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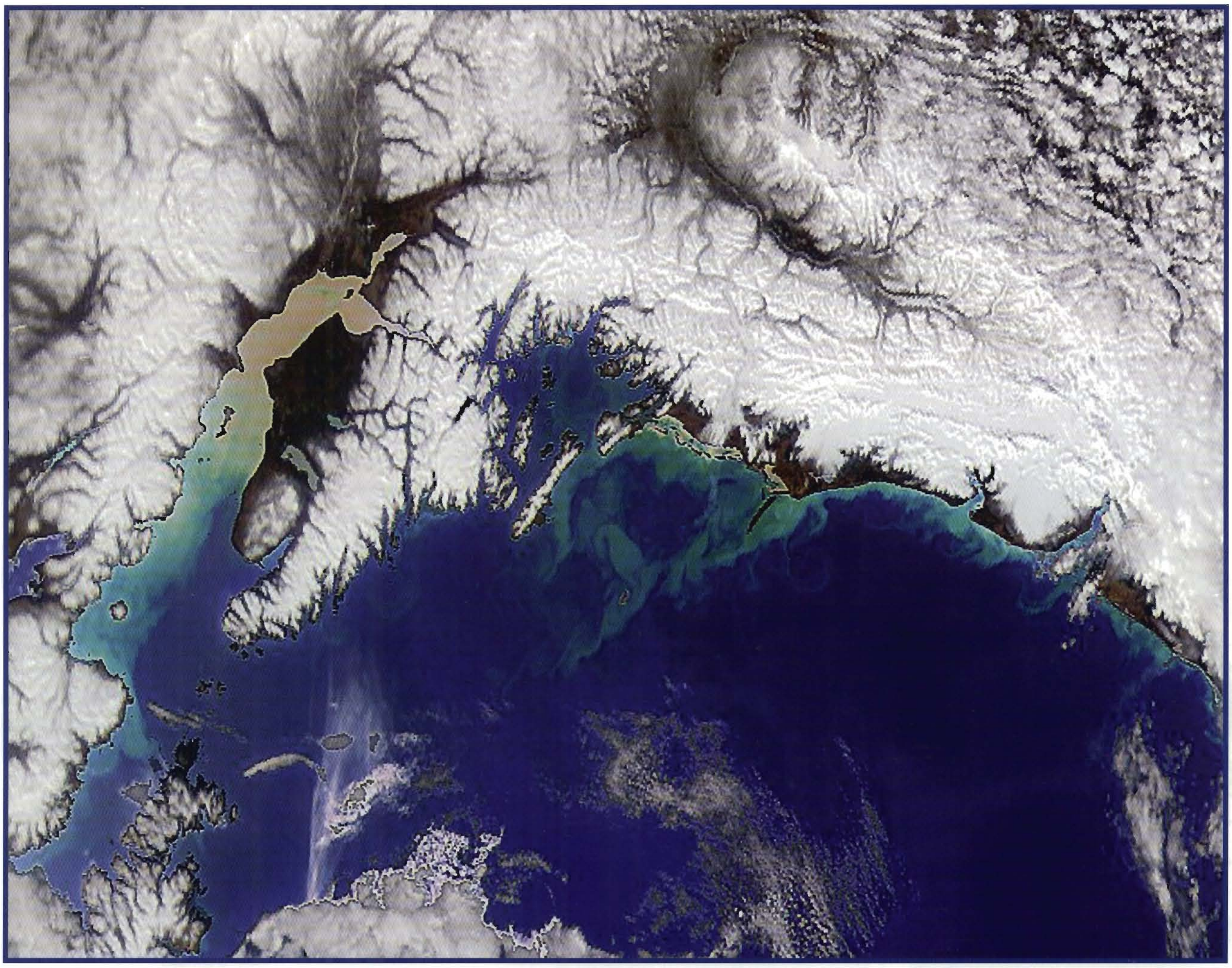


Photo courtesy the SeaWiFS Project, NASA/Goddard Space Flight Center and ORBIMAGE Corporation

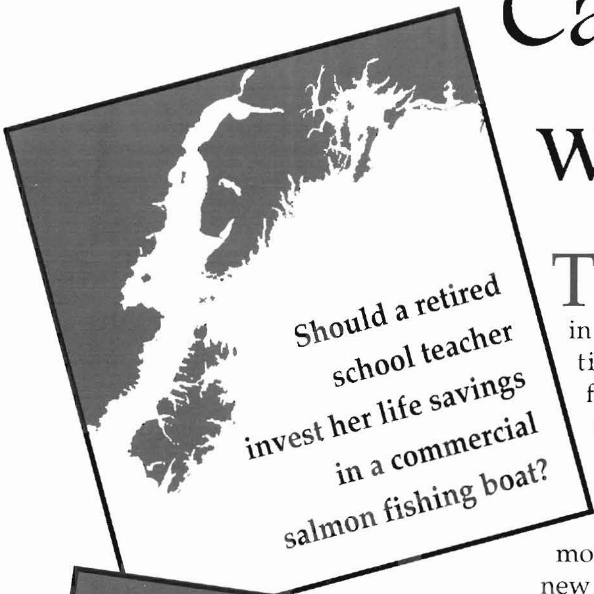
Gulf Ecosystem Monitoring

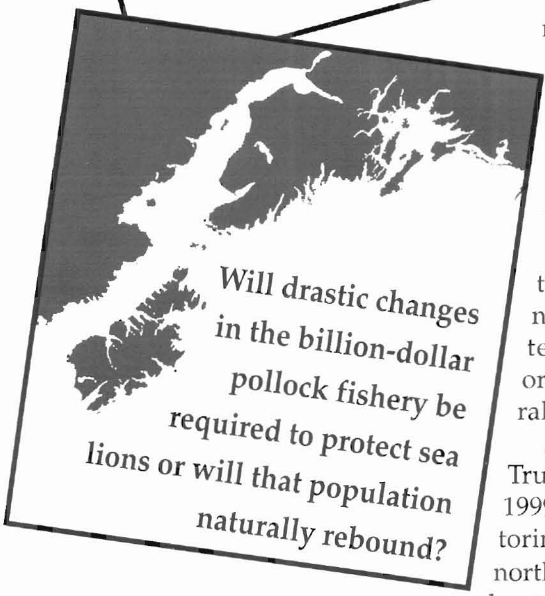
A DRAFT program to monitor vital signs of the northern Gulf of Alaska (including Prince William Sound, lower Cook Inlet, Kodiak Island, and the Alaska Peninsula)

GEM

Gulf Ecosystem Monitoring

Can we predict the ways of the sea?





The *Exxon Valdez* Oil Spill Trustee Council is investing in the prospect that vital questions about the future of fisheries and marine life in the northern Gulf of Alaska will one day be answerable using long-term data sets and dependable ecosystem models. The result would be a new view of this important ecological and economic engine for Alaska, providing clear direction for resource managers, funding agencies, and individual citizens who work or live by the sea.

One of the clear lessons from the *Exxon Valdez* spill is that we need to have current and long-term data on the ecosystem in order to understand ongoing natural and human-caused changes.

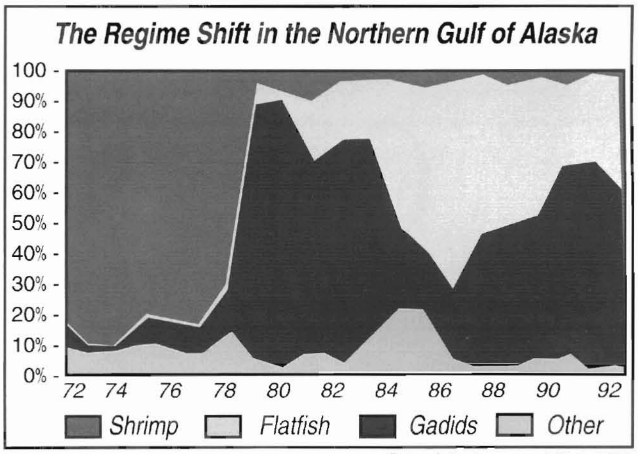
As part of the oil spill legacy, the Trustee Council decided in March 1999 to establish a long-term monitoring and research program in the northern gulf, seeded with at least $115 million. In making this decision, the Council recognized that variables within this vast ecosystem are like billiard balls on a pool table. You can't strike one ball — a rise in water temperature, for instance — without it bouncing off of other balls, starting a chain reaction, and permanently altering the landscape. Some balls are forever relocated, some unmoved, and some, perhaps, forced off the face of the table. The only way to understand how natural and man-made forces interact within a complex ecosystem is to collect the data over time and look for patterns.

The Gulf Ecosystem Monitoring (GEM) program is being designed to do exactly that. Its mission is to foster a healthy, biologically diverse marine ecosystem in the northern Gulf of Alaska through greater understanding of how productivity is influenced by human activities and natural changes.

Patterns tell the story

Data sets that extend decades are rare, yet scientists consider them extremely valuable when it comes to deciphering nature's cycles. Routine monitoring of Gulf of Alaska fisheries over the last 40 years, for example, has resulted in a dependable data set from shrimp-trawl surveys. In the 1980s, when shrimp and some small species of fish almost disappeared from the north gulf, researchers studied the trawl surveys for clues (Figure 1). They saw that water temperatures had risen slightly and that pollock and bottom fish began to dominate the ecosystem. Marine mammals and seabirds that depend on shrimp and small forage fish, such as harbor seals and cormorants, began to decline.

Corresponding data showed that the re-



Data of: Anderson and Piatt, 1997

Figure 1. *Data from trawl surveys illustrates a sharp change in species composition from 1978-80. Shrimp nearly disappeared as flatfish (such as flounder and halibut) and gadids (such as pollock and cod) began dominating the north Gulf of Alaska.*

> An ecosystem is not more complicated than we think, it is more complicated than we can think.
>
> Jack Ward Thomas

verse was taking place in the Atlantic Ocean off the east coast. Cooling waters there were accompanied by the cod fishery bottoming out and a boom in shrimp.

By studying the long-term data, scientists have come to believe that weather, rather than human activity, is the primary cause of change in the ecosystem. Yet, 40 years worth of data is not enough. It does not show if the pollock dominance, now two decades old, will end in the coming years and whether shrimp will return to the north gulf.

The lack of good data leaves many salmon fishermen wondering about their futures. Some fisheries researchers have noted that the spectacular returns of salmon over the last 20 years correlate closely with weather patterns that include warming waters. Does this mean a cooling trend will cause salmon returns to drop back to their historic averages, about half of what has been seen in recent years?

What is a model?

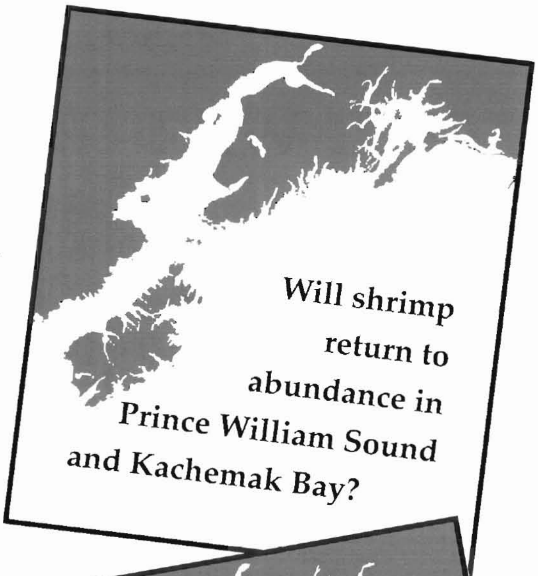
A model is a concept of how things work. Some models can be turned into a computer-aided tool that attempts to predict the forces of nature, based on millions or billions of pieces of data collected over time.

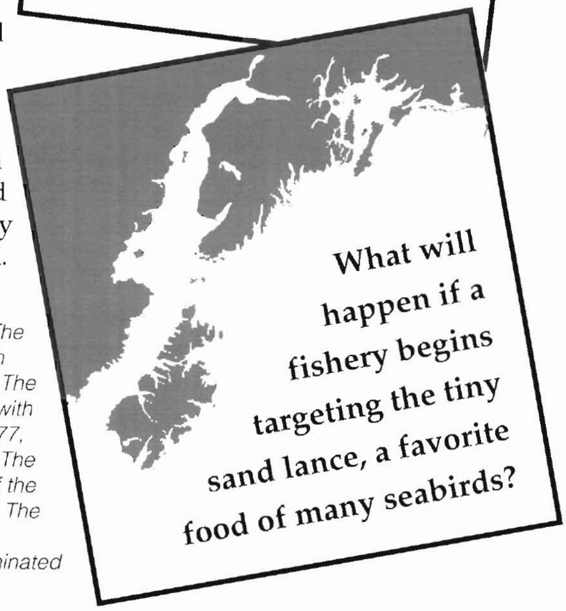
Computer-based modeling has become the standard on which long-term weather forecasting is based. Forecasting the weather has long been known as the art of predicting the unpredictable. After decades of collecting detailed information on the ground, in the oceans, and in the atmosphere, computer models were developed that considerably increased the accuracy level of weather forecasting.

A predictive model is only as good as the data it is based on. The better the data collection, the more likely a computer model will provide some insights into the behavior of a natural system.

Modeling the complexities of the sea is an imprecise science. Yet, it is the best means we have of predicting how an ecosystem as vast as the north Gulf of Alaska will react over time to both human activity and the ever-changing forces of nature.

The Trustee Council is currently funding development of a conceptual model of processes controlling salmon, seabird and marine mammal populations. Monitoring under GEM will test that model, which has been greatly influenced by current thinking on long-term climate change and by ecosystem studies previously funded by the Trustee Council.





The change in species composition during the late 1970s was dramatic. The photo below left shows a typical catch during trawl surveys from 1977-1980. The catch was dominated by shrimp, but with some forage fish and cod. Before 1977, the catch was almost entirely shrimp. The photo below right shows the results of the same survey conducted in the 1980s. The transition from a shrimp-dominated ecosystem to a pollock- and cod-dominated ecosystem took only a few years, as illustrated by Figure 1.

Photos courtesy National Marine Fisheries Service - Kodiak Laboratory

Small-mesh trawl survey harvest - 1977-1980

Small-mesh trawl survey harvest - 1981-99

The role of climate change and long-term weather patterns in the gulf

Just as ocean waves come in patterns with varying sizes of and intervals between crests, so does climate. Worldwide monitoring of weather has illuminated three distinct patterns in the climate of the North Pacific.

El Niños (ENSO) are well known, repeating sometimes dramatic warm and cold periods every three to seven years. Pacific Inter-Decadal Oscillation (PDO) is longer term and more profound, with 20 or more years of warming followed by 20 years of cooling. The largest crest among the climatic waves is Global Warming, a trend underway now for more than 40 years. Global Warming has an unknown duration (Figure 6).

Understanding the impact of weather patterns on the northern gulf is the foundation of long-term monitoring efforts. It's theorized that natural fluctuations in species mirror long-term weather patterns.

Scientists are beginning to note that dynamic shifts in climate occur at the same time as equally dramatic changes in sea life. A comparison of pink salmon harvests over the last 80 years, for example, shows fluctuations on a scale similar to the climatic shifts of decadal (PDO) warming and cooling (Figure 2). A study of groundfish showed that recruitment into that population usually rises and falls with each El Niño event (Figure 3). A recent study of red king crab in Alaska waters, from Cook Inlet to the Aleutians, shows the collapse of those populations correlates with an intensification of the Aleutian low pressure weather system (Figure 4).

Scientists are increasingly coming to believe that dramatic changes in the northern

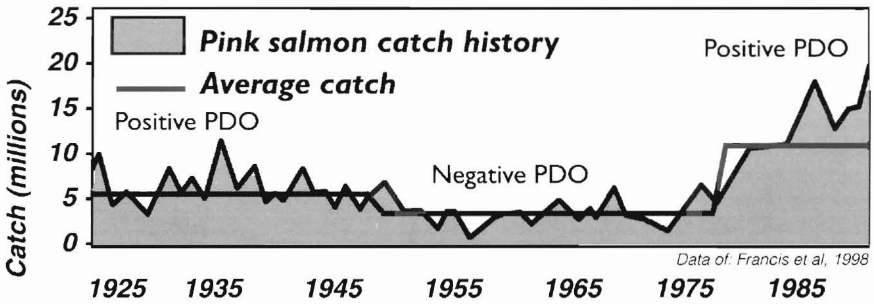


Figure 2. *Salmon harvests since 1925 show three distinct periods in which harvests went up and down, possibly influenced by Pacific Decadal Oscillations (PDOs).*

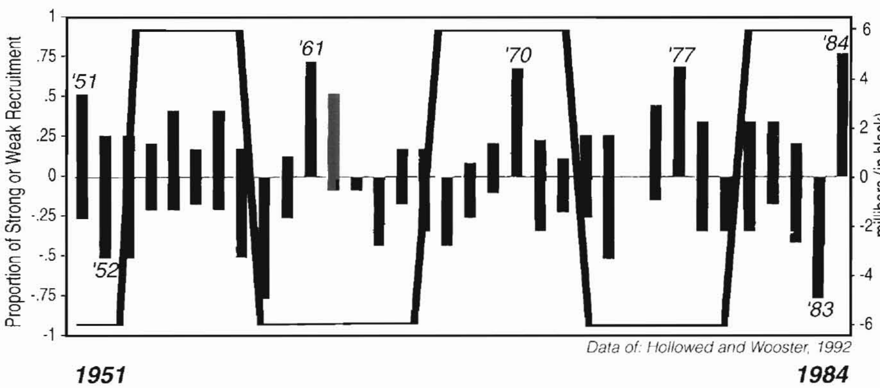


Figure 3. *The survival of juvenile groundfish appears to be influenced by the short term warming of El Niños. This illustration shows that successful recruitment of groundfish in the North Pacific tends to be during periods of lower than normal atmospheric pressure.*

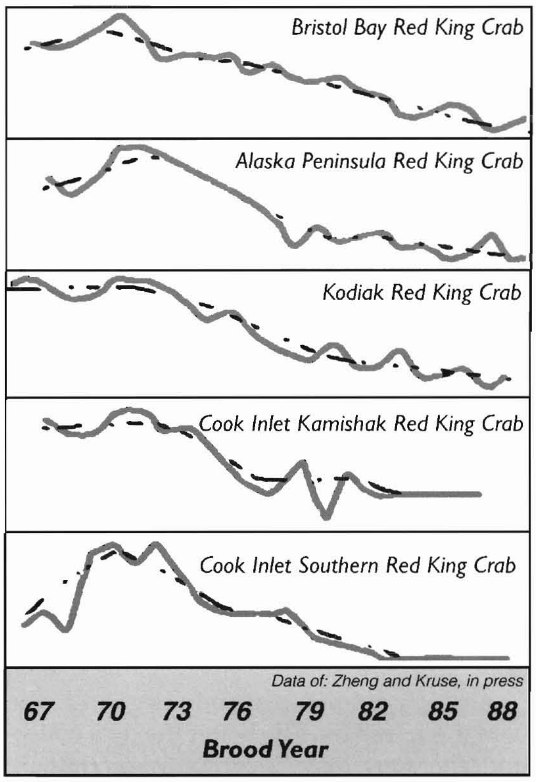


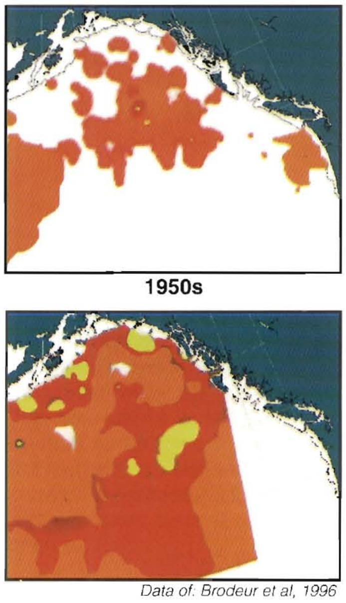
Figure 4. *The decline in king crab recruitments throughout a large portion of Alaska waters indicates a weather-induced event. This graph shows that a decline in king crab occurred during a strengthening in the Aleutian low pressure system 1976-1988.*

Pacific over the last 20 years are due to a decadal pattern in the climate, the PDO. Since the late 1970s, several fish, bird, and mammal species have declined while other species flourished. Crab, shrimp, some seabirds, harbor seals, and sea lions have all seen dramatic drops in population (Figures 1,4, and 7). At the same time, salmon, pollock, cod, and halibut have been on the increase (Figures 1 and 2). Researchers are also finding more evidence that the strong salmon returns recorded since 1978 may be directly related to the warming effects of the current PDO.

It appears that the northern Gulf of Alaska is beginning to transition to a cooler climate. The impact this will have on salmon production in Alaska is a question researchers, fisheries managers and commercial fishermen are all concerned about. Will harvest levels return to those common in the 1950s and 1960s?

The change in climate begins impacting species at the very base of the food chain. A warming or "positive" PDO inhibits the plankton bloom nearshore while improving plankton abundance offshore, where salmon spend most of their lives. Animals living nearshore, such as seabirds and harbor seals, decline during the warming PDO. A cooling or "negative" PDO promotes plankton production nearshore, and not offshore.

Figure 5 maps the plankton bloom in the northern Pacific during the 1950s, a period with a Negative PDO and contrasts the results with a similar study in the 1980s during a Positive PDO. The offshore production during the 1980s is far greater than the offshore production in the 1950s and '60s. The salmon harvests in Alaska compare favorably to the offshore production of plankton. (Figure 2).



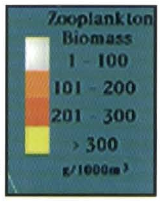


Figure 5. *Measurements of plankton during the 1950s illustrates how a decadal cooling period or Negative PDO impacts the base of the food chain. A decadal warming period or Positive PDO in the 1980s resulted in strong plankton blooms offshore. Offshore feeders, such as salmon, do well during a Positive PDO.*

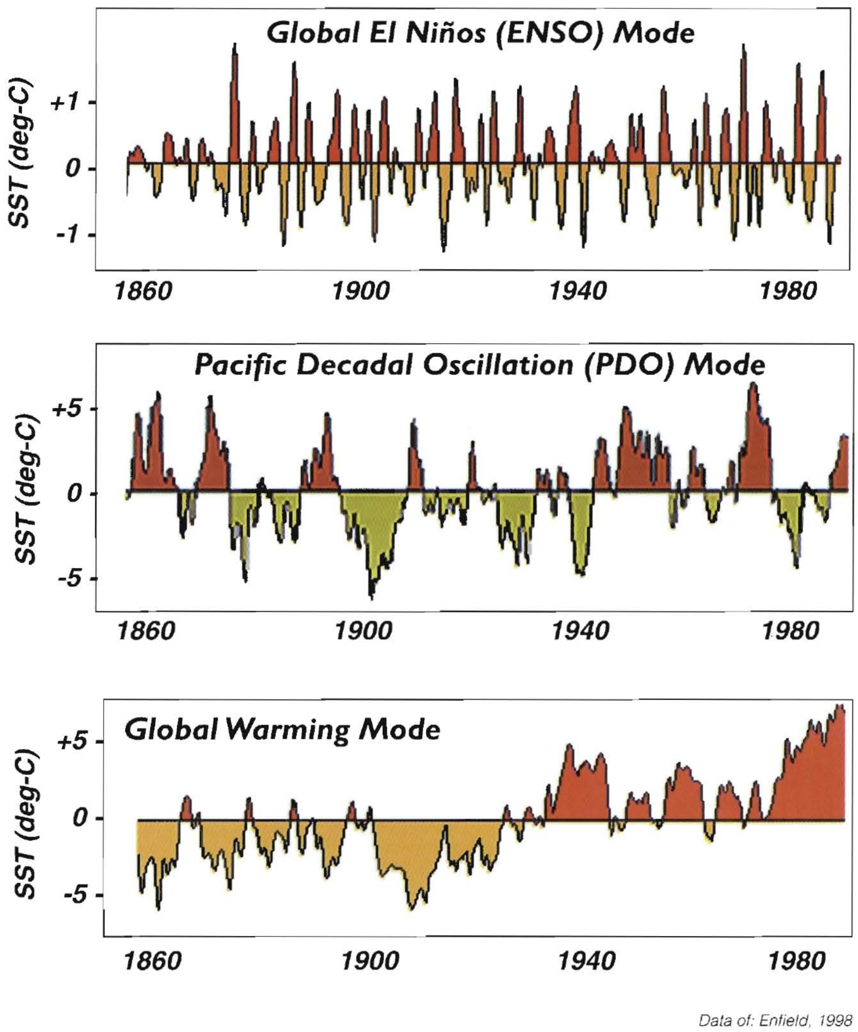


Figure 6. *Warming and cooling trends in the North Pacific follow three distinct patterns: short term El Niño (ENSO), longer term Pacific Decadal Oscillation (PDO), and the unknown duration of Global Warming. Each of these weather patterns impacts marine life.*

Modeling the ecosystem impacts of decadal climate change in the gulf

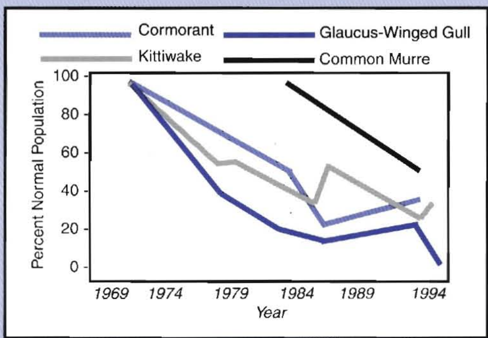
Theories explaining how the decadal climate changes (PDOs) affect the north Gulf of Alaska are beginning to emerge. Figures 9-12 on the opposite page provide a possible explanation as to why PDOs are having dramatic impacts on several species. One role of GEM would be to create models to validate or disprove these theories.

One prominent emerging theory is that in some decades the Gulf of Alaska is warm and windy with lots of precipitation (Figures 9 and 10). Under those conditions, offshore grazers, such as salmon, do well, but nearshore grazers, such as seabirds and seals, do not thrive. In other decades, the gulf is cooler and less windy with less precipitation (Figures 11 and 12). Under those conditions, salmon do poorly, but inshore seabirds and seals do well.

Offshore planktonic production during these warm and cool periods is illustrated by the maps in Figure 5.

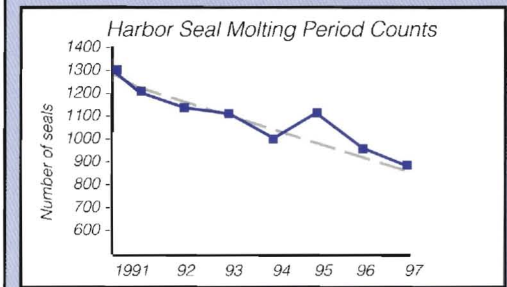
The changes in ocean structure in response to climate alters the supply of nutrients and food production, as well as currents and wind-driven movement of the water. Nearshore feeders do well when there is greater imported and local production. Offshore feeders do well when offshore production is good, and it does not get pushed toward shore by wind and currents.

Population declines over the last 20 years



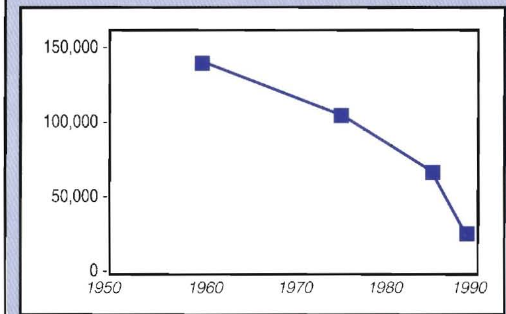
Data of: Piatt and Anderson, 1996

Seabirds at Chisik Island



Data of: Frost, 1998

Harbor Seals in Prince William Sound

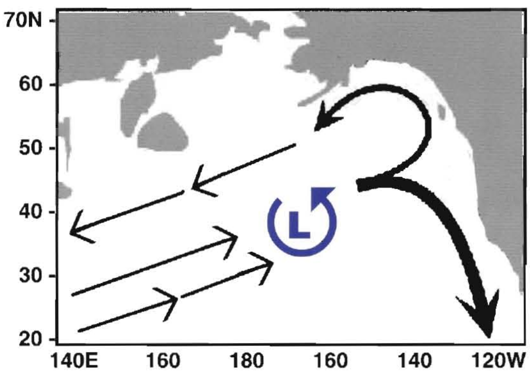


Data of: Springer, 1992

Sea Lions in Western Alaska

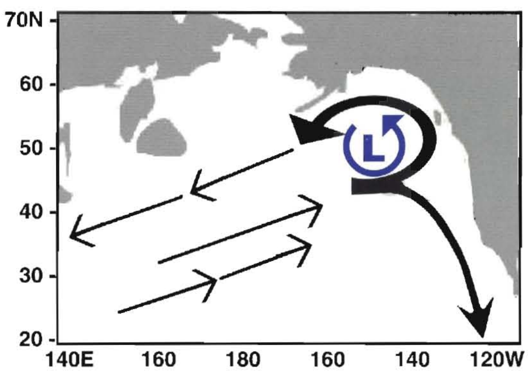
(Kiska I. to Kodiak I.)

Figure 7. *Several fish, bird, and mammal species are in decline in the north gulf region. Seabird colonies in Cook Inlet and Prince William Sound are in decline at some locations, even as other colonies in the area are doing well. The harbor seal population in Prince William Sound dropped by 80 percent over the last 20 years and has declined at a rate of 6 percent per year in the 1990s. Sea Lions in western Alaskan waters have been listed as threatened after their numbers plummeted. Weather patterns may help explain some declines and may help point to human causes for the declines when natural, weather-related changes can be ruled out.*



Winter 1972 - Negative PDO

Data of: Hollowed and Wooster, 1992



Winter 1977 - Positive PDO

Figure 8. *When the Aleutian low pressure system, which dominates the weather pattern in the gulf region, is in a southerly position, a Negative PDO results. The North Pacific Current splits with the primary portion moving south as the California Current and secondary portion moving north as the Alaska Current. During 1977, the low pressure system moved northward and the Alaska Current became the primary arm of the North Pacific Current.*

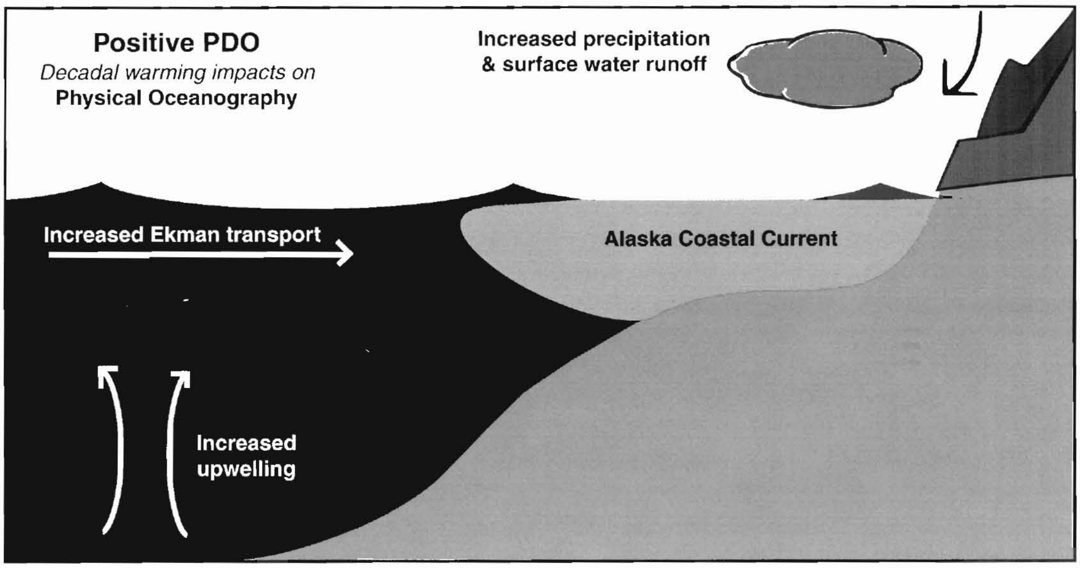


Figure 9. *The Gulf of Alaska is warm, windy and has lots of precipitation with increased runoff. The Alaska Coastal Current is larger, bringing more fresh water along the shores. The more dense saltwater, pushed by high winds toward shore, does not mix with the low-saline coastal current. The saltwater is forced down and circulates back to the surface offshore.*

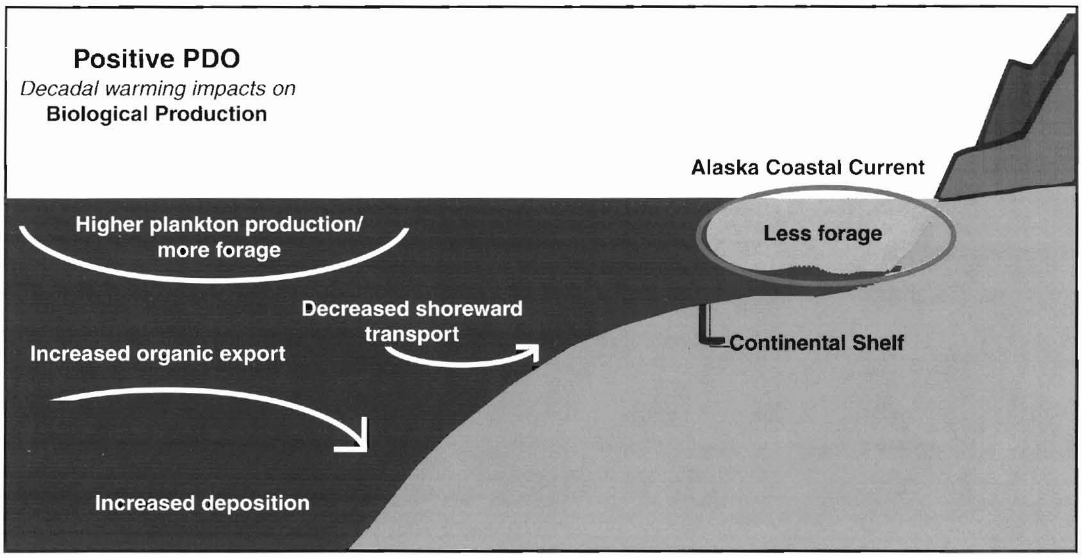


Figure 10. *Warming waters offshore are good for planktonic production. But plankton are not carried to the nearshore areas because mixing does not occur with the Alaska Coastal Current. The bloom remains out at sea and planktonic production nearshore is poor. Those species that forage offshore do well. Species that forage nearshore do poorly.*

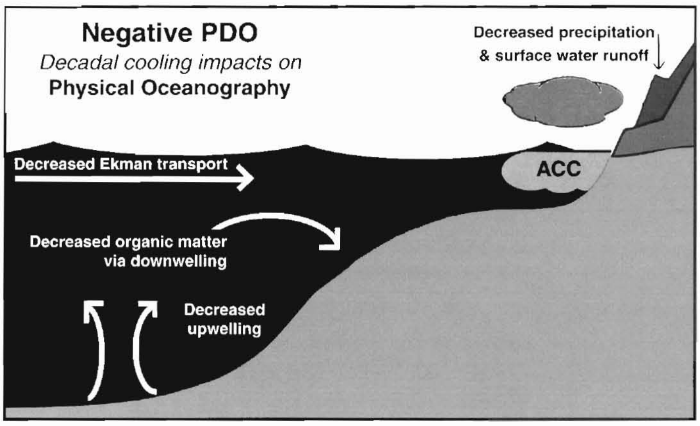


Figure 11. *Atmospheric pressure increases during the winter and the Gulf of Alaska cools, with less precipitation and less wind. The Alaska Coastal Current is smaller and the nearshore water is more saline. This allows mixing to occur as the dense offshore water is pushed by winds toward shore. Upwelling occurs in a shoreward direction, bringing nutrients with it.*

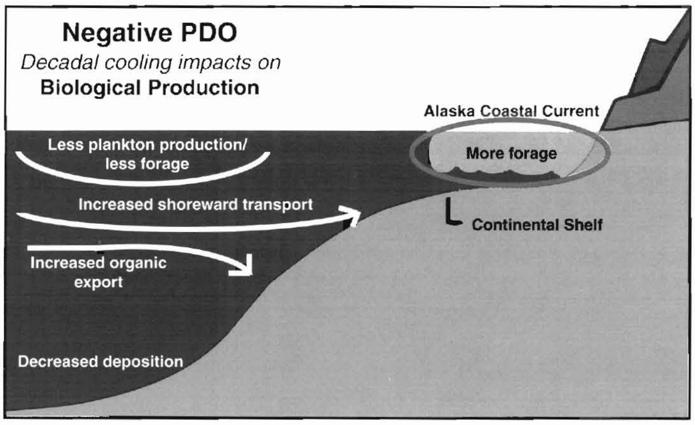


Figure 12. *Cool waters offshore decrease planktonic production. Plankton production nearshore increases as saline offshore currents mix with the Alaska Coastal Current. Those species that forage offshore have poorer survival rates. Species that forage nearshore do well.*

Scientists are widening their fields of vision

"How can we sustain the richness of the northern gulf and at the same time maintain our Alaskan way of life, which is defined by using those resources?"

By Phil Mundy
Science Coordinator

When I was a graduate student in the 1970s, I studied nothing but fish. As an ichthyologist and fisheries manager in Alaska during the '80s, the focus was on the biology and the life cycles of salmon, but oceanography was becoming increasingly important. Even so, an international conference on fisheries might be attended by hundreds of scientists, every one of them a fish expert.

Prior to the mid-'80s, no matter what the scientific discipline, the experts rarely ventured out of their fields of expertise. Fisheries managers, oceanographers, climatologists, ornithologists, and marine mammalogists stayed in their corners, only vaguely aware of what breakthroughs were made in other fields.

Thankfully, that narrow approach is going away. As we enter into the 21st century, it has become clearly necessary for experts to expand their horizons to include the entire ecosystem in their field of vision. It is not now unusual for a conference on Pacific herring, for example, to be well attended by experts on climate, currents, plankton, seabirds, harbor seals, and other disciplines that contribute to our knowledge of herring's role in the ecosystem. Commercial fishermen and Alaska Natives might also attend, contributing practical insights into the biology and trends of herring.

GEM is the logical extension of this emerging ecosystem approach to science. Hundreds of programs and projects have been identified, conducted by dozens of federal and state agencies, universities and private institutions, which can shed some light on the ecosystem of the northern Gulf of Alaska. Bringing these groups together and, more importantly, bringing their accumulated data together, is one of the vital roles GEM will play over the next century.

The discussion on these pages about the various long-term weather patterns and how they impact the movements and biology of the sea is a primary example of how numerous disciplines come together to answer our primary question: *How can we sustain the richness of the northern gulf and at the same time maintain our Alaskan way of life, which is defined by using those resources?*

If GEM can play a role in answering that question, even as human pressures on the northern gulf increase, then the century-long investment will be well worth the effort.

It's important, however, that GEM not become solely an academic pursuit or data manager. GEM researchers must always be looking for the practical results in the data, providing affordable tools for fish and wildlife managers.

Creating computer models from the data is one way to translate knowledge into tools. The Sound Ecosystem Assessment (SEA) program, for example, has provided new insights into the ecosystem needs of pink salmon and Pacific herring. One small facet of that program resulted in a model that predicts the timing of the plankton bloom in Prince William Sound. This type of model could become an inexpensive way to estimate the survival rate of salmon fry and better predict the rate of return as adults. (Figure 13)

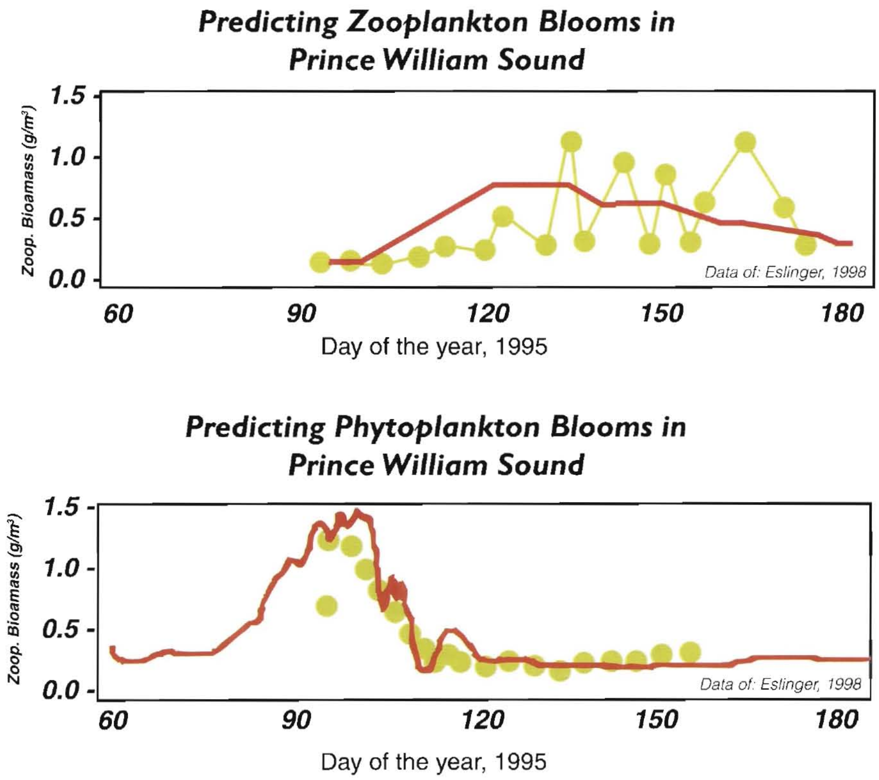


Figure 13. *Models generated through the Sound Ecosystem Assessment (SEA) project estimated the timing and size of the animal and plant plankton blooms. The RED lines show the models' predictions compared to the actual measurements, represented by yellow dots.*

GEM at a glance . . .

The Problem

Although decades of salmon and herring harvest data are available, other significant ecosystem information is lacking. Much of the life cycle of salmon and herring remains a mystery and little is known about many species in the gulf. Solid data on the physical condition of the sea (temperature, salinity, current, etc.) and how this impacts species from plankton to sea lions is not available. Therefore, the historical context necessary to understand why harvests fluctuate greatly or why several fish, birds, and mammals are in decline is lacking.

The Solution

Collect data over time that will fill in the gaps and identify the physical and biological changes to the north Gulf of Alaska ecosystem. Distinguish between natural trends and human caused changes in the environment. Use the information to model potential future changes. Conduct research to better understand species (as needed) and develop practical tools for managers of fish, wildlife, and land.

What is GEM?

The Gulf Ecosystem Monitoring (GEM) program is a conceptual plan for a long-term monitoring and research program in the northern Gulf of Alaska.

The Mission

The mission of GEM is to foster a healthy, biologically diverse marine ecosystem in the northern Gulf of Alaska through greater understanding of how productivity is influenced by human activity and natural changes. Data gathered over time will allow researchers to better understand how one change in the ecosystem impacts another and lead to improved management of the resources.

Who is involved with GEM?

The Trustee Council will fund the program, but in order to be successful, GEM must be coordinated with existing efforts and funds should be leveraged for the most economically efficient collection of data. Research and monitoring projects would be funded on a competitive basis, subject to merit-based review and compatibility with program goals. More than 200 projects by government, university and private research groups are expected to make some contribution of data to GEM.

When would GEM begin?

GEM would begin financing research and monitoring efforts in October of 2002, when the current restoration program ends. The GEM program would run on a cycle similar to the restoration program, with an annual invitation for proposals issued in February, proposals due in April, a draft work plan issued in June, and final work plan in place by October.

Where will GEM be carried out?

The primary focus of the GEM program is within the oil-spill area, including Prince William Sound, Cook Inlet, Kodiak Island, and the Alaska Peninsula. The northern Gulf of Alaska marine ecosystem does not have a discrete boundary, however, and some monitoring and research activities will necessarily extend into adjacent areas.

Funding

The Trustee Council in March earmarked at least $115 million as seed money to fund a long-term research and monitoring program. It is envisioned that this funding will provide about $5-6 million of interest income to be expended annually. About half of that amount would be used for long-term monitoring and the remainder used to fund shorter-term, focused research. Both components would include elements of local stewardship, science management, synthesis, and public information.

The Objectives

GEM will have six specific goals:

1. Track lingering effects from the 1989 oil spill.
2. Detect long-term changes in the marine ecosystem.
3. Improve fish and wildlife management through development of new information and technologies.
4. Integrate and synthesize information on the status, trends and health of fisheries, sea birds, marine mammals and other marine populations over the long-term.
5. Provide continuing information on the fate and effects of contaminants on marine animals and human consumers.
6. Help identify important marine habitats, basic life history and habitat requirements of marine animals.

As the program matures, studies of spill impacts should decrease and those of natural and human-caused changes should grow.

U.S. GLOBEC
Global Ocean Ecosystems Dynamics

Pacific Marine Environmental Laboratory

oar Office of Oceanic and Atmospheric Research

USGS

Pacific Salmon Commission

Alaska Dept. of Fish and Game

Center for Global Change & Arctic System Research

National Climatic Data Center

Resource Assessment & Conservation Engineering
Alaska Fisheries Science Center

NOAA National Marine Fisheries Service

National Marine Mammal Laboratory
Alaska Fisheries Science Center

The U.S. Department of the Interior

CIFAR
Cooperative Institute For Arctic Research

U.S. Department of the Interior March 3, 1849

National Oceanic and Atmospheric Administration U.S. Department of Commerce

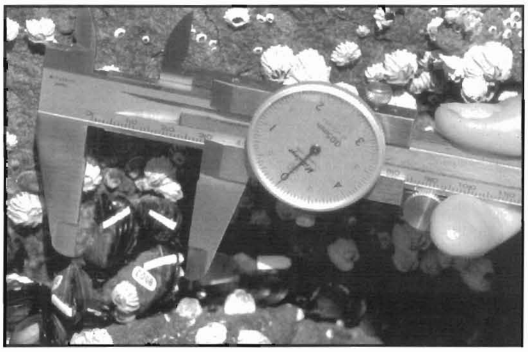
International Pacific Halibut Commission

Elements of GEM

GEM will have three main components:

- long-term ecosystem monitoring (decades in duration);
- short-term focused research (one to several years in length); and
- ongoing community involvement, including traditional knowledge and local stewardship.

In addition, GEM will require a strong science management effort and a concerted public information and data management program.



Monitoring of flora, fauna, and oceanographic conditions will be the primary force behind GEM.

Long-term ecosystem monitoring

GEM will contribute to a core of strategic measurements taken over decades by many agencies in order to track changes in the outer shelf and coastal regions of the northern Gulf of Alaska. Monitoring goals are to understand the factors involved in productivity of fish, birds, and marine life, improve our ability to distinguish between natural and human-caused changes, and accurately model and predict ecological change. This information will be available to organizations, agencies, universities, and individual stakeholders for the use, management, and conservation of marine resources.

GEM will take advantage of existing projects being carried out by agencies and other institutions. Funds will be used to obtain measurements that are essential to taking the pulse of the Gulf of Alaska and that are not being obtained reliably through other programs.

Research will provide information and tools to aid managers of fish, wildlife, and land.

Short-term research

Strategically chosen research projects with relatively short-term goals will be funded as needed. Research will:

• Follow-up on issues related to any lingering effects of the *Exxon Valdez* oil spill. This research is expected to diminish over time as impacts from the spill become more and more difficult to distinguish.

• Explore questions or concerns that arise out of the monitoring data. Research would focus more on individual species to understand how they are being impacted by changes in the ecosystem. A sudden rise or decline in a species population is one way to trigger such research.

• Provide key information and tools for management and conservation purposes. This would include, for example, improved scientific techniques and better technologies for stock assessments of fisheries. Research can also identify sensitive habitats in the marine environment so that this information can be considered in management strategies.

Traditional knowledge, community involvement, and local stewardship

The last 10 years of oil spill research has proven that community involvement and local knowledge can provide important observations and insights about changes in the status and health of marine resources. Encouraging local awareness and participation in research and monitoring enhances long-term stewardship of living marine resources.

Local monitoring, documentation, and

Youth Area Watch is one approach to involving and educating young people about ecosystem monitoring.

stewardship projects must be linked under GEM wherever possible with other monitoring, research, and conservation projects to promote sharing of information and ideas. Scientific steering committees, composed of academic, agency and local representatives, can identify and oversee opportunities for productive collaboration.

The actual mechanisms for achieving this goal are not fully developed. Several approaches have been tried in the current restoration program and elsewhere in Alaska, and GEM will draw on these experiences to design processes for involving communities and their expertise. One approach, the Youth Area Watch, has proven to be an effective and popular means of involving and educating young people and their home communities about oil spill research. Similar projects may be developed as part of GEM in coastal communities throughout the oil-spill area.

Science Management

It's expected that GEM will be governed by the Trustee Council until impacts from the oil spill are no longer discernible. It would be administered by the current Restoration Office, made considerably smaller to reflect the scope of the program.

Coordinating with researchers and agencies will require a strong science management effort.

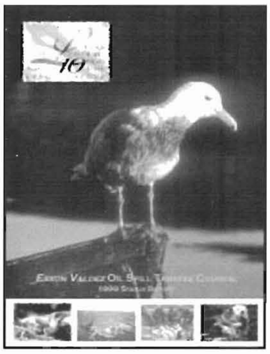
A senior staff scientist will work with the executive director, Trustee Council, scientific community, resource managers, and stakeholders to implement and evaluate GEM. The program will be administered consistent with the Restoration Plan, adopted by the Trustee Council in 1994.

Public participation and independent peer review will be an essential part of the process. An independent panel of scientists will fine tune the GEM program every five years.

Public information, data management, and integration of results

Gathering data is one thing. Managing and maintaining that data in a consistent form that can be utilized easily by researchers is another. It is essential that a strong data management strategy be in place before long-term monitoring projects are initiated.

The data will be analyzed and integrated into predictive ecosystem models. Results will be available to the public through periodic "State of the Gulf" workshops and reports and this will be made accessible on the internet. Workshops and other forums will bring together a variety of participants in the various aspects of GEM to stimulate discussions and spark new ideas.



1999 Status Report

The Trustee Council is committed to public input and public outreach as vital components of the long-term GEM program. Public meetings, newsletters, annual reports, informational web sites, and the 17-member Public Advisory Group are some of the ways the public is currently informed about restoration activities.

It's envisioned that this effort would continue, but to a lesser degree to reflect the smaller GEM program. The Trustee Council will likely develop a series of alternatives on continuing public advice in the next two years and then go out for public comment before taking any final action.

Coordination and cooperation between groups gathering oceanographic and biological data in the northern Gulf of Alaska are essential. In June 1999, the Restoration Office began to develop a database of ongoing projects in the northern gulf. As of October, 240 projects were identified that might be able to contribute to the goals of GEM. This includes everything from weather data to ocean currents to population and harvest levels. GEM's monitoring component would seek to consolidate data, fill in the gaps, and interpret the information through the production of computer models.

Auke Bay Laboratory
Alaska Fisheries Science Center

National Ocean Service
Working for America's Coasts
National Oceanic and Atmospheric Administration U.S. Department of Commerce

National Weather Service

U.S. Fish & Wildlife Service
Department of the Interior

National Environmental Satellite, Data, and Information Service

Alaska Fisheries Science Center
National Marine Fisheries Service

PICES
North Pacific Marine Science Organization

Alaska Department of Environmental Conservation

Environmental Research Laboratories

Implementing GEM: On the road to 2002

The Draft GEM Program will undergo a thorough review and likely revisions before it is ultimately implemented beginning October 1, 2002. The public, fish and wildlife managers, researchers, and stakeholder groups will all be asked to review and comment on the Draft Plan before a final plan is adopted by the Trustee Council. In addition, the Draft GEM Program will be submitted to the National Research Council for a full review. The NRC is expected to conduct its review for a year before providing formal comments and recommendations to the Trustee Council.

October 22, 1999
- Trustee Council received briefing on GEM Draft
- Draft Plan released to the public

October 26, 1999
- Public Advisory Group received GEM briefing

November 1999 - January 2000
- Briefings to be held throughout the spill region for the public, fish and wildlife managers, and stakeholder groups

February 2000
- Public hearing in Anchorage
- Revise Draft based on public and agency input
- Submit Draft to the National Research Council for review
- FY 2001 Invitation to seek transition proposals

October 2000
-Initiate FY 2001 transition projects

January 2001
- Receive preliminary NRC feedback
- Begin revisions to GEM plan to address NRC recommendations and use results from transition projects

February 2001
- Invite additional transition projects for FY 2002

October 2001
- Begin FY 2002 transition projects

January 2002
- Trustee Council finalizes GEM Program

February 2002
- Issue GEM invitation for proposals (FY 2003)

October 2002
- Begin GEM monitoring and research program

How to participate . . .

Attend GEM briefings
Watch for notices about public meetings in your community.

Review the Draft GEM Program
On the web: www.oilspill.state.ak.us

Comment
e-mail: gem@oilspill.state.ak.us

phone: 907-278-8012
800-478-7745 (within Alaska)
800-283-7745 (outside Alaska)

write: Restoration Office
645 G Street, #401
Anchorage, AK 99501

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