ALASKA LEGISLATURE COMMITTEE FILES 1985-1986 8672

3586 HRES HJR 67 - HJR 68

462

RECORDS CERTIFICATION

I, the undersigned, an employee of the State of Alaska, do hereby certify that the microfilm images on this microform are accurate reproductions of the original records of the State of Alaska as accumulated during the regular course of business, and that it is the established policy and practice of this State to microfilm its records and to dispose of the original records after microfilm reproductions have been made.

Signature of Camera Operator

9/5/89

Date

02-519 (REV 8/78)

HJR

67

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James O. Smith
Signature of Camera Operator

9/5/89
Date

02-519 (REV 8/78)

HJR

67

HJR 67: Requesting the United States Congress to establish advanced all-weather satellite coverage of North Pacific waters.

LIST OF PACKET CONTENTS

MAP - Color coded to show the data that could be provided

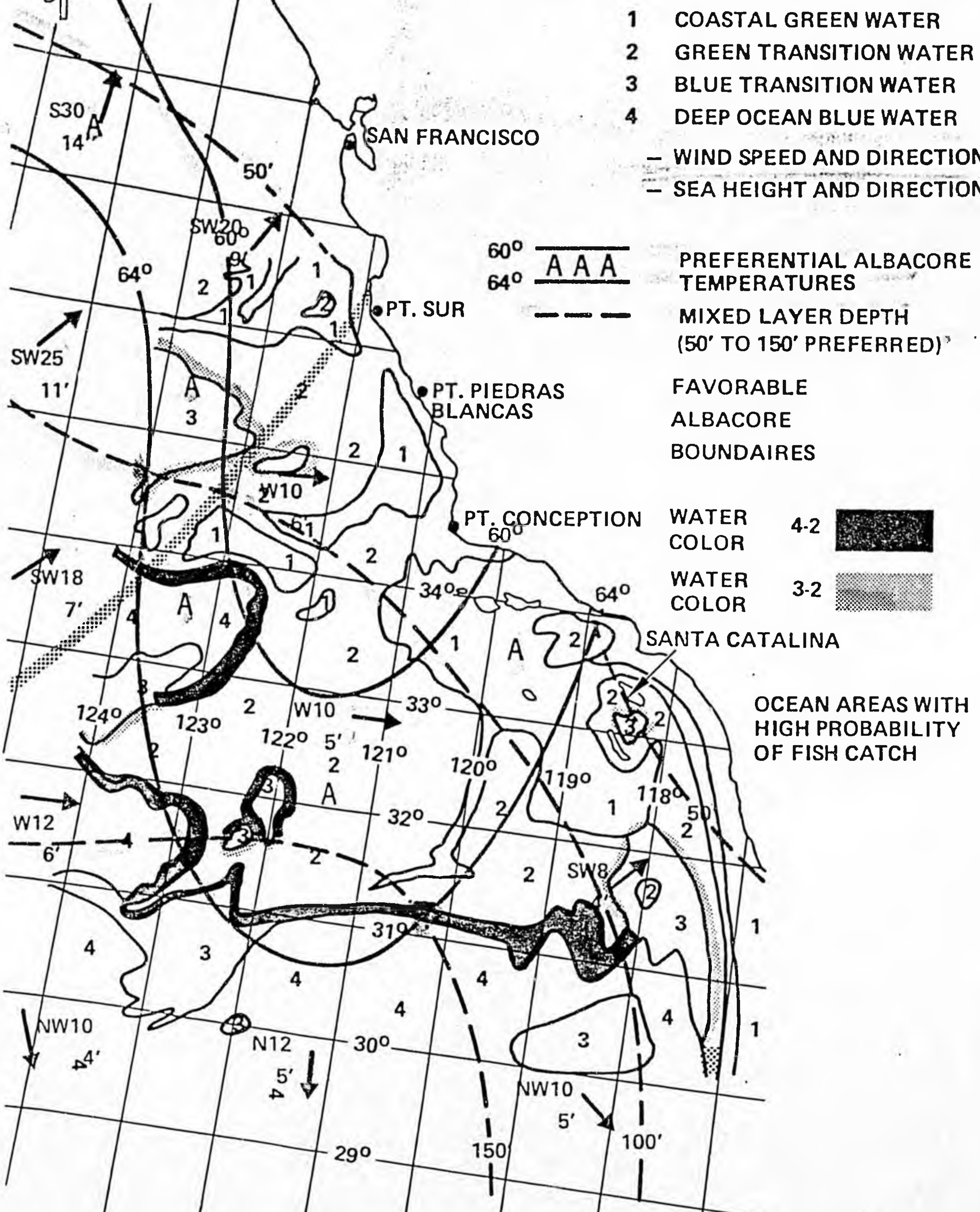
Memo - From Rep, Ben Grussendorf re: bill analysis

Ocean Space Utilization '85 - Proceedings of the International Symposium

Fisheries Application of Satellite Data in the Eastern North Pacific

HJR 67 - the original bill

OCEAN COLOR BOUNDARIES FROM NIMBUS-7



Alaska State Legislature

House of Representatives
SPEAKER OF THE HOUSE

M-E-M-O-R-A-N-D-U-M

To: Rep. Herrmann, Co-Chair
House Resources Committee

Fr: Rep. Ben Grussendorf
Speaker of the House

Dt: 18 March 1986

Re: HJR 67: Requesting the United States Congress to establish advanced all-weather satellite coverage of North Pacific waters

We would like to request that you consider scheduling House Joint Resolution 67 before your committee. Attached you will find a fiscal note and bill analysis prepared by the department of Fish and Game. Other backup material is also included.

<u>Analysis</u>

The resolution requests congress to establish and fund two elements of a weather satellite system:

1) The Gilmore Creek receiving station. This station, located 25 miles northeast of Fairbanks, was abandoned by NASA in October of 1984. Transfer of this facility to National Oceanic and Atmospheric Administration (NOAA) would greatly enhance the National Weather Service's ability to gather weather data.

2) The placement of a color scanner and other all-weather equipment on the next available satellite with a view of the north Pacific Ocean.

The receiving station and satellite equipment will provide a powerful system of interpreting oceanographic data to track salmon patterns in the northern Pacific Ocean. This information is vital to determine the location of salmon, and thus, the location of foreign vessels who may be in violation of international fishing treaties. It will also target the location of salmon for use by Alaskan fishermen.

The Gilmore Creek receiving station can be easily modified by the Weather Service, with little capital outlay. The data link from Gilmore Creek to the weather computer in Anchorage is already in place.

The Hawaii legislature has passed a similar resolution, which is attached. Other back-up information has been provided to your staff.

STATE OF ALASKA

OFFICE OF THE GOVERNOR

BILL ANALYSIS

DEPARTMENT	DIVISION	BILL NUMBER	SPONSOR
Fish and Game	Commercial Fisheries	HJR 67	Grussendorf

DEPARTMENT POSITION

Support

PREPARED BY	DATE	COMMISSIONER'S SIGNATURE	DATE
Robert C. Clasby	3/5/86		3/7/86

SUMMARY

OTHER AGENCIES AFFECTED BY BILL	CONSTITUENT GROUP(S) AFFECTED BY BILL
DEC, DNR, DOT/PF, DPS	Marine Resource Users

ORGANIZATIONAL SUPPORT FOR BILL	ORGANIZATIONAL OPPOSITION TO BILL
Unknown	Unknown

FISCAL IMPACT: ☐ NONE ☒ FISCAL NOTE ATTACHED

BACKGROUND/LEGISLATIVE INTENT

Most likely the intent of the Legislature is to increase knowledge of oceanographic and weather conditions.

ANALYSIS OF BILL/PROGRAM EFFECTS

If the satellite system will indeed provide the information outlined in the resolution, then the system would be very helpful to the department for fisheries and marine mammals' research and management.

AMENDMENTS PROPOSED

PLEASE ATTACH A SEPARATE SHEET FOR ADDITIONAL COMMENTS OR ANALYSIS.

STATE OF ALASKA 1986 LEGISLATIVE SESSION
FISCAL NOTE

Revision Date : ________

REQUEST

Bill/Resolution No. : HJR 67
Title : Requesting the US Congress to establish advanced all-weather satellite coverage of the North Pacific
Sponsor : Grussendorf
Requestor :
Date of Request :

FISCAL DETAIL

Agency Affected : Fish and Game
BRU : Fisheries Resource Conservation
Components : Commercial Fisheries

EXPENDITURES/REVENUES : (Thousands of Dollars)

OPERATING	FY 86	FY 87	FY 88	FY 89	FY 90	FY 91
PERSONAL SERVICES						
TRAVEL						
CONTRACTUAL						
SUPPLIES						
EQUIPMENT						
LAND & STRUCTURES						
GRANTS, CLAIMS						
MISCELLANEOUS						
TOTAL OPERATING	0	0	0	0	0	0
CAPITAL	0	0	0	0	0	0
REVENUE	0	0	0	0	0	0

FUNDING : (Thousands of Dollars)

GENERAL FUND						
FEDERAL FUNDS						
OTHER						
TOTAL	0	0	0	0	0	0

POSITIONS :

FULL-TIME	0	0	0	0	0	0
PART-TIME	0	0	0	0	0	0
TEMPORARY	0	0	0	0	0	0

ANALYSIS : Attach a separate page if necessary

Prepared by : Robert C. Clasby — Phone : 465-4210
Division : Commercial Fisheries — Date : 3/5/86

Approved by Commissioner — Date : 3/7/86
Agency :

Distribution (by Agency preparing fiscal note) :
- Legislative Finance
- Legislative Sponsor
- Requestor
- Office of Management and Budget
- Impacted Agency(ies)

10/25/85

(To be made one and seven copies)

THE SENATE
THIRTEENTH LEGISLATURE, 1986

STATE OF HAWAII

S.R. NO.

SENATE RESOLUTION

REQUESTING THE UNITED STATES CONGRESS TO ESTABLISH SATELLITE REMOTE SENSING RECEIVING STATIONS IN HAWAII, GUAM AND MIDWAY.

WHEREAS, remote sensing of the ocean is playing an increasingly important role in fishery research and fish harvesting along the Pacific Coast of the United States and Canada; and

WHEREAS, satellite sensors give a unique view of the ocean surface and provide extensive and detailed images of sea surface temperature and color; and

WHEREAS, the oceanic measurements taken by the satellite are used in determining variations in ocean conditions which play key roles in causing fluctuations in stocks of fishes and in their vulnerability to harvesting; and

WHEREAS, this information on the changing ocean, rather than on average ocean conditions, is necessary to understand and eventually predict the effects of the marine environment on fish populations; and

WHEREAS, the use of satellite sensors combined with conventional data collection techniques provide a powerful tool toward ensuring the wise use of living marine resources; and

WHEREAS, the Japan Radio Company Limited has developed an oceanographic color display designed to receive signals from the satellite and to display in color an absolute surface temperature distribution for a large water area; and

WHEREAS, in order to provide this information to fishermen, receiving stations need to be established in Hawaii, Guam and Midway to monitor the entire Pacific region; now, therefore, S.R. NO.

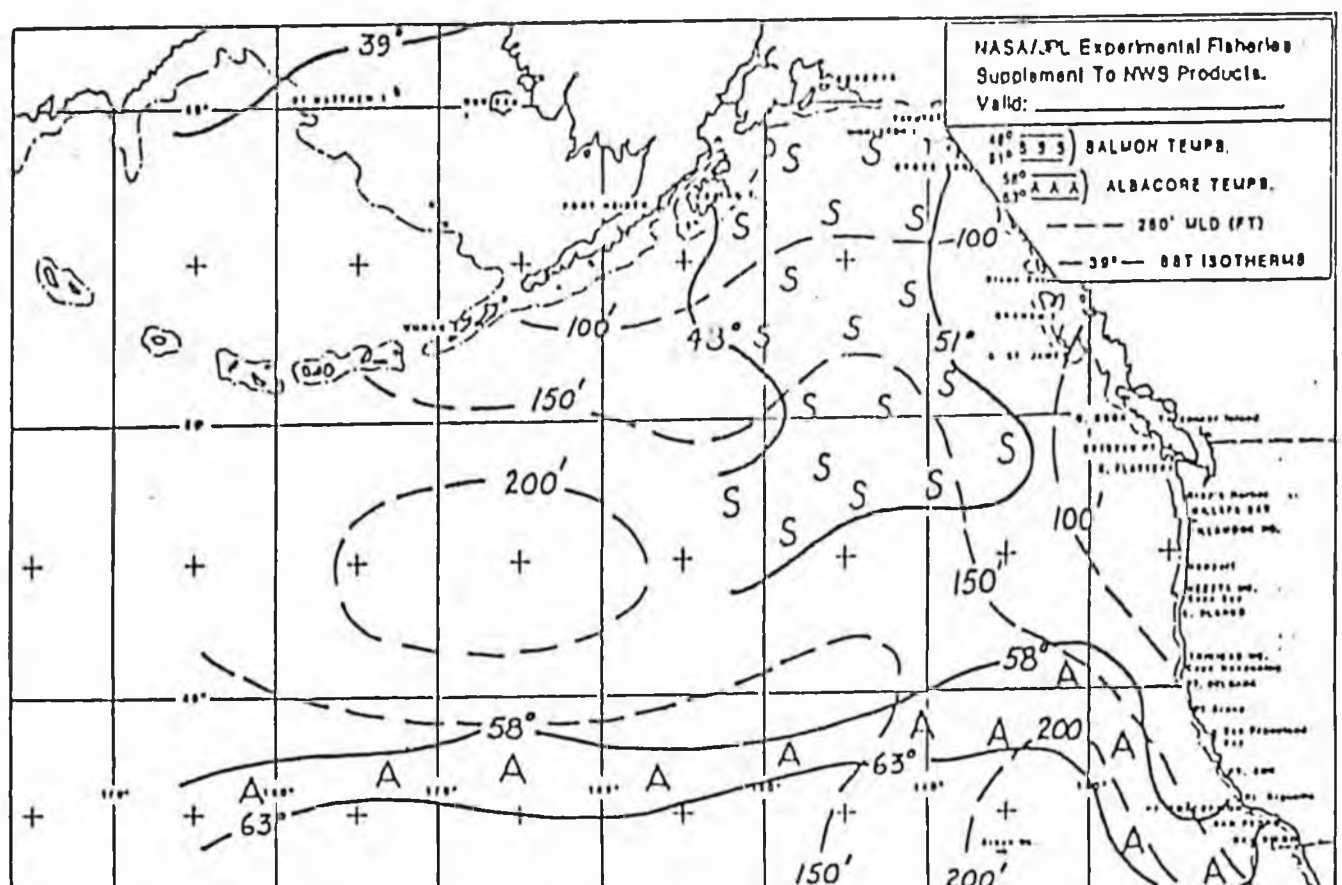
BE IT RESOLVED by the Senate of the Thirteenth Legislature of the State of Hawaii, Regular Session of 1986, that the Legislature requests that the United States Congress establish satellite remote sensing receiving stations in Hawaii, Guam and Midway to assist the fisheries industry in locating stocks of fish for harvesting; and

BE IT FURTHER RESOLVED that the Legislature also requests that funds are allocated for the purchase of oceanographic color displays for the receiving stations and for the distribution of ocean temperature information to fishermen; and

BE IT FURTHER RESOLVED that certified copies of this Resolution be transmitted to the Speaker of the United States House of Representatives, the President of the United States Senate, to each member of Hawaii's congressional delegation, to Guam's congressional delegate, and to the Secretary of the Navy.

OFFERED BY: ______________________________

6-SR
SMCR01



SAMPLE 3. PACIFIC BASIN (AREA 5) FISHERIES-AID CHART.

Ocean Space Utilization '85

Proceedings of the International Symposium,
Nihon University, Tokyo, Japan, June 1985

Springer-Verlag
Tokyo Berlin Heidelberg New York

Application of Satellite Remote Sensing to U.S. Fisheries

R.M. Laurs

National Marine Fisheries Service, Southwest Fisheries Center, La Jolla, CA 92038, USA

ABSTRACT

Satellite oceanic remote sensing is beginning to play important roles in fishery research and fish harvesting. Spaceborne sensors are being used to make synoptic oceanic measurements for use in determining variations in ocean conditions which play key roles in causing fluctuations in stocks of fishes and in their vulnerability to harvesting.

INTRODUCTION

The use of satellite remote sensing to provide synoptic measurements of the ocean is becoming increasingly important in fisheries applications. Variations in ocean conditions play key roles in natural fluctuations of fish stocks and in their vulnerability to harvesting. Information on the changing ocean, rather than on average ocean conditions, is necessary to understand and to eventually predict the effects of the marine environment on fish populations. The evolving capabilities of satellite sensor and data-processing technology, combined with conventional data collection techniques, provide a powerful tool toward ensuring the wise-use of living marine resources.

Laurs and Brucks (1985) review fisheries applications of satellite oceanic remote sensing in the U. S. Examples of recent and potential uses of satellite imagery in U. S. fisheries in the eastern North Pacific are given in Fiedler et al. (1985). Yamanaka (1982) describes the utilization of satellite imagery in Japanese fisheries. Gower (1982) gives an overview of the different kinds of remote sensing data relevant to fisheries science and oceanography, and Montgomery (1981) discusses the utility of satellite imagery to ocean industries, including fisheries.

SATELLITE DATA USED IN FISHERIES

Satellite remote sensing applications in U. S. fisheries have concentrated on the measurements of ocean temperature and color, and computation of ocean transport based on satellite measured wind stress.

Ocean Temperature

Virtually all fisheries studies employing satellite ocean temperature measurements have utilized imagery from thermal infrared sensors. The advanced infrared sensors, notably the Advanced Very High Resolution

Radiometer (AVHRR) aboard the TIROS orbiting meteorological satellites, are characterized by high sensitivity in narrow wave lengths, fine ground resolution and an extensive data archival (Fiedler et al. 1985). These sensors yield high quality data which, except for some limitations, meet the requirements for most fishery investigations.

There have been a very limited number of attempts to apply ocean temperature measurements made from microwave instruments aboard satellites to fisheries studies. These attempts have been only marginally successful, mostly because of the large footprint of the measurements and the contamination of the data in the vicinity of land. However, an a uate evaluation of the utility of satellite microwave ocean tempe ture measurements in fisheries problems has yet to be conducted. Efforts to do so have been hampered because of difficulties in obtaining microwave temperature data and lack of high speed data processing capabilities to process it.

Ocean Color

The Coastal Zone Color Scanner (CZCS) on board the NIMBUS-7 satellite, launched in October 1978, is the only sensor in orbit that is specifically designed to study living marine resources (Hovis et al. 1980). The CZCS is capable of measuring very subtle variations in water color resulting primarily from variations in phytoplankton concentrations. Ocean color measurements from the CZCS are being used in fishery resource applications (a) to determine the locations of oceanic fronts, effluents, and water masses, (b) to determine circulation patterns, and (c) to make quantitative measurements of chlorophyll and sestonic concentrations.

Ocean Winds

The scatterometer (SASS) aboard the SEASAT-A satellite provided data which demonstrate the importance to fisheries of high resolution surface wind stress measurements made from space. Winds stress measurements made by satellite can be used to calculate ocean surface layer transport which controls the distribution of larval stages and the subsequent recruitment and harvests of many marine fishes and shrimps (Brucks et al. 1984). Satellite measurements of winds are also important in the detection of wind conditions that affect the safety and performance of fishing vessels at sea (Hawkins and Black 1983). While the data record of satellite measured winds is very limited due to the unfortunate, premature failure of SEASAT, extensive global coverage of oceanic surface winds will be made by satellite systems planned for launch in the late 1980's (Li et al. 1984)

USE OF SATELLITE MEASUREMENTS IN FISHERIES RESEARCH

Variations in environmental conditions affect the recruitment, distribution, abundance, and availability of fishery resources. It is not possible to measure remotely from satellites the entire spectrum of information needed to assess changes in the marine environment. However, knowledge of important oceanographic conditions and processes affecting fish populations may often be deduced using ocean measurements made by satellite e.g., distribution of surface isotherms, locations of oceanic frontal boundaries, information on currents and circulation patterns, regions of upwelling, etc.

Ocean measurements made by satellite remote sensing can be extremely useful in defining the distribution of marine fish habitats. Lasker et al.

(1981) and Fiedler (1983) have demonstrated that the northern boundary of northern anchovy spawning habitat in the Southern California Bight may be delimited using AVHRR imagery from NOAA polar orbiting satellites (Figure 1). In general, the northern extent of spawning in the Bight and the offshore extent of spawning north of Santa Catalina Island are limited by cold, upwelled waters advected south of Point Conception. The cold waters are readily evident in satellite infrared imagery of the region. The southern limit of spawning may be defined using ocean color measurements made by the CZCS aboard the NIMBUS-7 satellite showing low chlorophyll concentrations (Fiedler 1983).

The distribution and availability of albacore tuna off the west coast of the U. S. have been found to be related to oceanic fronts seen in AVHRR infrared and CZCS imagery (Laurs et al. 1984) (Figure 2). Commercially fishable aggregations of albacore are found in warm, blue oceanic waters near temperature and color fronts on the seaward edge of coastal water masses. These oceanic boundary features, which are believed to result primarily from coastal upwelling, are clearly observable in satellite imagery collected along the U. S. Pacific coast. The distribution of albacore during winter time in regions hundreds of miles off the coast has also been related to sea surface temperature fronts, believed to mark the outer boundary of the California Current, observed in AVHRR imagery (Laurs et al. 1981).

Satellite infrared measurements have also been used to trace the development and duration of the various bluefin tuna fisheries along the east coast of the U. S. (Roeffer et al. 1982). These fisheries follow the movement of seasonal warming of near-surface waters which are monitored by observing the northerly progression of the 19-20°C isotherms in satellite infrared imagery. Limited success has been achieved during winter months in relating the distribution of tuna longline fishing in the Gulf of Mexico with the position of the Loop Current deduced from temperature frontal patterns observed in Geostationary Orbiting Earth Satellite (GOES) infrared imagery (Leming, Internal Report, NMFS). In summer months after seasonal warming has occurred, it is not possible to resolve temperature frontal structure in the GOES infrared imagery of the Gulf of Mexico.

Satellite remote sensing has been an especially important tool during the recent El Niño for monitoring anomalous ocean conditions along the U. S. Pacific coast (Fiedler 1984a). The satellite imagery contains invaluable information for use in assessing the effects of the El Niño conditions on U. S. west coast fisheries. Virtually all of the fisheries were affected in varying degrees with some fisheries showing benefits from the El Niño, and others being harmed substantially. Many fish populations experienced changes in their distribution and centers of abundances. For example, there were shifts in the usual distribution of anchovy spawning which Fiedler (1984b) found could be delineated using AVHRR infrared imagery.

USE OF SATELLITE MEASUREMENTS IN FISHERIES-AID PRODUCTS FOR FISHERMEN

Several projects and programs have used or are using satellite derived ocean data in fisheries-aid products which are distributed to U. S. fishermen by a variety of mechanisms, including radio facsimile transmission, voice broadcast, U. S. mail, and telephone telecopier. A prime motivation leading to the expanded use of satellite observations in fisheries-aid products was provided by the SEASAT Commercial Demonstration Program sponsored by the National Aeronautics and Space Administration/Jet

Propulsion Laboratory. This program led to the development of an operational Satellite Data Distribution System used to distribute oceanographic products to ocean users (Montgomery 1981).

Charts showing the locations of oceanic thermal boundaries are derived from AVHRR infrared imagery from polar orbiting satellites and are provided to commercial and recreational fishermen for use in locating potentially productive fishing grounds along the Pacific coast from central Baja California to British Columbia, Canada (Breaker 1981) (Figure 3). Fishermen use these charts to save time in searching for productive fishing areas associated with oceanic frontal features (Short 1979 and Breaker 1981). High resolution infrared images from the GOES satellite and ship reports are used in the preparation of charts for waters off the Atlantic Coast, which are distributed to fishermen and other interested users (Chamberlain 1981). Of particular interest to fishermen these charts show (a) the outer limit of the shelf water mass, in which many fishery resource species reside, and (b) the numbers, sizes and persistence of warmcore Gulf Stream rings, which can markedly alter conditions on the fishing grounds. These charts have been particularly useful to lobster fishermen in reducing loss of fishing pots due to strong currents of the Gulf Stream warmcore eddies. Charts based on GOES infrared imagery are also prepared to show the path of the Loop Current in the Gulf of Mexico and are used mostly by recreational fishermen (Lowry and Leaky 1982).

Experimental ocean color boundary charts based on CZCS imagery are distributed to U. S. west coast fishermen (Montgomery 1981). These charts show four categories of ocean color---green coastal, transition green, transition blue and deep ocean blue (Figure 4). They are produced at almost weekly intervals depending on cloud conditions, and cover coastal areas up to 700,000 km^2 between Guadalupe Island and Vancouver Island. NIMBUS-7 CZCS passes along the Pacific coast are collected and processed in near-real time, and transmitted by radio facsimile the following day to fishing boats at sea. Color photographs of the satellite images are also distributed by express mail to various fishing ports and to Sea Grant marine advisors in daily contact with fishermen. The color boundary charts and photographs are used primarily by commercial albacore and salmon fishermen, and recreational fishermen in southern California.

Sea ice forecast charts derived from NIMBUS-7 Scanning Multichannel Microwave Radiometer (SMMR) and AVHRR infrared imagery are prepared for regions of Alaska and transmitted by radio facsimile to fishermen and other marine users.

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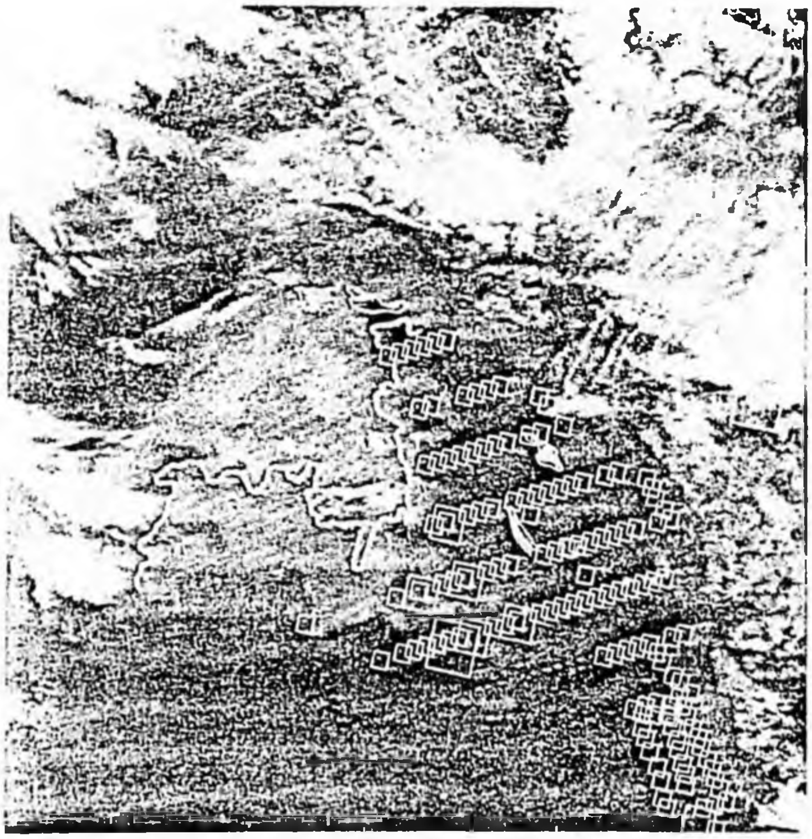


Figure 1. Distribution of anchovy eggs superimposed on the thermal image of the Southern California Bight taken 6 April, 1980. The 14°C isotherm plotted from satellite gray-scale calibration has been drawn in. Feathery white objects are clouds. Squares indicate number of anchovy eggs under one square meter of sea surface (from Lasker et al., 1981).

Figure 2. Central California daily albacore catches, Sept. 27-Oct. 2, 1981 and NOAA-7 AVHRR sea surface temperatures, Sept. 30, 1981 (from Laurs et al., 1984).

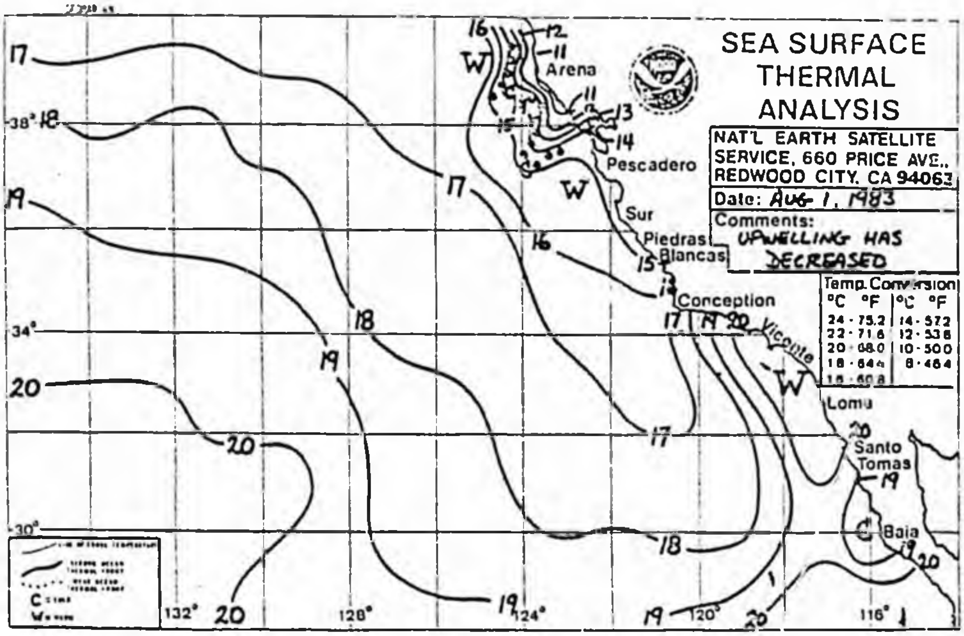


Figure 3. Sea surface temperature charts based on satellite infra-imagery and ship reports issued by U.S. National Weather Service (from Fiedler et al., 1985).

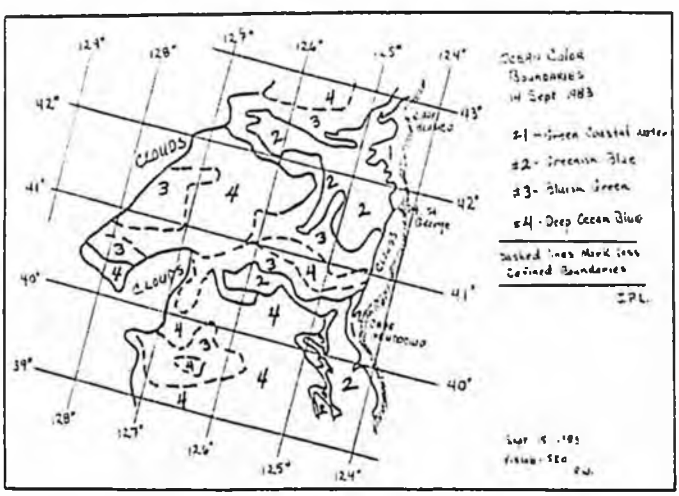


Figure 4. Ocean color boundary chart off northern California and Oregon (R. Wittenberg, Scripps Institution of Oceanography, Visibility Laboratory).

Fisheries Applications of Satellite Data in the Eastern North Pacific

PAUL C. FIEDLER, GARY B. SMITH, and R. MICHAEL LAURS

Introduction

Remote sensing of the ocean is playing an increasingly important role in fishery research and fish harvesting along the Pacific coast of the United States and Canada. Satellite sensors make synoptic measurements of water temperature and color, winds, ice cover, wave height, and surface currents over large areas of the ocean surface. Variations in these ocean conditions play key roles in natural fluctuations of fish stocks and in their vulnerability to harvesting.

The promise of remote sensing techniques for fisheries research, management, and exploitation has been recognized since the early 1960's when the first visible and infrared images of the earth's surface were obtained from orbit. However, successful applications have only recently been realized with the advent of advanced and sensitive radiometers, high-speed data processing, and the availability of imagery to fishery scientists and fishermen.

ABSTRACT—Satellite sensors provide extensive and detailed images of sea surface temperature and color. Synoptic daily sampling by satellites gives a unique view of the ocean surface that can be extremely useful when used in conjunction with conventional shipboard data. Current and potential applications of satellite data off the U.S. Pacific coast and Alaska include interpretation of ship survey data, explanation of pelagic fisheries distributions, prediction of stock recruitment, spatial/temporal monitoring of the coastal zone and sea ice, studies of migration routes and timing, and production of charts to aid commercial fisheries.

Gower (1982) provides a useful overview of the different kinds of remote sensing data relevant to fisheries science and oceanography. Laurs and Brucks (In press) review living marine resources applications in the United States. Yamanaka (1982) gives examples of some uses of satellite data for fisheries applications off Japan. Other potential, ocean-related uses of remote sensing data were discussed by Montgomery (1981). This paper will review the satellite sensors currently measuring sea surface temperature and ocean color, data processing and availability, and several examples of recent and potential applications to eastern North Pacific fisheries.

Satellites provide a unique view of the ocean by covering large areas synoptically. Coverage of historically data-poor areas is particularly useful. However, satellite measurements are usually limited to the surface or near-surface layers in cloud-free areas. Therefore, satellite data complement conventional shipboard observations but cannot replace them. The best research approach often requires close coordination of the two sources of information. In this way, the evolving capabilities of satellite remote sensing are providing a powerful tool to enhance the efficient use of living marine resources.

Satellite Sensors

A variety of instruments measure radiance from the earth's surface in visible, thermal infrared (IR), and microwave wavelength bands (Table 1). The most readily available and useful data come from the Advanced Very High Resolution Radiometer (AVHRR) on meteorological satellites operated by the National Oceanic and Atmospheric Administration (NOAA) and the Coastal Zone Color Scanner (CZCS) on the experimental Nimbus-7 satellite operated by the National Aeronautics and Space Administration (NASA). These advanced sensors are characterized by high sensitivity in narrow wavelength bands, fine ground resolution, and extensive data archival.

Satellites receive electromagnetic radiation emitted from the sea surface (the IR temperature signal) and back scattered from below the surface (the visible ocean color signal). These signals are contaminated by reflection from the sea surface and clouds, and by absorption, emission, and scatter by atmospheric particulates and molecules. Some of these errors can be eliminated or minimized very simply. For example, sunglint and "limb darkening" (by long atmosphere paths at oblique viewing angles) are avoided by constraining the viewing geometry of the sensor. Corrections of some other errors, however, require advanced image processing methods.

Dense clouds may so completely absorb visible and IR radiation from the sea surface that no type of data

Paul C. Fiedler and R. Michael Laurs are with the Southwest Fisheries Center, National Marine Fisheries Service, NOAA, 8604 La Jolla Shores Drive, La Jolla, CA 92038. Gary B. Smith is with the Northwest and Alaska Fisheries Center, NMFS, NOAA, 2725 Montlake Boulevard East, Seattle, WA 98112.

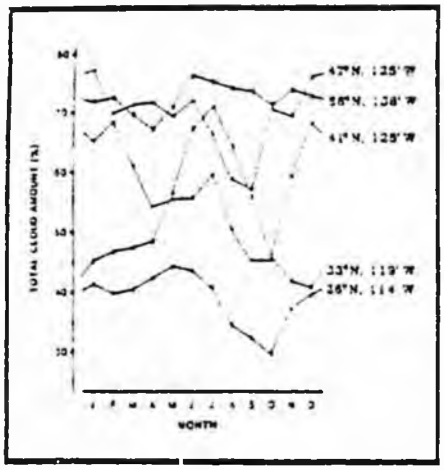


Figure 1.—Mean monthly total cloud amount over coastal waters, from surface marine weather observations, 1921-72 (Nelson and Husby, 1983): Baja California (27°N, 115°W), Southern California Bight (33°N, 119°W), Cape Mendocino (41°N, 125°W), Vancouver Island (48°N, 126°W). Gulf of Alaska data (56°N, 138°W) are from satellite observations, 1967-72 (Sadler et al., 1976), intercalibrated against data from Nelson and Husby (1983).

Table 1.—Some satellite sensors measuring visible, infrared, or microwave radiance for oceanographic measurements. Wavelengths are band midpoints. Ground resolution dimensions are directly beneath the satellite.

Sensor[1]	Satellite	Channel	Spectral band	Wavelength (µm)	Scan width (km)	Ground resolution (km)	Primary measurements
AVHRR	TIROS-N	1	Visible	0.63	3,000	1.1	Sea surface temperature, sea ice
	NOAA-6, 7, 8	2	Near-infrared	0.91			
		3	Infrared	3.74			
		4	Infrared	10.8			
		[2]5	Infrared	[2]12.0			
CZCS	Nimbus-7	1	Visible	0.44	1,566	0.825	Phytoplankton pigments, turbidity, sea surface temperature
		2	Visible	0.52			
		3	Visible	0.55			
		4	Visible	0.67			
		5	Near-infrared	0.75			
		6	Infrared	11.5			
MSS	LANDSAT	1	Visible	0.55	185	0.079	Water color, turbidity, sea ice
		2	Visible	0.65			
		3	Near-infrared	0.75			
		4	Near-infrared	0.95			
VISSR	GOES	1	Visible	0.62	Earth disk	7 × 3	Cloud cover, sea surface temperature
		2	Infrared	11.5			
SMMR	Nimbus-7	1	Microwave	4.54×10^4	600	20-100	Sea surface temperature, sea ice, near-surface winds
	SEASAT	2	Microwave	2.8×10^4			
		3	Microwave	1.66×10^4			
		4	Microwave	1.36×10^4			
		5	Microwave	0.81×10^4			

[1]Sensors: AVHRR = Advanced Very High Resolution Radiometer; CZCS = Coastal Zone Color Scanner; MSS = Multispectral Scanner; VISSR = Visible and Infrared Spin Scan Radiometer; SMMR = Scanning Multichannel Microwave Radiometer.
[2]Channel 5 on NOAA-7 and NOAA-8 satellites only.

processing can retrieve a useful signal. Clouds severely limit satellite coverage of the sea surface in some regions of the eastern North Pacific, particularly north of lat. 40°N (Fig. 1). South of lat. 27°N, off Baja California, mean monthly cloud cover is consistently less than 50 percent, due to persistent offshore flow of dry continental air. From lat. 30°N to 38°N, coastal waters are covered by a dense layer of low stratus clouds during the summer upwelling season (Nelson and Husby, 1983). The most favorable conditions for remote sensing at these latitudes are found from October through March or April, especially during occasional brief periods when Santa Ana winds blow warm, dry desert air offshore and produce cloud-free conditions up to 1,000 km from the coast.

In contrast, the most cloud-free conditions at lat. 40°-50°N are found in late summer, from August to October. Mean monthly cloud cover increases to the north and is consistently 70 percent or greater in the Gulf of Alaska, although March and April may be relatively clear. As a general rule, percent cloud cover increases by at least 10 percent from the coast to a distance on the order of 200 km offshore in the eastern North Pacific (Nelson and Husby, 1983).

The probability of cloud-free conditions in a region of interest during regular satellite passes is loosely reflected in these monthly cloud cover statistics. Cloud cover restricts the extent to which satellite data can be anticipated, or depended upon, to be available. Whereas it may be possible to obtain regular daily or weekly coverage of sea surface features in the south, such as in the Southern California Bight, in the north there are generally more frequent and longer data gaps. Satellite coverage of ocean features in the Alaska region is characteristically limited to occasional cloud-free scenes that, despite being infrequent, can be rich in information. Microwave radiometers can measure sea surface temperature through clouds, but with a lower sensitivity and much coarser resolution than IR radiometers.

Data Processing

The AVHRR measures thermal infrared radiant energy in three wavelength bands (Table 1). Temperature calibration data are obtained by scanning deep space and internal blackbody targets. Accurate sea surface temperatures are calculated from empirical regressions of ship and buoy temperatures on satellite temperatures in two or three bands. Such multispectral corrections are based on the different response of each band to the cold bias caused by atmospheric water vapor (McClain et al., 1983). Pixels (samples) containing clouds even smaller than the sensor's field of view are screened in daytime passes using the near-infrared albedo data from channel 2 (Bernstein, 1982).

The CZCS measures visible light in five narrow wavelength bands selected for estimating phytoplankton pigments, suspended sediments, and dissolved organic matter. Up to 90 percent of the visible radiance received at the satellite is skylight reflected and scattered within the atmosphere. Corrections are based on assumptions that the red light emitted by the ocean and measured by channel 4 is either negligible or can be accurately predicted from radiances in other bands. The atmospheric radiance measured by channel 4 can then be related to atmospheric radiances in other channels using known spectral properties of atmospheric scattering (Gordon et al., 1983). Corrected ratios of blue to yellow-green (channel 1/channel 3) or green to yellow-green (channel 2/channel 3) radiance are then used to calculate phytoplankton pigment concentration from empirical regression relationships (Smith and Baker, 1982).

Satellite data, properly corrected for the various errors described above, have been validated by sea truth data from ships to ± <1°C (Bernstein, 1982) and ±0.4 log chlorophyll concentration (Smith and Baker, 1982). While important subsurface features such as chlorophyll maximum layers and some cold-core eddies or oceanic fronts may not be detected by satellites, the measured parameters are, in general, closely related to properties such as mixed-layer temperature and integrated chlorophyll or primary productivity in the euphotic zone (Smith, 1981).

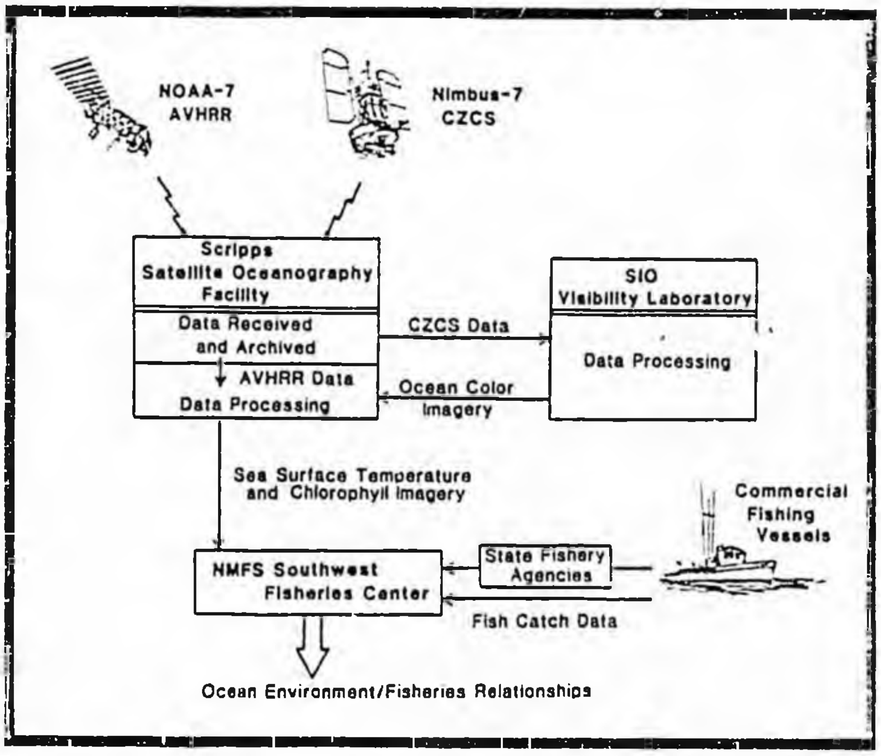


Figure 2. — Satellite data collection and processing network utilized by the National Marine Fisheries Service on the west coast.

Data Availability

Applications of satellite data are ultimately limited by their availability. Ideally, a user would have immediate access to data received directly from satellites and conveniently archived, with data processing facilities at his fingertips. This ideal has been approached by an arrangement at the Satellite Oceanography Facility of Scripps Institution of Oceanography in La Jolla, Calif., for most of the work reported here (Fig. 2). Similar arrangements, lacking direct data reception capabilities, have been established at the University of Miami and by the Northeast Area Remote Sensing System, which is a regional association of university, industry, and government organizations that was recently formed in the northeastern United States.

Global satellite data are archived by the Satellite Data Services Division of NOAA and are available to the public, although acquisition may require several months and a large backlog of CZCS data is unprocessed. AVHRR and CZCS data are available in various forms including photographic prints and negatives, digital data on magnetic tapes, and maps of derived sea surface temperature and ice cover. These products and a catalog of available CZCS data are available from the National Environmental Satellite Data and Information Service, Satellite Data Services Division, NOAA, Room 100, World Weather Building, Washington, DC 20233. Detailed procedures for obtaining environmental satellite data are given in Cornillon[1]. In general, photographic copies of raw data are of limited value and a user must have access to a computer-based, image processing system to extract useful information from satellite data on digital tapes (this situation may change in the future if products derived from satellite data are offered by commercial processing enterprises).

Applications

We briefly review here examples of general applications of satellite data to fisheries research and management problems along the Pacific coast between California and Alaska. Some of these examples have been published elsewhere, but none of the applications has as yet been fully realized.

[1]Cornillon, P. 1982. A guide to environmental satellite data. Univ. R. I. Mar. Tech. Rep. 79, 469 p. Available for $20.00 from the University of Rhode Island, Marine Advisory Service, Publication Unit, Narragansett, RI 02882.

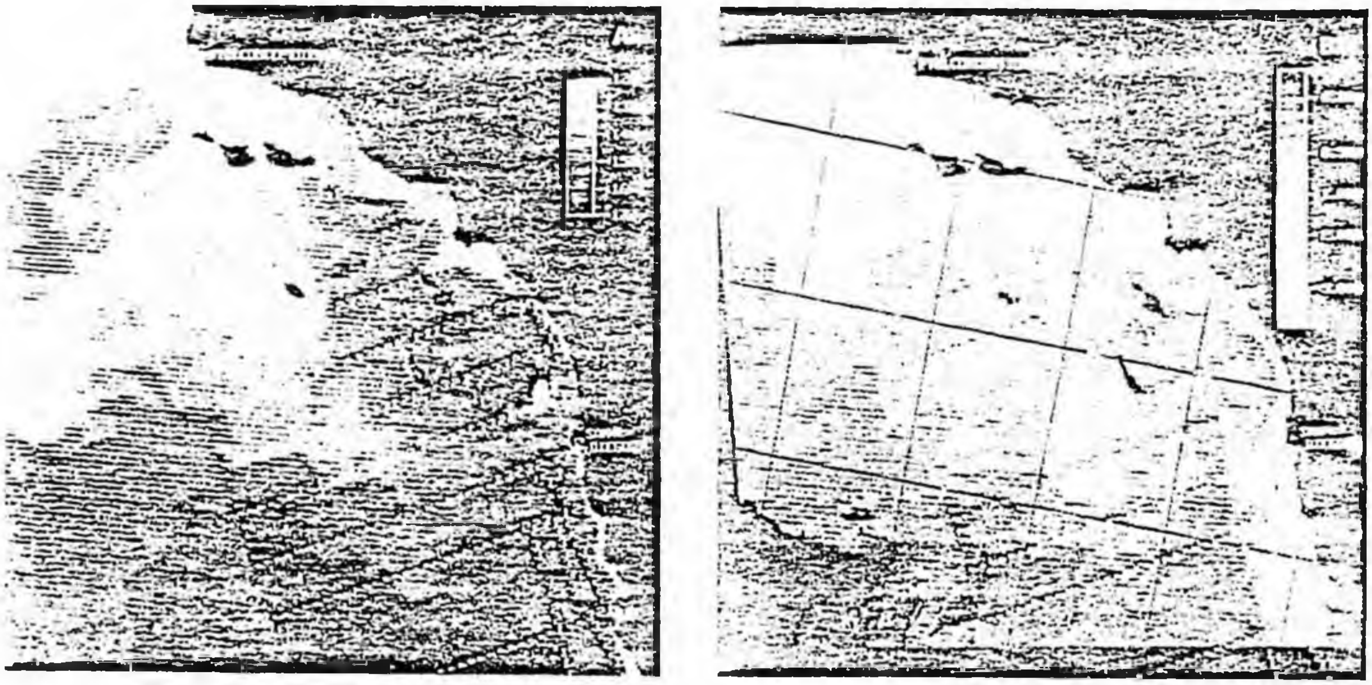


Figure 3. – Northern anchovy egg distribution, 20 March-10 April 1980: • = 0, 1 = 1-4, 2 = 5-17, 3 = 18-245 eggs/0.05 m^2. Top photo (A) is sea surface temperature (°C) from NOAA-6 AVHRR, 7 April 1980; Photo B is of phytoplankton pigments (mg m^{-3}) from Nimbus-7 CZCS, 8 April 1980.

Interpretation of Ship Survey Data

A large stock of northern anchovy, *Engraulis mordax*, is found off southern California, where intensive egg surveys have been conducted since 1980 to estimate spawning biomass. Satellite images of sea surface temperature and phytoplankton pigment concentration, obtained during an egg survey in April 1980, depict environmental limits on the range of spawning anchovy (Fig. 3). North of San Diego, no eggs were found in water colder than 14°C. To the south, spawning northern anchovy were confined along the coast to a narrow band of water with high pigment concentrations. Similar distribution patterns were observed in 1981 and 1982 (Lasker et al., 1981; Fiedler, 1983).

The distribution of spawning adults may reflect the critical need by first-feeding larvae for aggregations of suitable food organisms in a stable water column. The environmental limits revealed by the satellite images would not have been revealed by the egg survey data alone, because phytoplankton pigments were not measured and spatial coverage was limited.

Satellites data may be used to interpret the large-scale patterns and possible causes of spatial/temporal variability in other types of ship survey data. Most measurements of fish eggs and larvae, plankton concentrations, chlorophyll, nutrients, temperature, and salinity are made at point locations at regular intervals along transects or in grid patterns. Remote sensing data collected concurrently, if available, may provide valuable information on factors contributing to patterns in the shipboard data and on conditions beyond the area surveyed. Besides the insight that usually results from a synoptic view, this information is important in evaluating the validity of interpolation and extrapolation of ship survey results.

Pelagic Fisheries Distribution

Albacore, *Thunnus alalunga*, is a migratory oceanic tuna that is an important target species for jigfishing, live bait, and recreational fishing along the U.S. Pacific coast from July to October. Fishermen search for aggregations of these fish in warm, blue oceanic waters near temperature or water color fronts at the offshore edge of productive coastal waters. Daily catch records during peak fishing in late summer 1981 were taken from logbooks submitted to west coast state fisheries agencies. Concentrations of fishing activity and large catches indicate sites of albacore aggregations.

Satellite images of sea surface temperature and phytoplankton pigment concentrations clearly show favorable sites for aggregations in pockets of warm, blue oceanic water intruding into the colder and more turbid coastal water mass (Fig. 4; Laurs et al., In press). Albacore are visual predators and may feed most efficiently in the clear water adjacent to coastal waters where prey densities are higher. Albacore fishermen, running several days out of port in small boats to reach offshore fishing grounds, can benefit from timely maps of sea surface temperature and ocean color gradients derived from satellite data. Potential benefits include decreased search time, lower fuel use, and increased catches.

Satellite data may be applied to

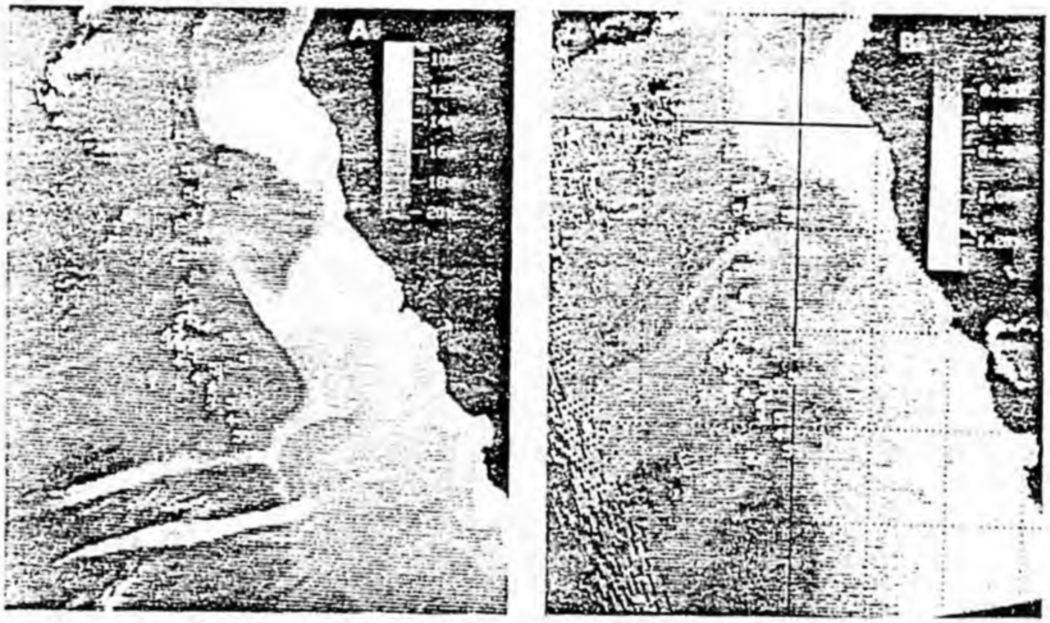


Figure 4. – Daily albacore catches off central California, 19-24 September 1981: 1 = 0-27, 2 = 33-63, 3 = 64-81, 4 = 87-140, 5 = 148-750 fish/boat. A is sea surface temperature (°C) from NOAA-7 AVHRR, 21 September 1981; B is phytoplankton pigments (mg m^{-3}) from Nimbus-7 CZCS, 22 September 1981.

other pelagic fisheries, both to direct fishing effort and for fisheries management. In the Pacific Northwest and off Alaska, five species of Pacific salmon – sockeye salmon, *Oncorhynchus nerka*; chum salmon, *O. keta;* pink salmon, *O. gorbuscha*; chinook salmon, *O. tshawytscha*; and coho salmon, *O. kisutch* – are important resources for a large fishing industry. During their oceanic life history phase, these salmon are caught by power or hand-trolling boats using methods similar to albacore fishing. The study described by Borstad et al. (1982) is an example of a use of remote sensing techniques to study relationships between salmon distributions, fishing, and oceanographic conditions. Other pelagic resources for which there may be analogous applications include Pacific herring, *Clupea harengus pallasi*, off Alaska; jack mackerel, *Trachurus symmetricus*, and Pacific mackerel, *Scomber japonicus*, off California; and bluefin tuna, *Thunnus thynnus orientalis*, off Baja California.

Stock Recruitment Predictions

An application of satellite data that merits investigation is the improved understanding and prediction of variations in recruitment to coastal fish stocks. In the eastern North Pacific, offshore transport and turbulent mixing may have important effects on the larval survival and subsequent recruitment of some species (Bakun and Parrish, 1982). Both processes are driven by surface wind stress. Offshore transport removes eggs and larvae from productive nearshore nursery grounds. This may be most important where strong seasonal upwelling occurs over a narrow continental shelf, as it does along the U.S. coast north of lat. 34°N. Turbulent mixing reduces stratification of the near-surface water column and disrupts aggregations of food organisms required for successful first feeding by newly hatched larvae (Lasker, 1981).

Variations in annual recruitment of Pacific whiting, *Merluccius productus*, have been related to monthly mean Ekman transport estimated from equatorward wind stress off central California (Bailey, 1981). Fiedler (1984) has used AVHRR imagery to document interannual changes in the sea surface temperature field related to variations in coastal upwelling off the U.S. Pacific coast. Satellite imagery has also revealed that offshore transport is a highly irregular process in both time and space, manifested as meandering jets and eddies of cold water (e.g. Fig. 5). Offshore transport could perhaps be quantified by measuring the areal extent of relatively cold water nearshore or the offshore displacement of frontal features between daily satellite passes. This application may be extended to other species for which there is evidence of similar environmental effects (e.g. Hayman and Tyler, 1980; Bakun and Parrish, 1982).

The seasonal timing and spatial location of northern anchovy spawning has been related to turbulent mixing, as indexed by the cube of mean surface wind speed in historical marine weather observations, by Husby and Nelson (1982). They suggested that strong year classes may depend upon the occurrence of "time-space windows" with sufficiently low turbulence to allow development of layers of food organisms.

The magnitude and direction of surface wind stress are directly

Figure 5. — Localized offshore transport of cold upwelled water (whiter shades) off northern California and southern Oregon. The three major coastal landforms, from top to bottom, are Cape Blanco, Cape Mendocino, and Point Arena. White features in the top left corner are clouds. Image from NOAA-7 AVHRR channel 4, 14 June 1982.

measurable by microwave sensors such as the scatterometer which flew on the short-lived SEASAT satellite in 1978. The U.S. government has not yet committed funds to orbit another such sensor, for which there are many potential scientific and commercial applications (NASA Satellite Wind Stress Working Group, 1982). Fisheries applications might include the real-time planning of fishing operations to avoid adverse sea state conditions, as well as the measurement of surface winds driving environmental processes affecting recruitment into coastal fish stocks. These benefits would be particularly significant in northern areas, such as the Pacific Northwest and Alaska regions, where present remote sensing coverage by visible and infrared sensors is usually limited by cloud cover.

Coastal Zone Monitoring

Mesoscale processes, such as upwelling and eddy formation, are very important components of the spatial and temporal variability of eastern North Pacific coastal waters, especially in the complex California Current System. Extensive and high-resolution satellite data are particularly valuable for studies of these processes (Bernstein et al., 1977). Anomalous ocean conditions along the U.S. Pacific coast were monitored during the 1982-83 El Niño event using AVHRR and CZCS data (Fiedler, 1984). Localized sea surface temperature anomalies up to +6°C were observed. Reduced coastal upwelling during the first half of the year was detected in patterns of cold, nearshore surface waters. CZCS images of the Southern California Bight indicated reduced phytoplankton productivity. This event affected many commercial and sport fisheries along the coast (Anonymous, 1984).

Monitoring coastal zone variability within a year or season with satellite data may be useful for developing better release strategies for hatchery-reared juvenile salmonids by enabling management decisions to be more adaptive and based on conditions in nearshore nursery areas. It might be possible to improve the growth and survival of hatchery-reared salmon by scheduling releases during periods of most favorable ocean conditions. AVHRR and CZCS imagery could be used as sources of information on sea surface temperature, river plume trajectory, upwelling intensity, primary production, and the oceanic frontal areas associated with each of these factors. Small improvements in the survival of juveniles released from hatcheries could result in substantial increases in the numbers of returning adults. If successful, this application would be particularly important in the Pacific Northwest and Alaska region, where hatchery operations are extensive and salmon resources have high value.

Salmon enhancement programs on the Columbia River, the largest river on the Pacific Coast of North America, provide an example of the potential. The National Marine Fisheries Service funds 22 salmon hatcheries and 7 rearing ponds on the Columbia River at an annual cost exceeding $4.5 million. Each year, these facilities culture and release 50-100 million salmon smolts in late April and early May. The present release schedule is decided largely on the basis of administrative criteria, tradition, and attempts to emulate nature. However, survival rates for these hatchery-reared salmon are relatively low, only about 3.7 percent (range, 0.23 to 12.35 percent) for coho salmon in their first year (Mathews, 1980).

There is increasing evidence that juvenile salmon survival, and subsequent adult returns, are critically influenced by conditions in the ocean environment within the first 6 months after hatchery release (Hartt, 1980; Wahle and Zaugg, 1982). Important factors may be food availability and the extent that food limitations occur in the nursery habitats as a result of crowding. On the Columbia River, although hatchery-reared salmon pass downstream and through the lower river and estuary relatively rapidly, significant losses occur in each of these migratory stages and areas. After reaching the ocean, juvenile salmon typically migrate along a relatively narrow coastal belt (Hartt, 1980). In purse seine studies off the Columbia River, juvenile salmonids (<50 cm) have been found to be distributed mainly within 28 km of shore; chinook salmon and steelhead, *Salmo gairdneri*, were distributed almost entirely in the river plume (Miller et al., 1983). Upwelling and its effects on food production have been related to juvenile survival and adult salmon production (Gunsolus[1]). A better understanding of these environmental relationships is a goal of current research.

Figure 6 shows three satellite images of sea surface temperatures along

[1]Gunsolus, R. T. 1978. The status of Oregon coho and recommendations for managing the production, harvest, and escapement of wild and hatchery-reared stocks. Oreg. Dep. Fish Wildl., Columbia Reg. Off., 17330 S.E. Evelyn St., Clackamas, OR 97015. Unpubl. manuscr., 59 p.

the Pacific Northwest coast during summer 1982, illustrating changes in coastal conditions that can occur over relatively short (2-3 week) time intervals. On 5 July, coastal upwelling was very weak, although signs of intensification were developing at Cape Mendocino. By 23 July, upwelling had intensified considerably, especially to the north. By 18 August, however, upwelling was again weaker. Changes in the mesoscale pattern of cold-water jets and meanders can be seen. In the latter two images, the Columbia River plume is indicated by a dark, warm-water break in the band of cold, upwelled water along the coast.

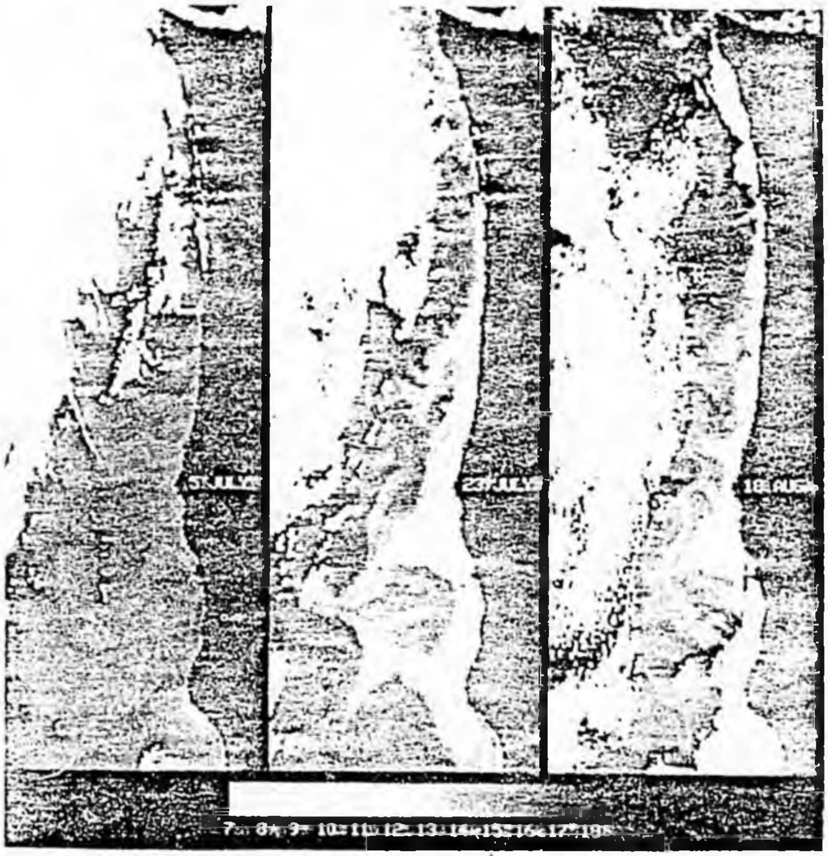


Figure 6. — Variations in the intensity and pattern of coastal upwelling off the Pacific Northwest between lat. 39°00'N and 48°30'N, July-August 1982. Sea surface temperature (°C) from NOAA-7 AVHRR channels 4 and 5. Clouds (white) screened with channel 2 data.

Monitoring Sea Ice

Sea ice is an important seasonal feature of the Alaskan environment that can be monitored by satellite coverage (Weeks, 1981; McNutt, 1981). Ice affects commercial fishing activities by threatening vessel safety, limiting navigation and access, and damaging fishing gear. Yet sometimes waters near the edge of pack ice can offer shelter or rich fishing grounds. Ice is also important because of its significance in the ecology of, and as a habitat for, northern marine mammals.

In the eastern North Pacific, winter ice cover occurs in inlets along the coasts of southeastern Alaska, the Gulf of Alaska, and the Aleutian Islands. Its formation is often associated with freshwater runoff, such as in Cook Inlet (Poole and Hufford, 1982). Freshwater ice forms on stream and river deltas, then sea ice forms in lower parts of the embayments. However, much greater ice cover occurs in the extended area to the north. Ice covers the Chukchi Sea, Bering Strait, and nearly the entire northeast half of the eastern Bering Sea during winter and spring. Movements of pack ice in the Bering Sea are influenced by winds and water currents, and are highly dynamic.

Ice off the North Slope, along the southern coast of Alaska, and in the Bering Sea, is monitored routinely by the National Weather Service. When cloud cover permits, ice and open water can be discriminated with a 1 km resolution using AVHRR visible and infrared data (Fig. 7). Combined with data from the Nimbus-7 Scanning Multichannel Microwave Radiometer, which are not influenced by clouds but have a resolution of 60 km, large-scale maps of ice coverage or concentration are produced. Some information about ice type (age and thickness) can be gleaned from satellite data, but the analysis is supplemented by aerial reconnaissance and reports from ships and shore stations. Ice analysis maps are distributed to users in the fishing and oil industries three times a week by radio facsimile and once a week by mail.

Winter fisheries affected by ice cover in the eastern Bering Sea include: Foreign groundfish fisheries, involving 200-300 vessels per year and an annual catch of about 1.3 million metric tons (Bakkala et al., 1979); highly-valued U.S. fisheries for king crab, *Paralithodes* spp., and snow (Tanner) crab, *Chionoecetes* spp. (Otto, 1981); and U.S. fisheries for Pacific herring that take place along the north shore of Bristol Bay. Vessels operating in these fisheries often need to work around sea ice, can have stability problems, and are sometimes trapped in shifting pack ice and lost.

Ice is an important part of the habitat of 25 species of marine mammals that occur in the Bering Sea (Fay, 1974; Burns et al., 1981). It may serve as a substrate, barrier, or to force migrations. Species that regularly come in contact with ice include the following: Polar bear, *Ursus maritimus;* walrus, *Odobenus rosmarus;* harbor seal, *Phoca vitulina;* ringed seal, *P. hispida;* ribbon seal, *P. fasciata;* bearded seal, *Erignathus barbatus;* narwhal, *Monodon monoceros;* beluga whale, *Delphinapterus leucas;* and bowhead whale, *Balaena mysticetus.* For these and other species, the wide views of ice

Figure 7. – Ice cover in the eastern Bering Sea, 18 February 1983, NOAA-7 AVHRR channel 4. Ice, clouds, and snow-covered land all appear whiter (colder) than open water. Pack ice extends from the Bering Strait, in the top left corner, past St. Matthew and Nunivak Islands, but does not reach the Alaska Peninsula to the southeast. Photograph courtesy of G. L. Hufford, NOAA/NESDIS, Satellite Field Services Station, Anchorage, Alaska.

characteristics that can be obtained from satellite imagery provide unique information for use in conservation and management.

Migration Routes and Timing

Satellite imagery can provide useful information on environmental conditions related to the routes and timing of long-distance migrations by marine mammals and fish. In the eastern North Pacific and in waters off Alaska, many important species occupy large habitat areas and make extensive seasonal migrations. These large activity areas are often in remote and data-poor regions. Satellite coverage, because of its wide areal views and long-term repeated observations, provides data with time and space characteristics that are appropriate for interpreting large-scale migratory phenomena. Applications include planning research, experimental design, and evaluating strategies for population enumeration.

The North Pacific albacore, *Thunnus alalunga*, performs transpacific migrations and supports important commercial fisheries in the western, central, and eastern North Pacific. Seasonal migration into North American coastal waters is associated with the Transition Zone between Pacific central and subarctic water masses (Laurs and Lynn, 1977). The frontal structure of these waters may affect both the timing and location of the arrival of albacore into the summer fishery along the coast. Figure 8 illustrates CZCS color frontal patterns in the central Pacific that could influence the course of the migration.

The potential for using both color and infrared temperature imagery in

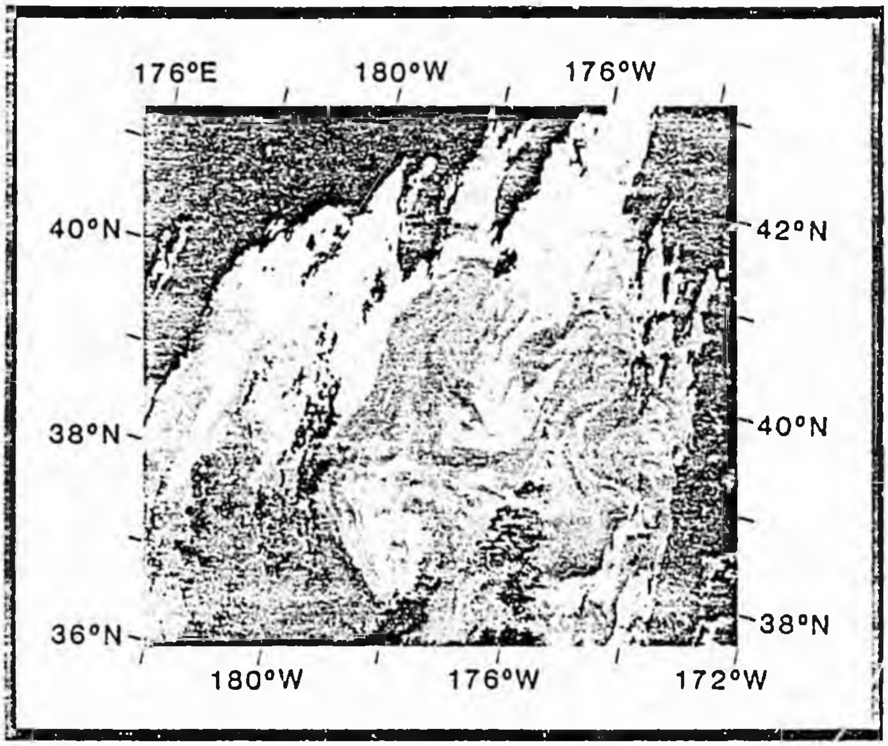


Figure 8. — Phytoplankton pigment concentration in a 600 × 600 km area of the central North Pacific, measured by the Coastal Zone Color Scanner, 30 June 1980. Black = clouds, darkest gray = 0.08 mg m^{-3}, white = 5.7 mg m^{-3}.

fishery operations in these waters has been explored on a limited basis with promising results. Although cloud cover allows only infrequent views of the sea surface, the surface patterns seem to be less dynamic than in coastal waters. Color boundaries are detectable from satellites during all seasons, but pronounced sea surface temperature fronts are not present during summer-autumn due to seasonal warming. However, infrared satellite imagery has been used to locate the subtropical front during winter (Van Woert, 1982) and spring months[3].

In Arctic and subarctic areas, such as the Beaufort Sea and northern Bering Sea, the movements and distribution of sea ice have important influences on the movements of marine mammals. Bowhead and beluga whales make regular seasonal migrations through the shear zones and lead systems that develop in the Arctic pack ice (Braham et al., 1980). In the case of the bowhead whale, the prediction and evaluation of migration paths is important because it is an endangered species and the western Arctic population requires careful annual censusing. Satellite imagery showing ice cover and open-water corridors is used to spot check the sampling design for summer whale counts.

There is potential for similar applications of satellite data in other oceanic and coastal areas, although the relationships between environmental characteristics and marine mammal migrations are not as obvious. For example, the eastern Pacific stock of gray whale, *Eschrichtius robustus*, undergos regular annual migration between summer feeding grounds in the Chukchi Sea and winter breeding grounds in Mexico (Pike, 1962). Satellite coverage of the onset of winter ice cover in the Bering Strait may help explain the environmental signals that initiate the southern migration. Other marine mammals that are important in the region, and that undergo long-distance movements, include: Northern fur seal, *Callorhinus ursinus*, migrating between summer breeding grounds on the Pribilof Islands in the eastern Bering Sea (and on other islands around the Northern Pacific rim) and wintering areas in the Gulf of Alaska and off the U.S. Pacific coast (Fiscus, 1978); humpback whale, *Megaptera novaeanglice*, an endangered species of which the eastern Pacific stock migrates between breeding and calving areas in the Hawaiian Islands and summer feeding grounds in the inland waters of southeastern Alaska (Wolman, 1978); and a number of species of dolphins and porpoise.

Allocation of Sampling Effort

Annual egg and larva surveys of northern anchovy are a regular activity of the California Cooperative Oceanic Fisheries Investigations (CalCOFI). Each survey requires 4-5 weeks of ship time to make vertical net tows at 800-900 stations. The accuracy of the estimate of spawning biomass derived from each survey depends on complete coverage of the geographic range of the spawning stock. Without a priori knowledge of this distribution, many extra stations beyond the range limits must be sampled to ensure adequate coverage. We are now investigating the use of satellite imagery to plan egg surveys based on environmental limits characterizing the spawning habitat and detectable from satellites, as described above.

The 1983 survey plan was modified during the cruise using information from satellites. When the cruise began north of Point Conception in February, eggs were found much farther north and offshore than in recent years. Upon examination of AVHRR temperature imagery, we realize that this extension of the spawning range was due to the 1982-83 El Niño event. The cold-water boundary which normally limits

[3]R. Lynn. 1984. Southwest Fisheries Center, National Marine Fisheries Service, NOAA, P.O. Box 271, La Jolla, Ca 92035. Pers. commun.

Figure 9.—Northern anchovy egg distribution, 9 February-29 March 1983: • = 0, 1 = 1-3, 2 = 4-12, 3 = 13-229 eggs/0.05 m^2. Sea surface temperature (°C) from NOAA-7 AVHRR, 10 February 1983.

spawning to the southeast of Point Conception had shifted to the north and offshore (Fig. 9, compare with Fig. 3). As a result, the lines of sampling stations were extended farther offshore than originally planned, to ensure coverage of the entire spawning stock.

In another study conducted in June 1980 on the feeding biology of larval jack mackerel, satellite data were used to locate an intensive sampling grid on a temperature front. The front was observed southwest of San Diego in a NOAA-6 AVHRR image obtained over 1 week prior to the cruise, and it persisted during the sampling period (Fig. 10). The front was subsequently found to be related to an important gradient in food availability[4].

These two examples demonstrate how a single satellite image, from data received and processed in a matter of hours, can save days of ship time by locating significant environmental features and permitting efficient allocation of sampling effort. The potential cost savings are obvious, but the real-time use of satellite data requires facilities for direct reception and processing.

Fisheries Aid Charts

Operational applications of satellite data to commercial fishing activities

[4]R. Hewitt, 1983. Southwest Fisheries Center, National Marine Fisheries Service, NOAA, P.O. Box 271, La Jolla, CA 92038. Pers. commun.

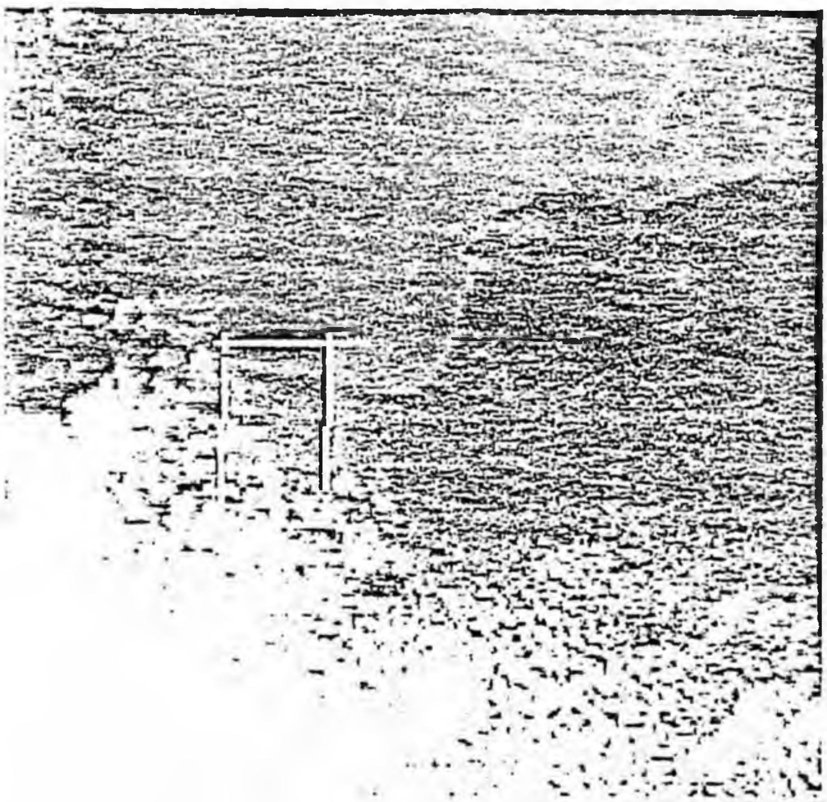
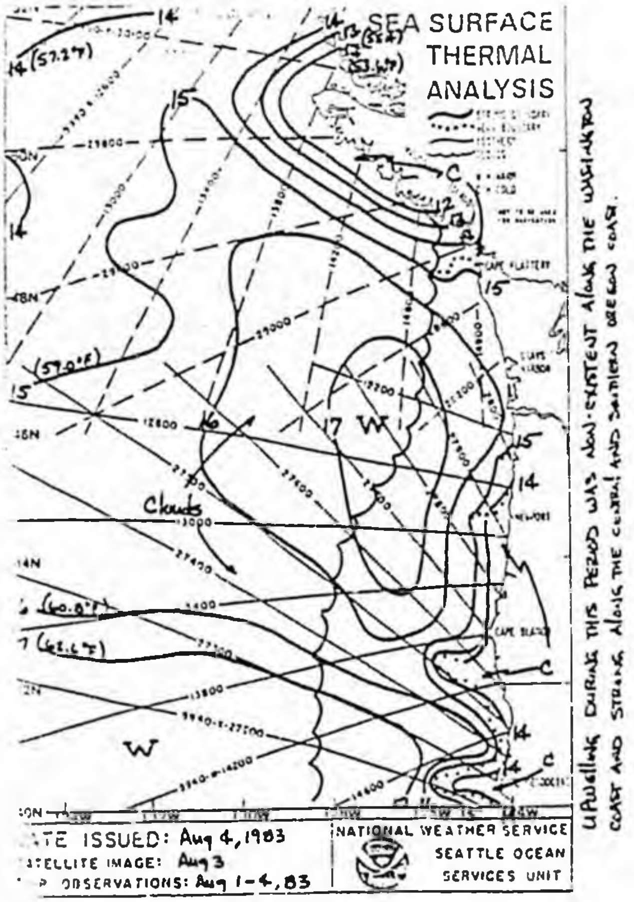
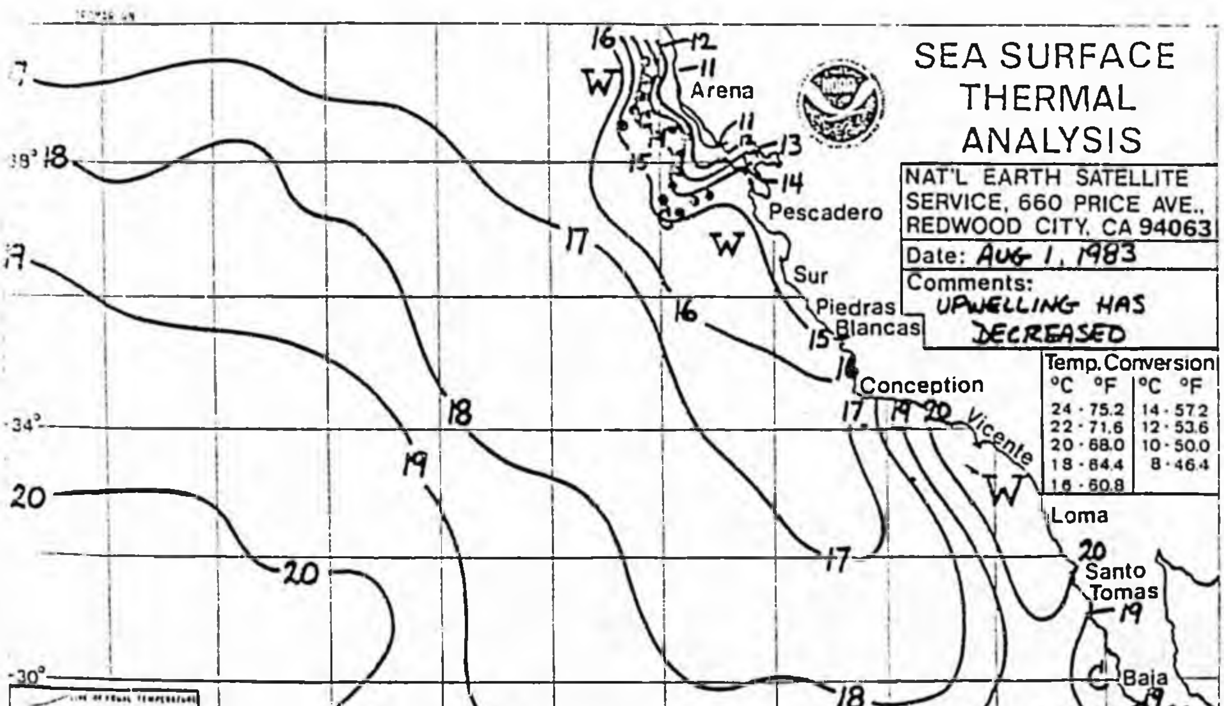


Figure 10.—Uncalibrated NOAA-6 AVHRR channel 4 image off southern California, 5 June 1980. Lighter shades represent cold sea surface temperatures, clouds appear white. Box encloses a 30 × 67 km grid of 41 stations centered at lat. 31° N, long. 120°30′ W.



began along the Pacific coast in 1975 (Breaker, 1981) and have now been extended to Alaska. Charts showing sea surface temperature fronts and sea ice visible in satellite AVHRR images, and surface isotherms mapped from satellite and ship data, are produced routinely by NOAA (Fig. 11). The Northwest Ocean Services Center in Seattle produces a chart covering northern California, Oregon, Washington, and southern British Columbia, from lat. 40°N to lat. 52°N. The Satellite Field Services Station in Redwood City, Calif., produces a chart covering central and southern California and northern Baja California, from lat. 28°N to lat. 40°N. Coverage of both charts extends offshore to long. 135°W. They are produced once or twice weekly year-round and are distributed primarily by radio facsimile from the U.S. Coast Guard

Figure 11.—Sea surface temperature charts produced by the National Weather Service.



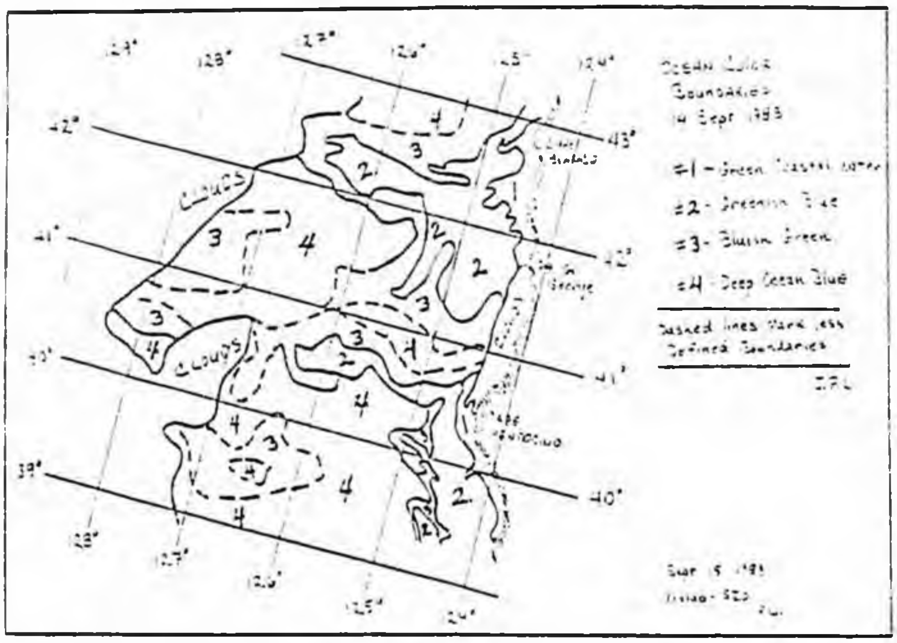


Figure 12. — Ocean color boundary chart off northern California and Oregon (R. Wittenberg, Scripps Visibility Laboratory).

radio station at Point Reyes, Calif. Fishermen use these charts to save time in searching for productive fishing areas associated with frontal features.

The Alaska Ocean Services Unit, located in Anchorage, produces charts covering British Columbia, the Gulf of Alaska, Aleutian Islands, eastern Bering Sea, Chukchi Sea, and Beaufort Sea, from lat. 48°N to lat. 75°N. Charts showing sea surface temperature and sea ice are distributed three times a week; these are intended to aid the safety and efficiency of fishing. Other charts showing 3-and 5-day sea ice forecasts are also distributed daily in winter. Both types of charts are issued by radio facsimile from the U.S. Coast Guard Station at Kodiak, Alaska.

Ocean color boundary charts have been produced experimentally from CZCS data since 1981 in a NASA/Jet Propulsion Laboratory program (Montgomery, 1981). The charts delineate strong gradients in the blue/green color ratio (channel 1/channel 3 radiance). In 1983, charts were produced at almost weekly intervals from May to October (18 charts total), covering coastal areas up to 700,000 km² between Vancouver Island, B.C., and Guadalupe Island, Mex. (Fig. 12). A chart was produced only when a large, cloud-free area was located in a Nimbus-7 pass. The chart was then broadcast on the same or following day to fishing boats by radio facsimile from Point Reyes and La Jolla, Calif. Color photographs of the satellite images were distributed by express mail to various fishing ports and to Sea Grant marine advisors in daily contact with fishermen. The color boundary charts and photographs are used by albacore and salmon fishermen. These fish are sometimes found aggregated along color fronts which do not correspond to temperature fronts.

Conclusions

Satellites have altered our perceptions of the ocean environment through the extensive spatial coverage, temporal continuity, and high resolution of the data they provide. Limited, but useful, applications to several types of problems in fisheries research and operations have been demonstrated. Continued development of these and other applications will depend on inexpensive and convenient access to data and data-processing facilities. Recent trends in the federal budget have not been encouraging. For instance, there are no current prospects for a new ocean color scanner to replace the aging CZCS on Nimbus-7. The commercial utility of satellite data depends largely on near real-time availability to fishermen and other maritime users. In the future, this demand may be met by processed satellite data products tailored more to particular user needs.

Acknowledgments

This work was supported jointly by the Southwest Fisheries Center, La Jolla, Calif., and the Northwest and Alaska Fisheries Center, Seattle, Wash., as a cooperative research project. We thank the many persons who contributed information and ideas for various applications, as well as those who provided technical support at the Scripps Satellite Oceanography Facility and the Scripps Visibility Laboratory. Processing of CZCS data was supported by NASA order W15,334.

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RECORDS CERTIFICATION

I, the undersigned, an employee of the State of Alaska, do hereby certify that the microfilm images on this microform are accurate reproductions of the original records of the State of Alaska as accumulated during the regular course of business, and that it is the established policy and practice of this State to microfilm its records and to dispose of the original records after microfilm reproductions have been made.

Signature of Camera Operator

9/5/89
Date

HJR

68

HJR 68: Requesting additional action by the United States to reduce high seas interception of Alaska-bound salmon.

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Letter - To Senator Stevens from Mountain Village

Memo - To all Legislators from Peter Goll
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  United Fishermen of Alaska

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SJR 27 & HJR 43 - Re: High Seas Interception

U.S./Japanese Bilateral Salmon Talks
Alaska Department of Fish and Game
March 13, 1986

An agreement was concluded between the U.S. State Department and Japanese negotiators in Tokyo on March 8 after nine months of bilateral talks.

The U.S. objective has been to eliminate significant interception of North American salmon and steelhead by these fisheries. The U.S. had proposed elimination of their fishery in the central Bering Sea, reduction of their effort in our fisheries conservation zone (FCZ) and substantial movement to the west of their landbased fishery. The State Department was not able to accomplish all of these objectives in this current round of negotiations. The agreement falls well short of our original objective to eliminate all significant interceptions.

The agreement does <u>not</u>:

1. Reduce interceptions in the U.S. FCZ.

2. Move the landbased fishery ten degrees farther west, which current data indicates would be required to eliminate significant interceptions.

3. Get them out of the Bering Sea immediately.

The agreement only moves us part way to our objective and should not be viewed as an acceptable end point to the interception issue, although it is an improvement over the present situation and gives us some directions to pursue in further reducing the interceptions.

The agreement does:

1. Phase-out their fishery in the central Bering Sea over an eight year period of time. This has long been a U.S. goal since the chinook salmon caught in this area are nearly all from western Alaska and since this area is outside our zone, we have had serious doubts that we can adequately tell what they are catching in this area. Actually, they will have to end their fishery in the eastern part of this area after only two more years and there are provisions to prevent transfer of their effort to other areas as these fisheries close.

2. Limit their fishery in our FCZ. Currently, there is no effort limit in this area. The agreement will keep them from increasing their fishery from current levels. The agreement also specifies an improved monitoring program in this area to better verify the Japanese catch data.

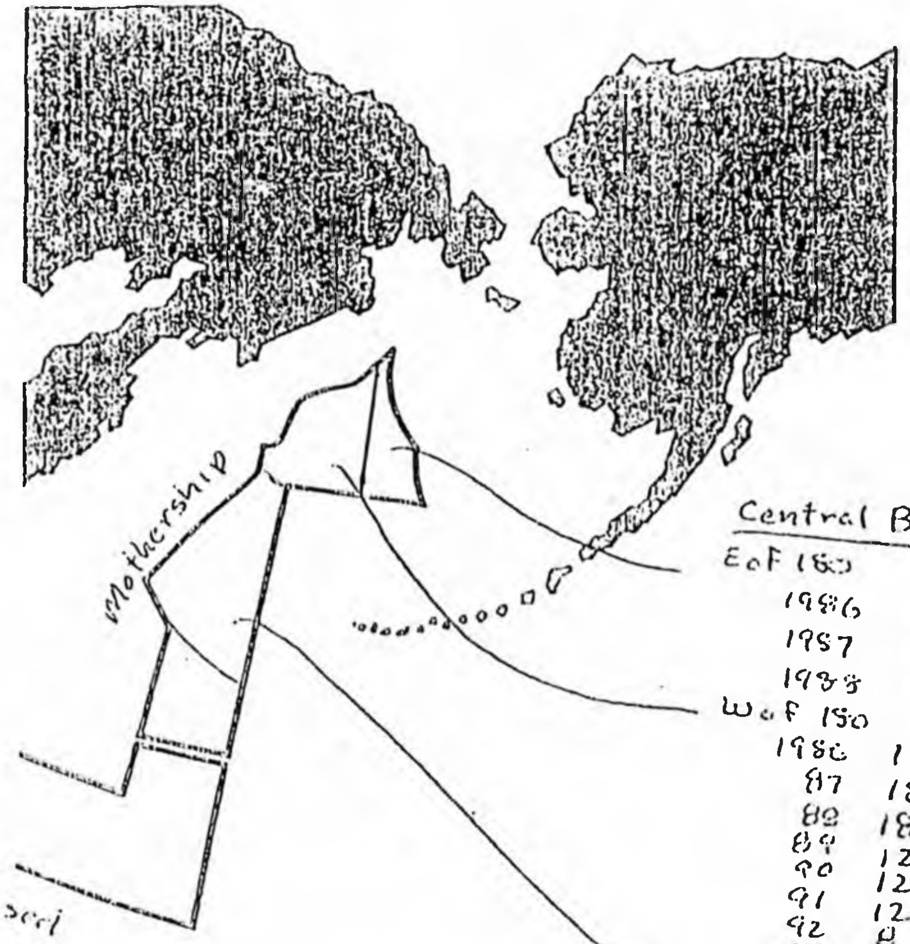
3. Move their landbased fishery one degree of longitude (45 miles) farther west. We had wanted more movement in this fishery, but the Japanese maintained that this movement, plus enforcement would eliminate most interceptions. We know the fleet has chronically violated the current eastern closure line and we do not know how much of the current interceptions are due to these violations as opposed to fishing in legal areas. The agreement for the first time has provisions for specific agreed enforcement and catch monitoring measures with annual review of their adequacy and change if needed.

4. The agreement provides for a three to five year research and monitoring program to determine if these regulations really do the job. By the 1991 season, the closure line in the landbased fishery will be renegotiated if necessary.

Involved parties must see that pressure is maintained to keep moving toward elimination of interceptions. The federal government must provide the funding for research, observers and enforcement. The state is writing to Secretary of State Shultz and our Congressional delegation to request this support.

The state will continue to press for elimination of interceptions. We are dealing with a problem that has existed for more than 30 years. Significant reductions in interceptions occurred in 1978 when the International North Pacific Fisheries Convention was renegotiated to move the Japanese fisheries farther west. Now eight years later, this agreement is another step in this process and provides for further negotiations within the next five years. The state will make every effort to keep the process going.

US/Japan Salmon



MFD - 1 mothership fishing day

Central Bering Sea

EoF 180

- 1986 12 MFD
- 1987 8 MFD 180-175
- 1988 0 MFD

Current Limit 31 MFD
Actual Use 2 - 19 MFD
Average 12 MFD

WoF 180

- 1986 18 MFD
- 87 18
- 88 18
- 89 12
- 90 12
- 91 12
- 92 8
- 93 8
- 94 8

Current limit 21 MFD
Actual Use 12 - 23 MFD
Average 16 MFD

US FCZ

1986-93
140 MFD
June 10 - July 31

1994 —
144 MFD
June 10 - July 26

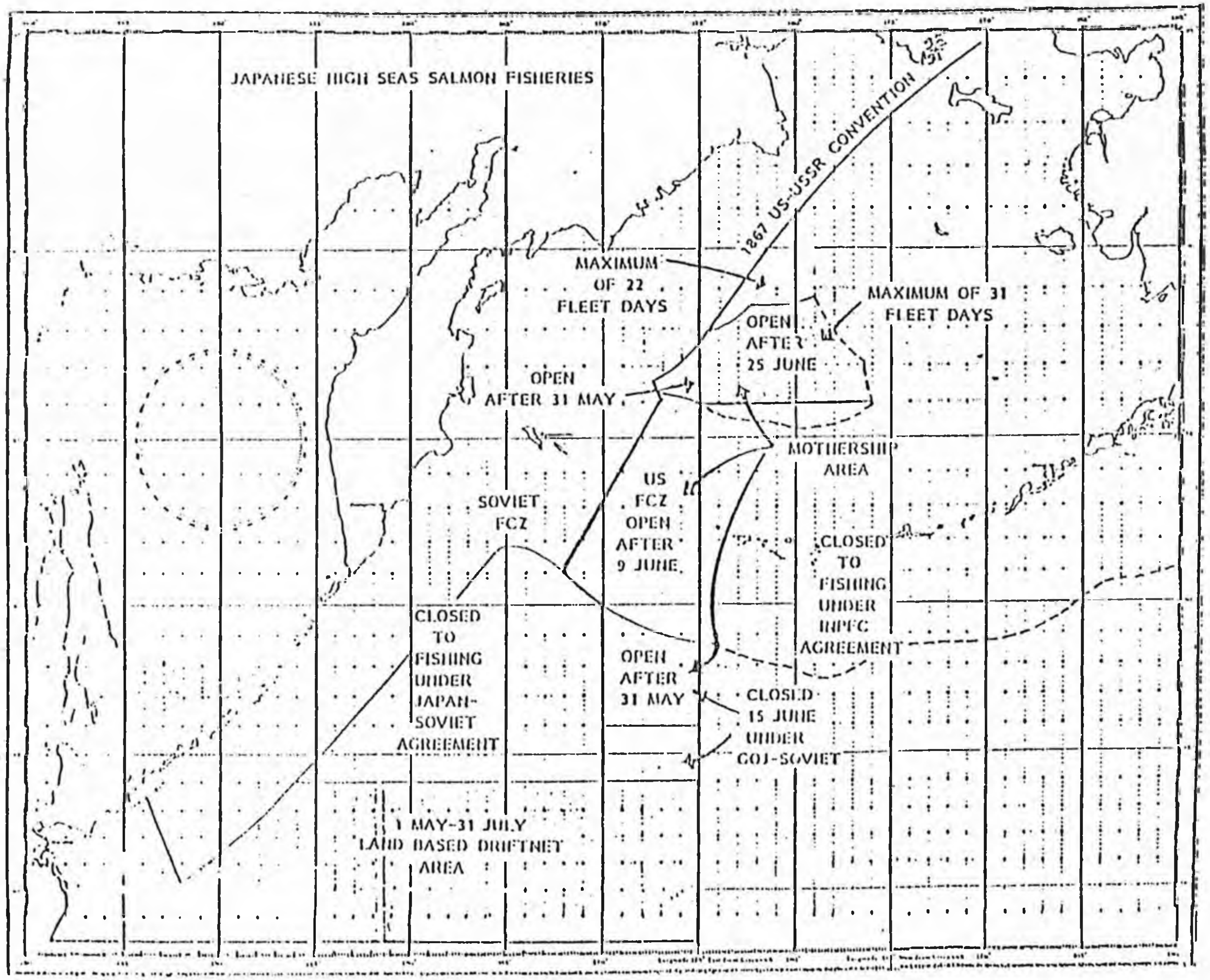
equates to no increased effort in FCZ

Improved catch [illegible]

Landbased

1956 Move eastern boundary from 175 E to 174 E

Research, enforcement, monitoring provisions.


JAPANESE HIGH SEAS SALMON FISHERIES
1867 US-USSR CONVENTION
MAXIMUM OF 22 FLEET DAYS
MAXIMUM OF 31 FLEET DAYS
OPEN AFTER 25 JUNE
OPEN AFTER 31 MAY
MOTHERSHIP AREA
US FCZ OPEN AFTER 9 JUNE
SOVIET FCZ
CLOSED TO FISHING UNDER INPFC AGREEMENT
CLOSED TO FISHING UNDER JAPAN-SOVIET AGREEMENT
OPEN AFTER 31 MAY
CLOSED 15 JUNE UNDER GOJ-SOVIET
1 MAY-31 JULY LAND BASED DRIFTNET AREA

UNITED FISHERMEN OF ALASKA

Jack Cadigan
Executive Director
907-586-2820
1-800-478-FISH

17 MARCH 1986

FOR IMMEDIATE RELEASE

SALMON INTERCEPTION ON THE HIGH SEAS

The recent developments towards final agreement between the Japanese and United States over the dispute of High-seas salmon interception is both "good news" and "bad news", as described today by Bob Blake, President of United Fishermen of Alaska (UFA), the umbrella organization representing virtually all commercial fishing interests in Alaska. The "good news" is that there has been an agreement reached. The "bad news" is that it only achieves in very small part what the UFA, believed to be both necessary and achievable.

Salmon is a highly valuable, highly renewable, resource. The tentative agreement between the U.S. and Japan concerning the matter of high seas fisheries is one which accomplishes little and accomplishes it too slowly. It is from that level of disappointment that any basis for optimism or rays of encouragement must be sought. "It is from being realistic that the position of UFA is one whereby although we cannot endorse the agreement or sing its praises, we realize that the miniscule gains made overall are nonetheless gains," according to Blake. According to Blake, that is why UFA does do not endorse or support any efforts being made by environmental or other groups who may seek to pressure the U.S. or Canada into refusal to sign the tentative agreement. "One slice of bread off the loaf is better than no bread at all," said Blake.

What does the agreement include which provides any encouragement to UFA? The agreement moves the land based fisheries one degree (a little less than 60 miles) further west. Specifically, no salmon fishing by the land-based fleet will take place east of 174 degrees East longitude. This will help - maybe not much - but it will help. More importantly, the agreement includes provision for U.S. Coast Guard enforcement of that line. This is an important feature which United Fishermen of Alaska consider critical. We now seek to insure that in a climate of shrinking dollars in Washington D.C. we don't find that feature moot by virtue of the Coast Guard not getting the fuel money it needs to do the job. That may seem a remote possibility only to those unaware of how ridiculously restricted the service is in that regard. The Japanese have agreed to assign six of their own enforcement vessels in the area, and to permit a U.S. observer aboard. We think there should be a U.S. observer on each Japanese enforcement vessel, and that observer should be a Coast Guard officer, not a summer employment collegian. However, since the agreement requires the fishing vessels to report by radio if they are within 50 miles of the line, and assuming there will be a high endurance U.S. Coast Guard cutter on scene, plus U. S. air surveillance, as provided for in the agreement, we do not foresee difficulties in the enforcement aspects.

Another very critical part of the agreement is the increase in tagging and biological samplings by Japanese Research ships in critical fishing areas, as well as the presence of U.S. scientists aboard to insure concurrence between the two countries of the scientific data achieved. This feature, as well as the onboard observer aspects, must be fully funded by the federal government for the next three to five years to provide the needed basis for renegotiations called for in 1990 under the terms of the agreement.

Thus the most critical parts of the agreement are those that provide the data base needed by this country for meaningful negotiations to take place in five years. "Without good solid enforcement by the Coast Guard, without the presence of U.S. scientists and observers, we will be right where we were in the talks preceding this agreement - unable even to agree on the data base!" said Blake.

There are other features of the agreement which are both complex and accomplish less than expected by UFA. Specifically, there is an area commonly called "the donut" which is in the central Bering Sea and encircled by U.S. and Soviet 200 mile limits. This fairly circular region is split by the 180th meridian (International Date Line, and essentially lies within the 1867 U.S.-Russia Convention Line. The current agreement would incrementally phase out all Japanese High Seas salmon fishing on this side of 180th meridian by 1988, and all fishing in the entire "donut" by 1994. Blake said "We certainly had hoped for a speedier timetable than that, but again, at least it is a phase out!"

The area of really no movement at all is in the slot which runs near Attu (which is 173 degrees East longitude), at the end of the Aleutian Chain. This is also the area of primary concern to environmentalists. In this area fishing will continue, essentially unabated, indefinitely.

The Japanese salmon fleets are large and efficient. There are four "High Seas" companies, each owning a mothership and servicing 40 to 50 gillnetters or a total of 172 catcherboats. The land-based fleet numbers over 200 medium and nearly 700 small driftnetters. There is also a fleet of 125 driftnetters and 171 longliners which fish salmon in the Sea of Japan. The total crew of these fisheries totals over 17,000 persons. UFA concern centers upon the impact these Japanese Salmon fisheries have on North American salmon, not Asian salmon. In a closing summary, Blake said: "The crux of the dispute has been over the numbers of returning Alaskan salmon caught by these fisheries, and how the treaties can be redefined to reduce that number reasonably close to zero. Since data supported by the U.S. did not even remotely resemble the data provided by the Japanese, there was scant foundation to even begin talks. ~~Our tying in allocations of groundfish in an entirely different fisheries, and one which involves some U.S. joint venture fisheries, was a weak and ill-conceived bargaining chip.~~ The area in which we take heart focuses on the enforcement, research, and on-board observer aspects of the agreement. Even though we also consider the on-board observer arrangement weaker than it should be, we believe that if the U.S. fully uses its ability under the agreement to police the effort and achieve the necessary data for rengotiation in five years, we will have the potential capability at that time to accomplish our most reasonable goals. As the strongest voice of the fishing industry in Alaska, we now can only say "This agreement is better than nothing...but not by much!"

UNITED FISHERMEN OF ALASKA

Jack Cadigan
Executive Director
907-586-2820
1-800-478-FISH

POLICY OF UFA RE: SALMON INTERCEPTION ON THE HIGH SEAS

THE UFA TOTALLY SUPPORTS HJR 68 AND SJR 47, AND HERE'S WHY!

The recent developments towards final agreement between the Japanese and United States over the dispute of High-seas salmon interception is both "good news" and "bad news". The "good news" is that there has been an agreement reached. The "bad news" is that it only achieves in very small part what the UFA, believed to be both necessary and achievable.

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Thus the most critical parts of the agreement are those that provide the data base needed by this country for meaningful negotiations to take place in five years. Without good solid enforcement by the Coast Guard, without the presence of U.S. scientists and observers, we will be right where we were in the talks preceding this agreement - unable even to agree on the data base!

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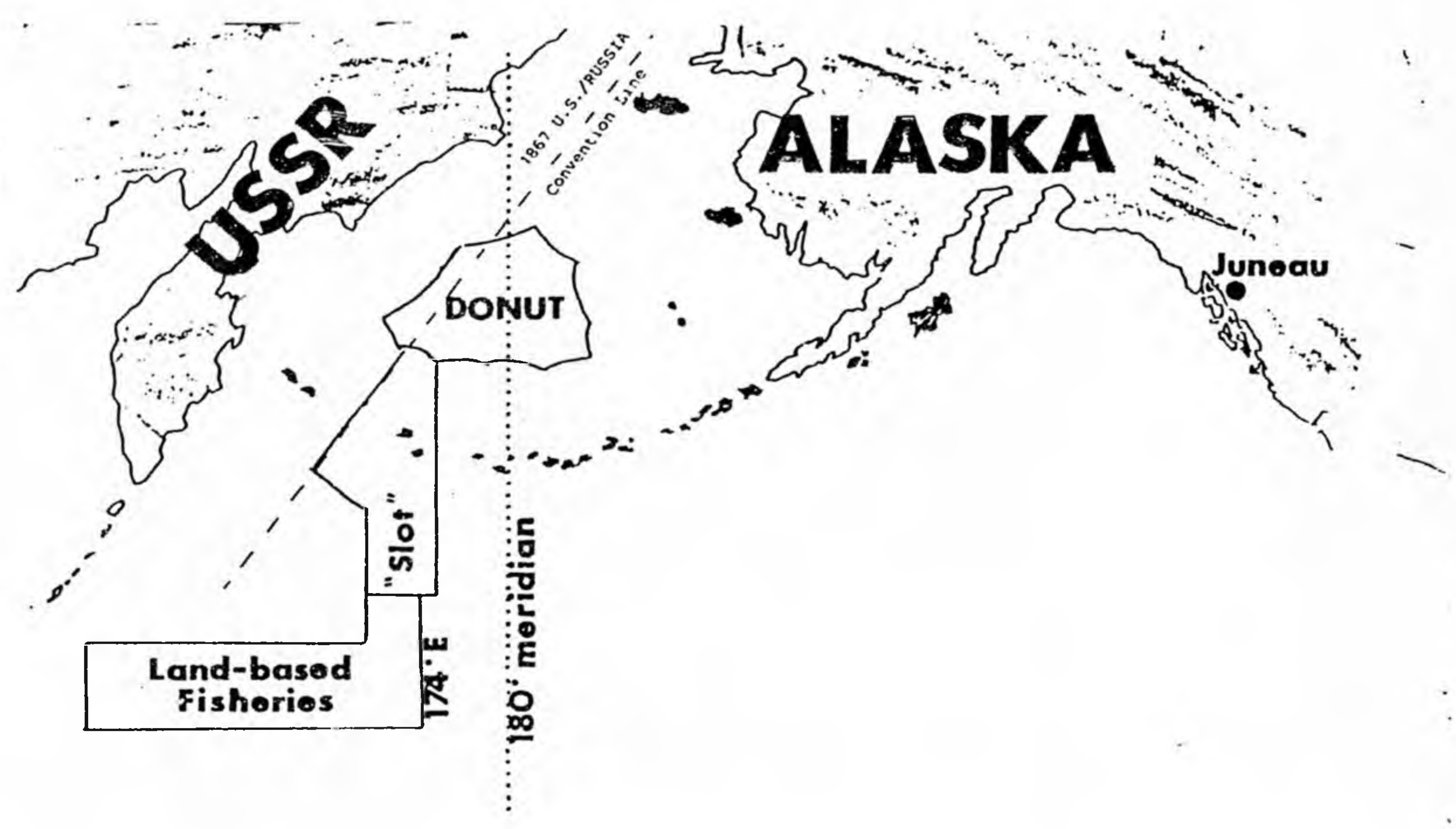
UFA considers it important that Alaskan legislators fully understand what this issue is about, and why it is **IMPERATIVE** that a united position be established. We must all try to insure that the federal government provide the required law enforcement and scientific support needed, or else the agreement is useless!


USSR
ALASKA
Juneau
1867 U.S./RUSSIA Convention Line
DONUT
"Slot"
Land-based Fisheries
174°E
180° meridian

BILL SHEFFIELD
GOVERNOR

STATE OF ALASKA
OFFICE OF THE GOVERNOR
JUNEAU

March 14, 1986

The Honorable Frank Murkowski
United States Senate
709 Hart Building
Washington, DC 20510

Dear Frank,

Enclosed is a copy of a letter I have just sent to Secretary of State George P. Shultz regarding the recently concluded agreement between the United States and Japan on the salmon interception issue. As reflected in the letter, we are very disappointed that the State Department was unable to achieve our objective of eliminating significant interceptions of Alaskan salmon in this current round of negotiations. I believe that we must continue to work on further measures to reduce these interceptions.

The agreement does contain measures which will assist Alaska fishermen if properly implemented. This implementation will require that the provisions of the agreement are adequately enforced and that the research and monitoring provided for in the agreement are carried out as a basis for further negotiations on the reduction of interceptions.

I have requested that the State Department seek funding to support these activities. I have enclosed a copy of a research and monitoring proposal drafted jointly by the University of Washington, the National Marine Fisheries Service, and the Alaska Department of Fish and Game which gives their assessment of the program which would be required to fulfill the U.S. obligations under the agreement and put us in the best position for future negotiations regarding regulation of these fisheries. I do not have a specific proposal related to enforcement funding. However, as indicated in my letter to the Secretary, I believe that the presence of a U.S. Coast Guard vessel in the eastern part of the land-based fishing area for the entire season is essential to both the enforcement of the line and monitoring of the activities of this fleet. Provisions in the agreement call for an exchange of observers only if we have an enforcement presence in the area.

I would like to request that you support State Department funding of these activities. I know that we all want to see an end to the interceptions of our salmon by Japan on the high seas, and that this agreement takes us only part way toward this objective. However, even this movement will have no value either directly to our fisheries or in terms of supporting future negotiating positions unless we can assess to what degree these measures reduce interception levels. This can be done only if, in fact, the United States can hold up our end of the cooperative research, management, and enforcement provisions called for in the agreement.

I believe that the agreement currently before us must be viewed only as a partial step toward our ultimate objective of eliminating significant interception of North American salmon. We still have a long way to go. While we certainly want the enforcement and other limitations imposed on the Japanese fisheries this summer, we must immediately start to focus on what our direction should be, both within and outside the terms of this agreement, to continue the campaign to end interceptions. To this end, I would like to propose forming a work group to advise us on strategies to follow in this campaign. I believe the Alaska members of our delegation to this last ten months of talks could form the nucleus of such a group since it included congressional staff, Alaska fishermen, state officials, and industry representatives. Interested Alaska legislators may also wish to take part or have staff participate. I would hope such a group could meet within the next month so that we can initiate required action as soon as possible. Programmatic support and planning for the 1986 season, for example, need to be accomplished in the immediate future.

I plan to initiate this type of brainstorming session within the state and hope that you or your staff will be available to participate. I would appreciate any suggestions you might have on timing relative to your ability to participate.

Thank you for your assistance.

Sincerely,

Bill Sheffield
Governor

Enclosure

(Identical letter sent to Senator Ted Stevens and Congressman Don Young.)

cc: Senator Arliss Sturgulewski
Senator John C. Sackett
Representative Johne Binkley
Representative Kay Wallis
Representative Adelheid Herrmann
Representative Peter Goll
Representative Richard Shultz
Commissioner Don W. Collinsworth
Mr. Ron Jolin
Mr. James Campbell
Mr. Deming Cowles
Mr. Clement V. Tillion
Mr. Harold Sparck
Mr. Henry Mitchell
Mr. Rick Lauber

Brief Outline of FY 86-87 U.S. High Seas Salmonid Research Program Under Terms of U.S./Japan Agreement Initialed March 8, 1986

Additional funding for U.S. high seas salmonid research is required to intensify continent-of-origin research in response to the new research mandate included in the March 8, 1986 U.S./Japan bilateral agreement on salmon interceptions and scheduled to be included in a new INPFC Annex, Memorandum of Understanding or Agreed Minutes.

Additional funding of $80K for FY 86 will provide the following activities:

1. Hiring of two scientific observers who will travel to Japan and board Japanese salmon research vessels to collect supplementary scale samples and biological data during June cruises of the vessels in the landbased fishery area and vicinity.

2. Purchase of an image analyzer system to facilitate more rapid measurement of scales and simplify statistical analyses. The new, "state-of-the-art" system will also possibly be purchased by Japan's Far Seas Fisheries Research Lab; coordination of scale studies between the two agencies will be greatly enhanced if they both have the same scale measurement equipment.

3. Purchase of IBM-compatible micro-computers for use in data management, statistical analysis, word processing and report preparation, graphics preparation, and project administration.

4. Necessary travel to attend the extraordinary meeting of the INPFC; the present project budget does not provide for the unforeseen travel expense.

5. Collection of whole-fish steelhead from 1986 Japanese commercial and research operations.

6. Intensified efforts to increase high seas tag recovery from Asian and North American coastal fisheries.

In general, the major features permitted by supplementary funding in FY 86 will be limited (due to late timing) observer participation in Japanese salmon research vessel cruises, and gearing-up for intensified scale pattern analyses in 1986-90.

Funding of $400K for FY 87 will provide for the following activities in addition to those routine and ongoing activities covered by existing, base-level funding:

1. Two scientific observers on two cruises of Japanese salmon research vessels in 1987, for the purpose of collecting supplementary scale samples and data, and possibly tissue samples for parasitological and electrophoretic analysis.

2. A trip by a senior staff member to Kamchatka for, in part, collection of high quality scale samples for use in new scale pattern analyses, and communication with Soviet personnel regarding scale sampling requirements. Such a trip would be made under provisions of the 1986 U.S./U.S.S.R. Bilateral Talks on Fisheries Assessments, and would be contingent on cooperation and invitation from the U.S.S.R.

3. New scale pattern analyses (with special emphasis on coho, chinook, and sockeye salmon) to determine continental origins of salmonids migrating in the high seas fishery area. These studies will be largely contingent on the success of obtaining improved scale samples for the U.S.S.R.

4. Full laboratory analysis of 1985-86 whole-fish steelhead samples, including parasitological and food habitat analyses, and initial efforts to obtain gene frequency data for stock groups not sampled previously, and data on infestation rate of origin indicating parasites in Pacific Northwest steelhead.

5. Further intensified efforts to increase high seas tag recovery, including perhaps television advertisements.

6. Continued collection of whole-fish salmonid samples from Japanese commercial and research vessel operations.

Bilateral USG/GOJ Salmon Accord, 1986
Estimated Funding Requirements for Research Annex II

Projected addition to FY 86 budget to begin intensified continent of origin studies on salmonids.

<u>Salary (including benefits)</u>

1.	Perm. Biol. II	6,630
2.	2 observers to work 1 month at sea on FAJ research vessels	4,000
3.	Student helpers to process 1985 steelhead parasite samples	4,320
		14,950

<u>Travel</u>

1.	To attend extraordinary INPFC meeting, April 1986	3,000
2.	2 observers to travel to and from Japan for boarding research vessels	3,400
		6,400

<u>Supplies and Services</u>

1.	Transport of 1986 steelhead whole fish	5,000
2.	PC software	1,000
3.	Fisheries Cost Center	1,200
4.	Misc.	1,286
5.	Extra CDC computer time	2,000
		10,486

<u>Equipment</u>

1.	Image analyzer for scale processing	25,000
2.	PC and ancillary hardware	11,000
		36,000

<u>Indirect Costs</u> 12,164

FY 1986 Total = $80,000

Projected Budget for FY 87

<u>Salaries</u>	
Faculty	7,000
Biologist 5 FT	129,640
Res. Asst. (steelhead parasites and electr.)	10,800
Temp. Biol. I (U.S.S.R.)	2,369
Temp. Biol. I (2 for FAJ RV's for 2½ months)	8,459
Student hourly:	5,000
	163,468
<u>Benefits</u>	33,387
<u>Travel</u>	
U.S.S.R.	3,000
Japan Observers	3,500
INPFC Meetings	3,000
Alaska	4,000
Alaska + local for R.A.	3,000
Misc.	3,500
	20,000
Supplies and Services	41,000
Cost Center	18,000
CDC Computer Time	6,000
Equipment (misc. micro hardware)	4,000
Total Direct Costs	$285,855
<u>Indirect Costs</u>	$114,586
<u>Total Budget</u>	$400,441

BILL SHEFFIELD
GOVERNOR

STATE OF ALASKA
OFFICE OF THE GOVERNOR
JUNEAU

March 14, 1986

The Honorable George P. Shultz
Secretary of State
U.S. Department of State
Washington, DC 20520

Dear Mr. Secretary:

The recently concluded agreement between negotiators regarding U.S./Japan high seas salmon relationships falls far short of our ultimate goal of eliminating significant interceptions of North American salmon and steelhead by the high seas fleets of Japan. By our calculation, the agreement in its present form will provide no more than a 20 to 30 percent reduction in the interceptions currently being made by these fleets over an eight year period.

The agreement does not reduce interceptions in the U.S. Exclusive Economic Zone. It does not move the land-based fishery ten degrees farther west as required to eliminate significant interceptions, nor does it remove the Japanese from the central Bering Sea as quickly as we desired.

I am extremely disappointed that you were unable to achieve greater reductions in Japan's time and area of fishing, particularly in the land-based fishery. Although an improvement over the current situation, the agreement is not an acceptable end to the interception problem. We must continue to seek further movement in reducing interceptions.

While the phase-out of Japanese fishing in the central Bering Sea has long been an objective of ours, I believe that the primary value of this agreement is the improved enforcement, research, and catch monitoring programs jointly agreed to by the two countries. These aspects of the agreement serve as the basis for future evaluation of what further measures will be required to eliminate significant interceptions.

The agreement contains the appropriate language regarding research and monitoring, but the governments of both countries must commit resources to ensure that this program goes forward. Since the U.S. State Department has committed to this process in lieu of immediate regulatory relief from interception, I believe that it is the obligation of the State Department to help secure the funding to support this agreement.

The National Marine Fisheries Service, Fisheries Research Institute at the University of Washington, and the Alaska Department of Fish and Game are cooperating in drafting proposals for research and monitoring, including the presence of U.S. observers on Japanese research and enforcement vessels. These proposals will be provided to Ambassador Ed Wolfe for his information.

I respectfully request that you strongly support Administration funding of these proposals. I also request that you support funding of the presence of a U.S. Coast Guard cutter in the eastern part of the land-based fishery during the entire season that this fishery is open. I believe only by this type of cooperative research, monitoring, and enforcement presence can we ensure that the government of Japan will reciprocate and that any long-range benefits of this agreement can be realized.

Thank you for your consideration of my views.

Sincerely,

Bill Sheffield

Bill Sheffield
Governor

FRANK H. MURKOWSKI
ALASKA

COMMITTEE ON ENERGY AND NATURAL RESOURCES
COMMITTEE ON FOREIGN RELATIONS
COMMITTEE ON VETERANS AFFAIRS
SELECT COMMITTEE ON INDIAN AFFAIRS
SELECT COMMITTEE ON INTELLIGENCE

United States Senate

WASHINGTON, DC 20510

WASHINGTON OFFICE
(202) 22[illegible]
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FAIRBANKS OFFICE
[illegible] 12TH AVENUE, BOX 7
(907) 456-0233
JUNEAU OFFICE
FEDERAL BUILDING, BOX 1647
(907) 586-7400

February 27, 1986

The Honorable Adelheid Herrmann
Alaska State Legislature
Pouch V (MS 3100)
Juneau, Alaska 99811

Dear Adelheid:

Thanks for sending me a copy of your letter to Secretary Shultz concerning ongoing negotiations between Japan and the United States on the salmon interception issue. Despite recommendations from U.S. Secretary of Commerce Malcolm Baldrige, the Alaska Congressional delegation, and most Alaskan groups, the State Department has thus far not been willing to effectively withhold bottomfish allocations from Japan. After seven rounds of bilateral talks Japan still does not appear willing to sit down and work out a solution.

However, that battle is not over yet. I met this week with Ambassador Negraponte, who is directing the State Department negotiations on this issue and expressed my disappointment over their inability to use allocations to bring about a solution to this problem. I told him that I have not lessened my resolve to solve the problem and that I expected the State Department to be a tough negotiator and come up with a winning solution.

The State Department's reluctance to withhold bottomfish allocations has disturbed me, and it is apparent that they are weighing the salmon interception issue with other foreign policy questions. I am also aware of the extent to which Japan is willing to retaliate if we withhold allocations. I believe that Japan may try to disrupt our salmon industry if the State Department does completely withhold bottomfish allocations. I will continue to resist the State Department's attempts to trade away this issue, and Japan's delaying tactics.

This is a very complicated and difficult issue. It has risen to a high level of visibility within the governments of both Japan and the United States, and we are now closer to a resolution than at any time since 1978. It is important not only for Alaska's salmon fishermen whose fish are being intercepted, it also addresses very important questions regarding high seas resource management. The resolution of the interception problem will also affect future Japan-U.S. fishery development plans, both directly and indirectly.

Please be assured that I will continue to work to resolve the salmon interception issue.

Sincerely,

Frank H. Murkowski
United States Senator

CITY COUNCIL OF MOUNTAIN VILLAGE

P.O. BOX 204 • MOUNTAIN VILLAGE, ALASKA 99632

Honerable Ted Stevens
United States Senate
Washington D.C. 20510

Dear Honerable Stevens,

I am writing you and asking for support for Western Alaskan Fishermen.

Fishing is the only source of income for our village, fishermen within my village, and others. The fish is also the major source of food for our families.

We would like to see all interceptions fisheries on the 200 mile area removed immediately. This includes all gill net fisheries and trowl fleets.

We immediately request that the United States and other foreign trowlers be deceased within the South Unimek Shumgin Islands.

I am requesting this due to the reason that the Western Alaska Fishermen are suffering from hardship this summer season. The majority of the fishermen did not make enough monies this summer to pay for their winter and summer bills.

Majority of the fishermen would not like to depend on welfare to make ends meet with their families.

We need your immediate assistance and support for our Western Alaska Fishermen. Quyana.

Sincerly,

Harry Wilde, Sr.,
Chairman of AVCP

cc: Honorable Governor Sheffield
Honorable Frank Murkowski
Honorable Donald E. Young
Sen. John C. Sacket
Sen. Frank Ferguson
Rep. Kay Wallis
Rep. John Fuller
Rep. Albert Adams
Rep. Adelheid Herrmann
Pres. AVCP Gene Peltola
Calista Fisheries Ray Christiansen

HW/las

REPRESENTATIVE
PETER GOLL

POUCH V
JUNEAU, ALASKA 99811
(907) 465-4925

STATE OF ALASKA
HOUSE OF REPRESENTATIVES

M E M O R A N D U M

May 8, 1985

TO: All Legislators

FROM: Representative Peter Goll

SUBJECT: High Seas Interceptions of Alaska Salmon

Attached are three letters of support for House Joint Resolution 43, which requests the federal government to take quick action to halt the interception of Alaska salmon on the high seas by Japanese gillnet fleets. The widespread support for this effort is reflected in the letters from the state's two largest sportfishing associations and Alaska's largest group representing commercial fishermen.

Renegotiation of the treaty with Japan affecting the high seas fisheries is currently under consideration in Washington, D.C. Quick passage of this resolution will help trigger a decision.

I respectfully request your support of this resolution in the waning days of the session.

Alaska Sportfishing Association
3605 Arctic Blvd., Suite 300 • Anchorage, Alaska 99503

TO: All Alaska Legislators DATE: May 7, 1985

SUBJECT: HJR 43

The Kenai River Sportfishing Association urges your support of HJR 43 which calls for a halt to the High Seas interception of Alaska Salmon by Japanese fishing fleets.

The most recent figures estimate that the Japanese mothership and the landbased salmon gill net fleets intercepted one million, ninety-nine thousand Alaska bound salmon in 1983. These interceptions include 106,000 King Salmon from South Central Alaska spots; more than the combined sport, commercial, and subsistence catches in Cook Inlet that year. An end to these destructive fisheries would greatly enhance recreational sportfishing opportunities in Cook Inlet.

We urge immediate passage of this important resolution.

Hunter Fisher

KENAI RIVER SPORTFISHING ASSOCIATION
3301 "C" Street Suite 202
Anchorage, Alaska 99503
Phone (907) 276-1451

May 7, 1985

Kenai River Sportfishing Association urges your support of HJR #43 which calls for a halt to the high seas interception of Alaska salmon by Japanese fishing fleet. The most recent figures estimate that the Japanese mother ship and the land based salmon gill net fleet intercepted 1,990,000 Alaska bound salmon in 1983. These interceptions include 106,000 King Salmon from southcentral Alaska spots more than the combined Sport, Commercial and Subsistence catches in Cook Inlet that year.

An end to these destructive fisheries would greatly enhance recreational sportfishing opportunities in Cook Inlet. We urge immediate passage of this important resolution.

by Bob Gerdon, Jr.
acting President of Kenai River Sportfishing Association

UNITED FISHERMEN OF ALASKA

319 Seward Street, Suite #10
Juneau, Alaska 99801-1198
(907) 586-2820

Cass M. Parsons
Executive Director

May 8, 1985

Honorable Peter Goll
House of Representatives
Pouch V
Juneau, AK 99811

Dear Representative Goll:

The United Fishermen of Alaska (UFA) wish to inform you of our position and recommendations regarding the interception of Alaskan salmon on the high seas. The UFA is the largest association of commercial fishermen in the United States, and represents fishermen throughout Alaska. The UFA are strongly opposed to any foreign interception of Alaskan salmon, since interception decreases the ability of our hardworking members to earn a living.

Of course, it is not just the fishermen who are hurt by the loss of Alaska bound salmon. The over 40,000 people employed in the seafood industry, and the many thousands of other people employed in the transportation and service industries which support the commercial fishing harvest, are all negatively impacted. This needless loss of Alaskan salmon also translates into a loss of revenues to the State and local governments.

Just one example of interception is the 106,000 king salmon which have been denied to commercial, recreational, and subsistence users in Southcentral Alaska. The UFA would like to know what, if any, benefit the State of Alaska enjoys in exchange for this subsidization of the foreign fleet?

The UFA supports HJR 43 because the complete elimination of high seas interception is long overdue. For this reason, we recommend that the State of Alaska request the U.S. State Department to immediately begin negotiations which will bring an end to high seas interception.

Sincerely,

Cass M. Parsons

Cass M. Parsons
UFA Executive Director

Introduced: 5/2/85
Referred: House Special Committee on Fisheries and Resources

IN THE HOUSE BY GOLL

HOUSE JOINT RESOLUTION NO. 43

IN THE LEGISLATURE OF THE STATE OF ALASKA

FOURTEENTH LEGISLATURE - FIRST SESSION

Relating to the interception of Alaska salmon on the high seas.

BE IT RESOLVED BY THE LEGISLATURE OF THE STATE OF ALASKA:

WHEREAS Alaska's salmon represents one of the state's most important renewable resources; and

WHEREAS more than 40,000 people are employed in commercial fish processing and harvesting jobs in the state during the salmon season, and thousands of other people in the transportation and service industries in the state benefit from this economic activity; and

WHEREAS the Alaska commercial salmon industry contributes millions of dollars annually to state and local government treasuries through taxes, assessments and fees, and salmon fishing and processing represent the economic backbone of many coastal communities in the state; and

WHEREAS salmon is a mainstay in the diets of state residents who harvest the great fish by rod and reel, net, and fishwheel for personal and family consumption; and

WHEREAS recreational fishing for salmon is an experience enjoyed by most state residents each year; and

WHEREAS an estimated 1,099,000 salmon originating in the state were harvested on the high seas by Japanese fishing fleets during 1983; and

WHEREAS these high seas interceptions deprived state residents of commercial fishing opportunities valued at $16,100,000 to fishermen, and $30,500,000 to seafood processors; and

WHEREAS this lost opportunity cost the state treasury between $482,452 and $804,086 in lost fisheries business tax revenue alone; and

WHEREAS the interception figures include 106,000 chinook salmon from South Central Alaska stocks, more than the combined catches of recreational, commercial and subsistence fishermen in Cook Inlet in 1983; and

WHEREAS Japanese fishermen catch billions of pounds of fish and shellfish in the state's 200-mile fishery conservation zone each year;

BE IT RESOLVED that the Alaska State Legislature respectfully requests the U.S. Department of State to immediately begin negotiations that will lead to complete elimination of high seas interceptions of salmon of Alaska origin; and be it

FURTHER RESOLVED that the Alaska State Legislature respectfully requests U.S. Congress to adopt amendments to the Magnuson Fishery Conservation and Management Act preventing nations that intercept Alaska-bound salmon on the high seas from receiving allocations to harvest groundfish in the United States' 200-mile fishery conservation zone.

COPIES of this resolution shall be sent to the Honorable Ronald Reagan, President of the United States; the Honorable George Schultz, Secretary of State; the Honorable Robert Dole, U.S. Senate Majority Leader; the Honorable Thomas P. O'Neill, Jr., Speaker of the U.S. House of Representatives; and to the Honorable Ted Stevens and the Honorable Frank Murkowski, U.S. Senators, and the Honorable Don Young, U.S. Representative, members of the Alaska delegation in Congress; to Mr. William Gordon, assistant administrator for fisheries, National Marine Fisheries Service; and to Mr. James Campbell, chairman, North Pacific Fishery Management Council.

2/25/83 Draft

Briefing Paper

High Seas Salmon Interception Issues

The primary issues currently being considered relative to limitation of high seas salmon interceptions are: (1) elimination of high seas salmon interceptions by the directed landbased and mothership salmon fishing fleets of Japan; (2) improvement of the data on incidental catches of salmon by the high seas squid fishery of Japan; (3) better data and regulation of high seas incidental and/or directed salmon catches by the "squid fisheries" of Korea and Taiwan and; (4) assessment of incidental salmon catches in groundfish trawl fisheries and possible means of reducing such interceptions while allowing for full development of U.S. groundfish fisheries.

Brief issue papers with supporting documents for each one of these areas of concern are enclosed.

Japanese High Seas Salmon Fisheries

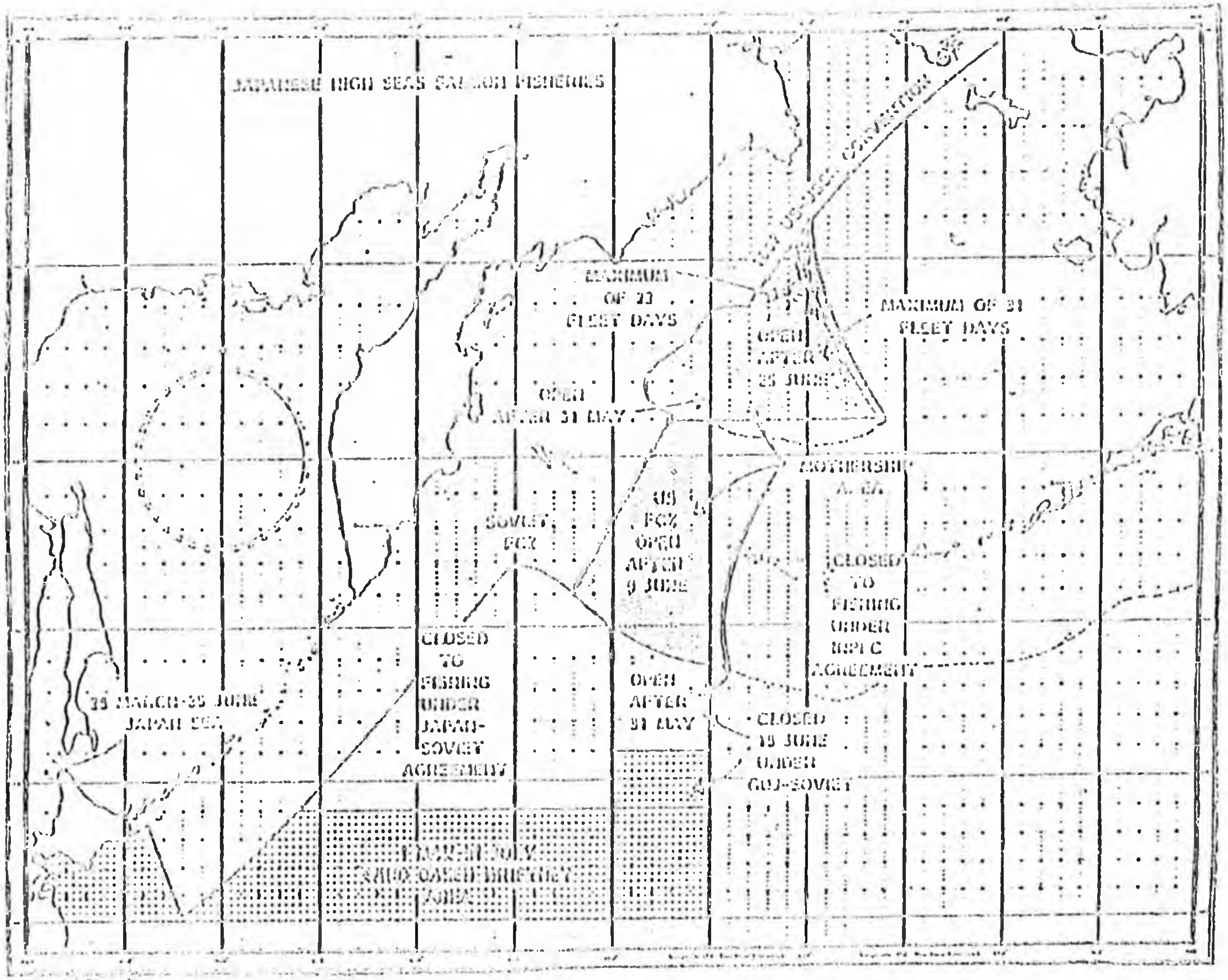
- Two Japanese high seas salmon gillnet fisheries operate in the north Pacific Ocean and the Bering Sea. The Japanese mothership fishery operates primarily in the Bering Sea, both within our fisheries conservation zone and outside it. The Japanese landbased fishery operates in the north Pacific Ocean south of the area of operation of the mothership fleet. (Map 1 enclosed).

- Between them, these two gillnet fisheries catch 20-25 million salmon annually, the preponderance of which are of Asian origin (mostly U.S.S.R.). The Japanese pay a fee to Russia to fish Asian salmon on the high seas, but the Soviets do not allow them to fish within their fisheries conservation zone.

- The combined harvest of these two fleets used to be in the 40-60 million catch range prior to the renegotiation of the International North Pacific Fisheries convention and harvest limit reductions in the Japan/U.S.S.R. salmon agreement.

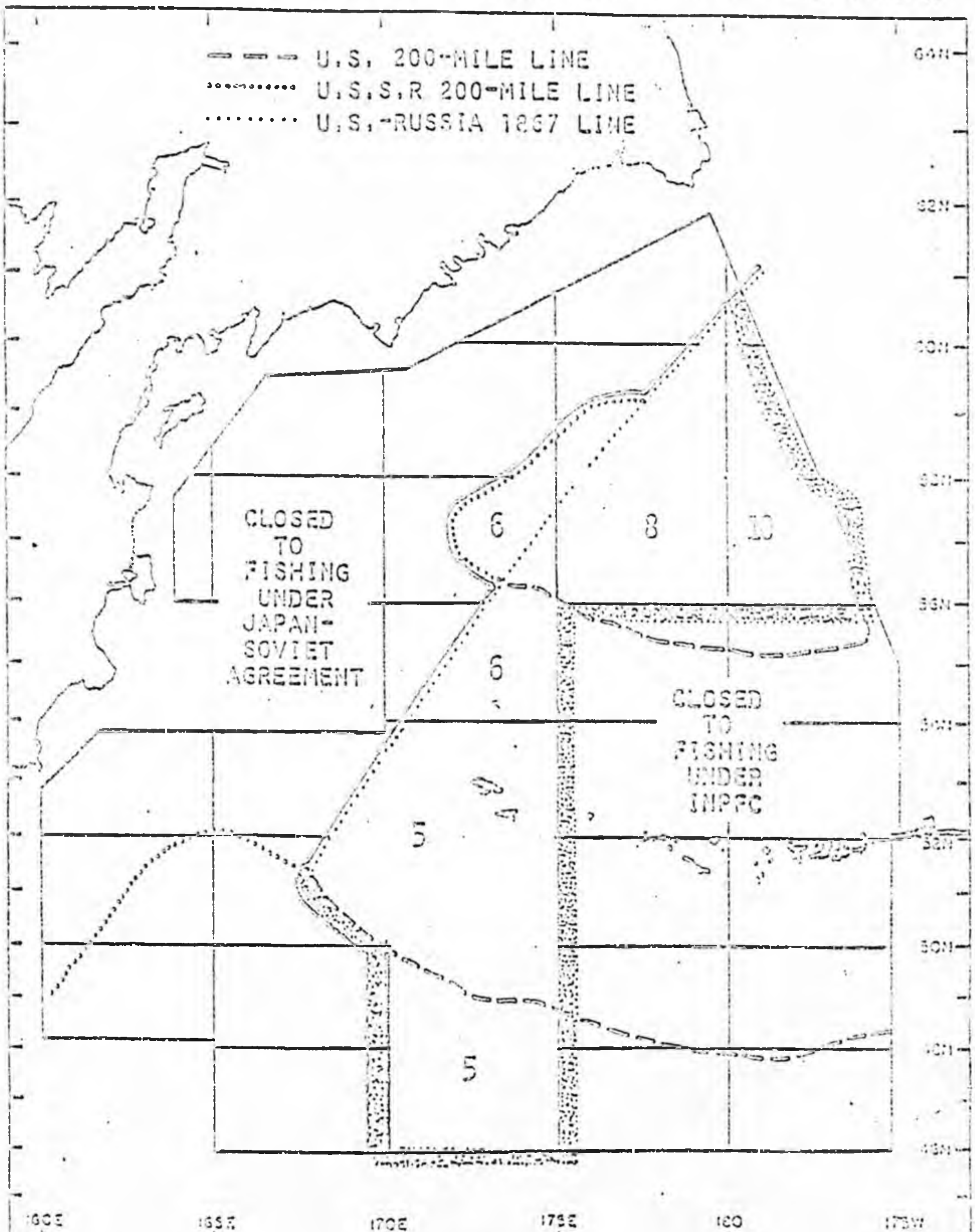
MAP 1

Annex C – Map of the Japanese High-Seas Salmon Fishery



MAP 2

JAPANESE MOTHERSHIP FISHING AREAS



INPFC SUBAREAS

° The recent renegotiation of International North Pacific Fisheries convention between Canada, Japan, and the United States in 1978 resulted in a substantial reduction in the harvest of North American salmon by the Japanese. Japanese mothership fishery had to pull back ten degrees of longitude to the west and incurred further time and area restrictions (Map 1 and 2). Landbased fisheries likewise pulled back ten degrees farther to the west (to 175° east longitude). Interceptions of Bristol Bay sockeye salmon in the mothership fishery alone had been estimated to average at least 2½ million salmon per year. Losses were probably quite a bit higher due to unreported dropout loss from the gillnets. These catches have been reduced to about 200-400 thousand per year. Reductions in catches of coho, chinook and chum salmon of Alaskan origin were also realized by these changes in fishing area.

° Levels of interception in the landbased area were less clearly defined prior to the renegotiation of INPFC, but were known to be significant. The western pullback of ten degrees did move this fleet out of areas of known concentrations of North American sockeye and coho salmon, mostly from western Alaska.

While the renegotiation did reduce interceptions, it was known that North American salmon were still being caught in both the landbased and mothership fleets in the new fishing areas. We knew, for example, that western Alaskan chinook were vulnerable to harvest in the mothership fishery. Four years ago, the Japanese undertook voluntary measures after discussions with fishermen from western Alaska to limit their chinook harvest in the mothership fleet to an average of 110,000 chinook per year to prevent peak catches of the sizes that occurred in 1980 when 704,000 total chinook were taken, of which over half were of western Alaskan origin. This agreement, however, did not reduce the average level of chinook harvest that has been experienced since 1970, with the exception of the 1980 season. There were also problems with ensuring that it was being enforced, particularly in regards to discard of chinook from catcher boats fishing outside our fisheries conservation zone. Discarded fish would still be lost to the U.S. harvest, but it would not count against the Japanese quota. We initially had problems in getting adequate observer coverage on catcher boats within our fisheries conservation zone and the Japanese would not allow observers on catcher boats outside our FCZ (in the central Bering Sea).

- Recent information from a study contracted by the department to the Fisheries Research Institute, University of Washington, showed that substantial number of chinook in both the landbased and mothership fleets were of Alaskan origin and, surprisingly, a large proportion were from central Alaska, as well as western Alaska. The catch of central Alaska salmon may average about 100,000 chinook per year, which exceeds the annual catch for recreational, commercial and subsistence fishermen in this area. Again, these figures do not take into account unreported loss due to dropout from the gillnets. Also, these fish are being taken as immatures weighing an average of only five or six pounds compared to an inshore average as adults of 20 pounds or more.

- The United States has consistently maintained that high seas salmon fisheries should be eliminated for a variety of reasons, including the fact that stocks are fully utilized in coastal areas, stocks are broadly mixed on the high seas, making management for conservation difficult, and significant wastage occurs in high seas salmon fisheries because of the harvest of immature fish and the dropout from high seas gillnets.

- Prior to the INPFC meeting November 1984, the Governor sent letters and issued press releases regarding this interception with a request that INPFC take action to halt it. Since INPFC is composed of United States, Canada, and Japan, and the action has to have concurrence of all three parties, no specific action was possible at this meeting. The U.S. did, however, informally indicate to the Japanese that it thought that bilateral discussions should be started as soon as possible to reduce these interceptions. The U.S. also made formal strong statements regarding its position on the elimination of high seas salmon interceptions. Resolutions in this regard were also forthcoming from the Board of Fisheries and the North Pacific Fisheries Management Council.

° Subsequently, the State Department has indicated interest in initiating an appropriate bilateral with Japan, but no specific dates have been set. The North Pacific Council, at its February meeting in Sitka, passed a motion that the initiation of such a bilateral should take place as soon as possible and that successful culmination of discussions was a prerequisite to future Japanese allocations of groundfish species.

° While we have not taken an official negotiating position on this issue, an appropriate phased reduction would take care of most of our concerns. Obviously, timetables and degree of cutback would be areas of negotiation, but the thrust would be to eliminate all areas of known salmon interception on the high seas. We have no problem with the Japanese harvesting Asian salmon if the Russians and their own coastal fishermen want them to do so. They should be able to conduct those harvests adequately within their own and the Russian 200 mile zones.

Japanese High Seas Squid Fishery

- The Japanese initiated in 1978 a high seas gillnet for squid in the north Pacific (map enclosed). A jig fishery for squid has existed for some time to the west of 170° east in the North Pacific. The gillnet fishery consists of over 500 vessels fishing over 10,000 miles of a net which of a size that will retain salmon. As far as we can determine, the jig fishing does not harvest salmon.

- Japanese regulations for this fishery include that it is limited between 145° west and 170° east longitude, the northern boundary shifts by month to keep the squid fishing effort south of the cooler waters of high salmon abundance, catching or possession of salmon or trout is prohibited and that the vessels and gear must be marked.

- The fishery in 1981 caught 82,000 tons of squid. Salmon incidental catch is unknown, but reported to be low.

- U.S. scientists estimate that if Japanese vessels adhere to their own northern boundary limitations on