FINANCE COMMITTEE

MINUTES

September 25, 1985

The Finance Committee met on Wednesday morning, September 25, 1985 with the following in attendance: John Winther (Chairman), Donald Bevan, Jim Branson, Larry Cotter, Fred Gaffney, John Harville, Robert McVey, Clarence Pautzke, John Peterson, Donald Rosenberg, Guy Thornburgh and Judy Willoughby.

I. FY85 and FY86 Administrative Funds Review

The Committee reviewed the status of funding for FY86. Staff reported that the funding for FY86 will be late (possibly November) and in order to pay regular expenses FY85 monies will have to be used. This will be in violation of the grant award which states no obligations may be made after September 30th. John Harville moved and John Peterson seconded that FY85 funds be used until the letter of credit for FY86 is awarded, noting the committee realizes the audit of this grant will show these expenditures "questioned." The motion passed unanimously.

Harville then moved that the Council request that NOAA/NMFS develop procedures to award grants under a different time frame, thus eliminating the late award problem. Rosenberg seconded. The motion passed unanimously.

NMFS had notified the Council it would be level funded for $1,057,200 in FY86. The Committee instructed the staff to continue to push for the initial funding request of $1,254,000.

II. Funding of Groundfish Central Base Coordinator

This project was approved by the Council at the August meeting for $15,000. Clarence Pautzke reviewed the progress of the contract and noted some minor changes. The committee approved the changes and re-emphasized the importance of the data gathering funding as the State of Alaska has notified the Council they will no longer be able to fund any groundfish data programs.

III. Rewrite of the Salmon FMP

The proposal to rewrite the Salmon FMP to framework with the provisions of the U.S./Canada Treaty was submitted by Mike Fraidenburg and was reviewed by Jim Branson. After lengthy discussion of the need of a Salmon Plan and the need of a revised Salmon Plan, Harville moved, with Bevan seconding, to authorize the staff to negotiate with Fraidenburg to rewrite, with direction of the Plan Team and staff, the Salmon FMP, and the contract is not to exceed $25,000. This passed unanimously.

IV. Audit Contract

Perhaps clarify how chosen

The Committee reviewed the proposals received from four firms to conduct an audit of five grants. It was noted two bids were much higher than the other two, so they were automatically rejected. Of the other two, Price Waterhouse firm's price was $700 over the low bidder estimate. Harville moved, seconded by Petersen and Rosenberg, that Price Waterhouse be awarded the contract on the basis of past history with the Council and the price. The motion passed unanimously.

# M E M O R A N D U M

TO: Council, SSC and AP Members

FROM: Jim H. Branson
Executive Director

DATE: September 17, 1985

SUBJECT: Status of Contracts and Programmatic Funds

## ACTION REQUIRED

Approve revision of Groundfish Data Coordinator contract.

## BACKGROUND

In August the Council approved using $15,000 from administrative funds to support a central groundfish data coordinator. The $15,000 was to be pooled with $30,000 from NMFS to fund salary and travel. It now appears that the most expeditious funding route is for NMFS to separately fund the data coordinator's salary through the Commercial Fisheries Entry Commission and for the Council's $15,000 to be used, through a contract with the Pacific Marine Fisheries Commission, to provide $3,500 for the coordinator's travel, $10,000 to offset Will Daspit's salary for his work in providing North Pacific groundfish data via PacFIN, the Pacific Fisheries Information Network, and the remainder to go to PMFC to cover overhead. The Council should be aware of these changes in the funding approach before a final contract is signed with PMFC.

## Status of Other Projects

In May the Council approved Contract 84-6, Bering Sea Herring Scale Analysis - Part II and authorized me to sign off on the following three contracts after they were approved by the appropriate SSC subgroup:

Contract 83-4: Joint Venture Trawl Logbook Program
Contract 84-1: Sea Lion Pup Census
Contract 84-3: Origin of Chinook Salmon - Part II

I approved them this summer and Council documents are available for 84-1, 84-3, and 84-6.

Currently the Council is only supporting Groundfish Data Monitoring, Contract 84-4, from programmatic funds for $145,000 with ADF&G. The objective of this project is to enhance the ability of ADF&G to provide timely, high quality fisheries catch data from shoreside deliveries of groundfish. The information will be aggregated by ADF&G and input to PacFin for reporting to state, federal and Council groundfish managers. The contract has been signed and a progress report was due September 13.

In August the Council also approved using up to $20,000 from administrative funds to support workshops by Sea Grant on fishery management options. The parameters for this project are now being developed.

Another request pending for Council support is the $60,000-$70,000 needed for analyses of the stock composition of chinook salmon caught by groundfish trawlers in the FCZ. The Council approved this request in May contingent upon programmatic funds becoming available.

SSC ONLY

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AGENDA E-1
SUPPLEMENTAL TO SSC

UNIVERSITY OF WASHINGTON
SEATTLE, WASHINGTON 98195

School of Fisheries, WH-10
(206) 543-0295

| ACTION | ROUTE TO | INITIAL |
|---|---|---|
| | Exec. Dir. | |
| | Deputy Dir. | |
| | [illegible] | |

11 September 1985

Mr. Jim H. Branson
Executive Director
North Pacific Fishery Management Council
P.O. Box 103136
Anchorage, AK 99510

Dear Mr. Branson:

Enclosed please find the proposal I discussed with you today. Much of the information will be familiar to you, because the document was prepared for submittal to major foundations. As I noted, our idea for a method to ascertain bycatch and discard species and levels of magnitude in foreign and joint venture fisheries are set out in Appendix B-1.

Given your intent to develop a single, Gulfwide OY for individual species or species complexes to include the bycatch harvest, I believe our efforts could be useful. I look forward to speaking with you again in the near future, and to the possibility of working with the Council on this aspect of our larger project.

Sincerely yours,

E.C. Bricklemyer, Jr.
Visiting Scholar,
School of Fisheries
Senior Fellow,
School of Law

ECBj:sr
encl.
cc: (without enclosures)
Dr. Donald E. Bevan
Professor William Burke
Dean Douglas G. Chapman
Dr. Warren Wooster

# DISCARD CATCH
# IN U.S. COMMERCIAL MARINE FISHERIES:
# ANALYSIS AND RECOMMENDATIONS

## A RESEARCH PROPOSAL

Eugene C. Bricklemyer, Jr.
Senior Fellow, Law
Visiting Scholar, Fisheries

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Ph.D. Candidate, Fisheries

University of Washington
Seattle, Washington 98195

June 1, 1985

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# DISCARD CATCH IN U.S. COMMERCIAL MARINE FISHERIES: ANALYSIS AND RECOMMENDATIONS

## I. SUMMARY

Each year an estimated seven[1] to ten[2] million metric tons (over 14 to 20 billion pounds) of organisms are caught and thrown back overboard in the world's commercial marine fisheries. This constitutes at least 10% of the total harvest of fish from our seas.[3] Exact figures for what percent of the fish harvested in U.S. waters are discarded are not available, but certainly can be expected to exceed one million tons.[4] This practice constitutes real, but currently unassessed costs to numerous groups. As detailed in the formal proposal, those costs include: lost harvests and wasted effort to fishermen; lost food to people deprived of sufficient, economical protein; and, to us all, losses from the disruption of an important, complex ecosystem without our deriving any benefit. As we are discovering in our relationship with the natural environment (from acid rain to hazardous wastes), the price of ignorance--continuing past practices based upon outdated, insufficient information--can be high. This interdisciplinary project proposes to furnish a better assessment of the causes and effects of discard catch through an investigation of the species, ecosystem, social, legal

and economic implications of this practice, and thereafter to make recommendations so that the costs can be incorporated into our management decisions and the impetus provided to reduce or eliminate these losses.

## II. BACKGROUND

With the exception of the work of a small number of treaty-established commissions, U.S. commercial marine fisheries are managed by the coastal states to the 3-mile limit of the territorial sea (Florida, Louisiana and Texas have somewhat greater authority over living resources). Beyond, authority is vested in the federal government's National Marine Fisheries Service (NMFS) in the Department of Commerce, and with the eight regional Fisheries Management Councils established under the Magnuson Fishery Conservation and Management Act enacted in 1976.[5] The latter mentioned legislation sets out goals, machinery and procedures for the management of U.S. fishery resources. The goals, or National Standards, include the following points, relevant here, with which management plans and regulations must be consistent.

1. Conservation and management measures must prevent overfishing while achieving, on a continuing basis, the optimal yield from each fishery.
2. Conservation and management measures must be based upon the best scientific information available.
3. To the extent practicable, an individual stock of fish must be managed as a unit throughout its range, and interrelated stocks of fish must be managed as a unit or in close coordination.

4. Conservation and management measures must, where practicable, promote efficiency in the utilization of fishery resources.

5. Conservation and management measures must take into account and allow for variations among, and contingencies in, fisheries, fishery resources and catches.[6]

These standards should be read in light of the findings, purposes and policy of the Act, which include in part: that fishery resources are valuable and renewable and contribute to the food supply, economy and health of the nation; that the Act itself is necessary to prevent overfishing, rebuild overfished stocks and ensure conservation in order to realize the full potential of our fishery resources; and that under the national fishery conservation program management measures must use the best scientific information available to promote efficiency while being workable and effective.[7] This language, when taken together with other national and international treaty and customary laws, makes a strong argument for requiring that situations involving waste, expecially at the high levels suspected with discard catch, be addressed.

## III. DEFINITION OF PROBLEM

Before further discussion, the terminology to be used should be defined.[8] In a fishing vessel's take from the sea, or catch, there normally is a mix of target (species toward which the fishery's effort is directed) and non-target species. By-catch

refers to organisms (non-target species) captured incidentally to the target species.[9] Discard catch is that portion of the gross take of target and non-target species either never landed, or more commonly, thrown back overboard as whole organisms, totally unused (it is not to be confused with offal, the heads, tails, bones and guts remaining from seafood processing). This discard catch can include four categories of individuals from the targeted species: those too small to process (often juveniles of target species); those under or over the legal size limit; in quota fisheries, those exceeding the maximum take limits; and those lost during fishing (e.g., gillnet dropouts) or purposely not landed.[10] It also includes non-target species or by-catch. The latter individuals (by-catch) may be other species variously recognized as valuable (but usually not to the fishery at hand), or those with no current commercial worth. By-catch often includes species of special status, such as marine mammals (e.g., pinnipeds, porpoise), or endangered species (e.g., sea turtles), or seabirds. Economics, applicable laws and regulations as well as the propensity of the harvester determine whether some, all or none of the by-catch will be discarded. Finally, it should be noted that discarded organisms are almost always dead before being dumped overboard, and those which survive capture and deck exposure are weakened and highly vulnerable to new predators after being returned to the water.[11]

Waste of this magnitude deserves attention, if solely because of the lost nutritive potential it represents. Discard

may also be an important population mortality factor that should be, but is not currently taken into consideration for effective resource management.[12] This is not to mention other human values that may be disturbed by the deaths of creatures for no useful purpose, some of which we may be thus driving to extinction.[13]

There are further problems associated with discard catch: some obvious, but largely unaddressed; others more subtle or obscure and perhaps currently beyond our understanding. Population dynamics of currently exploited, target species are obviously affected by discard mortalities. These species also experience indirect impacts through the removal of other species that are members of the target species' community. If species with no current value are taken as by-catch and discarded without knowledge about population levels, optimum yields or population dynamics effects, we may damage the potential for a viable future fishery on this species should we later change our tastes and recognize their economic worth. Regardless of the current or potential economic value of the discards, discard practices appear to ignore the ecologically significant and economically costly impacts of the return to the marine environment of artifically concentrated detritus in the form of whole organisms and offal. Finally, there is little doubt of the negative impacts on commercial fishers, ranging from lost time and effort in dealing with discards, to lost profits from being unable to harvest economically valuable species taken and discarded by others.[14]

## IV. GOALS AND OBJECTIVES

The ultimate objective of effective ecosystem management should be to reduce catch discards to levels approaching zero: we do not catch what we should not or cannot use by employing new methods, including development and deployment of species-specific fishing gear; what we catch we use through better storage, processing and marketing strategies. The objectives of the joint University of Washington School of Law/School of Fisheries Discard Catch Project work toward achieving this ideal by assuming the following tasks:

1. To summarize the state of the information available on the problem through a comprehensive literature survey.
2. To identify, retrieve, analyze and make available additional information through the use of unconventional sources generally underutilized or ignored.
3. To provide detailed illustrations of the reasons for concern, to carry out an in depth scientific and economic analysis of five commercial marine fisheries occurring in the U.S. waters where discard catch is acknowledged to be a problem and where some corrective measures have already been attempted.
4. To determine,using the above-generated data, the areas where further social, economic and scientific investigation must be concentrated in order to improve

the management of our marine fisheries and to help draft guidelines for future management practices.

5. To recommend that, based on current data, investigative and managerial priorities should immediately be rearranged in order to:

   -- accord to the discard catch problem the greater recognition it deserves;

   -- increase the frequency and intensity, and raise the bureaucractic level of discussions on currently feasible technological and legal solutions; and finally to

   -- rapidly adopt and implement those solutions which are most likely to be successful.

## V. REVIEW OF CURRENT KNOWLEDGE

### A. World Fisheries

The problem of discard catch often gains some passing mention in our attempts to manage specific marine resources (e.g., fishery management plans) or to save an endangered species (e.g., recovery plans) or in expositions aimed at forecasting trends in world fisheries,[15] world food supplies[16] or world survival scenarios.[17] It is also just as often ignored, as is illustrated in a recent World Watch Institute article. In Maintaining World Fisheries, Lester R. Brown points out the loss of 11 million tons per year of fishery harvest due to prior mismanagement, but does not comment on discard catch that amounts to

nearly the same or greater tonnage and that is similarly being lost right now.[18]

Rarely does the issue gain the detailed study it received in the recent FAO Fisheries Circular prepared by the University of Rhode Island's S.B. Saila.[19] Saila surveys the problem internationally, points out the magnitude of the waste of potential food, looks briefly at the possible ecological implications of discard catch, and stresses the need for and suggests possible ways of obtaining better information on the issue. He cautions that while on a worldwide basis, figures on the magnitude of by-catch and discards are not reliable, rough estimates are available. For instance, in the world shrimp fisheries annual landings of 1.1 to 1.5 million tons, by-catch may range from 5 to 21 million tons, of which one-half to one-quarter (3-5 million tons) is discarded (in the U.S. shrimp fisheries almost all of the by-catch is discarded; in Southeast Asia, most is retained).[20] In other commercial fisheries, discard catch is virtually impossible to estimate; but crude, conservative approximations place it in the range of 3.6 million tons.[21]

## B. Illustrative Fisheries in U.S. Waters

### 1. Sturgeon

Our view of the discard catch problem generally appears to be guided by the economics of the directed fishery, thus often ignoring elements other than the short-term maximization of profits from the catch of the target species. How much we

have learned from the errors of this practice in the past is open to question. An interesting example is provided close at hand in the Pacific Northwest. All available evidence points to an extremely abundant sturgeon (**Acipenser transmontanus**) population when white settlers first came to the Columbia River in the middle part of the 19th century. Prior to commercial exploitation that began in the early 1880's, sturgeon were incidentally caught in the gear employed in the Columbia salmon fishery that began a decade or more earlier. Large, strong, persistent and prevalent, sturgeon were considered a detriment. They became entangled in gillnets or the webbing of traps, were caught in seines and wheels, and often damaged the gear because of their armored side plates. Therefore, they were killed by the thousands and thrown away.[22]

Columbia River sturgeon, eventually recognized as a valuable resource, never recovered from the combination of this discard practice and a succeeding decade of over-exploitation. Although there is a fishery in the Columbia now, it does not nearly approach early levels of harvest even though it is very strictly managed.[23]

## 2. Dogfish

Today, unknown quantities of dogfish (*Squalus acanthias*), a shark that like the sturgeon is a slow-growing species, are discarded in domestic trawl fisheries (this, despite its large size, comparable to the target species).[24] In the New England

domestic groundfish fishery, dogfish may represent 30-40% of the total catch per haul during the summer. They too, like the sturgeon in the 1870's, are considered a nuisance because they get entangled in the mesh and have no current economic value. Therefore, they are not just discarded. In order to be sure that they do not foul the nets again, either their heads are cut off before they are thrown back, or they are left on deck until they die.[25] Based upon historical example, the question arises: will we later want to harvest dogfish only to find their populations depressed because of past practices?

### 3. Shrimp (Finfish and Turtles)

Currently, when discard catch involves commercial species, the issue is addressed because of the biological implications (estimating and maintaining sustained yield) combined with economic considerations (the loss associated with killing and discarding fishes which are marketable). For non-commercial species, the need to address the problem is recognized either because of extremely high levels of discard catch, or because the by-catch includes species of a special or protected status.

In the shrimp trawl fishery, both of these situations exist. Worldwide, levels have been stated;[26] in U.S. waters, discard catch includes traditional discard (i.e., small shrimp, other invertebrates and finfishes, both commercial and non-commercial species, amounting to approximately 960,000 tons a year) plus thousands of endangered sea turtles.[27]

In the Gulf of Mexico shrimp fishery alone, over 150 species of finfishes are incidentally taken, with an average ratio of fish to shrimp of 9 to 1. In some areas, over 15.9 pounds of fish by-catch are discarded for every pound of shrimp landed. If the incidental harvest of the South Atlantic shrimp fishery is added to that of the Gulf of Mexico, estimates of incidentally caught and discarded finfishes alone annually exceed 500,000 tons per year.[28] Sea turtles, when incidentally captured in shrimp trawl nets, often asphyxiate during the tow. The National Marine Fisheries Service estimates that in the South Atlantic and Gulf of Mexico, 12,500 of the 45,500 turtles annually caught in the shrimp trawl nets do not survive the encounter.[29]

Because of the turtles' special status and the resulting pressure from conservationists, the National Marine Fisheries Service (NMFS) developed a device to eliminate turtle by-catch. The TED or Trawling Efficiency Device (the name was changed from "Turtle Excluder Device" to make it more acceptable to fishers) has been proven effective in field trials in the Gulf and South Atlantic: it increases the numbers of shrimp caught per trawl; it eliminates catch of most finfishes; it reduces up to 97% of the by-catch of sea turtles; and it excludes other commercially undersirable organisms such as horseshoe crabs, jelly balls, loggerhead sponges and fat grass. The device also increases the efficiency of the operation by decreasing the amount of non-usable by-catch load that is towed in the cod end of the net.[30] The elimination of by-catch during shrimp trawling would

thus reduce fuel consumption, the costs of which are becoming an increasingly important limiting factor to fishing time and to the distance from shore at which fishers can economically operate their boats. Useful, light-weight and inexpensive, the TED is now gaining some limited acceptance in the fishing community and is being refined by users, the fishing gear industry and the NMFS laboratory in Pascagoula, Mississippi. And yet, four years after its introduction, no more than 200-300 devices are currently available for use in the over 6,000 boats of the Southeast shrimp fleet.[31]

### 4. Purse Seine Tuna (Porpoise)

Certainly in the mind of the general public, the best known discard catch example came about because of the discovery that over 300,000 porpoise of various species were being killed each year by the U.S. West coast purse seine tuna fleet.[32] The porpoises, visible from the surface, lead the fishers to the tuna because of a poorly understood relationship which causes the fish and the marine mammals to swim together. Traditionally, after location, both tuna and porpoises were set upon and when the nets were pursed, the porpoises were caught and suffocated. After being hauled on deck and separated from the catch, they were thrown back dead. Following protracted litigation under the Marine Mammal Protection Act,[33] the kills have been limited to approximately 21,000 a year.[34] This dramatic reduction was made possible by the use of new gear and new procedures by the entire

U.S. fleet. Undoubtedly, it represents a rare but encouraging instance of substantial progress being made toward avoidance of unnecessary mortality and waste.[35]

### 5. West Coast Groundfish (Halibut)

The Pacific halibut (**Hippoglossus stenolepis**) fishery is fully utilized and takes place in the Pacific Ocean off the U.S. West coast and that of British Columbia, and in the Gulf of Alaska and Eastern Bering Sea and Aleutian Islands area. Here the yield to the directed fishery is reduced substantially by the incidental take of halibut in the foreign and joint venture groundfish fishery, and by the domestic crab pot fishery. Furthermore, juvenile halibut are taken incidentally as by-catch in the Alaskan shrimp fishery. The directed fishery for Pacific halibut is managed through the International Pacific Halibut Commission (IPHC), while any quotas for incidental catches of halibut are determined by the North Pacific Fishery Management Council (NPFMC). Pacific halibut is categorized by the Council as an unallocated or prohibited species, in the same manner as are salmon, king and tanner crabs.[36] Outside the directed fisheries, take of these species cannot be retained and must be returned to the sea;[37] but in most fishing operations, at least half of the discarded halibut are dead, thus rendering the return futile.[38]

It has been suggested that the incidental catch, taken together with the directed halibut harvest, may result in

overexploitation of the stocks and may have led to the serious decline of halibut availability experienced in the 1960's and 1970's.[39] The yearly incidental take is substantial, equaling or exceeding the annual catch quota for the directed halibut fishery, which in 1983 was 13,800 metric tons.[40]

Halibut incidental catch quotas are set by the NPFMC by estimating halibut by-catch rates in other directed fisheries using foreign (NMFS) and domestic (Alaska Department of Fish and Game) observer data and then applying that ratio to catch quotas for each target fishery that takes halibut incidentally.[41] It would be preferable to determine by-catch quotas by incorporating allowable mortality figures derived from population dynamics considerations of halibut itself. However, due to the multi-species nature of the groundfish fishery, this may be difficult to achieve.

The halibut issue has been the subject of several NPFMC-sponsored studies. A recent one by Natural Resources Consultants states that in rough figures the present value of losses to U.S. fishermen from the 1982 incidental catches of halibut range from over $4 million to over $10 million.[42] Methods for reducing by-catch of halibut have been investigated and alternative management strategies are being discussed.[43] These include modifications of crab pots in the crab fishery and prohibition of on-bottom trawls in the groundfish fishery entirely or in yellowfin sole-, flatfish- and turbot-designated areas.[44] The Council has recently recognized that any long-term

strategy to control prohibited species by-catch should be "comprehensive,"[45] and that a redefinition of the optimum yield concept with regard to incidental catch might be in order.[46]

### 6. High Seas Gillnet (Porpoise, Birds)

In the Japanese gillnet fishery for salmon, Dall porpoises, other marine mammals and fish, as well as seabirds, are caught in monofilament drift nets set out at or near the surface in the eastern Pacific within the U.S. 200-mile Fishery Conservation Zone. The porpoises drown at a rate initially estimated at 10,000-20,000 per year,[47] but now thought not to exceed 5,500;[48] and the fishery has been implicated in the annual deaths of 250,000-700,000 seabirds which become entangled in the nets and drown.[49] As this fishing method has been ongoing since the late 1950's, there is now concern that populations of the Dall porpoise may be stressed and declining,[50] and that takes of some of the species of sea birds may exceed their annual recruitment capabilities.[51] Although research, funded in part by the Japanese, has been carried out for many years, no apparently reliable solution has been found.

## C. Ecosystem Effects

Where discarded catch is a source of economic or biological concern, it is usually seen as a single problem, one of waste of a potential food source (e.g., shrimp finfish by-catch), of interference with fishing operations (e.g., dogfish), or of

excessive kills of highly valued commercial or endangered species (e.g., halibut or porpoise), rather than a set of problems arising from the interference with and response of a complex ecosystem. Our current viewpoint appears to be derived from the practices of traditional fisheries management, which tend to regard fish stocks as single biological units rather than components of a complex system in which all parts play more or less significant roles. Current federal regulations, for example, imply that economically unimportant species taken as by-catch have no ecological significance.[52] This unfortunate analysis can lead to misguided management decisions. As recently stated by ecologists Andrewartha and Birch, it is widely recognized that in the marine enviroment, relatively little is known about the ecosystem role and the components of the "envirogram"[53] of even commercially important organisms.[54]

Discarded catch affects ecosystem dynamics through two major pathways.

- Interference with predator-prey dynamics: Continuous, selected removal of organisms alters predator-prey and competitive interactions and may significantly modify ecosystem structure and function. Discarded organisms are transformed from active participants in the predator-prey cycle to passive, highly vulnerable prey and more commonly, carcasses and detritus.

- Recycling of dead organic matter:
  Recycling of carcasses into the marine environment enriches the detritus-based food web, attracting scavengers and decomposers, thus changing community structure and diversity, and enhancing energy turnover, nutrient release and biochemical oxygen demand.

1. Predator-Prey Dynamics, Shrimp Fishery

Information about effects of by-catch removal and discards on predator-prey interactions is limited, due to a lack of long-term studies that are necessary to detect significant effects. Most of the relevant work has until recently been concentrated on the shrimp fishery, where the by-catch to shrimp catch ratio is high in some areas (up to 30:1[55]) and where frequently 95%-100% of the by-catch is discarded.[56]

An energy-flow model by Browder[57] for the Gulf of Mexico shrimp fishery examined the potential effects of excessive shrimp by-catch discards on groundfish populations and shrimp-groundfish predator-prey interactions. Browder's data showed that under current harvesting practices, the rate of groundfish kill through shrimp by-catch is equal to the natural predation rate; the model predicted that it was possible that groundfish stock's can be affected by the shrimp fishery. More importantly, Browder's model showed that natural predation on shrimp were three times their harvest rate and that removal of alternative food sources from shrimp predators through the by-catch process increased

predation pressure on shrimp, reducing stock size and potential shrimp harvest.

Browders mathematical findings are substantiated by results from a long-term field study of the German North-Sea shrimp fishery.[58] In this fishery, the by-catch rate is comparatively small (3-5% of total shrimp catch) and most of the by-catch is retained and made into fish meal. Twenty-five years of by-catch records revealed no direct evidence that by-catch removals affected groundfish stocks and landings. Tiews and other German investigators have shown that many of the by-catch species (cod, sole, place, goby, bullhead, dab) become, when larger, predators on shrimp and on each other.[59] Increased by-catch one year was generally followed by reduced shrimp yields the following year, suggesting that the excessive by-catch removal, by reducing the availability of alternate prey, increased predation on shrimp.[60] Other short-term field studies have been less conclusive: In the Newfoundland shrimp fishery, Atkinson[61] showed that considerable small redfish (**Sebastes spp.**) discards (10-139% of shrimp annual catches) represented only a small fraction (3.4% by numbers) of the small redfish population. He implied that recruitment to the exploitable stock would not be seriously affected by the discard practices. However, the biomass of small redfish declined ten-fold over the study period (1976-1980). In the absence of other information on predator and prey abundances and feeding habits, it cannot be ruled out that such a decline was at least partially caused by incidental harvest and discard.

The shrimp studies show how two important predator-prey processes may be affected by by-catch losses: recruitment can be directly affected if losses are sufficiently high (e.g. at least 50% of total mortality in Browder's study), and by-catch increases predation pressure on shrimp by removing disproportionate numbers of other, similar-sized species from the predators' potential menu.

2. Predator-Prey Dynamics, Other Fisheries.

Much less is known about the impact of by-catch removals in other important fisheries. Discard percentages of commercially important species are significant in some U.S. commercial trawl fisheries. In the Gulf of Maine for example, on the average 12 to 57% by weight of several commercial bottomfish are discarded from each tow.[62] From the same location, complete discards (100% of catch) of commercial species have been reported.[63] Investigators have generally acknowledged that excessive incidental take of undersized, targeted fish in fisheries like the Gulf of Maine's may have contributed significantly to the decline of historically important groundfish and pelagic species harvests.[64] However, analyses of the possible severity of these effects have not been conducted, due both to the lack of accessible and accurate data on mortality of fish in discard catch and to the poorly understood ecology of juvenile and young fishes.[65]

Ecosystem studies of trawl fisheries have looked at the effects of predator removals due to directed fishing, without

considering incidental catch effects. These include the MARMAP project for the U.S. Atlantic trawl fishery[66], the predator-based PROBUB model of the Bering Sea trawl fishery[67] and Anderson and Ursin's resource-based North Sea food web model[68]. In general, they demonstrate that predation mortality on any of the commercial species is significant, equalling or outweighing mortalities from directed fishing.[69] Given the high discard catch rates found in many commercial trawl operations, these models should be examined for their potential use in studying effects of combined fishing and by-catch mortalities.[70]

### 3. Recycling of Discards

Recycling of discards into the marine food web may follow a number of pathways. Incapacitated organisms, carcasses, body pieces and tissue may be consumed in the water column by large and small predators. Discards that are not consumed immediately and reach the sea floor become part of the benthic food web, attracting scavengers and decomposers, and locally enhancing biological energy turnover, oxygen consumption and nutrient regeneration rates. The role of discards as a food source and their associated effects on marine communities have traditionally been disregarded or been considered inconsequential.

There is ample evidence that discards attract and are consumed by many organisms. Saila contends that the proportion of discarded by-catch consumed directly by large organisms is relatively small, because the total biomass of the larger

organisms is small compared to the weight of by-catch discarded.[71] However, he dealt with organisms observed feeding briefly at discard sites, and not with their long-term feeding habits; and apparently he did not consider subsurface and benthic organisms.

Some pelagic and benthic organisms in coastal waters may feed exclusively on discard windfalls: discards from fish-processing, which include whole fish bodies, heads, and smaller tissue pieces, were found almost exclusively in stomach samples of local herring, walleye pollock, and Dolly Varden trout, among others, collected during fish processing operations in Alaska waters.[72] Carcasses and pieces that reached the seafloor one-half mile away from processing barges were consumed within 2-4 days by a variety of small and large benthic organisms.[73] Where processing wastes were sufficiently concentrated, they attracted urchins, anemones and starfish.[74]

Large (greater than 70 cm) Atlantic cod in the North Sea were found with plaice and sole too large to have been eaten alive in their stomachs.[75] Discarded flatfish were assumed to be a considerable portion of the cod's diet, with an estimated total annual consumption of 132 million plaice and sole per year by large cod, and discards of cod-sized flatfish by Dutch trawlers estimated at 230 million fish per year.[76] Discarded fish may also enhance the survival of sea birds (terns, cormorants, puffins, seagulls)[77] or encourage establishment of seabird nest sites.[78] In deeper waters, carcasses have been

observed to attract large aggregations of fish and invertebrates. Carcass windfalls may contribute significantly to the deep ocean's benthic community respiratory requirements and could affect life histories of important community members.[79] If some megafaunal members of benthic and pelagic communities thrive and grow rapidly at times when discards are abundant, then resulting increased size and abundance may cause predation pressure on commercially valuable species to increase during times when discards are scarce. Both in terms of a numerical growth in resident species population sizes and attraction of new species, artificial additions of detritus at a high rate must cause changes in community structure and diversity.

The rate of nutrient release from decomposition is affected by degree of concentration of dead organisms, water temperature, depth, bottom configuration and by proximity to shore and to areas where scavengers are concentrated. Consequently, results from nutrient release studies are varied. For example, processing wastes affected water quality in several Alaska harbors during the summer processing season when circulation and mixing was reduced.[80] However, similar effects were not found in areas adjacent to deep channels with strong tidal currents.[81] Some investigators speculated that decaying salmon carcasses and fish processing wastes may significantly increase ammonia ($NH_4^+$-H) ion concentrations in Bering Sea coastal waters.[82] On the other hand, Browder calculated that in the Gulf of Mexico, regeneration of nitrogen from discarded shrimp by-catch is likely

to be 3-4 orders of magnitude lower than nitrogen input from marine animal excretions and land runoff combined.[83] Browder concluded that the nutrient contributions of discards to the phytoplankton-based food chain appears inconsequential in the Gulf of Mexico. While Browder's model may have "adequately resolved" the nutrient budget question for the Gulf of Mexico,[84] the question remains unresolved for other important fishing areas such as the Bering Sea, where the magnitude and fate of discards of both by-catch and offal are virtually unknown.

### 4. Summary of Ecosystem Effect

Several significant effects of incidental catch removal and discard on predator-prey interactions, community structure, nutrient recycling and water quality are apparent, even given largely qualitative evidence and order-of-magnitude estimates:

1. Where by-catch equals or greatly exceeds directed catch, it may contribute significantly to the mortality of commercially important fish stocks.
2. Excess by-catch removal may increase predation pressure on target species.
3. Mortality due to excessive by-catch removals may have been a major factor in the decline of several important pelagic and demersal trawl fisheries and will possibly threaten other commercial fisheries not yet fully exploited.
4. Commerically important as well as many other predators are able to feed almost exclusively on discards when available.

5. Large pieces of discarded material that reach the sea floor are consumed rapidly and significantly affect community structure and metabolism by attracting a variety of benthic organisms that may or may not be economically desirable.
6. Larger organisms (e.g., birds, seals, sharks, etc.) that are attracted to and feed on discards may thrive and, if the artificially provided food becomes unavailable, may increase their predation pressure on commercially valuable species.
7. Nutrient release and oxygen consumption associated with scavenger activity and decomposition may affect water quality in shallow, stratified local waters. Data are currently insufficient to assess nutrient and water quality effects on larger marine basins.

These effects are potentially severe and may have long-ranging, continuous impacts. It is surprising that so little attention has been paid to such a seemingly significant factor in the study of ecosystem effects of intensive commercial fishing operations. It was only recently suggested that by-catch removal and discarded by-catch may have played a significant role in the expansion of the king and tanner crab populations in the eastern Bering Sea and Gulf of Alaska during the 1970's, following the first initial heavy groundfish exploitations there in the 1960's and early 1970's.[85] Discards may also have contributed to population increases in economically less desirable and fast growing fishes, such as the sand lance (**Ammodytes sp.**) in the northeast Atlantic during the 1970's[86] or to the increase of

demersal over pelagic fish species in the North Sea during the 1960's and 1970's.[87] It is impossible, however, to substantiate such speculations without a better knowledge and assessment of the magnitude and extent of the by-catch and discard problem in important commercial fishing operations.

## VI. PROPOSED INVESTIGATIONS

In order to fully understand the problem and present substantiated evidence for the need for change in our management of living marine resources, the project proposes to carry out the scientific, economic, sociological and legal investigations outlined in the following sections.

Information outlining biological and economical levels of magnitude of the discards in commercial marine fisheries in U.S. waters, will be obtained from two types of data, currently the only ones available. One source is the Magnuson Fishery Conservation and Management Act fishery management plans prepared by the eight regional management councils. The documents will be reviewed and information will be extracted using the format outlined in Appendix A. The other data source, also derived from the Act, is that compiled by the National Marine Fisheries Service under its Foreign Fishery Observer Program. This, together with complementary information from records required of foreign vessel captains and their countries taking fish in U.S. waters, will be analyzed as outlined in Appendix B.

Thereafter, the project will focus on five selected fisheries on the Pacific and Atlantic coasts and the Gulf of Mexico to look at impacts on the populations and associated communities in detail. These include a New England/Northwest Atlantic fishery (groundfish); a South Atlantic/Gulf fishery (shrimp); a Pacific West Coast fishery (hake); an Alaskan/North Pacific fishery (groundfish); and a Western Pacific fishery (salmon high-seas drift gillnet).

By conducting a survey and review of primary and gray literature as well as investigating, collecting and analyzing unconventional or unrecognized data sources (including the above-mentioned fishery management plans, and the foreign fishery and joint venture observer and mandatory record-keeping data as well as anecdotal information from fishermen and observers), the project will seek answers to four questions for each fishery:

- What are the levels of magnitude and proportions of discard in terms of both numbers of organisms and biomass?
- What species are affected, both target and by-catch?
- What are the associated population dynamic effects (growth, survival, mortality, reproduction) on those species?
- How do discards affect associated communities and ecosystems in terms of predator-prey interactions and biological energy turnover?

The project will then discuss management responsibilities as currently perceived and practiced by the fishery management councils and federal and state governments with regard to this issue, and compare this with an ideal situation. This section will include a thorough evaluation of the ethical, social, economic, technological, and legal framework for living marine resource management.

A consideration of the ethical responsibilities in our harvest of living marine resources will include consideration of works by authors such as Peter Singer,[88] Tom Regan,[89] Lawrence Tribe,[90] Daniel G. Kozlovsky,[91] Erazim Kohak,[92] David Ehrenfeld,[93] and Paul and Anne Ehrlich,[94] among others.

An investigation of social, technological and economic aspects of fisheries management strategies in regard to the issue will look at the economic incentives and disincentives for fishermen to voluntarily reduce discard catch, and to develop new gear. Works by Olsen,[95] Stokes,[96] and Kreuger[97] will be discussed. The problems of increased capitilization changing the old fishery mentality of acceptance of deferred gratification will be explored,[98] as will instances where new gear has been developed but is resisted by the fishing community even though positive economic advantage can be shown.[99] Sociological aspects of the study will include how innovation diffusion affects gear modification rates[100] and the relative merits of using limited entry, tax, fee or individual share allocation systems in this situation.[101] This could lead to a discussion of management

options evident in the use of a multi-attribute utility theory (MAUT) framework.[102]

A discussion of the current regulatory regime will include an analysis of federal and state statutes and the regulations and rules promulated thereunder, as well as the U.S. Constitution, state constitutions and common law remedies. Some of the acts that would be investigated would be the Magnuson Fishery Conservation and Management Act,[103] the National Environmental Policy Act of 1969,[104] the Endangered Species Act of 1973,[105] the Marine Mammal Protection Act of 1972,[106] the Migratory Bird Treaty Act,[107] the Marine Protection Research and Sanctuaries Act,[108] and the Federal Water Pollution Control Act.[109]

## VII. PROPOSED RECOMMENDATIONS AND CONCLUSIONS

Based upon the foregoing, the project will summarize the reasons it has identified for making changes in the way we fish. Recommendations will call for increased efforts by federal and state agencies, the fishery management councils, and fishing industry organizations to develop better information on discard levels and the implications of such actions, as well as seeing that this information is made available to all interested parties. In addition to current strategies of quotas, gear restrictions, and time and area fishing closures, they will stress that increased efforts by the same organizations should be devoted to developing more and better species-specific gear and to facilitating its use. Modifications in food science may be

recommended to ensure that acceptable levels of currently discarded catch will be utilized. These might include ways to improve onboard storage, processing and marketing of these species. And, as necessary to accomplish these and other recommendations which will be developed, the project will propose alterations in the current statutory, regulatory or enforcement regime.

The study will conclude with a concise statement of what we now know; what more we need to know; and what will be required to gain that knowledge in order to ultimately reduce discard catch in U.S. commercial marine fisheries to levels approaching zero. Written in law review article format, the study will be printed and distributed within 90 days of the formal date of completion for the project. It will be copyrighted by the authors, with free rights of use accorded the sponsors, and publication will be sought in appropriate professional and serious lay publications.

FOOTNOTES TO THE TEXT

1. S.B. Saila, Importance and Assessment of Discards in Commericial Fisheries 1 (FAO Fisheries Cir. No. 765, 1983).

2. Authors of proposal suggest the higher figure. Current reporting is minimal as Saila, supra note 1, comments. Furthermore, the reporting which is done often underestimates by-catch and discard. Letter from Dr. Warren Wooster to E.C. Bricklemyer (March 7, 1985). If species other than the finfishes, and the few species of crustaceans that are included in Saila's estimate are added (for example special status creatures such as porpoise or sea turtles), totals would appear to reach our estimates. In the U.S. tuna purse seine fishery alone roughly 15 million porpoise may be set upon a year and, although most of these now survive (mortality is now estimated to be below 17,000, see note 34, infra), at an average of 200 pounds per animal 1.5 million tons of by-catch would be added. Telephone interview with Tim Smith, National Marine Fisheries Service, Southwest Fisheries Lab (April 8, 1985).

3. Saila, supra note 1, at 2. World fisheries harvest for 1983 was in excess of 74 million tons. L. Brown, "Maintaining World Fisheries," in State of the World--1985, 73 (1985).

4. Saila, supra note 1, at 5, 7. He estimates U.S. shrimp industry by-catch at 960,000 metric tons. See also note 2.

5. 16 U.S.C.A. §§ 1801 - 1882 (West supp. 1975-1983).

6. 16 U.S.C.A. § 1851 (a)(1)-(3), (5), (6) (West supp. 1975-1983).

7. 16 U.S.C.A. § 1801 (West Supp. 1975-1983).

8. This is generally in conformity with that adopted by Saila, supra note 1.

9. Even the best attempts at clarity present some problem: porpoise in the western Pacific purse seine tuna fishery are actually targeted upon, but are considered by-catch because there is no desire to keep them and it is illegal to land them.

10. In the purse seine tuna fishery, a fifth category could be established, that of a species whose capture is prohibited but which facilitates capture of the target species, and thus is itself targeted upon.

11. Saila, supra note 1, at 1, 9.

12. Saila, supra note 1, at 9.

13. An important percentage of the unnatural deaths of Kemp's ridleys, the most endangered of the sea turtles, has recently been attributed to incidental capture by the Gulf of Mexico shrimp fleet. M. Weber, Minutes of the Meeting of TED Voluntary Use Committee May 3, 1984, with attachments (June 18, 1984) (available in UW School of Fisheries Discard Catch Project Library); Gulf of Mexico Fishery Management Council, Fishery Management Plan for the Shrimp Fishery off the Gulf of Mexico, United States Waters 3-111, -121 (Nov. 1981) [hereinafter cited as Shrimp Plan].

14. The ecosystemic and economic effects outlined here are discussed in more detail hereinafter in sections V and VI of the proposal.

15. M. Robinson, Trends and Prospects in World Fisheries (FAO Fisheries Cir. No. 772, 1984).

16. Council on Environmental Quality & U.S. Dept of State, Global Future: Time to Act 107-108 (1981).

17. World Resources Institute, The Global Possible: Resources Development and the New Century 18 (1985).

18. Brown, supra note 3, at 77.

19. Saila, supra note 1.

20. Saila, supra note 1, at 3.

21. Saila, supra note 1, at 8.

22. J. Craig & R. Hacker, The History and Development of the Fisheries of the Columbia River 206 (Bureau of Fisheries, U.S. Dept. of Interior Bull. No. 32, 1940). An early cannery operator stated, describing sturgeon destruction in the first years of the salmon fishery: "In 1879 the sturgeon were so thick in Baker Bay that we did not consider it safe, early in the season, to put our gillnets out. The fish were so numerous and large that they were able to destroy a great amount of netting. For years every sturgeon taken was multilated or killed with an ax and thrown back into the water. The shores of the river would be lined with dead sturgeon, and numbers could always be seen floating down the river." Id.

Even once the commercial sturgeon fishery began, so few fish were sold that little or no attempts were made to return smaller, unmarketable specimens to the water uninjured. Id.

23. N. Parks, The Pacific Northwest Commercial Fishery for Sturgeon, Marine Fish. Rev., July 1978, at 17, 19. For instance, in 1895 landings equalled 4.7 million pounds, but were only a little over 73,000 pounds in 1899. Only since the mid-1940's has the fishery recovered sufficiently to provide harvests in the 200,000 to 400,000 pound range. Id.

24. Saila, supra note 1, at 4.

25. Telephone interview with Tara Murphy, former New England groundfish vessel deckhand and currently Fisheries Intern, National Andubon Society (March 25, 1985).

26. Saila, supra note 1, at 3.

27. Id., at 5. Shrimp Plan, supra note 13, at 3-110, -111, -121; 8-1, -2. Endangered Species Act of 1973, 16 U.S.C.A. §§ 1531-1543 (West 1974 & Supp. 1975-1983).

28. Pellegrin, "Fish Discards from the Southeastern United States Shrimp Fishery," in Fish By-catch ... Bonus from the Sea at 51, 52 (1982).

29. National Marine Fisheries Service, U.S. Dept. of Commerce, Environmental Assessment of a Program to Reduce the Incidental Take of Sea Turtles by The Commercial Shrimp Fishery in the Southeastern U.S. 1 (1983) [hereinafter cited as Incidental Take EA]. These include the severely

endangered Kemp's ridley of which the only known colony nests almost exclusively near Rancho Nuevo, Mexico. From a time, less than forty years ago, when over 40,000 females nested in a single day, it is now estimated that only 800 nest per year. The Marine Turtle Recovery Team, National Marine Fisheries Service, U.S. Dept. Commerce, Recovery Plan for Marine Turtles 13, 14 (1984) [hereinafter cited as Recovery Plan].

30. Incidental Take EA, supra note 29.; see also Protected Species Program, Southeast Fisheries Center National Marine Fisheries Service, U.S. Dept of Commerce Annual Report FY 84, Sea Turtle Excluder Trawl Project (1984), and Recovery Plan, supra note 30.

31. Incidental Take EA, supra note 29; Letter from Charles A. Oravetz, Chief, Protected Species Management Branch, NMFS, to Eugene C. Bricklemyer, Jr. (February 2, 1985).

32. Coe, Holts & Butler, "The 'Tuna-Porpoise' Problem: NMFS Dolphin Mortality Reduction Research, 1970-81," Marine Fish. Rev., March 1985, at 18, 21.

33. Committee for Humane Legislation v. Richardson, 414 F. Supp. 297 (D.C.D.C. 1976), aff'd 540 F.2d 1141 (D.C. Cir. 1976); see Nafziger and Armstrong, "The Porpoise-Tuna Controversy; Management of Marine Resources after Committee for Humane Legislation v. Richardson," 7 Envtl. L. 223 (1977);

34. Coe, supra note 32, at 21, estimates mortality in 1980 at the level of 16,900; 50 C.F.R. § 216.24 (d)(2)(1983).

35. Coe, supra note 32. While the exact figure varies depending upon the type of vessel, gear configuration, captain, locale, etc., as well as the source of the computations, it is generally agreed that it is cost effective to not kill and thus have to separate out on deck porpoises. This too was ultimately an incentive to the tuna fleet.

36. Prohibited species are generally defined as any species for which there is no allocation, or any species taken in excess of an allocation, i.e. any species which the vessel is not specifically authorized to retain. 50 C.F.R. §§ 611.2 (bb) (1984).

37. 50 C.F.R. §§ 611.13, 611.92 (b)(1), 611.93(b)(1)(ii)(A) (1984).

38. Saila, supra note 1, at 3, 9; Interview with Wayne Palsson, former foreign fishery observer (February 15, 1985).

39. Bell, "Management of Pacific Halibut," in A Century of Fisheries in North America 209-221 (Amer. Fish. Soc., Special Pub. No. 7, 1970). Hoag, The Effect of Trawling on the Setline Fishery for Halibut 1-20 (Int'l Pac. Halibut Commm., Scientific Report No. 61, 1976). Skud, "Management of the Pacific Halibut Fishery," 30 J. Fish. Res. Bd. Canada 2393-2398 (1978). North Pacific Fishery Management Council, Council Doc. No. 13, Reducing the Incidental Catch of

Prohibited Species By Foreign Groundfish Fisheries in the Bering Sea 3 (1981).

40. International Pacific Halibut Commission, Annual Report 1983 (1984). Annual by-catch ranged between 2268 and 7256 metric tons between 1976 and 1982 in the Gulf of Alaska crab fishery and from 4319 to 7836 metric tons between 1970 and 1982 in the Gulf of Alaska and Bering Sea foreign and domestic groundfish fisheries. In 1983 this would have added 47.7 to 109.6% to the landed halibut catch quota of 13,800 metric tons for all IPHC-managed areas combined. S. Hoag, C. Schmitt & G. Williams, Incidental Catches of Halibut, (Draft Report, Internat. Pacific Halibut Commission, 1984). See also V. Wespestad, S. Hoag & R. Narita, "Reducing the Incidental Catch of Prohibited Species in the Bering Sea Groundfish Fishery through Gear Restrictions," 5-14 Int'l Pac. Halibut Comm. Tech. Rept. No. 19 (1982).

41. Memorandum from J. Branson, Ex. Dir., to North Pacific Fishery Management Council (September 17, 1984); 50 C.F.R. Part 675 (1984). [hereinafter cited as Branson Memorandum].

42. Natural Resources Consultants, Development of Large-scale Trawling in the Gulf of Alaska and The Bering Sea and its Economic and Ecological Impacts 160-161 (1984). If King and tanner crab and salmon incidental takes are added into the

loss, the figures range from over $11 million to over $21 million. Id.

43. G. Williams, D. McCaughran, S. Hoag, & T. Koeneman, "A Comparison of Pacific Halibut and Tanner Crab catches in Side-entry and Top-entry Crab Pots with and without Tanner Boards," 15-35 Int'l Pac. Halibut Commn. Tech. Rept. No. 19 (1982).

44. Wespestad, supra note 40.

45. Branson Memorandum, supra note 41.

46. Letter from Donald E. Bevan, Director, School of Fisheries, U. Wash., to Jim Branson (Nov. 2, 1984).

47. T. Newby, Life History of Dall Porpoise (**Phocoenoides dalli**, True 1885) Incidentally Taken by the Japanese High Seas Salmon Mothership Fishery in the Northwestern North Pacific and Western Bering Sea, 1978 to 1980, 2 (Doctoral Diss., U. of Wash., Seattle, Wash. 1982).

48. R. Eisenbud, "The Pelagic Driftnet," Oceanus, Winter 1984/85, at 76.

49. Id. This includes murres, shearwaters, puffins, fumars, small alcids, albatross and storm petrels. National Marine Fisheries Service, U.S. Dept. Commerce, Draft Environmental Impact Statement in the Incidental Take of Dall Porpoise in the Japanese Salmon Fishery 11, 12 (1981) [hereinafter cited as Dall Porpoise EA].

50. Newby, supra, note 47, at vii, 101.

51. Dall Porpoise EA, supra note 49, at 11, 12; Fish and Wildlife Service, U.S. Dept. of the Interior, "Pacific Seabird Group Policy Statement," in Pacific Seabird Bull. 19, 20 (Spring 1975).

52. "Nonspecified species include all fish other than those specifically listed in paragraphs(b)(1), (2) and (3) of this section. It is thus a residual category of **species of no current or foreseeable economic value or ecological importance** which are taken by the groundfish fishery as an accidental by-catch and are in no apparent danger of depletion" (emphasis added by author). 50 C.F.R. §611.92(b)(4)(1984).

53. H.G. Andrewartha & L.C. Birch, The Ecological Web, (1984). They define "envirogram" as follows: "According to the theory of environment, activity in the directly acting components [the centrum] is the proximate cause of the condition of the animal, which reflects it chance to survive and reproduce. But the distal cause of the animal's condition is found in the web, among the indirectly acting components which modify the centrum. A modifier may be one or several steps removed from the centrum, and the pathway from a particular modifier to its target in the centrum may be joined by incoming pathways from other modifiers that may be behind or alongside the first one.... The envirogram is a graphic representation of these pathways." Id. at 19.

54. "We know of no single species of fish in the oceans for which information is available to construct an envirogram with any degree of completeness. This is in large part due to failure by students of fisheries to realize that the environment of a fish is more than its human predator. The examples we have given indicate that the distribution and abundance of fish depend on many components of the environment, of which man is only one." Andrewartha & Birch, supra note 53, at 407.

55. Saila, supra note 1, at 6 (table 2b).

56. Saila, supra note 1, at 6 (table 2b).

57. J.A. Browder, "Use of an energy flow model to evaluate alternative harvesting strategies in a multispecies fishery," in Internat. Symp. Energy Ecol. Modeling 571-583 Louisville, Ky, (1981).

58. K. Tiews, "Uber die Veranderungen im Auftreten von Fischen und Krebsen im Beifang der deutschen Garnelenfischerei wahrend der Jahre 1954-1981," Arch. FischWiss. 34, Beih. 1 1-156 (1983).

59. H. Kuhl, "Nahrungsuntersuchungen an einigen Gadiden im Elbe-Mundungsgebiet," 24 Arch. FischWiss. 141-149 (1973).

60. K. Tiews, "The predator-prey relationship between fish populations and the stock of brown shrimp (Crangon crangon L.) in German coastal waters," 172 Rapp. P.-V. Reun. Cons. Int. Explor. Mer 250-258 [hereinafter cited as Rapports] (1978). K. Tiews, "Non-commercial fish species

in the German Bight: Records of by-catches of the brown shrimp fishery," Id, 259-265.

61. D.B. Atkinson, "Discarding of small redfish in the shrimp fishery off Port au Choix, Newfoundland, 1976-80," 5 J. Northw. Atl. FishSci 99-102 (1984).

62. R. Langan & W. H. Howell, Commercial trawler discards of four flounder species in the Gulf of Maine, (manuscript, Univ. of New Hampshire Marine Program Contribution Series--UNH- MP-JR-84-7, 1984).

63. Saila, supra note 1, at 7 (table 3).

64. A. Saville, "The assessment and management of pelagic fish stocks: discussion and conclusion of the symposium," 177 Rapports [supra note 60] 513-517 (1980). Affected fisheries include the Northeast Alantic herring, North Sea pelagic fish, Gulf of Maine and Gulf of Thailand groundfish. N. Daan, "A review of replacement of depleted stocks by other species and the mechanisms underlying such replacement," Id .405-421 (1980).

65. G. Hempel, "North Sea fish stocks--recent changes and their causes: synopsis of the symposium," 172 Rapports 445-449 [supra note 60] (1978). M.C. Mercer, "Multispecies approaches to fisheries management advice: workshops report," 1-15 in Multispecies Approaches to Fisheries Management Advice (Can. Spec. Publ. Fish. Aquat. Sci. 59, 1982).

66. K. Sherman "MARMAP, a fisheries ecosystem study in the Northwest Atlantic: fluctuations in ichthyoplankton-zooplankton components and their potential for impact on the system," 9-37 in Advanced Concepts in Ocean Measurements for Marine Biology (Belle W. Baruch Library in Marine Science 10, 1980).

67. T. Laevastu & F. Favorite, Dynamics of Pollock and Herring Biomasses in the Eastern Bering Sea (Processed Report, Northwest and Alaska Fisheries Center, Nat. Mar. Fish. Serv., NOAA, Seattle, Wash., 1976).

68. K. P. Anderson & E. Ursin, "A multispecies extension to the Beverton and Holt theory of fishing, with accounts of phosphorus circulation and primary production," 7 Meddr. Danm. Fish.-og-Hauvunders. N.S. 319-435 (1977).

69. Natural Resources Consultants, supra note 42, at 134 (table 15).

70. Natural Resources Consultants, supra note 42, at 101-143.

71. Saila, supra note 1, 15-16 (table 5). R.E. Nakatani, D.L. Beyer & C.P. Staude, The Effects of Salmon Cannery Waste on Water Quality and Marine Organisms at Petersburg, Alaska, 1971 1-47 (report by Fisheries Research Institute, School of Fisheries, Univ. Washington, Seattle, Wash. for the National Canners Association, 1971).

72. Fisheries Research Institute, The Effects of the Disposal of Salmon Cannery Waste on the Marine Environment Adjacent to some Kodiak Island Canneries 1-44, (School of Fisheries,

Univ. Washington, Seattle, Wash., 1971). See also Saila, supra note 1, at 15-16.

73. Fisheries Research Institute, supra note 72, at 19-22.

74. D.L. Beyer, R.E. Nakatani & C.P. Staude, "Effects of salmon cannery wastes on water quality and marine organisms," 47 J. Wat. Poll. Cont. Feder. 1857-1869 (1975). Nakatani, Beyer & Staude, supra note 71, at 23-29, 36.

75. N. Daan, "Consumption and production in North Sea Cod, Gadus morhua: An assessment of the ecological status of the stock," 9 Neth. J. Sea Res. 24-55 (1975).

76. Daan, supra note 75, at 49.

77. Interview with Dr. Dee Boersma, Institute for Environmental Studies, Univ. Washington, Seattle, Wash., March 15 1985.

78. Fisheries Research Institute, supra note 72, at 9, 38.

79. On the Santa Catalina Basin floor, off Southern California, energy flux from carcass wind falls was estimated to contribute perhaps 11% to all measured benthic community respiratory requirements. C.R. Smith, "Food for the deep sea: utilization, dispersal, and flux of nekton falls at the Santa Catalina Basin floor," 29 Deep Sea Research 953-965 (1985).

80. P. Comar & P. Stocks, Water Quality Study of Dutch Harbor/ Unalaska (report, Nat. Seafood Quality Inspect. Labor., Nat. Mar. Fish. Serv., Pascagoula, MI, Sept. 1981) K. Iwanura, Reconnaissance Investigations of four Floating Crab Processor Waste Disposal Sites in Akutan Harbor, May

25-26, 1978 (report, Division of Water Programs, State of Alaska Dept. Envir. Conserv., 1978). Kodiak Harbor Receiving Water Quality (working paper, Division of Environmental Quality Operations, State of Alaska Dept. Envir. Conserv., 1980).

81. Beyer, Nakatani & Staude, supra note 74, at 1860-1863, 1867, 1868.

82. D.C. Brickell & J.J. Goering, "Chemical effects of decomposing salmon carcasses on aquatic ecosystems," in Oceanography of the Bering Sea Phase I 183-200 (Rep. No. R-719, Univ. Alaska, Fairbanks, Alaska, 1971).

83. Browder, supra note 57, at 580, 581.

84. Saila, supra note 1, at 15, § 3.

85. Natural Resources Consultants, supra note 42, at 102, 136-143. It is also thought possible that the subsequent crash in these stocks could be related to a dramatic decrease in the amount of detritus being provided by fish processors, due to federal regulations requiring effluent treatment for discharges. Interview with Dr. Richard Marasco, Director, REFM, Northwest & Alaska Fisheries Center, NMFS, Seattle (September 22, 1983).

86. Sherman, supra note 66, at 10, 30-34.

87. Daan, supra note 64, at 412-420.

88. P. Singer, Animal Liberation (1975).

89. T. Regan, The case for Animal Rights (1983).

90. Tribe, "Ways not to Think About Plastic Trees," 83 Yale L.J. 1315 (1974).

91. D. Kozlovsky, An Ethological and Evolutinary Ethic (1974).

92. E. Kohak, The Embers and the Stars (1984).

93. D. Ehrefeld, The Arrogance of Humanism (1978).

94. P. & E. Ehrlich, Extinction (1981).

95. M. Olsen The Logic of Collective Action (1965).

96. Stokes, "Fisheries Economics and Fisheries Management," in Economic Analysis for Fisheries Management Plans (L. Anderson, 1981).

97. C. Krueger, The Domestic Groundfish Fisheries of the Eastern Bering Sea and Gulf of Alaska: Management Issue and Regulatory Options (M.S. Thesis, U. of Wash., Seattle, Wash., 1984)

98. Pollnac, Gersuny & Poggie, "Economic Gratification Patterns of Fishermen and Millworkers in New England," 34 Human Organization (1975)

99. J. Easeley, A Preliminary Estimate of the Payoff to Investing in a Turtle Excluder Device for Shrimp Trawls. (final report prepared for Monitor International and the Center for Environmental Education, Feb. 5, 1982).

100. E. Rogers, Diffusion of Innovations (1983).

101. See eg. Christy, "The Fishery Conservation and Management Act of 1976: Management Objectives and the Distribution of Benefits and Costs," 52 Wash. L. Rev. 657 (1977); Pearse,

"Fishing Rights, Regulations and Revenues," 5 Marine Policy 135-146 (1981).

102. W. Edwards, "The Use of Multi-Attribute Utility Measurement for Social Decisions," in Conflicting Objectives in Decisions (D. Bell, R. Keeney, H. Raiffa 1977). The multi-attribute utility theory can be briefly stated as one in which the best decision is that rated highest with respect to attributes measuring multiple-valued objectives.

103. 16 U.S.C.A. §§ 1801-1882 (West Supp. 1975-1983).

104. 42 U.S.C.A §§ 4321-4341 (West 1977).

105. 16 U.S.C.A. §§ 1531-1543 (West 1974 & Supp. 1975-1983).

106. 16 U.S.C.A. §§ 1361-1407 (West 1974 & Supp. 1975-1983).

107. 16 U.S.C.A. §§ 703-711 (West 1974 & Supp. 1985).

108. 33 U.S.C.A. §§ 1401-1445 (West 1978 & Supp. 1984); 16 U.S.C.A. §§ 1431-1434 (West 1974 & Supp. 1975-1983).

109. 33 U.S.C.A. §§ 1251-1376 (West 1978 & Supp. 1984).

110. For instance, the project will investigate the idea, in the Northeastern Pacific groundfish fisheries, of requiring the retention and landing of prohibited species of crab and finfish which are now required to be immediately dumped. In order to minimize the incentive to target on these prized species by those without a permit for directed harvest, the net profits from the sale of prohibited catch (determined after deducting a cost to the fishers for harvest), might be distributed to NMFS, regional fishery management councils or the states for further research on incidentally caught and

discarded species. This proposal could currently be efficiently applied in the joint venture fishery where, because of the time involved between catch and transfer of the cod end from the catcher to the processing ship, all incidentally caught species are certainly dead before their discard. It might not be necessary in a domestic fishery where the catch is landed immediately and the incidentally caught species can be returned to the water rapidly.

## APPENDIX A

### OUTLINE OF FORMAT TO BE USED TO ANALYZE MAGNUSON FISHERY CONSERVATION AND MANAGEMENT ACT FISHERY MANAGEMENT PLANS

1. INFORMATION REGARDING MANAGED FISHERY
   - 1.1. Species comprising the Management Unit
   - 1.2. Ecological relationships
     - 1.2.1. Prey-predator relationships.
     - 1.2.2. Competitor relationships.
     - 1.2.3. Food web.
   - 1.3. Harvesting of managed species
     - 1.3.1 Where fishery occurs.
     - 1.3.2. Gear types used.
     - 1.3.3. Who is making the harvest:
       1. Commercial: domestic, foreign, joint venture.
       2. Recreational.
     - 1.3.4. Magnitude of harvest.
     - 1.3.5. Where is catch landed (state).
   - 1.4. Reporting methods/requirements (Observers?)

2. SPECIES IN MANAGEMENT UNIT NOT MANAGED
   - 2.1. Same information as for directed fishery
   - 2.2. How much is utilized/discarded

3. DISCARD CATCH AND LOSS

3.1. Target Species

3.1.1. Types of discard/loss of target species:

1. Not within legal size limit.
2. Too small to process.
3. Exceed allowable catch ("surplus").
4. Loss during fishing (gillnet fallout; loss of gear).

3.1.2. Magnitude and effects of discard catch for each species:

1. Relative to magnitude of fishery and population unit (size frequency).
2. Species population dynamics and ecosystem effects.

3.2. Non Target Species

3.2.1. Types of discard catch/loss:

1. Commercial value but to another fishery.
2. Not of commercial value ("undesirable").
3. Prohibited/exceed allowable catch of non target species.

3.2.2. Magnitude and effects of discard catch for each species:

1. Relative to magnitude of directed fishery.

2. Species population dynamics and ecosystem effects.

3.3. Attention Paid by Councils to Discard Catch Problem

3.3.1. Is discard catch addressed as a management objective (Section 1.3).

3.3.2. If so, what level of importance is accorded to research/monitoring of discard catch.

3.4. Attention to Discard Catch in Comments to Draft Plan

3.4.1. By whom.

3.4.2. Type of concern.

3.4.3. Response of Council.

4. ASSESSMENT OF QUALITY OF DATA IN PLAN MEASURED AGAINST NATIONAL STANDARDS

# APPENDIX B

## PART 1

## USING FOREIGN AND JOINT VENTURE OBSERVER AND CAPTAINS' DATA TO MAKE INFERENCES REGARDING DISCARD CATCH LEVELS

### 1. INTRODUCTION.

The National Marine Fisheries Service's (NMFS) foreign fishery and joint-venture observer programs have, since 1977 and 1979, respectively, compiled targeted and incidental catch statistics from foreign fishing operations in the U.S. Fishery Conservation Zone.[A1] The program is particularly well managed for the Bering Sea and Gulf of Alaska groundfishery and the hake fishery off Washington, Oregon and California (WOC).[A1.5]

The data have been used to monitor foreign fishing operations and to determine catch levels of targeted and incidentally caught species and species groups by vessel class, statistical area and time of year.[A2] Although observer coverage was initially low, often below 20%,[A3] it has recently approached 100%.[A4]

The data set contains computerized historical and up-to-date information on incidental catch for species or species groups, as well as comprehensive, length-weight correlated catch information on prohibited species (e.g. Pacific halibut, salmon, king and tanner crabs, marine mammals), and discard statistics for the WOC hake fishery. Observer notebooks also contain logs on catch and product disposition of species and species groups for individual

cruises. The data generated from observer operations form the only comprehensive, reliable and accessible set from which by-catch discard information can be extracted (figure 1).

We propose to use this information, together with data from foreign captains and joint venture fish receipt logs (figure 1),[A5] to estimate the extent and magnitude of discarded and non-utilized species and species groups in foreign and joint venture fisheries within the United States Pacific coast fishery conservation zone (WOC, Gulf of Alaska and Bering Sea).[A6] We also propose to develop, in cooperation with NMFS, a design for an observer special project to obtain detailed discard statistics from selected cruises covered by the observer program. The following outline presents available data types and proposes methods for obtaining incidental catch discard information.

## 2. INCIDENTAL CATCH DATA FOR ALL SPECIES OR SPECIES GROUPS.

### a. Data types available.

Observer data allow catch estimation for a species or species group by vessel class, statistical area and time of year. Since observer coverage is not always complete, catch figures are obtained by the "best estimate" method.[A7] Wherever observers are present, catch estimates can also be obtained for individual vessels. For many species and groups this has already been done by NMFS; summary data for these are available in technical reports.[A8] Typical species and species groups are listed on Table B-1.[A9]

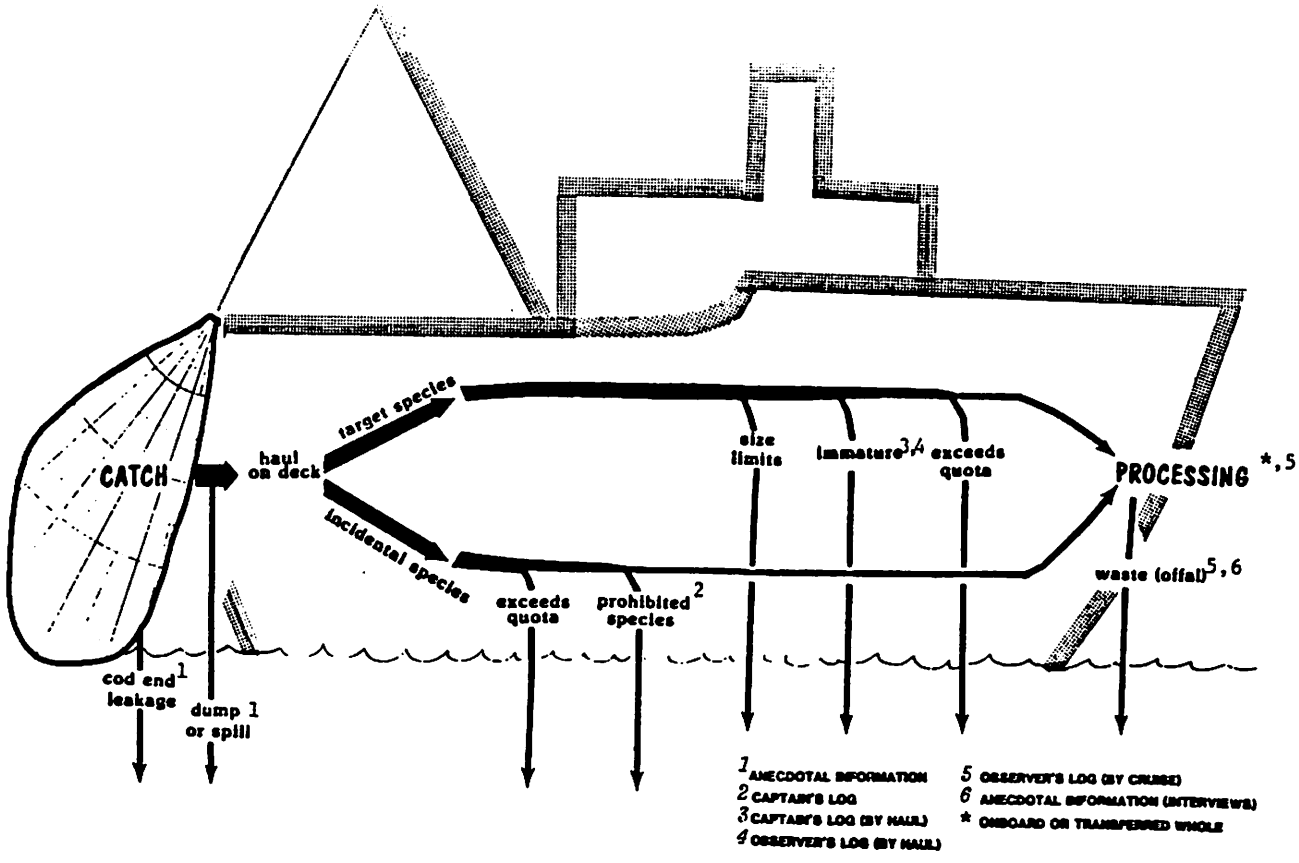



Figure 1. Pathways showing possible fates and disposition of fishes and other organisms caught in a trawl net, and where appropriate information may be obtained or recorded.

Table B-1. Typical Species and Species Groups Used in Pacific Coast, Bering Sea and Gulf of Alaska Trawl Fisheries Data Bases[a].

| | |
|---|---|
| **1. WASHINGTON-OREGON-CALIFORNIA HAKE FISHERY** | |
| **Target Species** | **Data Described** |
| Pacific whiting (hake) | Catch and discards[b] in metric tons |
| Shortbelly rockfish | Catch and discards in metric tons |
| **By-catch Species** | |
| Jack mackerel, north of 39° N | Catch and discards in metric tons |
| Pacific ocean perch (POP) | Catch and discards in metric tons |
| Rockfishes, excluding POP and shortbelly rockfish | Catch and discards in metric tons |
| Sablefish | Catch and discards in metric tons |
| Flounders | Catch and discards in metric tons |
| Other species | Catch and discards in metric tons |
| **Prohibited Species** | |
| Salmonids | Catch, numbers, incidence |
| Halibut | Catch, numbers, incidence |
| Dungeness crab | Catch, numbers, incidence |
| **Marine Mammals** | Catch, numbers, life status |
| **2. BERING SEA/ALEUTIAN GROUNDFISH FISHERY** | |
| **Target Species** | |
| Pollock | Catch in metric tons |
| Pacific cod | Catch in metric tons |
| Yellowfin sole | Catch in metric tons |
| Turbot group (3+ species) | Catch in metric tons |
| Other flatfishes | Catch in metric tons |
| Sablefish | Catch in metric tons |
| Atka mackerel | Catch in metric tons |
| Pacific whiting (Hake) | Catch in metric tons |
| Pacific ocean perch group (15 species) | Catch in metric tons |
| Other rockfishes | Catch in metric tons |
| Squid | Catch in metric tons |
| **Other Species[c]** | Total Catch in metric tons |

Table B-1 - Continued

| | |
|---|---|
| **Prohibited Species** | |
| Halibut | Catch, numbers, incidence |
| King crab | Catch, numbers, incidence |
| Tanner crab | Catch, numbers, incidence |
| Salmonids | Catch, numbers, incidence |
| Herring | Catch, incidence |
| Other prohibited species[d)] | Not recorded, except snails for snailpot licensed vessels |
| **Marine Mammals** | Catch, numbers, life status |
| **Non-specified Species[e)]** | Total amount retained |

3. GULF OF ALASKA GROUNDFISH FISHERY

| | |
|---|---|
| **Target Species** | |
| Pollock | Catch in metric tons |
| Pacific cod | Catch in metric tons |
| Flounders (all flatfishes) | Catch in metric tons |
| Sablefish | Catch in metric tons |
| Atka mackerel | Catch in metric tons |
| Pacific whiting (hake) | Catch in metric tons |
| Pacific ocean perch group (15 species) | Catch in metric tons |
| Thornyhead rockfishes (2 species) | Catch in metric tons |
| Other rockfishes | Catch in metric tons |
| Squid | Catch in metric tons |
| **Other Species[c)]** | Total catch in metric tons |
| **Prohibited Species** | |
| Halibut | Catch, numbers, incidence |
| Salmonids | Catch, numbers, incidence |
| Herring | Catch, incidence |
| Other prohibited species[d)] | Not recorded |
| **Marine Mammals** | Catch, numbers, life status |
| **Non-specified Species[e)]** | Total amount retained |

---

a) Source: J. Wall. Observer Guide to Foreign Fishing Regulations for the North Pacific Ocean and Bering Sea. Unpublished Manuscript, Northwest and Alaska Fisheries Center, National Marine Fisheries Service, Seattle, Wash., pp. 65, 79, 93 (1983).

b) Discards for joint-venture fishery only.

c) Sharks, skates, sculpins, eulachon, smelts, capelin, octopus.

d) Horsehair, lyre and dungeness crabs, shrimp, scallops, surf clams, snails, coral.

e) All other species, considered as having no current or foreseeable economic value or ecological importance.

b. Proposed methods.

Once observer cruises in the fisheries have been located, observer data will be used to estimate incidental catch. These data and methods are standard elements of NMFS estimation procedures and are accessible by computer.A10 Once all incidental catch statistics have been compiled they will be reorganized to suit the projects goals: Species and groups that are caught incidentally to a major targeted fishery (e.g. Pacific Ocean perch in the hake-directed fishery; Greenland turbot in the pollock-directed fishery) will be identified. Discard rates and tonnage will be applied to incidence, using information described hereafter in sections 3 to 5, to derive an estimate of discarded fish biomass.

c. Usefulness of results to study discard phenomena.

The methods described above allow levels of incidence of a fish stock or species group to be traced through various fisheries. The information will be necessary as a baseline from which discard rates and total discards can be estimated using observer information on catch disposition, captains' logs, etc. It will also serve as an upper-limit estimate against which independent estimates of discards and discard rates can be compared.

3. INCIDENTAL CATCH DATA FOR PROHIBITED SPECIES.

a. Data types available.

A well-defined, comprehensive data set for incidental catches of Pacific halibut, salmon, and crab species is available and has been summarized in NMFS technical reports.

b. Proposed methods.

Incidental catch and incidence rates in numbers and weight summarized in NMFS reports and computer files can easily be reorganized to suit the project's goal.

c. Usefulness of results to study discard phenomena.

Since all prohibited species are supposed to be discarded, their incidental catch constitutes a known fraction of the total discard for any cruise, vessel class, statistical area or time stratum. These records give the most accurate and easiest identifiable discard catch information available.

4. INCIDENTAL CATCH AND DISCARD DATA FOR PACIFIC COAST HAKE FISHERY.

a. Data types available.

In the Pacific Coast foreign hake fishery, observers' as well as captains' fishing records report species-specific catch by haul, total daily catch and cargo transfers. Discard and disposition of catch are recorded by captains only. In the joint venture hake fishery, receipt logs are required to be maintained by

captains and observers. Captains must in addition record daily cargo transfers. Tables B-2 and B-3 illustrate the data foreign captains are required to record. The data show the portion of each species or species group discarded from trawls brought on deck. Data on joint venture incidental catch species have been summarized in NMFS technical reports.

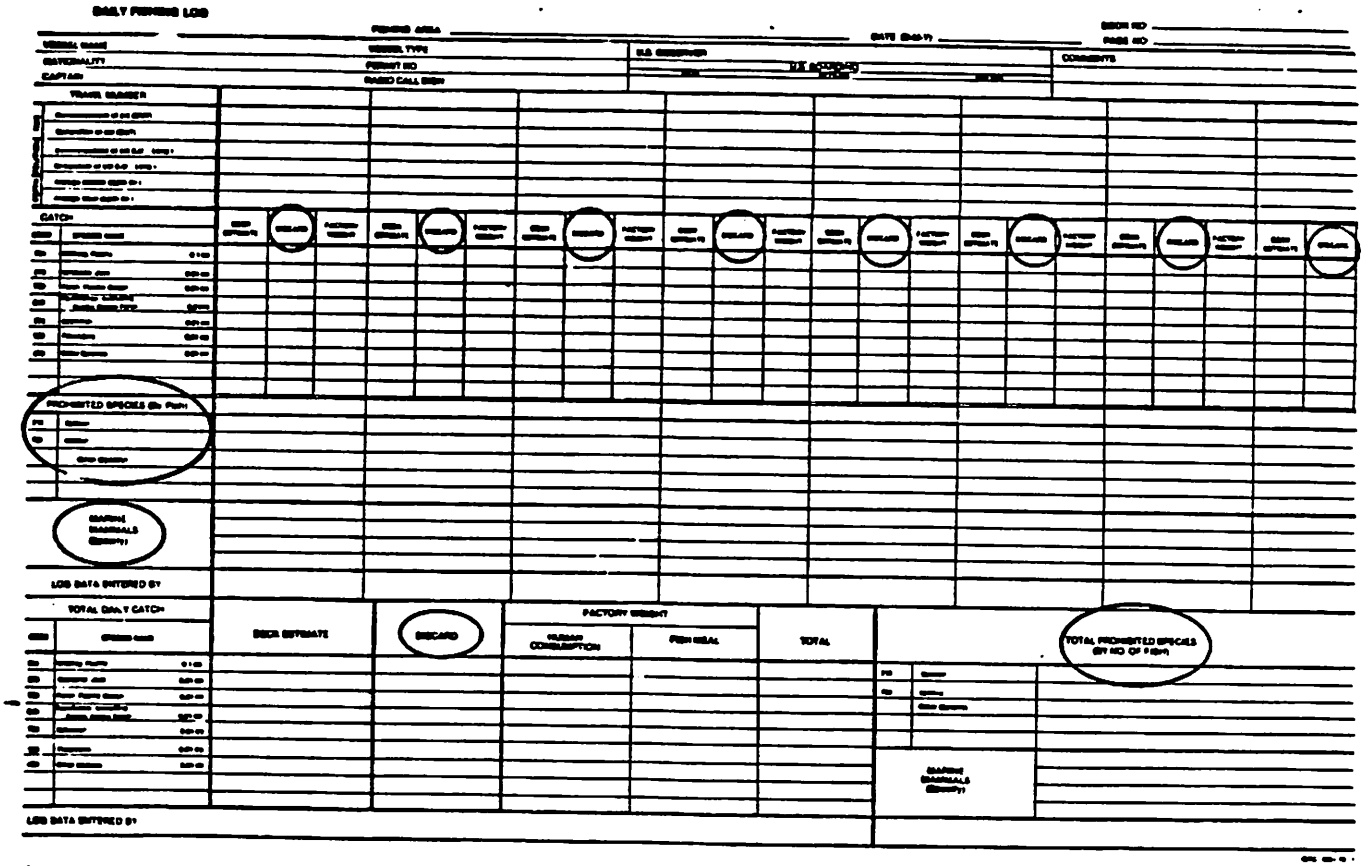
b. Proposed methods.

Methods for defining incidental species and summarizing incidental catch will be similar to those used for other incidental catch data (e.g., section 2). Information on discard in the joint venture operations is summarized in technical reports and will be reorganized to suit the project's goals. Where discard information has not been summarized, captains' records (log books, radio reports)[A10.5] and information from observers' reports (radio reports, summaries of catch, haul and species composition forms, written reports, product recovery rate reports) will be used and compared to obtain estimates of total discards and discard rates for both foreign fishing and foreign processing operations. The estimates will be optimized similar to NMFS' published procedures.[A11]

c. Usefulness of results to study discard phenomena.

This is the only data set where discard and discard rates can be estimated independently of incidental catch information. Besides compiling the data to

Table B-2. Information recorded by foreign ships' captains in the Washington-Oregon-California hake fishery: Daily Fishing Logs and Cargo Transfer Logs. Information on discards is circled.



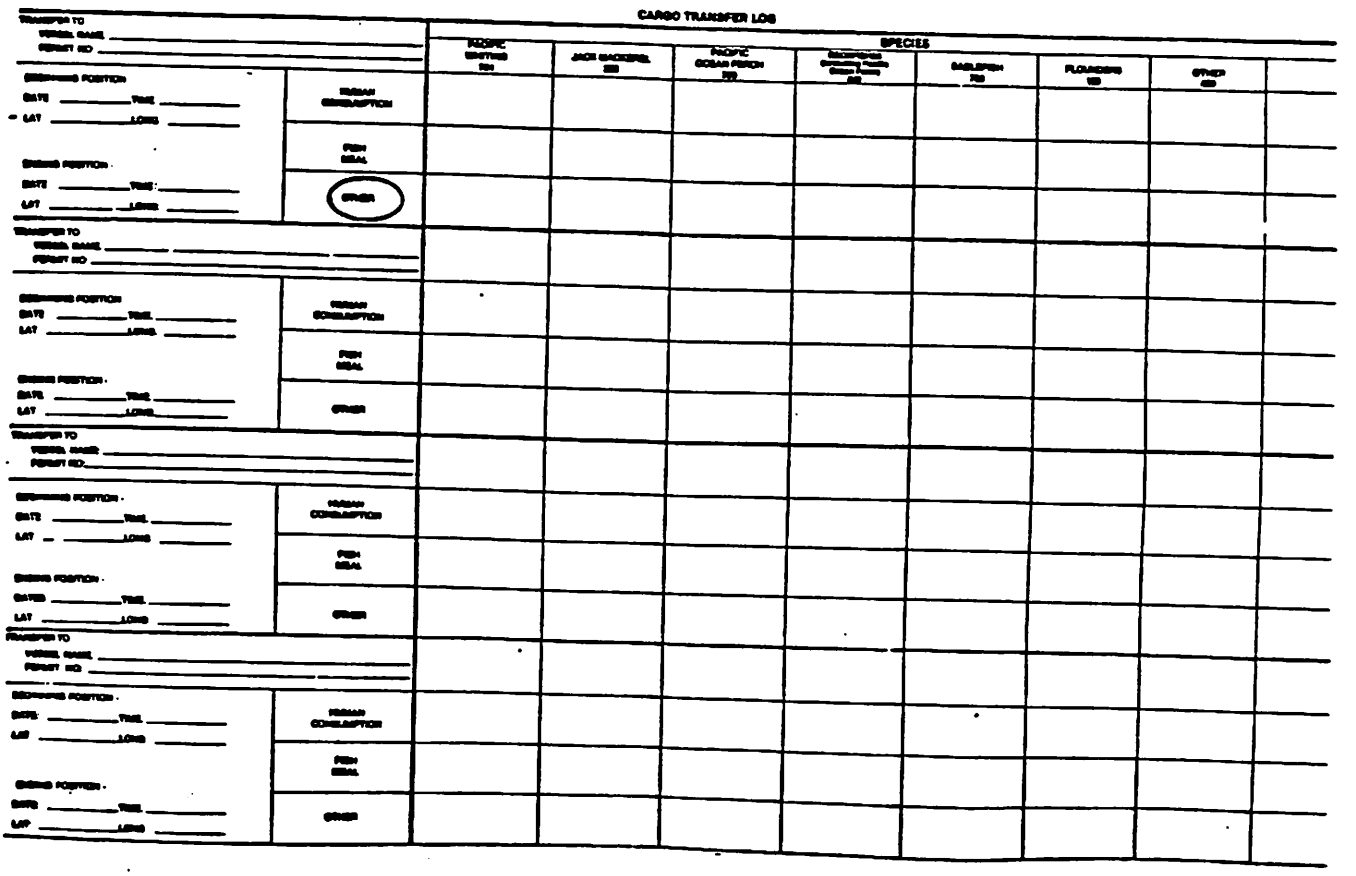
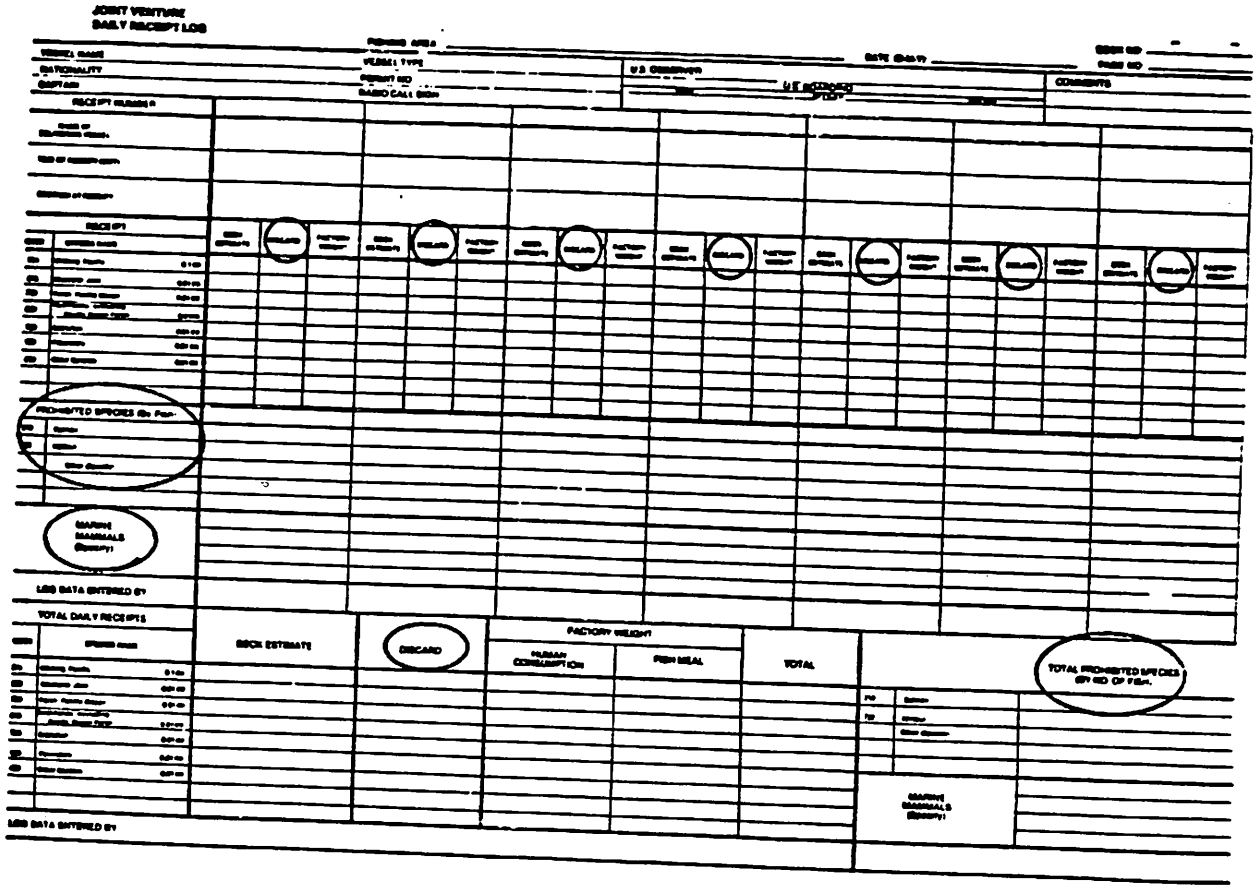
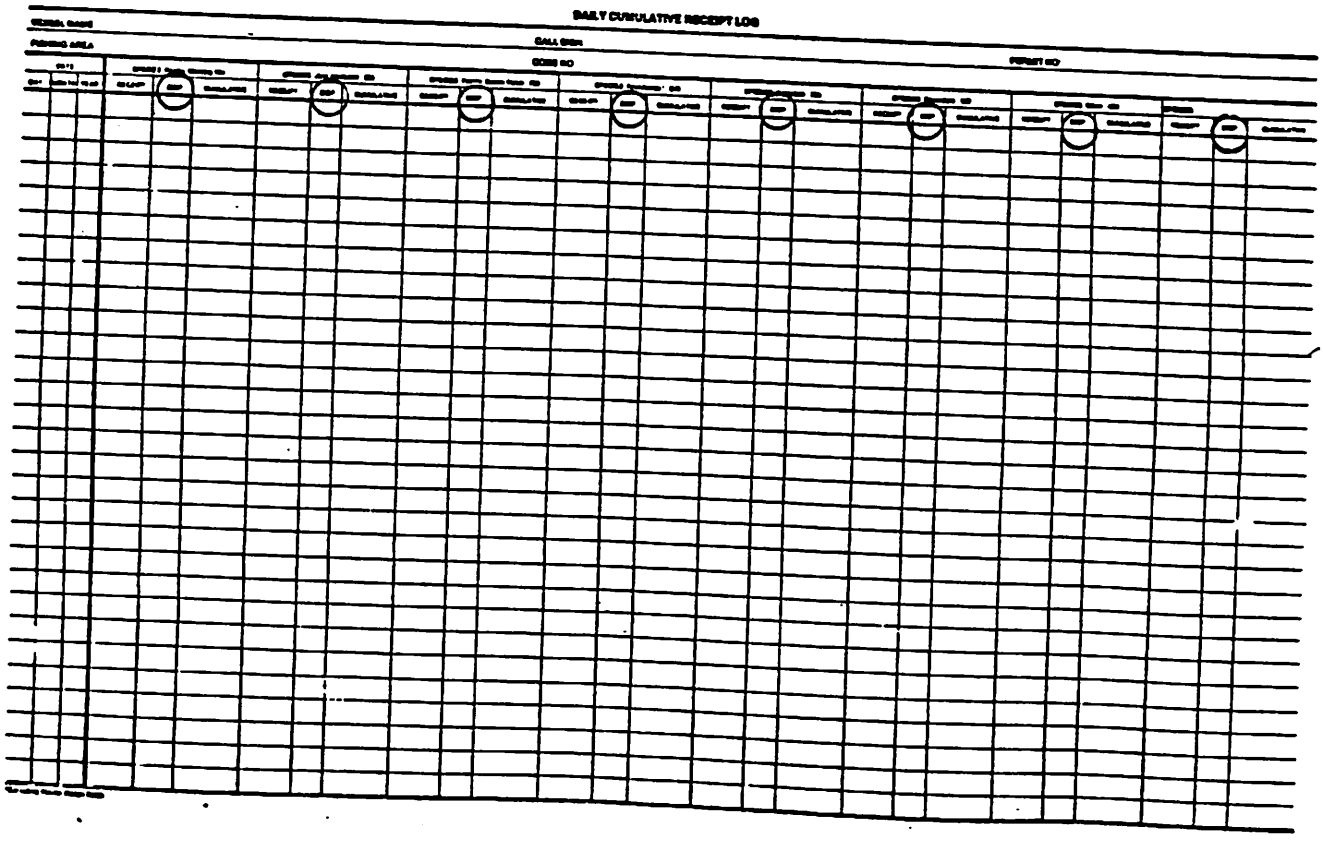



Table B-3. Information recorded by foreign processing ships' captains in the Washington-Oregon-California joint-venture hake fishery: Daily Receipt Logs and Cumulative Receipt Logs. Information on discards is circled.



obtain a summary of the magnitude of discard catch, we will compare incidence rates with discard rates to detect patterns and estimate a discard-to-incidental ratio for any species, vessel, and gear type. The results may be applied to other fisheries (i.e., Alaska and Bering Sea groundfish) where similar species or species groups (e.g., Pacific Ocean perch, rockfish) are incidentally caught, but only if fishing methods and gear types are similar.[A12]

5. PRODUCTION FIGURES.

a. Data types available.

Observers are required to complete Product Recovery Rate Reports, recording disposition of species or species groups, product types, product recovery rates, and discarded species for each cruise covered. The format has varied over the years, the current scheme being implemented in 1983 as is set out in Tables B-4 and B-5.

b. Proposed methods.

Observer-covered cruises for different vessel types will be identified. Observer summary reports on shipboard products and product recovery rates will be compared with observers' and captains' catch logs to obtain information about the species and species groups caught but not processed, and processing waste not utilized. Discards and discard rates can be estimated

Table B-4. Example of old observer shipboard product disposition records. Information useful for discard estimates is starred.

**Shipboard Products**

| | Species or group | Description of species product |
|---|---|---|
| 1. | Flatfish | headed, gutted, tail removed. |
| 2. | Roundfish | headed, gutted. |
| 3. | Rockfish | headed, gutted, spines trimmed. |
| 4. | Squid | tentacles and mantles separated. |
| 5. | | |
| 6. | | |

**How the various products were prepared :**

All processing was done by hand. Fish were sorted by size and species as they were removed from the belt and by size as they were put in freezer pans. Squid were cleaned by hand in salt water.

After placing the fish in pans a small amount of salt water was added prior to freezing. Frozen blocks of fish were dipped in water during the transfer from quick freezer to freezer hold.

**Type of freezers that were used :**

All freezers were ammonia cooled and built by My'Com Company. A shelf type freezer at -30°C compressed the fish into blocks as they were frozen.

The storage holds were kept at -20°C.

✳ **The species, species groups, or sizes of fish which were discarded and not utilized:**

Sizes discarded depended on who was sorting and whether or not the captain was watching.

Rat tails, snailfish, sculpins, poachers, other non-marketable animals and prohibited species were always discarded.

Table B-5. Example of Form 8, observer product recovery rate estimates.

FORM 8 PRODUCT RECOVERY RATES

Page 1 of 1

Cruise Number: 5 3 2 | Vessel Code: N S S 4 | Year: 8 4 | Month: 0 7 | Area: 5 2

| Species Name | Species Code | | | Description of Product | Product Code | H/M | Vessel Data: Percent Recovery | Vessel Data: Unit wt. to .1 kg | Observer Data: Percent Recovery | Observer Data: Unit wt to 1 kg |
|---|---|---|---|---|---|---|---|---|---|---|
| | 14 | 15 | 16 | | 17 18 | 19 | 20 21 22 | 24 – 27 | 28 29 30 | 32 – 35 |
| Pollock | 2 | 0 | 1 | Surimi | 36 | M | .25 | 10.0 | . | . |
| ↓ | | | | " | 36 | M | .34 | 10.0 | . | . |
| ↓ (large fish) | | ↓ | | dorsal fillets | 30 | H | .65 | 15.0 | . | . |
| Pollock (large fish | 2 | 0 | 1 | skinless fillets | 32 | H | .40 | ↓ | . | . |
| Pacific Cod | 2 | 0 | 2 | headed & gutted | 13 | M | .50 | | .54 | 15.4 |
| ↓ | | ↓ | | " " | 13 | M | .60 | | .60 | . |
| Pacific Cod | 2 | 0 | 2 | fillet-skin on one side | 31 | H | .43 | | . | . |
| Pacific Ocean Perch | 3 | 0 | 1 | headed & gutted | 13 | | .60 | | . | . |
| Harlequin Rockfish | 3 | 2 | 3 | " " | ↓ | | .62 | | .65 | . |
| Sharpchin Rockfish | 3 | 0 | 4 | " " | ↓ | | .62 | | . | . |
| Other Rockfish | 3 | 0 | 0 | " " | 13 | ↓ | .60 | | . | . |
| Sablefish | 2 | 0 | 3 | headed & gutted with pect. girdle | 15 | H | .70 | | .70 | 14.8 |
| Atka Mackerel | 2 | 0 | 4 | frozen whole | 10 | H | 1.00 | | . | . |
| Greenland Turbot | 1 | 0 | 2 | headed & gutted | 13 | H | .55 | | .59 | 15.1 |
| Flathead Sole | 1 | 0 | 3 | frozen whole | 10 | H | 1.00 | | . | . |
| Other flatfish | 1 | 0 | 0 | headed & gutted | 13 | H | .70 | | . | . |
| Octopus | | 6 | 0 | gutted | 51 | | .80 | | . | . |
| Squid | | 5 | 0 | mantles | 52 | | .50 | | . | . |
| " | | 5 | 0 | tentacles | 53 | ↓ | .30 | ↓ | . | . |
| All skates | | 9 | 0 | skate wings | 26 | H | .30 | 15.0 | .42 | . |
| All other fish & waste | 9 | 0 | 1 | fish meal | 40 | M | .20 | 20.0 | . | . |
| All other fish & waste | 9 | 0 | 1 | fish oil | 41 | M | .05 | . | . | . |
| | | | | | | | . | . | . | . |
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| | | | | | | | . | . | . | . |

Comments: The ship provided a range of figures for surimi and headed, gutted Pacific Cod, so only the high and low values are entered here. A rotary saw was sometimes used for heading the turbot as well as the cod, but cutting by hand was more common. Observer recovery figures were based on approx. 70 kg of each species (whole wt) and the unit weight was based on 15 trays of each species.

assuming all non-processed and unutilized processing wastes are discarded. This assumption will be checked, and information will be supplemented with interviews of observers during debriefing. Corrections will be applied, if necessary. Estimates will be compared within and between vessel types to identify discard patterns.[A13]

c. Usefulness of results to study discard phenomena. These results will be the least accurate and most biased discard estimates of all. This data set will yield some incomplete and anecdotal results. There will be large variations between individual cruises, and it may not be possible to establish accurate vessel-type discard patterns. The method relies on assumptions that are accurate only in a limited number of applications.[A14] Nevertheless, the data are most valuable, because they represent the only ones currently available for obtaining basic information on discards and discard rates in any of the Gulf of Alaska and Bering Sea groundfish fisheries.[A15]

6. SUPPLEMENTAL PROPOSAL FOR GENERATING MORE RELIABLE DISCARD DATA: DIRECT STUDY OF DISCARDS AS AN OBSERVER SPECIAL PROJECT.

Observer special projects are currently used in the Pacific Coast hake fishery and Gulf of Maine bottom fishery to examine discard practices and estimate discard rates in

domestic and joint venture fishing operation.[A16] We propose to develop, in cooperation with NMFS, the scope, methods and analytical procedures for a similar special project in the Gulf of Alaska or Bering Sea bottom fishery, where discard data aside from prohibited species are sparse. This observer project could take place on one or more cruises in instances where more than one observer is present on a vessel, and would result in accurate log book data on trawl composition and catch disposition, currently unavailable, being obtained.

Discard estimates obtained from this project can be compared to less reliable estimates from other data sets and could initiate a process that would implement sound investigative and regulatory methods designed to integrate, rather than ignore, catch discards into multispecies-based fishery management.

# APPENDIX B

## Part 2

## FOREIGN AND JOINT VENTURE FISHERIES MANDATORY DATA RECORDING AND REPORTING REQUIREMENTS

In addition to direct data from the foreign fishery observer program (described in Part 1), certain information is compiled by foreign vessel captains and their countries taking fishes in U.S. waters. This information can be used (also noted in Part 1) to supplement and test the accuracy of the observer data.

Captains' daily and weekly log requirements and cumulative reporting by vessels and their country of origin are set out in general at 50 Code of Federal Regulations (C.F.R.) § 611.9 (1984). This section is subject to amendment as set out in NMFS's proposed rules published December 26, 1984.[A17] Comments have been received and the final rule is expected to be released in May 1985, to become effective, at least in part, in July 1985. For the purpose of our proposal, we have described what should be available under the current regime. When the revised rule goes into effect, more detailed information should become on record.

Information contained in captains' logs is confidential. We assume that we can obtain those records without violating that confidentially.

## A. GENERAL REPORTING REQUIREMENTS

50 C.F.R. Part 611 establishes data reporting requirements at section 611.9. These general rules are subject to refinement, being waived or added to by the NMFS regional offices that correlate the data. They are then available to be used to establish quotas, seasons and area closures. However, with 100% observer coverage of direct foreign and joint venture fisheries, little reliance now appears to be placed on these data.[A18] A survey of the various sections indicates that following information as required by section 611.9 should be available to assist in assessing discard catch:

1. Daily Cumulative Log[A19]
   a. For all species with foreign allocations, a daily record in metric tons (round weight) and catch disposition (for human consumption, fishmeal or discarded) must be kept.
   b. For some species for which retention is prohibited[A20], numbers (not weights) caught and discarded must be recorded.
      (1) Salmonids - in Pacific Coast, Gulf of Alaska, and Bering Sea and Aleutian Islands groundfish fisheries.
      (2) Halibut - same locations as salmonids.
      (3) Dungeness crab - only in the Pacific Coast groundfish fishery.

c. While these logs must be kept, the regulations do not require them to be submitted. Under the regulations empowering the Assistant Adminstrator of NOAA for Fisheries to require any additional information necessary, these records could be requested.[A21] In lieu of submission, records are always subject to being made available for inspection.[A22]

2. Weekly Foreign Catch Reports.[A23]

a. These provide weight of allocated species caught and weight of receipts of U.S. harvested fish by foreign processors in joint ventures. Disposition is not provided, but discards are repored in the joint venture foreign captains' reports of the Pacific Coast hake fishery.

b. In the trawl fisheries of Washington, Oregon and California, the Gulf of Alaska, the Bering Sea and the Aleutian Islands, reports must include numbers of salmon and halibut caught.

c. Weekly report of marine mammals caught (species, numbers, but not weight) including the nature of the capture and the life-status of the animal.

## B. REGIONAL ADDITIONS OR DELETIONS

Regionally, regulations found at 50 C.F.R. §§ 611.50-611.94 appear to make the following record keeping and reporting requirement changes or additions to the general rules discussed above:

1. In the Northwest Atlantic fisheries, maintenance of a continuous set-by-set fishing log requires recording of weights for all fish caught and their disposition (this should therefore include all prohibited species). This record is not required to be submitted. Quarterly reports give all weight of each of species taken even if discarded.[A24]

2. In the Alantic, Carribean and Gulf of Mexico fisheries, the numbers of all prohibited species must be recorded as well as the number of those which were alive when released. These numbers are compiled weekly and reported quarterly.[A25]

3. In the Pacific Coast groundfish joint venture fishery, the daily cumulative receipt log requires weight of all species received to be reported; foreign processors must report weekly the weight of discard by species. An annual report giving total weights of allocated species and numbers of the three prohibited species (salmon, halibut, Dungeness crab) must be submitted.[A26]

4. In the Western Pacific seamount groundfish fishery weight of all catch by species is required to be submitted.[A27]

5. In the Western Pacific billfish, oceanic sharks, wahoo and mahimahi fishery, a quarterly report must list the numbers of each species released alive.[A28]

6. In the North Pacific Ocean and Bering Sea region catcher boats do not have to report cumulative catch, weekly catch and marine mammal catch if they deliver to a processor ship that does.[A29]

7. In the Gulf of Alaska and Bering Sea groundfish fishery, no record is kept of "nonspecified species" caught unless they are retained. An annual report is required listing catch weight for a number of species, and weight by species for any fish taken in excess of 1,000 metric tons.[A30]

8. In the Bering Sea and Aleutian Islands groundfish fishery it appears that in addition to salmon and halibut, records of the prohibited species Pacific herring (by weight)[A31] must be kept. King and Tanner crab catches must be submitted with the foreign captains' annual reports.[A32] The annual reports include figures for total catch and effort, but not disposition.[A33]

## FOOTNOTES FOR APPENDICES

A1. Regulations governing the foreign fishery observer program are set out at 50 C.R.F. §611.8 (1984).

A1.5. R. French, R. Nelson Jr. & J. Wall. "Summary of Observer Data obtained from the Bering Sea/Aleutian Island Region 1977-79," in Reducing the Incidental Catch of Prohibited Species by Foreign Groundfish Fisheries in the Bering Sea, 8-39 (North Pacific Fishery Management Council Document #13, 1981) [hereinafter cited as Council Doc. #13].

A2. R. French, R. Nelson Jr., J. Wall & B. Gibbs. "Description of the Groundfish and Prohibited Species Data Base," in Council Doc. #13, supra note A1, at 41-46.

A3. French, Nelson & Wall supra note A1, at 8, 12.

A4. Interview with J. Wall, Fisheries Biologist, Northwest and Alaska Fisheries Center (hereinafter cited as NAFC), National Marine Fisheries Service, NOAA, Seattle, Wash. (April 5, 1985).

A5. Recording and reporting information required of foreign vessels and countries is discussed in detail in Appendix B, Part II.

A6. Domestic fisheries may also be included, but only if fishing methods by domestic fishers are similar to joint venture or foreign fishing practices. This is rarely the case. Occasionally, observers have covered domestic fisheries (e.g., Alaska Department of Fish and Game Domestic Observer Program). Where possible, these data will be included in

the proposed analyses. Letter from K.A. King, Resource Management Specialist, Fisheries Mangement Division, Northwest Regional Office, National Marine Fisheries Service, NOAA, Seattle, Wash. to Eugene C. Bricklemyer (May 5, 1985); Interview with J. Wall (May 21, 1985).

A7. French, Nelson & Wall, supra note A1, at 13.

A8. R. Nelson Jr., R. French & J. Wall, Summary of U.S. observer sampling of foreign fishing vessels in the Bering Sea/Aleutians Islands Region, 1979, NAFC (1980) (INPFC Doc. 2336, unpubl. manuscript). Similar documents are available for years 1977, 1978 and 1980 to present, for both foreign and joint venture fisheries. Document titles vary from year to year. Available from J. Wall, NAFC.

A9. Interview with K.A. King (April 5, 1985). French, Nelson, Wall & Gibbs, supra note A2, at 44. The data base may have been expanded in recent years.

A10. Inspected during an interview with J. Wall, (Feb. 22, 1985).

A10.5. Foreign captains' vessels' and countries' information is considered confidential. The project assumes that we can obtain that data in a form that will not infringe upon that confidentiality.

A11. French, Nelson & Wall, supra note A1, at 13.

A12. Limitations to this method arise from two sources:

(i) Vessel to vessel variations on discards may be too great to justify application of results to other vessels and fishing operations.

(ii) Not all discards are reported. Trawls that are never brought on deck, but are discarded remain unrecorded. Leakage and spillage of fish from the net before it is hauled on deck may be significant, and a substantial fraction of hake itself may be discarded.

A13. Another method uses trawl-weight estimates. The observer is required to estimate the weight of each haul sampled. A few observers (e.g., P. Munro, School of Fisheries, Univ. of Washington) have made this estimate by back-calculating from the vessel's production records, using mean product recovery rates and that trawls catch composition. The production figures used in this method indicate species, groups and quantities going into the hold, and thus what gets discarded. We propose to allocate some minor effort to search observer summary reports to identify trips where trawl weight estimates were made by back-calculation. Observer and captain's log books from trips identified above can then be searched to find production reports and corresponding haul numbers to identify species and, where possible, weight per species retained. Catch composition and mean species weights for each haul can then be applied to the identified species to determine numbers and weight of discarded species, assuming all non-processed species were

discarded. This method will produce trawl-based discard information similar to, but more detailed than results from the cruise-based shipboard product report data.

A14. These assumptions include:

(1) For each species with a product report, it is assumed that no discarding occurred, unless specially reported. That is, if a vessel processed any individuals in a haul, then it processed all individuals. If this assumption is erroneous, it will lead to overestimation of discard of nonutilized species and gross underestimation of discard of utilized species.

(2) The product recovery rate for each species is periodically estimated. It is only made once and it is not modified as fishing conditions change. Error in this estimate will lead to bias is discard estimates; the nature of this bias will likely not be discernable.

A15. Similar data, using more or less anecdotal information, have been used successfully to estimate world-wide discard catch in various marine fisheries [S.B. Saila, "Importance and Assessment of Discards in Commercial Fisheries," FAO Fisheries Circular #765 (1983)]. That document provided a catalyst for launching more detailed discard studies elsewhere. Id.

A16. W.H. Howell & R.J. Langan, Discards of Commercial Fish Species from the Gulf of Maine Groundfish and Shrimp Fisheries (U. of New Hampshire/U. of Maine Sea Grant College

discarded. This method will produce trawl-based discard information similar to, but more detailed than results from the cruise-based shipboard product report data.

A14. These assumptions include:

(1) For each species with a product report, it is assumed that no discarding occurred, unless specially reported. That is, if a vessel processed any individuals in a haul, then it processed all individuals. If this assumption is erroneous, it will lead to overestimation of discard of nonutilized species and gross underestimation of discard of utilized species.

(2) The product recovery rate for each species is periodically estimated. It is only made once and it is not modified as fishing conditions change. Error in this estimate will lead to bias is discard estimates; the nature of this bias will likely not be discernable.

A15. Similar data, using more or less anecdotal information, have been used successfully to estimate world-wide discard catch in various marine fisheries [S.B. Saila, "Importance and Assessment of Discards in Commercial Fisheries," FAO Fisheries Circular #765 (1983)]. That document provided a catalyst for launching more detailed discard studies elsewhere. Id.

A16. W.H. Howell & R.J. Langan, Discards of Commercial Fish Species from the Gulf of Maine Groundfish and Shrimp Fisheries (U. of New Hampshire/U. of Maine Sea Grant College

Program Project, initiated 1 January 1985). E.K. Pikitch, S. Hanna, R.C. Francis, J.T. Golden, & R.L. Demory, Biological Risks and Economic Consequences of Alternative Management Strategies (Oregon State University, Pacific Fisheries Management Council Observer Program Special Project and Sea Grant, College Program Project, in progress 1985). R. Langan & W.H. Howell, "Commercial Trawler Discards of Four Flounder Species in the Gulf of Maine," (manuscript U. of New Hampshire Marine Program Series -- UNH-MP-JR-84-7, 1984).

A17. 49 Fed. Reg. S0498 (1984).

A18. Wall interview, supra, note A4.

A19. 50 C.F.R. § 611.9(d)(1984).

A20. Prohibited species are generally defined as any species for which there is no allocation, or any species taken in excess of an allocation, i.e., any species which the vessel is not specifically authorized to retain. 50 C.F.R. § 611.2(bb)(1984).

A21. 50 C.F.R. § 611.9(h)(1984).

A22. 50 C.F.R. § 611.9(i)(1984).

A23. 50 C.F.R. § 611.9(e),(f),(g)(1984).

A24. 50 C.F.R. § 611.50(e)(1984).

A25. 50 C.F.R. § 611.61(e)(1984).

A26. 50 C.F.R. § 611.70(j)(1984).

A27. 50 C.F.R. § 611.80(f)(1984).

A28. 50 C.F.R. § 611.81(e) (1984).

A29. 50 C.F.R. § 611.90(e)(1984).

A30. 50 C.F.R. § 611.92(h)(1984).

A31. 50 C.F.R. § 611.93(d)(2)(1984).

A32. 50 C.F.R. § 611.93(c)(2)1984.

A33. 50 C.F.R. § 611.93(d)(1984).

# APPENDIX C

## BUDGET

YEAR 1
June 1, 1985 to May 31, 1986

| | | |
|---|---|---|
| **Salaries** | | |
| Staff | | |
| (EB) 12 mo (1/2) (Law Stipend) | $ 24,000 | |
| (HH) 12 mo (1/4) | 6,414 | |
| | $ 30,414 | |
| Students | | |
| (DG) 12 mo. (1/4) | 6,138 | |
| (KM) 12 mo. (1/4) | 5,532 | |
| (PM) 12 mo. (1/4) | 5,448 | |
| | 17,118 | |
| Total Salaries | | $ 47,532 |
| **Consultants** | | |
| (SW) 6 mo. | 5,000 | |
| (MG) 6 mo. | 5,000 | |
| Total Consultants | | 10,000 |
| **Benefits** | | 3,327 |
| **Travel** | | 2,500 |
| **Supplies** | | 4,000 |
| **Other Direct Costs** | | |
| Computer Time | 2,000 | |
| Cost Center | 2,860 | |
| Total other direct costs | | 4,860 |
| TOTAL DIRECT COSTS | | $ 72,369 |
| Indirect costs (43% of total direct costs) | | 20,799 |
| TOTAL BUDGET YEAR 1 | | $ 93,168 |

YEAR 2
June 1, 1986 to May 3, 1987

| | | |
|---|---|---|
| **Salaries** | | |
| Staff | | |
| (EB) 12 mo. (1/2) (Law Stipend) | $ 24,000 | |
| (HH) 12 mo. (1/4) | 6,414 | |
| | 30,414 | |
| Students | | |
| (DG) 12 mo. (1/4) | 6,138 | |
| (KM) 12 mo. (1/4) | 5,532 | |
| | 11,670 | |
| Total Salaries | | $ 42,084 |
| Consultants | | |
| (MG) 6 mo. | | 5,000 |
| Benefits | | 2,946 |
| Travel | | 500 |
| Supplies | | 2,500 |
| Other Direct Costs | | |
| Computer Time | 1,000 | |
| Cost Center | 2,265 | |
| Total other costs | | 3,265 |
| TOTAL DIRECT COSTS | | $ 56,295 |
| Indirect Costs (43% of total direct costs) | | 13,887 |
| TOTAL BUDGET YEAR 2 | | $ 70,182 |
| TOTAL BUDGET YEARS 1 and 2 | | $163,350 |

APPENDIX D

## DISCARD CATCH PROJECT PERSONNEL AND ADVISORY BOARD

| NAME | DEGREES (INSTITUTION) | PROJECT ROLE | UW OR OTHER AFFILIATION |
|---|---|---|---|
| Eugene C. Bricklemyer<br>Environmental Attorney | B.A., Geography (UNC); J.D.(UNC); LL.M., Law & Marine Affairs (UW) | Principal Investigator | Senior Fellow, Law<br>Visiting Attorney, Fisheries |
| Hans J. Hartmann<br>Biological Oceanographer | B.S., Biology (Ludwig Maximilian); M.S., Oceanography (UW); Ph.D. Candidate, Fisheries (UW) | Co-Investigator:<br>Scientific Data;<br>Ecological Effects | Staff Oceanographer III |
| Dan Grosse<br>Fisheries Biologist | B.S., Natural Resources (U. Michigan); M.S., Fisheries (UW); pursuing Ph.D., Fisheries (UW) | Pacific Hake: Marine Policy | Research Assistant II |
| Kathleen Matthews<br>Fisheries Biologist | B.A., Zoology (UC Santa Barbara); M.A., Fisheries (San Jose State.); pursuing Ph.D., Fisheries (UW) | Groundfish; Dall's Porpoise; Seabirds | Research Assistant I |
| Susan Wade<br>Marine Policy Analyst | B.A., History (U Portland); M.M.A., Marine Studies (UW) | Fishery Management Plan Analysis | Policy Consultant |
| Xan Augerot<br>Marine Economist | B.A., Economics (UW); pursuing M.M.A., Marine Studies (UW) | Economic and Sociological Impacts | Research Assistant I |
| Peter Munro<br>Biostatistician | B.A., Zoology (UW); M.S. candidate, Fisheries (UW) | Population Dynamics; Observer Program Analysis | Biologist I |
| Susan Bishop<br>Fisheries Biologist | B.S., Marine Science (U. Miami); pursuing M.S., Fisheries (UW) | Population Dynamics; Salmon | Research Assistant I |
| Donald E. Bevan | | Advisor | Professor and Director, School of Fisheries; Professor, Institute for Marine Studies, UW |
| William T. Burke | | Advisor | Professor, School of Law; Professor, Institute for Marine Studies, UW |
| Douglas G. Chapman | | Advisor | Professor and Dean Emeritus, School of Fisheries and Center for Quantitative Science, UW |
| Warren J. Wooster | | Advisor | Professor, Institute for Marine Studies; Professor, School of Fisheries, UW |
| Louie S. Echols | | Advisor | Director, Washington Sea Grant Program, UW |
| John R. Clark | | Advisor | International Affairs<br>National Park Service<br>U.S. Department of the Interior<br>Washington, D.C. |

# RESUME


NAME: Eugene C. Bricklemyer, Jr.

ADDRESS: Oceanography Barge WH-10
University of Washington
Seattle, Washington 98195
206/543-0295


PROFESSION: Attorney
Admitted in South Carolina

EMPLOYMENT EXPERIENCE:

| | |
|---|---|
| 1984 to date | Senior Fellow, School of Law, Visiting Scholar, School of Fisheries, University of Washington, Seattle, WA |
| 1982 - 1984 | Research Associate Professor: School of Law, University of Mississippi, Oxford, MS |
| 1980 - 1982 | Managing Director: The Center for Lowcountry Environments, Charleston, SC |
| 1980 | Special Counsel: Washington State Energy Facility Site Evaluation Council, Olympia, WA |
| 1979 - 1984 | Counsel: Graber, Baldwin & Fairbanks, Beaufort, SC |
| 1978 | Attorney Advisor: Marine Mammal Commission, Washington, DC |
| 1977 - 1978 | Research Assistant: Institute for Marine Studies, University of Washington, Seattle, WA |
| 1973 - 1977 | Sole Practitioner: Charleston, SC |
| 1970 - 1973 | Associate: Buist, Moore, Smythe & McGee, Charleston, SC |
| 1969 - 1970 | Research Assistant: Institute of Government, Chapel Hill, NC |
| 1965 - 1967 | Teaching Fellow: Department of Geography, University of Michigan, Ann Arbor, MI |

LEGAL EDUCATION:

University of Washington School of Law
Seattle, Washington, 1977 - 1978.
Master of Laws in Marine Affairs.
Top 10 percent of class of 1978.

University of North Carolina School of Law
Chapel Hill, North Carolina, 1967 - 1970.
Juris Doctor
Top 16 percent of class of 1970.
Recognition: Moot Court Certificate winner and Bench member; Book Awards for Constitutional Law, Criminal Law, Corporations and Uniform Commercial Code (Sales); Bureau of National Affairs/Faculty Scholastic Achievement Award.

GRADUATE EDUCATION:

University of Michigan
Ann Arbor, Michigan, 1965 - 1967.
No degree (Ph.D. Candidate in Geography/Asian Studies).
Recognition: National Defense Education Act and University Teaching Fellowships.

UNDERGRADUATE EDUCATION:

University of North Carolina
Chapel Hill, North Carolina, 1961 - 1965.
Bachelor of Arts in Geography.
Top 11 percent of class of 1965.
Recognition: Dean's List, Student Scholarship and Student Legislature.

Georgia Institute of Technology
Atlanta, Georgia, 1960 - 1961.
No degree (B.S. Candidate in Chemical Engineering).
Recognition: Cooperative program of study in chemical engineering.

REFERENCES: See attachment.

DETAILED WORK EXPERIENCE:

October 1984 to date

Senior Fellow, School of Law, and Visiting Scholar, School of Fisheries, University of Washington, Seattle, Washington.
As a scholar visiting at the University, director of a joint School of Law/School of Fisheries project to ascertain the level of magnitude in terms of biomass and to determine the species, ecosystemic, social, economic and legal implications of discard catch occurring in U.S. commercial marine fisheries, and thereafter to make recommendations in order to reduce or eliminate the losses resulting from this practice.

Continuing private practice includes the following activities:
Of Counsel, Legal Environmental Assistance Foundation, Tallahassee, Florida.
Providing legal advice and assistance to regional, public interest law firm's offices in Knoxville, Atlanta, Montgomery and Tallahassee, especially as related to matters involving aquatic ecosystems.
Legal Counsel, Habitronics Centre for Ocean Space Exploration, Seattle, Washington. General corporate duties for nonprofit, long range ocean planning organization, working as well in development of master plan for establishment of an International Ocean Center on Seattle's waterfront and as project leader for Habitronics' proposal to designate the San Juan Island Archipelago as a National Marine Sanctuary.
Other representative clients include The Center for Lowcountry Environments, the Center for Environmental Education, the Seal and Sea Turtle Rescue Funds. Typical cases involve working for the establishment of critical habitat for the endangered Hawaiian monk seal, and for three species of beach mice resident in primary dune communities in western Florida and eastern Alabama; monitoring the possibility of application for transfer of authority for marine mammal management in state waters from the federal government to Alaska; monitoring of the status of Dall's porpoise incidental takings by the Japanese drift, gillnet salmon fishery and determination of mechanisms to reduce level of kills.

November 1982 through August 1984

Research Associate Professor, School of Law, University of Mississippi, Oxford, Mississippi.
Responsible for developing a national perspectives program of research and writing on the legal issues associated with man's use of oceanic, coastal and aquatic ecosystems and developing course work which would increase the role of the law school in the study of environmental management methodology; and for teaching introductory and advanced courses in marine and environmental law and policy. From November 1982 through June 1984 served as the director of the Mississippi-Alabama Sea Grant Legal Program, a program that provides policy and legal advice to natural resource agencies in Mississippi and Alabama and assists marine resource users on questions of law involving coastal, marine and environmental issues. Managed staff of two junior attorneys, ten to twelve law student research associates, two undergraduate students and a secretary/administrator.

Consultant, Aquatic Resource Conservation Consultants, Oxford, Mississippi.
Advisor to industry, environmental organizations, private individuals and the legal community, performing analysis and interpretation of the application and

impact of international, federal, state, and local laws, regulations and ordinances which relate to the use and conservation of living and non-living natural resources. Representative clients included Deyten Shipyards, the Center for Environmental Education, National Audubon Society, The Center for Lowcountry Environments, the National Wildlife Federation, the Sierra Club and its Legal Defense Fund, the Legal Environmental Assistance Foundation and attorneys in private practice.

November 1980 through December 1982

Managing Director, The Center for Lowcountry Environments, Charleston, South Carolina.
Coordinated activities of the Center, a public, nonprofit, conservation organization concentrating on aquatic issues in the South, raised funds and selected and directed TCLE's college student intern program. Representative projects included: being the lead organization in obtaining after five years, an Environmental Impact Statement relative to the siting of a 30,000 bpd oil refinery in an almost pristine South Carolina estuary utilized by more than 20 federally listed, threatened or endangered species, ultimately leading to a denial of permits by the Corps of Engineers Regional Office and by several state agencies; seeking to insure that a proposal to drain and log a 1,500 acre mature cypress and tupelo swamp adjacent to a major South Carolina river was done in a manner that assured minimum wetland degradation and maximum regeneration with similar plant species; working with other conservationists and the shrimp industry to show the efficacy of using an excluder device to prevent incidental capture and drowning of marine turtles by trawl gear; sponsoring a turtle nesting success and stranding survey, and a predation control effort on a South Carolina barrier island; formally petitioning a South Carolina agency to require it to prevent non-point source pollution of estuaries resulting from poor agricultural chemical applications on adjacent lowlands; and being the lead organization preparing a nomination proposal to designate Port Royal Sound as a National Marine Sanctuary, resulting in Port Royal Sound's being placed on NOAA's final Site Evaluation List as a possible sanctuary candidate.

Sole Practitioner, Charleston, South Carolina.
Maintained an exclusively environmental law practice in which representative clients included: the National Audubon Society; the Conservation Foundation; the Whale, Seal and Sea Turtle Rescue Funds of the Center for Environmental Education; and the City of Angoon, Admiralty Island, Alaska, for which I was Special Counsel for Environmental Affairs.

January 1980 through October 1980

Special Counsel, Washington State Energy Facility Site Evaluation Council, Olympia, Washington.
Senior staff attorney to Administrative Law Judge and Council (a one-stop siting body) in the hearing of application of Northern Tier Pipeline Company of Montana for the location of a deepwater, supertanker oil port at Port Angeles, Washington, and for the emplacement of a 42" common carrier crude oil pipeline running from that point, under Puget Sound, and through the state (the line terminating at Clearbrook, Minnesota). Duties included: legal advice to Administrative Law Judge and Council on procedure and substance of contested case; providing

continuing analysis of certain specific portions of the application including the design, construction, operation and related environmental impacts (e.g., on air and water quality, marine mammal and endangered species, and coastal zone) of the submarine and terrestrial pipeline.

January 1979 through September 1984

Counsel, Graber, Baldwin & Fairbanks, Beaufort, South Carolina.
Assisted C. Scott Graber, nationally recognized expert in use problems associated with multiple-ownership descendants' land ("heirs property"), and advised the firm on environmental, historic preservation, constitutional and immigration law matters.

July 1978 through December 1978

Attorney Advisor to Executive Director, Marine Mammal Commission, Washington, D.C.
Revised, supplemented and updated an assessment of all federal laws relating to marine mammal habitat protection through acquisition and regulation; worked on problems associated with conservation of harbor and elephant seal habitat at Point Reyes National Seashore, California; studied endangered Hawaiian monk seal/spiny lobster fishery interactions in the Leeward Islands; investigated Florida manatee survival options.

September 1977 through July 1978

Research Assistant, Institute for Marine Studies, University of Washington, Seattle, Washington.
Major research activities, under the direction of Director Donald L. McKernan, Dean Douglas G. Chapman and Professor William T. Burke, included the following: an ascertainment of the impact of the Marine Mammal Protection Act upon commercial fishery resources of the North Pacific; and the preparation of a multidisciplinary study of the legal, biological, economic and cultural aspects of the native Alaskan harvest of the endangered and depleted bowhead whale. Other areas of focused study involved: assessment of the ongoing program to reduce incidental porpoise kills in the tuna fishery; legal and environmental responses to the impacts of hydrocarbon exploration, extraction and transportation on the marine environment; conservation questions raised by the incidental kill of marine turtles due to shrimp fishing operations; preservation prospects of barrier islands of the south-eastern U.S.; benefits and detriments of limited entry as a fishery management tool; problems associated with the development of federally mandated ecosystem management techniques for marine resources.

February 1973 through August 1977

Sole Practitioner, Charleston, South Carolina.
Engaged in a general business practice which included work in the areas of constitutional, educational and products liability law, and the representation of an OEO (now CSA) funded venture capital corporation in Appalachia. Active involvement in environmental and land use matters included: co-counsel for the South Carolina Coastal Preservation Society which, with the Environmental Defense Fund, halted the building of a bridge to, and the subsequent development of, St. Phillips

Island, an unspoiled South Carolina barrier formation; preparation of a study entitled Certain Legal Implications of Selected Beach Process Management Activities as Related to Subsequent Erosion of Adjacent Shore-front Property; and counsel for and Vice President of the Preservation Society of Charleston, which effort resulted in the saving of two antebellum structures.

August 1970 through January 1973

Associate, Buist, Moore, Smythe & McGee, Charleston, South Carolina.
Working under Augustine T. Smythe, performed the majority of the firm's U.C.C. and appellate work, including preparation of two briefs to the Fourth Circuit setting important precedent in the area of federal civil procedure and products liability law. Involved in zoning, municipal corporation and ad valorem tax law matters, as well as real estate transactions, corporate tax, trusts and estates, and admiralty work. Assisted in representation of one bank-holding company's issuance of $15 million of corporate debentures. During a six-month leave of absence worked with Joslin, Culbertson & Sedberry, Raleigh, N.C., on corporate, U.C.C., and real estate transactions and conducted research at U.N.C. School of Law on problems of closelyheld corporations.

June 1969 through June 1970

Research Assistant, Institute of Government, Chapel Hill, North Carolina.
Worked for senior staff member who assists North Carolina Legislative Services in drafting and coordinating passage of all bills of an environmental nature. Researched and authored A Study of the Multi-Level Programs Directed Toward Research, Regulation and Control of Presticides, portions of which were transmitted to the state legislature, and were considered in North Carolina's subsequent passage of an act increasing state control over pesticide use.

August 1965 through June 1967

Teaching Fellow, Department of Geography, University of Michigan, Ann Arbor, Michigan.
Lectured in cultural geography of North America; reviewed the apparent environmental perturbations possibly resulting from Israel's construction of the Grand Canal in the Negev; and studied the reasons for and the importance of the historic stability of China's peasant society.

## REFERENCES

John R. Clark
National Park Service, International Affairs
U.S. Department of the Interior
1100 L Street, N.W., Room 2117
Washington, D.C. 20240 — 202/343-7049

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Senior Consultant, Negotiations
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Professor of Law
School of Law
The University of Mississippi
University, Mississippi 38677 — 601/232-7361

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5403 Ivanhoe Place N.E.
Seattle, Washington 98105;
(206) 527-2735

Business: School of Fisheries WH-10, University of Washington, Seattle, Washington 98195; (206) 543-7198.
Birth: 03 June 1949, Munich, West-Germany. United States Permanent Resident.

## EDUCATION

B.S., Biology, 1970. Ludwig-Maximilian University, Munich, West Germany.
Exchange Student, Sciences, 1971. Reed College, Portland, OR.
M.S., Biological Oceanography, 1974. University of Washington, Seattle, WA.
Ph.D., Fisheries-Aquatic Ecology, 1985. University of Washington, Seattle, WA.

## THESES TITLES

Release and assimilation of dissolved organic carbon by natural marine phytoplankton populations (M.S., 81 p.).
Control of algal dominance through zooplankton grazing changes in Lake Washington (Ph.D., expected completion June 1985).

## REPRESENTATIVE EXPERIENCE

Research:

**Co-Principal Investigator:** School of Fisheries, University of Washington. Control of Algae Study (1980-1984). Origination, development, fund-raising, management and principal research of a laboratory, field and modeling study to assess the role of zooplankton nutrient recycling and grazing in modulating phytoplankton abundance and species succession in Lake Washington. Experimental, theoretical and mathematical modeling work on phosphorus cycling in aquatic communities, algal nutrient uptake and growth dynamics, zooplankton excretion, optimal foraging and functional feeding morphology, community structure analysis. Training and suppervision of student assistants and independent study projects.

**Pre-Doctoral Research Associate:** School of Fisheries, University of Washington. Model Ecosystems Study (1978-1979). Development of methodologies, data processing and statistical comparison methods of primary production and associated parameters for standardization of aquatic microcosm test protocols. Investigation of community response to trophic-level and toxicant-induced stresses. Parameters included: Carbon-14 uptake, dissolved oxygen, in-vivo fluorescence, algal and zooplankton biomass, nutrients. Interdisciplinary work with statisticians, toxicologists, modelers, and policy-makers.

**Member, Squid Resources Research Group:** Sea Grant Program and Institute for Marine Studies, University of Washington (1976-1977). Assessment of the resource, harvesting, processing and marketing potential for the establishment of a United States Pacific coast squid industry.

**Research Assistant:** School of Oceanography, University of Washington. Metro Baseline Study (1975-1976). Zooplankton taxonomy and statistical evaluation of samples from Puget Sound.

**Research Assistant:** School of Oceanography, University of Washington. Columbia River Plume Study (1972-1974). Field and laboratory analysis of dissolved organic carbon cycling between phytoplankton and bacteria populations in the northeast Pacific Ocean. Parameters and processes evaluated include: nutrient and carbon cycling rates, dissolved organic carbon enzyme kinetics through radiotracer methodolgy, density and mixing of water masses, primary production, chlorophyll, phytoplankton, zooplankton. Extensive cruise experience, coordination of shipboard and onshore experimentation, sampling and processing of standard physical, chemical and biological parameters.

**Teaching:**
**Instructor (Acting Assistant Professor):** School of Oceanography and Continuing Education Program, University of Washington (1976-1984). Teaching and planning of courses in Introductory Oceanography, Coastal Dynamics and Coastal Ecology, and independent study projects in aquatic ecology. Supervision of teaching assistants.

**Director, Summer Science Minority Program:** Graduate School, University of Washington (1976). Management and supervision of a program to enhance science skills and opportunities for high school students. Principal duties included skill matching of students with scientific laboratories, teaching and coordination of an academic counseling program; development, planning, and proposal writing for subsequent programs.

**Teaching Assistant:** School of Oceanography, University of Washington (1971-1975). Planning and teaching of laboratory sections for courses in Introductory Oceanography, Biological Oceanography, and Plankton Research Methods.

## RELATED EXPERIENCE

**Science Book&Film Reviewer:** American Asssociation for the Advancement of Science (1981-1983). Review of secondary and professional-level books, films and filmstrips in all water-related fields.

**Member, Insurance Review Committee:** University of Washington (1981-1982). Implementation of major revisions in the student health insurance plan.

**Member, Planning and Search Committee:** Institute for Environmental Studies, University of Washington (1973-1975). Cooperation with students, faculty, and citizens for the establishment of the Institute, its philosophies and its initial course curriculum.

**Member, Board of Trustees:** Foundation of International Understanding through Students (FIUTS), University of Washington (1972-1973). Implementation and supervision of programs to enhance relations between international visitors and the Seattle commmunity. Also chairperson of the Student Activities Comittee.

## SPECIAL SKILLS

**International Communications Facilitator:** Coordination and supervision of multilingual student meetings, foreign exchange programs and international understanding organizations. Translation of technical and scientific literature. Languages include German and French (both fluent speaking and writing), Spanish (passable speaking and reading) and Italian (reading).

## AWARDS AND FELLOWSHIPS

Egtvedt Trust Award, University of Washington (1983).
Award for Excellence in Teaching Oceanography, University of Washington (1980).
Egtvedt Research Fellowship, University of Washington (1979).
Science Exchange Scholarship, Reed College, Portland, Oregon (1970-1971).

## AFFILIATIONS

American Association for the Advancement of Science
American Society of Limnology and Oceanography
Societas Internationalis Limnologiae

## PUBLICATIONS and REPORTS see Attachement.

# PUBLICATIONS, REPORTS, AND GRANTS

## HANS J. HARTMANN

### PUBLICATIONS

5. Hartmann, H.J. 1984. Feeding of Daphnia pulicaria and Diaptomus ashlandi on mixtures of unicellular and filamentous algae. Verhand. Internat. Verein. Limnol. 22: in press.

4. Hartmann, H.J., 1981, 1982 A-D, 1983. Book and film reviews. Six titles. In: Science Books and Films. 16:288; 17:80; 17:224; 18:18; 18:112; and one forthcoming title in press.

3. Taub, F.B., P.L. Read, A.C. Kindig, M.C. Harrass, H.J. Hartmann, L.L. Conquest, F.J. Hardy, and P.T. Munro, 1983. Demonstration of the ecological effects of streptomycin and Malathion on synthetic aquatic microcosms. In: Aquatic Toxicology and Hazard Assessment: Sixth Symposium, ASTM STO 802, (W.E. Bishop, R.D. Cardwell, and B.B. Heidolph, Eds.), American Society for Testing and Materials, Philadelphia, 1983, pp. 5-25.

2. Taub, F.B., M.C. Harrass, H.J. Hartmann, A.C. Kindig, and P.L. Read, 1981. Effects of initial algal density on community development in aquatic microcosms. Verhand. Internat. Verein. Limnol. 21: 197-204.

1. Taub, F.B., M.C. Crow, and H.J. Hartmann, 1980. Responses of aquatic microcosms to acute mortality. In: Microcosms in Ecological Research, (J.P. Giesy, ed.). CONF-781101, U.S. Dept. of Energy Symposium Ser. 52. pp. 513-535.

### REPORTS

9. Hartmann, H.J. 1984. Control of algal dominance through changes in zooplankton grazing, Lake Washington, Phase II. Research Project Technical Completion Report, Project # A-0124-WASH. U.S. Dept. of Interior, Washington State Water Res. Cent., September 1984. 53 p.

8. Hartmann, H.J. 1983. Feeding of Daphnia pulicaria and Diaptomus ashlandi on mixtures of unicellular and filamentous algae. Contributed report, Soc. Internat. Limnol., 22nd Congress. Lyon, France, August 1983.

7. Hartmann, H.J. 1983. Control of algal dominance through changes in zooplankton grazing, Lake Washington, Phase I. Research Project Technical Completion Report, Project # B-089-WASH. U.S. Dept. of Interior, Washington St. Water Res. Cent., May 1983. 76 p.

6. Hartmann, H.J., and A.C. Kindig, 1980. Primary productivity responses to nutrient enrichment in synthetic microcosms. Contributed report, American Society of Limnology and Oceanography, Third Winter Meeting. Seattle, Washington, December 1980.

5. Hartmann, H.J., 1980. In-vivo fluorescence as a tool in assessing microcosm algal biomass. Model Ecosystem Methods Report No. 2. U.S. Food & Drug Admin. Contract # 223-76-8348. 54 p.

4. Hartmann, H.J., 1979. Initial algal responses and nutrient dynamics in aquatic microcosms. Model Ecosystems Experiment Report No. ME28. U.S. Food & Drug Admin. Contract # 223-76-8348. 74 p.

3. Hartmann, H.J., 1977. Squid Resources of the North Pacific. In: A Scheme for the Expansion of the U.S. West Coast Squid Industry, (J. Tobolsky and B. Low, eds.). U.S. Sea Grant Office, Univ. of Washington, Seattle, Wash. pp. 2-13.

2. Hartmann, H.J., 1976. The Summer Science Minority Program. Graduate and Professional Student Senate, Publication No. 1. University of Washington, Seattle, Wash. 24 p.

1. Hartmann, H.J., 1975. In situ reutilization of dissolved organic carbon by marine phytoplankton populations. Contributed report. Annual Meeting, American Society of Limnology and Oceanography, Pacific Division. Corvallis, Oregon, June 1975.

## MANUSCRIPTS IN PREPARATION

1. "Selective feeding behavior of Daphnia and Diaptomus: effects of cell shape, biomass and body size." (A revision of Report# 9, above, for submission to Limnology and Oceanography, 1985).

2. "The mechanics of food gathering and selection of Daphnia pulicaria: Inferences from scanning electron microscopy." (Portions of Report #9, above, for submission to Crustaceana, with co-author Dennis Kunkel).

3. "Excretion and remineralization of phosphorus by herbivorous zooplankters from Lake Washington." (Recent results, to be submitted for presentation at the 1985 meeting of the American Society for Limnology and Oceanography, and subsequent submission to a major journal).

## GRANTS

1983-1984 Control of algal dominance through changes in zooplankton grazing, Lake Washington, PhaseII. U.S. Dept. of Interior, Office of Water Policy, Washington State Water Research Center, Prj.# A-0124-WASH. 7/20/83-9/30/84. $10,000. (Co-Principal Investigator (with F.B. Taub), Principal Author).

1980-1982 Control of algal dominance through changes in zooplankton grazing, Lake Washington, Phase I. U.S. Dept. of Interior, Washington State Water Research Center, Proj.# B-089-WASH, Cont.# 11-N-3933-2571. 10/1/80-9/30/82. $24,227. (Co-Principal Investigator (with F.B. Taub), Principal Author).

# CURRICULUM VITAE

DANIEL JOSEPH GROSSE

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School of Fisheries WH-10
University of Washington
Seattle, Washington 98195
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## Education

UNIVERSITY OF MICHIGAN SCHOOL OF NATURAL RESOURCES
B.S., 1978
UNIVERSITY OF WASHINGTON SCHOOL OF FISHERIES
M.S. in Fisheries, 1982 (Dr. Richard Whitney, advisor)
Ph.D. in Fisheries, expected 1986

## Research Experience

University of Washington School of Fisheries, Seattle, Washington
Research Assistant, 4/83 to present
Investigated the possible effects of $CO_2$-induced climate changes on herring and other fish and shellfish species in the northeastern Pacific Ocean.

University of Washington Cooperative Fisheries Research Unit, Seattle, Washington
Biologist II, 12/82
Developed profiles on amphipods (a crustacean), part of a series on mitigating effects of coastal development, under contract to the U.S. Army Corps of Engineers/U.S. Fish and Wildlife Service.

University of Washington School of Fisheries, Seattle, Washington
Research Assistant, 1/80-12/81
Designed and implemented a study on the relationships of feeding to growth and interaction among juvenile lingcod reared in floating cages.

Mariculture Laboratory, Israel Oceanographic and Limnological Research, Elat, Israel
Laboratory Assistant, 2/79-6/79
Operated an experimental hatchery for several marine fish species in a study on their "domestication" for rearing in desert ponds.

University of Michigan Museum of Zoology, Ann Arbor, Michigan
1/79-2/79

Collected fresh and brackish water fishes in coastal watersheds in eastern Mexico.

University of Michigan Museum of Zoology, Ann Arbor, Michigan
Laboratory Technician, 10/77-9/78
Assisted in all phases of experimentation on genetic and morphological variation in populations of several species of livebearing Mexican fishes.

## Teaching Experience

University of Washington School of Fisheries, Seattle, Washington
Teaching Assistant, 1/83-3/83
Taught a laboratory and field section in a course on biological problems of water pollution.

University of Washington School of Fisheries, Seattle, Washington
Teaching Assistant, 4/82-6/82
Taught the fieldwork for a course in fisheries methodology and surveying techniques, including lecturing, demonstrations, grading, and boat and gear handling.

University of Washington Department of Statistics, Seattle, Washington
Paper Grader, 1/82-3/82

University of Washington School of Fisheries, Seattle, Washington
Teaching Assistant (volunteer), 1/81-3/81
Organized and facilitated a graduate student seminar series in fisheries research.

## Other Experience

Participant, Graduate Intern Program in Science and Environmental Policy, University of Washington Institute for Environmental Studies, 1982.

Member, Citizens' Water Quality Advisory Committee, Municipality of Metropolitan Seattle (METRO).

Instructor, Professional Association of Diving Instructors

## Honors and Awards

Dean's List, Western Michigan University and University of Michigan
Academic Scholarship, University of Michigan School of Natural Resources, 1978
Claire L. Egtvedt and Evelyn S. Egtvedt Scholarship, University of Washigton School of Fisheries, 1981
John N. Cobb Scholarship, University of Washington School of Fisheries, 1982
Outstanding Young Men of America, 1982
Floyd E. Ellis Memorial Scholarship, University of Washington School of Fisheries, 1983
Egtvedt Research Scholarship, University of Washington School of

Fisheries, 1983
Finalist, Student Paper Competition, 1983 American Fisheries Society North Pacific International Chapter Conference

## Publications

Turner, B.J. and D.J. Grosse. 1980. Trophic differentiation in Ilyodon, a genus of stream-dwelling Goodeid fishes: speciation versus ecological polymorphism. Evolution 34(2): 259-270.

Brett, B.L.H. and D.J. Grosse. 1982. A reproductive pheromone in the Mexican Poeciliid fish Poecilia chica. Copeia 1982(1): 219-223.

Grosse, D.J. (in review). Species schema: Pacific herring (Clupea harengus pallasi). International Recruitment Investigations in the Subarctic. Wash. Sea Grant.

Grosse, D.J. (in preparation). Feeding and growth of juvenile lingcod, Ophiodon elongatus, in captivity.

Grosse, D.J. and P. Sampson (in preparation). Morphometrics, function and habitat: an analysis of morphological differentiation among four Pacific rockfish species.

## Technical Reports

Grosse, D.J. 1982. An experiment in the artificial rearing of lingcod (Ophiodon elongatus) for purposes of enhancement. Wash. Dept. Fisheries Tech. Rep. No. 70. 92 pp.

Grosse, D.J. and T. Sibley. 1984. Projected effects of $CO_2$-induced climate change on the Pacific herring (Clupea harengus pallasi) fishery in the northeastern Pacific Ocean. Univ. Wash. Schl. Fish., Fish. Res. Inst. Tech. Rep. FRI-UW-8410. 65 pp.

Grosse, D.J., G.B. Pauley and M.F. Shepard (in submission). Species profiles: life histories and environmental requirements (Pacific Northwest). The amphipods. (Contract work for U.S. Army Corps of Engineers/U.S. Fish and Wildlife Service).

Grosse, D.J., G.B. Pauley and M.F. Shepard (in submission). Species profiles: life histories and environmental requirements (Pacific Southwest). The amphipods. (Contract work for U.S. Army Corps of Engineers/U.S. Fish and Wildlife Service).

Sibley, T.H., R. Strickland, G. Ostrander, A. Stubin and D.J. Grosse. 1985. Indirect effects of increased atmospheric $CO_2$ on marine fisheries. Technical Report, Carbon Dioxide Research Program, U.S. Department of Energy, Washington, D.C.

# CURRICULUM VITAE

Kathleen Ryan Matthews
School of Fisheries
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## EDUCATION

Ph.D In progress. University of Washington School of Fisheries.

M.A. 1983. Moss Landing Marine Laboratories/San Jose State University. Emphasis in Subtidal Ecology and Fisheries Biology. Thesis Topic: The species similarity and movement of fishes on artificial and natural reefs in Monterey Bay, California.

B.A. 1977. Zoology. University of California at Santa Barbara.

## EXPERIENCE

| | |
|---|---|
| 9/83-present | Predoctoral Research Associate. University of Washington School of Fisheries. |
| 6/83-9/83 | Biological Aid. Worked on the California State Mussel Watch Program collecting mussels and analyzing for trace pollutants. California Department of Fish and Game. |
| 1/83-6/83 | Teaching Assistant in Subtidal Ecology. Instructor: Dr. Michael Foster. Moss Landing Marine Lab. |
| 8/82-12/82 | Teaching Assistant in Marine Ecology. Instructor: Dr. Gregor Cailliet. Moss Landing Marine Lab. |
| 4/82-9/82 | Biological Assistant. Worked on the Pacific Coast Rockfish Ageing Project. Supervisor: Tina Echeverria and Frank Henry. National Marine Fisheries Service. |
| 9/80-6/81 | Graduate Student Assistant. Worked on Ecological Survey of the Point Conception Area prior to construction of a public utility. Supervisors: Dan Gotshall and Kristine Henderson. California Department of Fish and Game. |
| 8/79-4/80 | Seasonal Aid. Worked on sportfish assessment in southern California. Supervisor: Dave Ono. California Department of Fish and Game. |
| 6/77-9/77 | Laboratory Assistant for Invertebrate Zoology Course. Instructor: Dr. Eric Hochberg. University of California at Santa Barbara. |
| 1/77-6/77 | Museum Curator Trainee. Supervisor: Dr. Eric Hochberg. Santa Barbara Museum of Natural History. |

9/76-12/76 Laboratory Assistant in Environmental Studies course. Instructor: Dr. Charles Woodhouse Jr. University of California at Santa Barbara.

## PROFESSIONAL ACTIVITIES

### Papers Presented

11/83 Matthews,K.R. Movement of fishes onto an artificial reef in Monterey Bay, California. 3rd International Artificial Reef Conference , Los Angeles, California.

3/84 Matthews,K.R. Movement of fishes on natural and artificial reefs. 1984 North-Pacific International Chapter of the American Fisheries Society, British Columbia.

### Publications

Matthews,K.R. In press. Species similarity and movement of fishes on natural and artificial reefs in Monterey Bay, California. Bulletin of Marine Science.

Matthews,K.R. and G.B. Pauley. In review. Species profiles:life histories and environmental requirements of coastal fishes and invertebrates of the Pacific Southwest--dungeness crab. U.S. Fish and Wildlife Service, Division of Biological Services.

Matthews,K.R. and G.B. Pauley. In review. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates of the Pacific Northwest--chum salmon. U.S. Fish and Wildlife Service, Division of Biological Services.

### Papers in preparation

Matthews,K.R. and A.C. Solonsky. A comparison of two techniques for describing nearshore reef fish populations. Calif. Fish. Game.

Matthews,K.R. Movements of three species of rockfish (Sebastes spp.) previously reported as sedentary. Calif. Fish. Game.

## AWARDS and HONORS

1984 Finalist Student Paper Awards.North-Pacific International Chapter of the American Fisheries Society

1984 Fisheries Memorial Scholarship. University of Washington School of Fisheries.

1983 Packard Foundation Student Research Grant

1981-1983 1st Place Underwater Photography Contest. California Department of Fish and Game.

## PROFESSIONAL AFFILIATIONS

American Association for the Advancement of Science
American Institute of Fishery Research Biologists
American Women in Science
American Fisheries Society
Ecological Society of America

## REFERENCES

Dr. Gregor Cailliet
Moss Landing Marine Laboratories
Box 223
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Dr. Michael Foster
Moss Landing Marine Laboratories
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Dr. Robert Lea
California Department of Fish and Game
2201 Garden Road
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# RESUME

SUSAN O'MALLEY WADE
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## Career Objective:

Environmental Affairs: Government Relations, Public Involvement, Resource Planning, Policy Analysis.

## Specialties:

Congressional Affairs; Policy Analysis; Marine Resource Management; Marine Pollution; Marine Transportation.

## Education:

1984 — Master of Marine Affairs (MMA).
Institute for Marine Studies (IMS)
Seattle: University of Washington

Thesis Title: A Proposal to Amend the Fisheries Conservation and Management Act of 1976: To Include Tuna in United States Fishery Jurisdiction.

1982 — Integrative Program in Administration (Certificate)
Graduate School of Business Administration
University of Washington

1975-81 — Natural Sciences & Public Administration.
Portland State University
Portland, Oregon

1966 — Bachelor of Arts (BA). (History).
Portland: University of Portland

1964-65: Univ. of Portland Extension Overseas
Salzburg, Austria

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Professional Experience:

1984 Program Manager. Washington Sea Grant (half-time), Seattle.

Generally, my responsibilities related to long-range program planning through the assessment of trends in regional marine resource research and activities.

Specifically, I worked on two projects. The first was the development of a marine sector categorization for use in regional program evaluation efforts. The second project was an on-going process to establish and maintain a network of regional contacts in order to make current and synthesize information. I focused particularly on regional efforts directed at fisheries enhancement and water quality issues.

1983 Staff. U.S. House of Representatives, Merchant Marine & Fisheries Committee, Washington, D.C.

Generally, I was responsible and accountable for the oversight, legislation and Committee business regarding all ocean dumping, and related uses affecting marine water quality.

Specifically, with respect to proposed and pending legislation, agency action and national ocean policy questions, I reviewed and analysed legislation and related scientific and policy reports, worked with parties of interest, and participated in legislative negotiations. I wrote status reports, position papers, analyses and recommendations, briefing summaries, Committee statements, and more. I was involved particularly with the Navy submarine disposal issue. This included review of the Navy's DEIS, consequent recommendation and draft of Committee position, liaison with other Committee Members' staffs and with public individuals and groups, and travel on behalf of the Committee to N. Carolina and California for the DEIS public hearings. Another area of intense activity was with negotiations on MPRSA Title I legislation which included the controversial sludge and dredge dump sites in the New York Bight.

Other major responsibilities included analyses of ports and shipping legislation for their effect on environmental interests and waste management controversies; and participation in a number of conferences relating to Committee concerns. For one of these in June 1983, I co-authored a paper with the Committee's Legislative Analyst, Tom Kitsos, and Counsel, Will Stelle, "The Structure of Congress: Toward an Explanation of the Struggle for an Ocean Dumping Policy".

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1981-82 Teaching Assistant. Introduction to Marine Affairs, (IMS), Professor Marc L. Miller.

Research Assistant. The North Pacific Project, Vol. III (forthcoming), (IMS), Professor Edward L. Miles.

As a teaching assistant, I assisted in recreating the IMS 500 survey course. Specifically, I designed an easy-to-update brief of materials which introduces students to the field of marine affairs through a multi-disciplinary lecture/discussion series. The brief identifies ocean use categories, issue areas, interest groups, historic and current policy perspectives.

As a research assistant, and in the context of an enquiry into whether and how scientific findings translated into policy level decisionmaking, I interviewed people who had been involved with the INPFC.

1979-81 ParaLegal. Lindsay Hart Neil & Weigler (Law Firm), Portland, Oregon.

Though also responsible for investigation, factual and legal research, document management, and client liaison in cases covering a number of areas of law, I was involved particularly in the representation of a client corporation seeking the City's Cable TV franchise. Generally, I tracked the Portland Cable Commission's formulation of the RFP, as well as the RFP's of surrounding municipalities, and acted as client representative in various government, public and private forums. I helped negotiate the local Board, set the guidelines for media, interest group and public relations, and kept the client advised on current and proposed regulations. Additionally, I organized an educational conference on Cable technology for government, interest group and media representatives.

Additional Professional Experience:

1978-79 Research Assistant. Office of Student Legal Services. Portland State University.

1977-78 Archives Technician. Historical Records Rescue Project. City of Portland, Oregon.

1973-77 Program Assistant. Oregon Legal Services Corp. & Multnomah Co. Legal Aid Services. Portland.

1971-72 Director & Scriptwriter. Perspectiv' Pty. Ltd. (Film Company). Perth, Western Australia.

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Honors:

Congressional Fellowship
National Sea Grant Program
Washington, D.C. (1983).

Noyes Fellowship, IMS. (1982).

President, Port of Seattle Student Propeller Club. (1982-83).

Work Products:

Author: "A Proposal To Include Tunas in U.S. Fishery Jurisdiction". Journal for Ocean Development and International Law. Crane Russak, New York. (Forthcoming).

Co-Author: With Thomas Kitsos and William Stelle. "The Structure of Congress: Toward an Explanation of the Struggle for an Ocean Dumping Policy", in Management of Wastes in the Ocean, forthcoming volume in the Wastes in the Ocean Series, John Wiley & Sons. (Presented at NOAA Conference, Rhode Island, May 1983).

Contributor: City of Portland Archives Guide. City of Portland. (1982).

Author: The Ladd Carriage House. Portland, Oregon. Application to the National Register for Historic Places, Dept. of the Interior, Washington, D.C. (Listed Feb. 1980).

Author: How To Get Money for College - 105 Tools. Portland State University. Booklet. (Feb. 1979).

Production Assistant/Editor: Alternative Photographic Processes. Morgan & Morgan, N.Y. (May 1978).

Director/Scriptwriter: Heard You Found Nickel, Son. Documentary Film, Perth, Western Australia. (1972).

XANTHIPPE AUGEROT
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OBJECTIVE

Employment as a research assistant or in a task or people-oriented job. Long-term: to work in the field of fishing and marine affairs.

WORK HISTORY

Marine Resources Co., Seattle, WA. Telex operator. 12/83-present.

"Target Seattle/Soviet Realities". Member of volunteer ticket sales team for Saturday Symposium. Recruited salespeople, processed ticket orders, phone solicitation and coordinated volunteer salespeople. 10-11/83.

"U.S./U.S.S.R. Young Leaders in Dialogue". Volunteer coordinator for fundraising event ticket sales, helped with guest lists, hosting and administrative details. 2/83.

Marine Resources Co., Seattle, WA. Company representative at sea. Russian/English translation, mediation and record-keeping. 6/82-9/82 and 4/83-9/83.

Suzzallo Library, Slavic Section, University of Washington, Seattle, WA. Librarian's assistant in acquisitions. Worked with all but the Asiatic languages of the Soviet Union plus the languages of Eastern Europe. 2/80-7/80, 8/80-4/81 and 12/83-9/84.

Treaty Research Center, University of Washington. Researched and computer-coded treaties using Russian, Serbo-Croatian, Bulgarian and English sources. 7/80-9/80.

EDUCATION

Currently pursuing Masters of Marine Affairs at University of Washington, Institute for Marine Studies. Will finish Spring 1986.

Bachelor of Arts in Economics with Honors, University of Washington. Majority of electives in Russian and International Studies

"United Nations Semester", Long Island Universtiy, Brooklyn, New York. Chosen to participate in program to acquaint students from across the United States with international affairs and the United Nations. 9/81-12/81.

SCHOLASTIC

National Resources Fellow, 1984/85 academic year. Russian and East European area.
Member of Omicron Delta Epsilon and the National Collegiate Honors Council. Anna Grady tuition scholarship, 9/78-6/79.

HOBBIES

Play cello, sing in Bulgarian women's choir, swim, knit and read.

REFERENCES FURNISHED UPON REQUEST.

PETER TODD MUNRO
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Seattle, Washington 98115
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(W) 206-543-7275

## EDUCATION

Master of Science, Fisheries, 1985 (anticipated)
University of Washington, Seattle, Washington

Bachelor of Arts, Zoology, 1981
University of Washington, Seattle, Washington

## QUANTITATIVE AND DATA MANAGEMENT EXPERIENCE:

Research Assistant , Center For Quantitative Science, University of Washington. (September 1984 - June 1985).
Developed estimators and tested simplifying assumptions in estimating sport catch in Puget Sound, under a grant from Washington Department of Fisheries.

Teaching Assistant, Center For Quantitative Science, University of Washington. (May 1983 - June 1984).
Assisted in teaching applied statistics courses on such topics as probability, distributions of test statistics, hypothesis testing, linear models, nonparametrics, and estimation.

Reasearch Assistant, School of Fisheries, University of Washington. (January 1981 - September 1982).
Collected data and preformed various statistical analyses for ecological experiments using synthetic aquatic microcosms, and wrote summary reports.

Fisheries Biologist I, Commercial Fisheries Division, Alaska Department of Fish and Game, Sitka, Alaska. (1979 - 1980).
Collected and created a datafile for catch and tagging data from commercially caught salmon and sablefish in Southeast Alaska. Developed an in-season catch estimation method for making management decisions.

## FIELD EXPERIENCE

Fisheries Biologist I, National Marine Fisheries Service, Northwest and Alaska Fisheries Center, Seattle, Washington. (1983).
Collected catch data on Japanese trawlers fishing the Bering Sea as an observer in the Foreign Fisheries Observer Program.

Fisheries Technician III, Commercial Fisheries Division, Alaska Department of Fish and Game, Sitka, Alaska. (1978).
Captain of a research vessel collecting in-season data on the strength of salmon runs in the Sitka area and on catch rates of salmon purse seine boats.

Fisheries Technician II, I, Commercial Fisheries Division, Alaska Department of Fish and Game, Sitka, Alaska. (1975 - 1978). Collected and edited commercial fisheries catch data from sales records (fish tickets).

PUBLICATIONS

Taub, F.B., P.L. Read, A.C. Kindig, M.C. Harrass, L.L. Conquest, F.J. Hardy, and P.T. Munro. 1983. Demonstration of the ecological effects of streptomycin and Malathion on synthetic aquatic microcosms. Aquatic Toxicology and Hazard Assessment: Sixth Symposium, ASTM STP 802, W.I. Bishop, R.D. Cardwell, and B.B. Heidolph, Eds., American Society for Testing and Materials, Philadelphia, pp. 5-25.

AWARDS AND HONORS:

Committee for Excellence in Undergraduate Experimental Biology, University of Washington: Award for an independent research paper in ecology.

References availible upon request.

**SUSAN MARIE BISHOP**

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(206) 526-2411

## EDUCATION

M.S., Fisheries, University of Washington, Seattle, Washington (in progress)

B.S., Marine Science/Biology, University of Miami, Coral Gables, Florida, 1984

## EMPLOYMENT EXPERIENCE

Research Assistant--Dr. Donald Rogers, Fisheries Research Institute, University of Washington, Seattle, Washington (1984 - present).

Duties: Population data analysis, chlorophyll analysis, literature surveys for individual projects, survey of beach-spawning sockeye populations in the Wood River Lake System, Alaska. Investigation and research related to masters thesis: possible stock selection of beach-spawning sockeye salmon populations in the Wood River Lake System.

Lab Technician--Steve Berkeley, Rosenstiel School of Marine and Atmospheric Sciences, Miami, Florida (summer, 1984).

Duties: Sorted shrimp (Peneus spp.) and four commercially important species from plankton samples. Worked with microscopes extensively. Assisted in report preparation.

Teaching Assistant--Electron Microscopy Lab, University of Miami, Coral Gables, Florida (1983-1984).

Duties: Supervised students in the use of lab equipment. Instructed students in use of lab equipment. Prepared chemicals. Fixed and prepared materials for electron microscopy study. Used the electron microscope in experiments for Dr. Jeffrey Prince and in independent projects. Printed micrographs. Consulted with students about their projects and made myself available after hours and on weekends in case of problems.

Fish Culturist--Wyoming Game and Fish, Speas Fish Hatchery, Casper, Wyoming (summer, 1982).

Duties: Cared for and fed hatchery fish (eggs to release). Maintained hatchery grounds. Cleaned runways. Transferred fish within the hatchery.

Field Assistant--Wyoming Field Science Program, Casper, Wyoming (summer, 1981).

Duties: Organized science material for program coordinators. Supervised students in the program. Planned and shopped for supplies. Assisted students in botanical identifications. Gave presentations about the program to local high schools.

## ACTIVITIES AND HONORS

Secretary for Golden Key Honors Society
Participated in Privileged Study Program
Isaac Singer Scholarship recipient
Teagle Foundation Scholarship recipient

Participated on intramural volleyball team
Worked on independent research projects
Participated as volunteer for Special Olympics
Enjoy camping, hiking, SCUBA, cross-country skiing, biking, sewing