in the distribution and abundance of predators and prey. Direct effects of regime shifts on marine ecosystems are manifested more quickly than indirect responses. Natural variability in the productivity of fish stocks in association with climate indicates that new approaches to managing fisheries should incorporate climatic as well as fisheries effects.

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1. The Regime Concept

Isaacs (1975) introduced fishery scientists to the concept of 'locked in' trends in climatic, oceanic and biological systems (MacCall, 1996; Beamish et al., 2000). He called these persistent trends *regimes*. Regimes have been defined as multiyear periods of linked recruitment patterns in fish populations or as stable conditions in physical data series (Beamish et al., 1999). Concurrent (and sometimes abrupt) changes in these biological and physical variables indicate a *regime shift*. These natural patterns of variability raise questions about the biological basis of sustainability of fisheries (Beamish, 1995), and are leading ecologists away from a single, steady state view of ecosystems to one that recognizes that ecosystems fluctuate because of internal and external sources of variability (e.g., Steele, 1996; Trites et al., 1999).

2. Climate/Ocean Variability

The basic state of the atmosphere-ocean climate system over the north Pacific Ocean shifted abruptly in the late 1970's (Ebbesmeyer, 1991; Graham, 1994). Atmospheric circulation changed throughout the troposphere (Trenberth, 1990), and the Aleutian Low pressure system deepened (Miller et al., 1994) and shifted eastward (Trenberth, 1990). This in turn advected warm, moist air over Alaska and colder air over the north Pacific. Concurrently, sea surface temperatures cooled in the central Pacific and warmed along the west coast of North America (Miller et al., 1994). Sea ice decreased in the Bering Sea (Manak and Mysak, 1987) and changes were observed in the surface wind stress (Trenberth, 1991) that would have affected ocean currents in the north Pacific.

Indices¹ of climate-ocean conditions indicate that a synchronous change occurred in the north Pacific in 1977. Since then, there has been a tendency for more frequent El Niño and fewer La Nina events (Trenberth and Hoar, 1996). Such large-scale changes suggest that an as yet unidentified common, global event may be responsible for the shift (Beamish et al., 2000).

The climatic shift noted in the late 1970's was not the first time such a change had occurred. In fact, it appears to have occurred three other times in the 20th century. Mantua et al. (1997) and Minobe (1997) identified shifts in the atmosphere-ocean climate record in 1925, 1947 and 1977. Overland (1999) and Beamish et al. (1999) also report that a fourth shift occurred in 1989.

¹ Our review is limited to the most common indices that characterize climate and ocean conditions over the north Pacific Ocean. Other indices developed include the Pacific Circulation Index (PCI) (King et al., 1998), the Northern Hemisphere surface (land and ocean) temperatures (NHST) (Jones, 1994), and the length of day (LOD) (Stephenson and Morrison, 1995) which demonstrates changes in the earth's rotational speed. Others have been developed for the Atlantic Ocean, these include the North Atlantic Oscillation Index (NAOI) (Walker and Bliss, 1932) and the Atmospheric Circulation Index (ACI) for the Atlantic basin (Beamish et al., 1999).

The climatic and biological events noted in the north Pacific in the mid 1970s and at other times this century have been quantified by a number of different indices. Four of the more commonly cited ones are 1) the Southern Oscillation Index (SOI), 2) the Aleutian Low Pressure Index (ALPI), 3) the North Pacific Index (NPI), and 4) the Pacific Decadal Oscillation (PDO). A comprehensive review of climate indices may be found in Beamish et al. (2000).

2.1 Southern Oscillation Index

The Southern Oscillation Index (SOI) describes the oscillation of air masses between the eastern and western tropical regions of the Pacific Ocean (Walker, 1924). It is commonly (but not always) linked with El Niño events and is termed the El Niño – Southern Oscillation (ENSO). This index measures the difference in sea level atmospheric pressure between Tahiti and Darwin, Australia (Beamish et al, 2000). Anomalous high pressure at Darwin (negative SOI) results in weakened westerly winds and warmer sea temperatures (El Niño) in the eastern Pacific Ocean (Trenberth and Hoar, 1996). The converse (intense westerlies, lower sea level pressure in the west, positive SOI) occurs in a La Nina event.

Figure 1 shows average monthly SOI oscillating between the negative (El Niño) and positive (La Nina) states. It also shows that a major change occurred after the 1977 El Niño when the familiar oscillations between positive and negative were replaced by persistent negative (El Niño) conditions. Since 1990, more exceptionally intense and frequent El Niño events have occurred than at any other time in the past 113 years of records (Trenberth and Hoar, 1996).

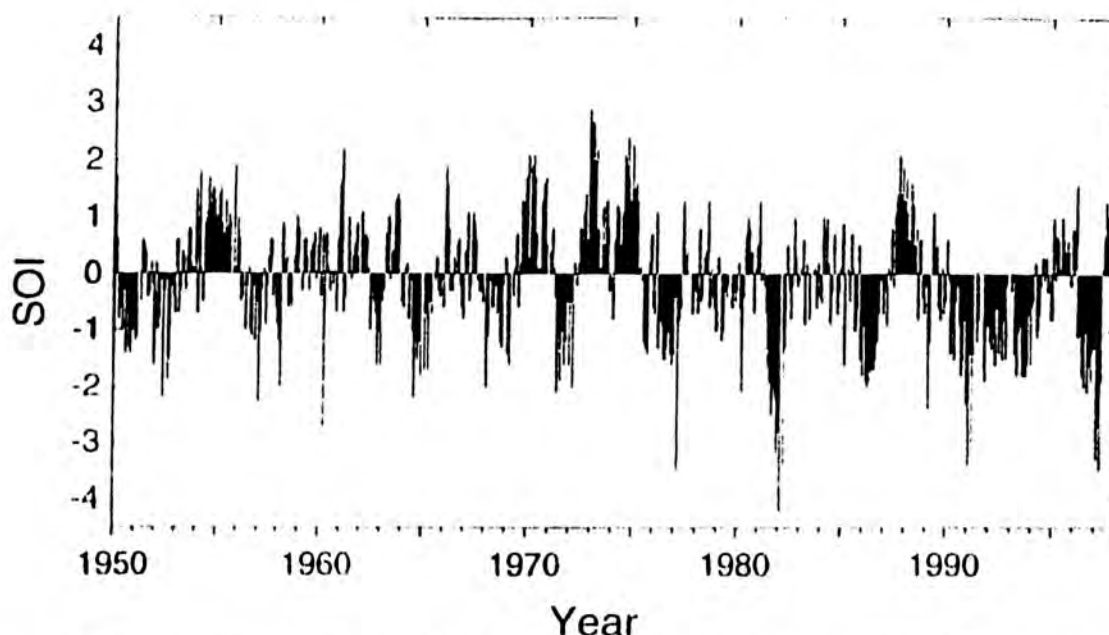


Figure 1. The monthly Southern Oscillation Index (SOI) January 1950-December 1998 provided by the National Oceanic and Atmospheric Association (NOAA) as it appears in Beamish et al. (2000).

2.2 Aleutian Low Pressure Index and the North Pacific Index

The Aleutian Low Pressure Index (ALPI) (Beamish and Bouillon, 1993) and the North Pacific Index (NPI) (Trenberth and Hurrell, 1995) are both measures of the intensity of the Aleutian Low atmospheric pressure system, which affects the strength of winter storms. The ALPI measures the area of low pressure while the NPI is the area weighted mean sea level pressure over the region 30°N to 65°N, 160°E to 140°W (Trenberth and Hurrell, 1995). The ALPI and the NPI are negatively correlated (Beamish et al. 2000), which means that a large Aleutian Low (positive ALPI) will have very low pressure (negative NPI). From 1947-1976, the ALPI was generally negative (i.e., the Aleutian Lows were smaller), while from 1977-1988, the ALPI was positive (reflecting a period of more intense Aleutian Lows) (Figure 2). The intense period ended after 1989. These decadal variations are also evident in the NPI (Figure 3).

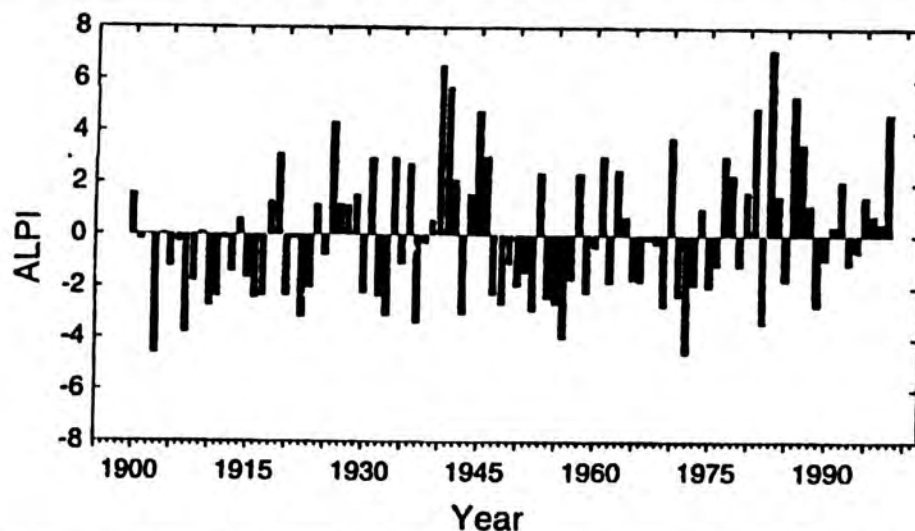


Figure 2. The Aleutian Low Pressure Index (ALPI) from Beamish et al. (2000).

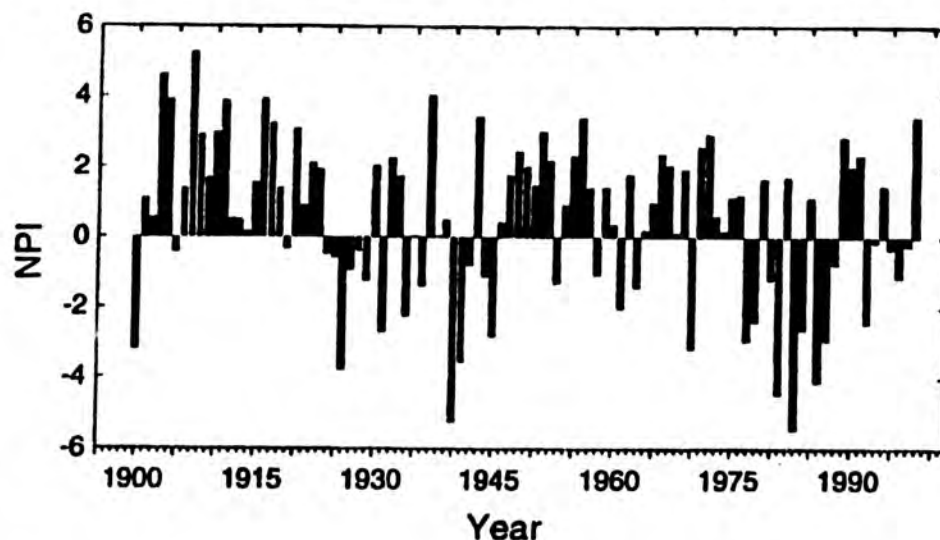


Figure 3. The North Pacific Index (NPI) of Trenberth and Hurrell (1995) from Beamish et al. (2000).

2.3 Pacific Decadal Oscillation

Mantua et al. (1997) examined a broad collection of data including sea surface temperatures (SST) and sea level pressure (SLP) from the tropical, extra tropical and coastal north Pacific. They also considered land surface temperature during winter and precipitation over North America, as well as North American river discharge rates and winter atmospheric pressure. Mantua et al. identified an interdecadal oscillation between phases (regimes) in the records they compiled. They called this decadal scale variability in the North Pacific climate-ocean environment the Pacific (inter) Decadal Oscillation (PDO). Like the NPI, ALPI, and SOI, the PDO has positive and negative phases. When the PDO is positive, a cooling occurs in the central North Pacific and a warming occurs along the coast of Canada. When it is negative there is a warming in the central North Pacific and cooling along the Canadian coast. Mantua et al. (1997) noted that the PDO was positive between 1925 and 1946, negative between 1947 and 1976, and positive since 1977 (Figure 4). They did not identify a significant change in 1989 (Beamish et al. 2000).

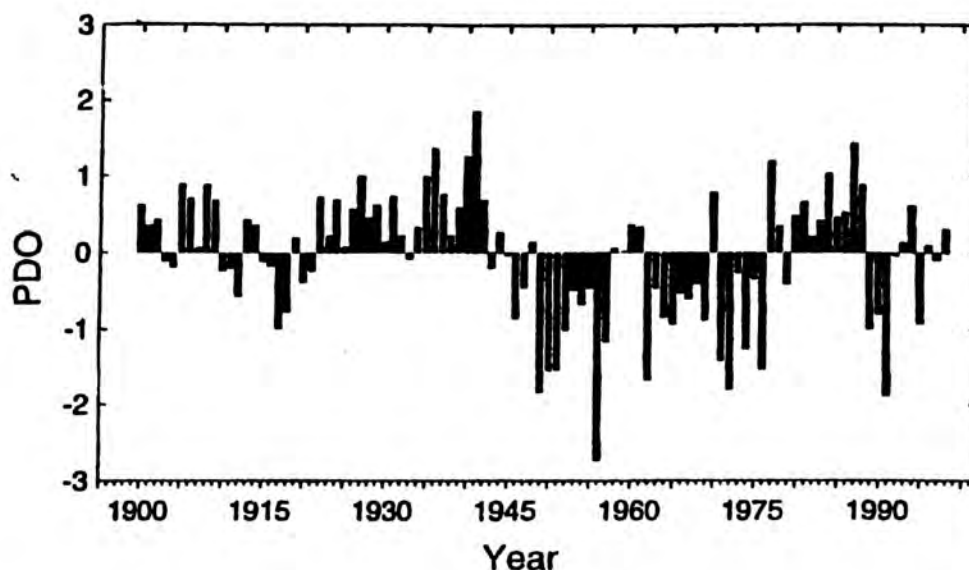


Figure 4. The Pacific Decadal Oscillation of Mantua et al. (1997) from Beamish et al. (2000).

3. Detecting a Change in a Time Series

Although the decadal variations in these four major indices of the north Pacific appear to be simple oscillations, Beamish et al. (1999) point out that there is no reason to assume regime shifts are cyclic. They point out, for example, that the weakening of the Aleutian Low after 1989 resulted in a different dominant wind direction than existed prior to 1977. The most common technique used to detect significant changes in regime shift time series (e.g. Mantua et al., 1997; Noakes, 1986) is called intervention analysis (Box and Tiao, 1975). A Box-Jenkins autoregressive integrated moving average (ARIMA) (Box and Jenkins, 1976) model is first fitted to the data to account for any autocorrelation