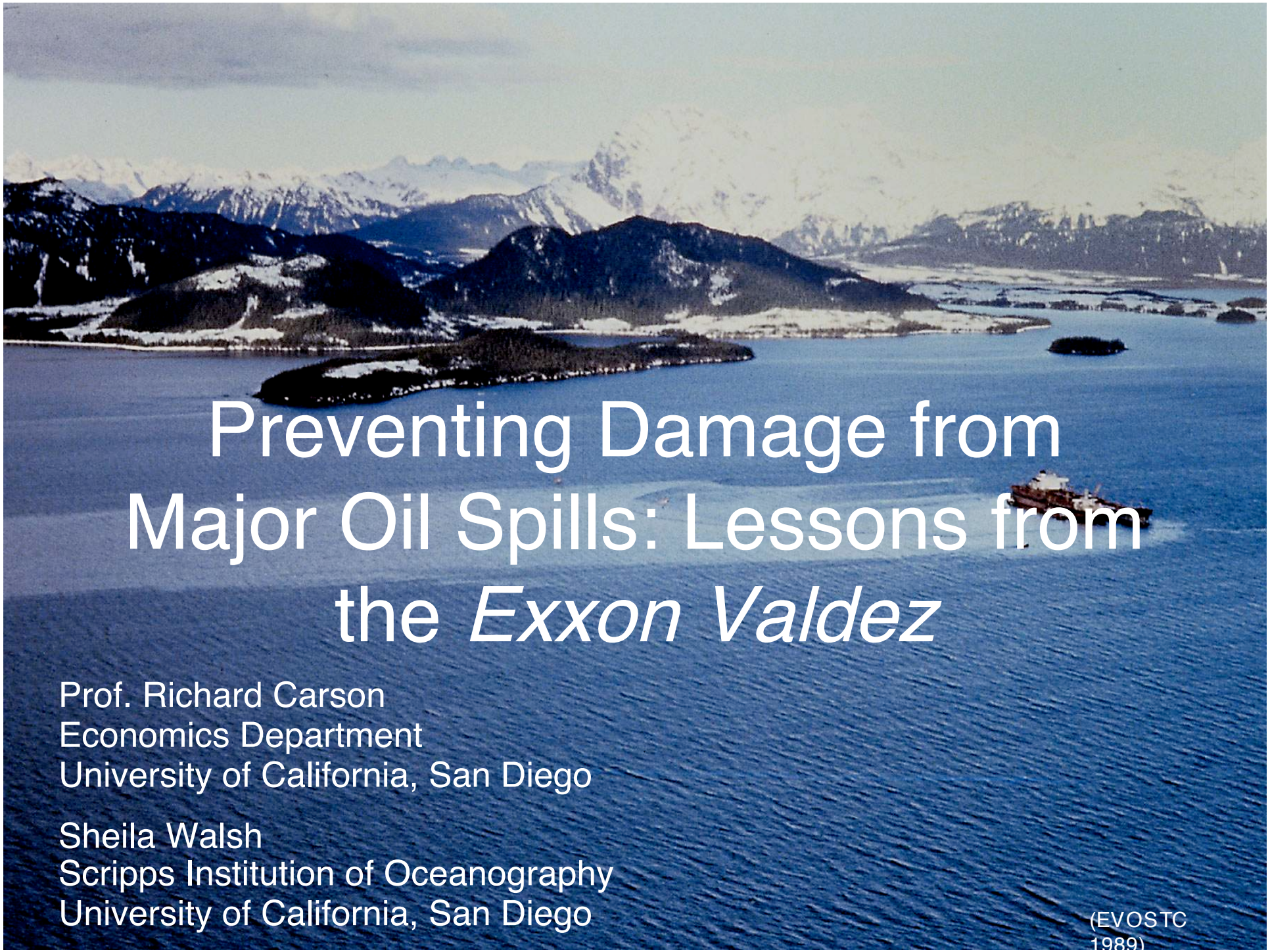

Preventing Damage from Major Oil Spills: Lessons from the *Exxon Valdez*

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(EVOSTC 1989)

Prestige Oil Spill, Spain 2002

(AP Photo File 2002)

Liability Limit $\leq$ Value of Vessel and Cargo

Simple Economic Solution

Solution:

Marginal Benefit of Prevention/Containment = Marginal Cost from Damages

Result:

Increased spending on prevention and reduction in major oil spills

Issues for Implementation

1) Determine the “correct” damage liability level
2) Establish a coherent administrative and legal framework
3) Address specifics of economic analysis
4) Consider undesired responses from shippers, or moral hazard
5) Pre-plan and allocate resources for prevention and containment
6) Decide how to allocate effort and monetary resources to initial response, restoration, and compensation

Over Supply of Oil Spills are Result of Market Failure

Resource allocation based on value:

Private individuals allocate market goods using prices

Trustees of the public good need measures of value of non-market goods for allocation decisions

Total economic value of natural goods and services not typically recognized

Damages from Oil Spills

1) Loss to profits from direct use
   -fisheries
2) Loss to profits from in-direct use
   -tourism
3) Loss to consumer surplus from in-direct use
   -recreation
3) Non-use or passive use value
   -value derived from existence of resource

Passive use value was not included prior to Exxon

Legal and Regulatory Framework

- Economists developing techniques for non-market goods
- U.S. government starts using cost-benefit analysis in policy evaluation in 1950s
- Government role as public trustee defined by Comprehensive Environmental Response, Compensation & Liability Act (CERCLA)/Superfund and applied to Clean Water Act

Measuring Value of Non-Market Goods

Economic value based on *revealed* or *stated* preferences

Three Methods:

1) Hedonic Pricing
2) Household Production Function (i.e. Travel Cost
3) Contingent Valuation

Contingent Valuation (CV)

- Survey Method:
  - Constructs missing market
  - Elicits stated preference
  - Preference represented by “Willingness to Pay” (WTP)
  - WTP contingent on scenario

Only method that measure total economic value, including passive use value

Limitation of liability to *actual* damages

- Optimal spending on prevention requires liability for all damages
- Shipper or insurer must be completely liable because they do the spending

  - joint compensation can result in full compensation *not* prevention
- Liability on shipper if large corporation, on insurer if small corporation

Liability too high, no oil will be shipped

Liability too low, too much spending on prevention

U.S. Legal & Institutional Changes

- *Ohio v. Department of Interior* 1989: Clean Air Act & The Comprehensive, Environmental Response, Compensation and Liability Act (CERCLA)

  - losses due to passive-use value considerations compensable
  - validate contingent valuation methods

- Oil Pollution Act of 1990

  - Liability for all actual damages
  - Trustee may claim passive use value losses

- NOAA Blue Ribbon Panel 1993

  - CV studies useful for assessing natural resource damage, including passive use value (Arrow, et al. 1993)

Result of *Exxon Valdez* CV Study and Settlement

Estimated value of preventing Exxon Valdez-type spill: US$ 2.8 billion

- lost passive use value

State of Alaska v. Exxon: US$ 1 billion

- natural resource damages, mostly lost passive use value
- restitution for injuries

Exxon Clean-Up/Restoration Costs: US$ 2 billion

Investment in Prevention Post-*Exxon Valdez*

- *Kenai*, Valdez Straits, Alaska, 1992
  - tug escort prevents similar spill to *Exxon Valdez*

(Logan 2003)

- *North Cape* Oil Spill, Rhode Island 1996:
  - 828,00 gallons spilled/ partially contained
  - 3.2 million gallons NOT spilled

(NOAA 1989)

Key Conceptual Issues for Measuring Economic Damages

a) Defining lost service flows

b) Measure total economic value with CV or use other methods for some injuries

c) Determining liability *ex ante* or *ex post*

d) Key design issues for a CV survey

a) Defining Lost Service Flows

Service Flows

- Baseline conditions and recovery path
- Lost “interim” service flows or permanent losses

Compensation and nature of loss

- Loss is valued greater than replacement
- Some losses are permanent due to thresholds in ecosystems

b) Distinction in damages and methods for measurement

- Damages separate into private and public claims
- Government can measure all of damages and allocate compensation to private losses
- However, CV technique is not appropriate for some private damage assessments
- Some private and public damages should be measured separately

c) *Ex ante* vs. *Ex post* studies

- Set of *ex ante* reference studies
  -can be done for various combinations of spill sizes and ecosystems
  -useful for planning and insurance purposes
  -decrease time for settlement
- Ex post
  -most accurate assessment of damages
  -plausibility of scenario may be improved

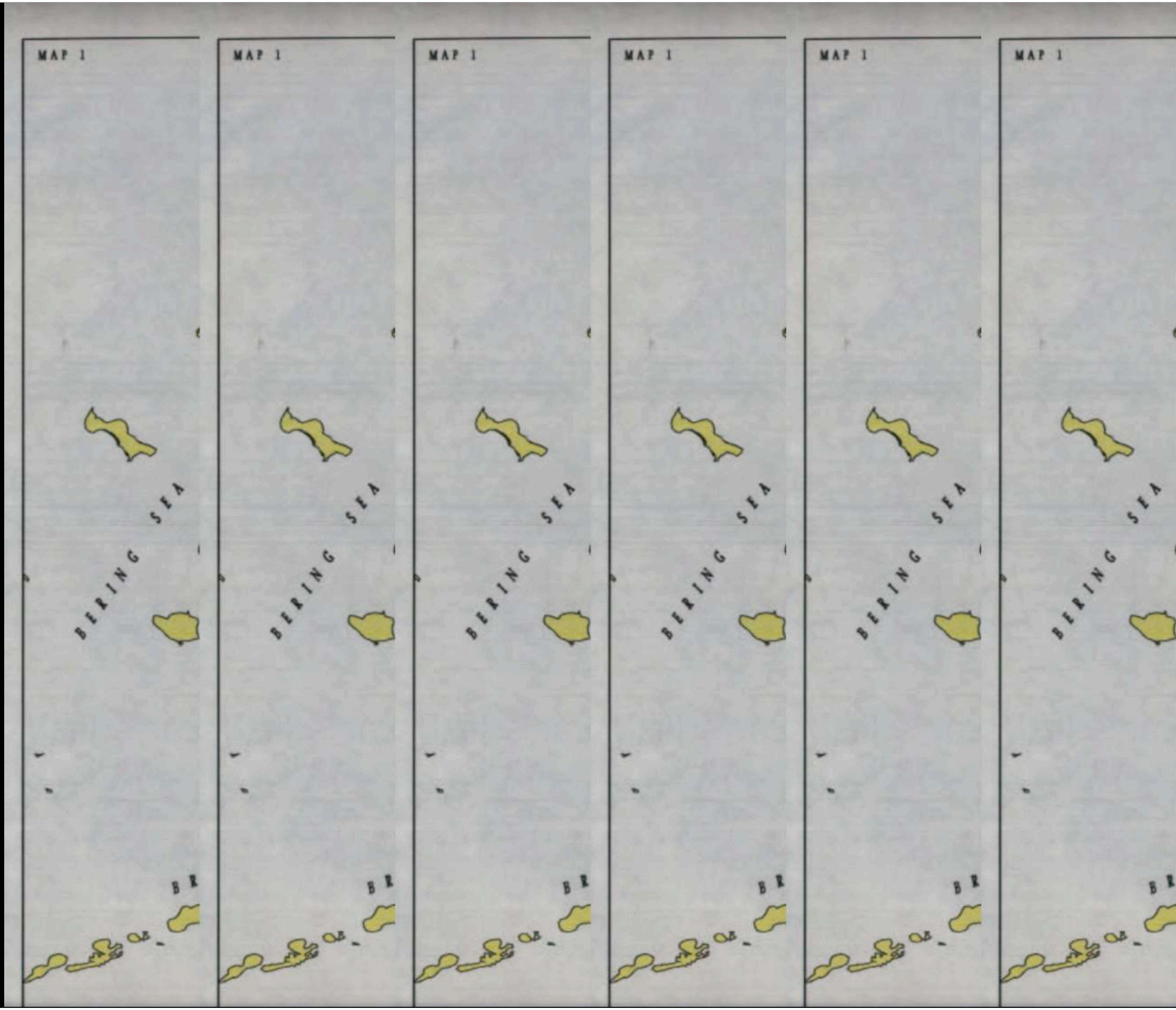
Exxon Valdez	California Oil Spill
ex post	*ex ante*
Specific, known injuries	Specific, predicted injuries
Local prevention program	Regional prevention program
Well defined area	Coastline with multiple ecosystems

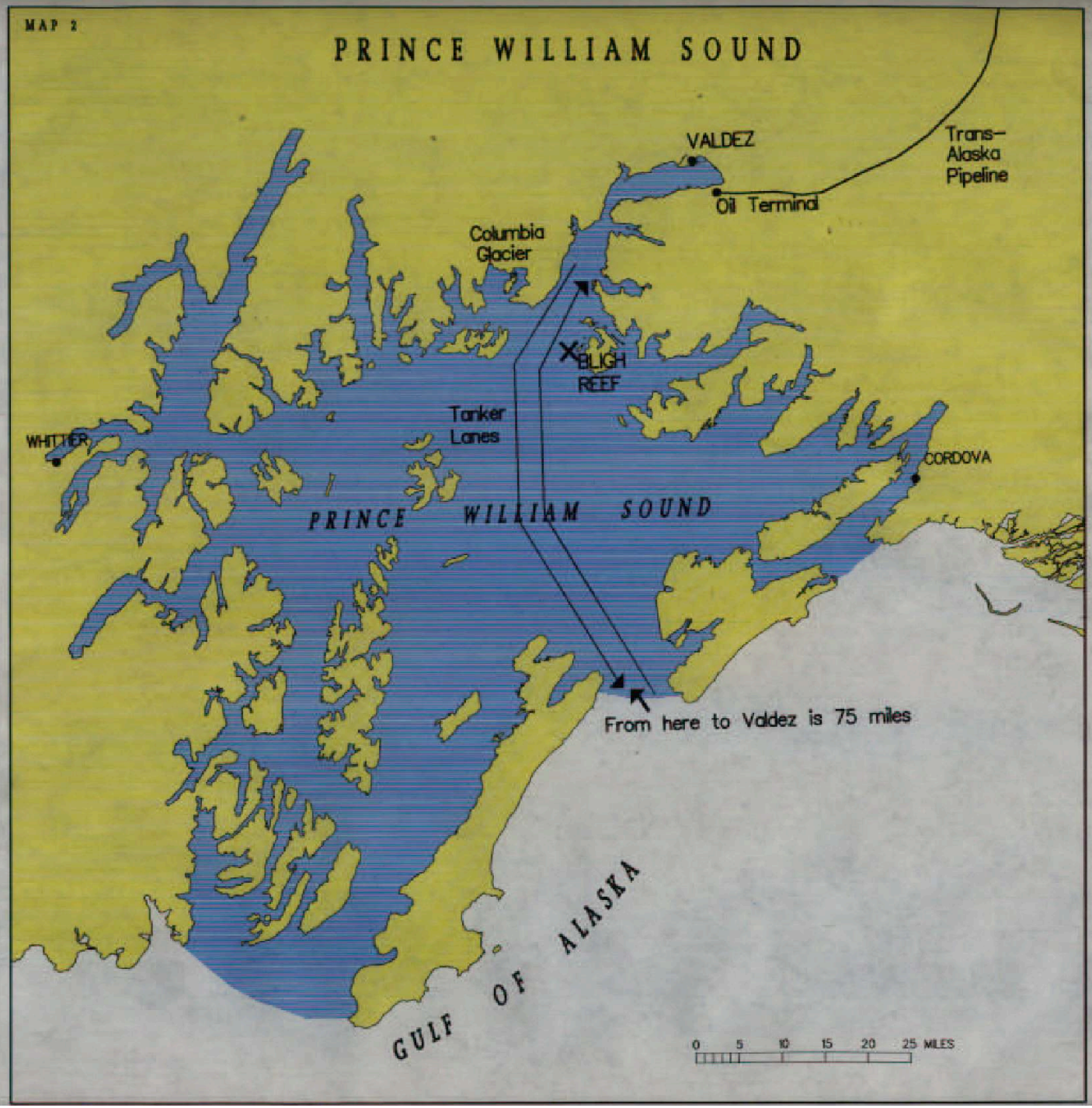
d) CV Survey: General Features

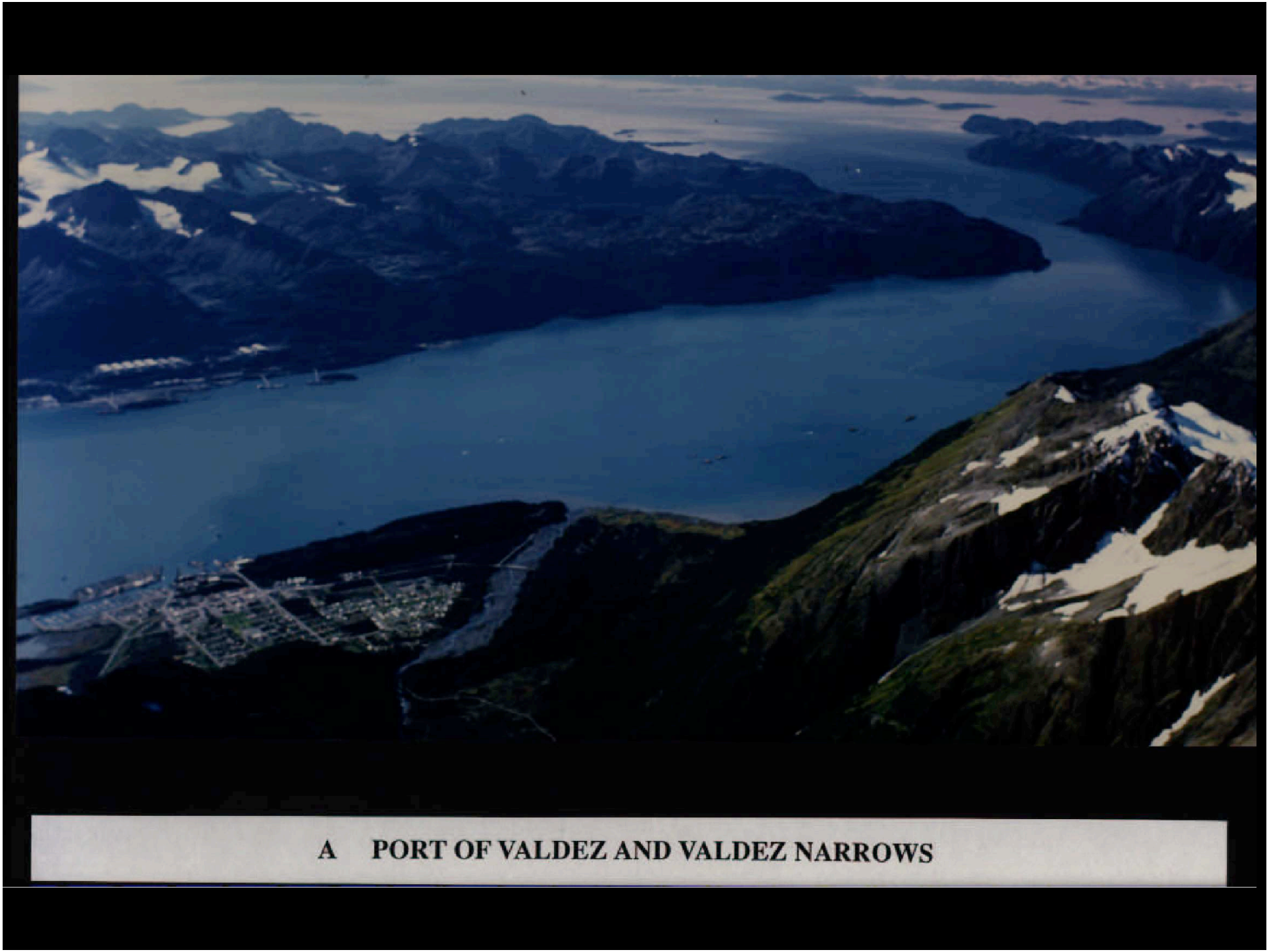
- Introduction sets context for decisions
- Detailed description of the good
- Institutional setting for provision of good
- *Mechanism of payment for good*
- *Method to elicit preference for good*
- Debriefing on reasons for responses
- Questions on respondent characteristics

Exxon Valdez CV Study

Carson *et al.* (1992)
Carson *et al.* (2003)

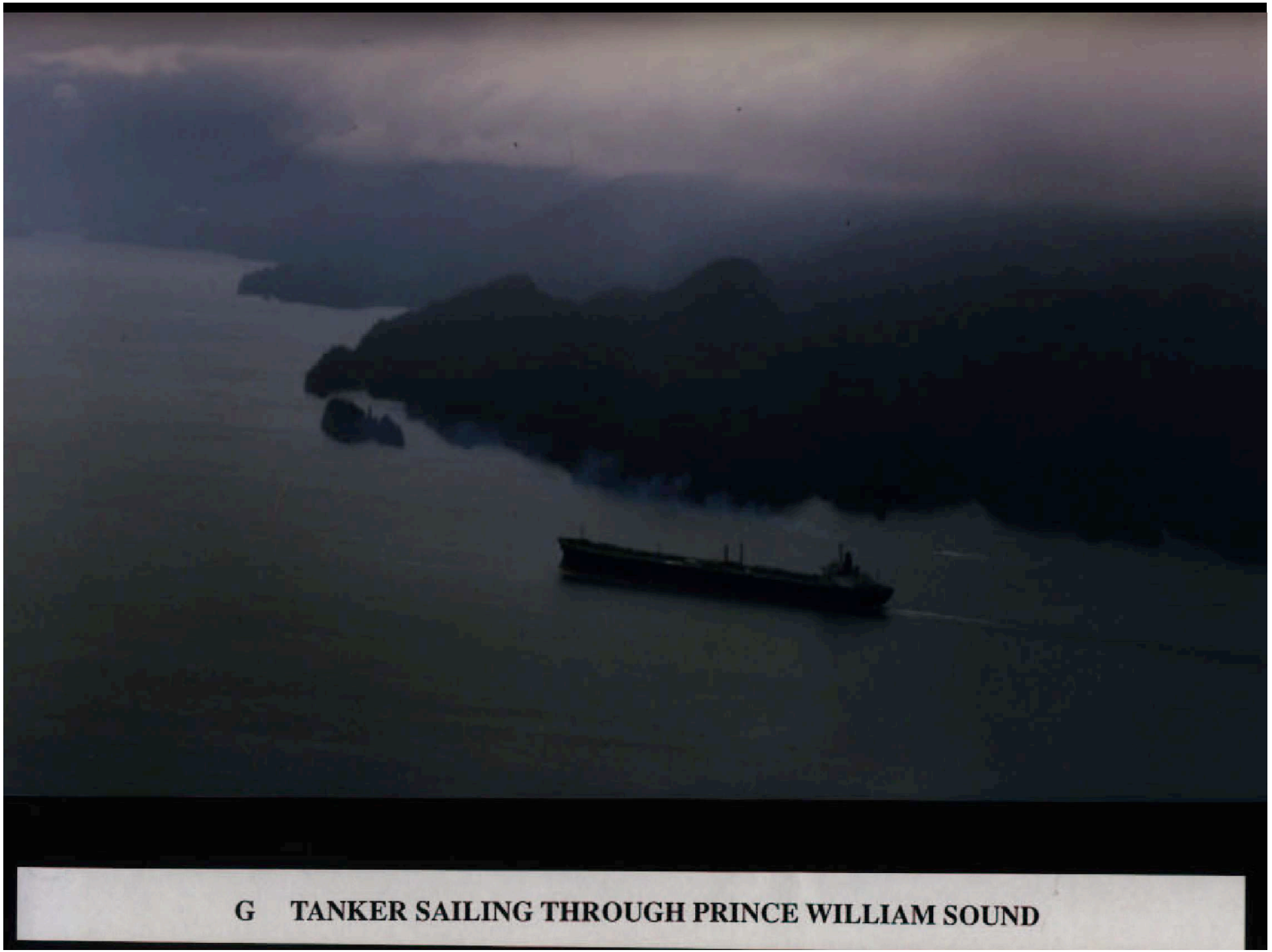

MAP 1
BERING SEA


MAP 2
PRINCE WILLIAM SOUND
VALDEZ
Trans-
Alaska
Pipeline
Oil Terminal
Columbia
Glacier
BLIGH
REEF
Tanker
Lanes
WHITTIER
CORDOVA
PRINCE WILLIAM SOUND
From here to Valdez is 75 miles
GULF OF ALASKA
0 5 10 15 20 25 MILES

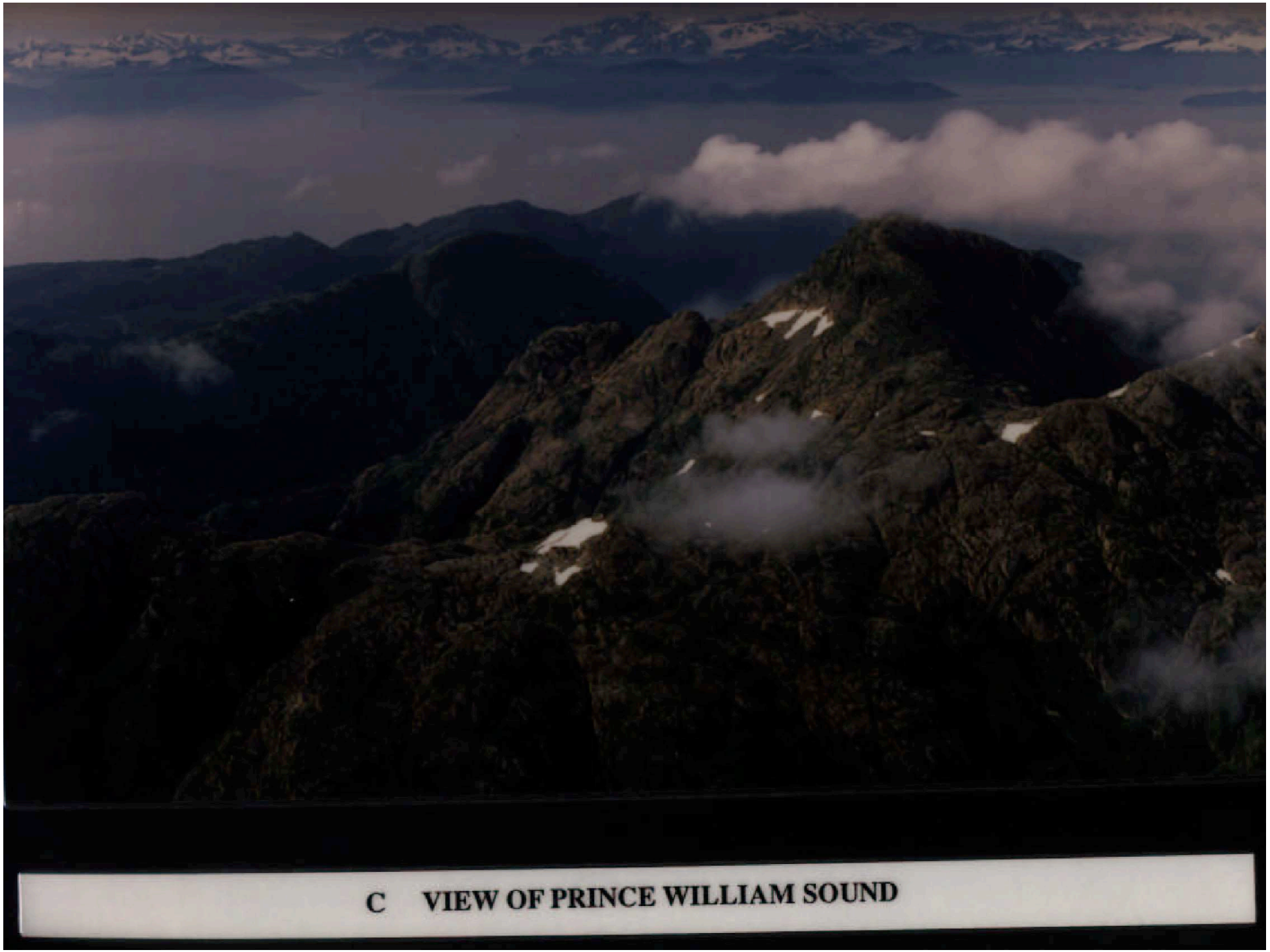


A PORT OF VALDEZ AND VALDEZ NARROWS

B COLUMBIA GLACIER ON PRINCE WILLIAM SOUND

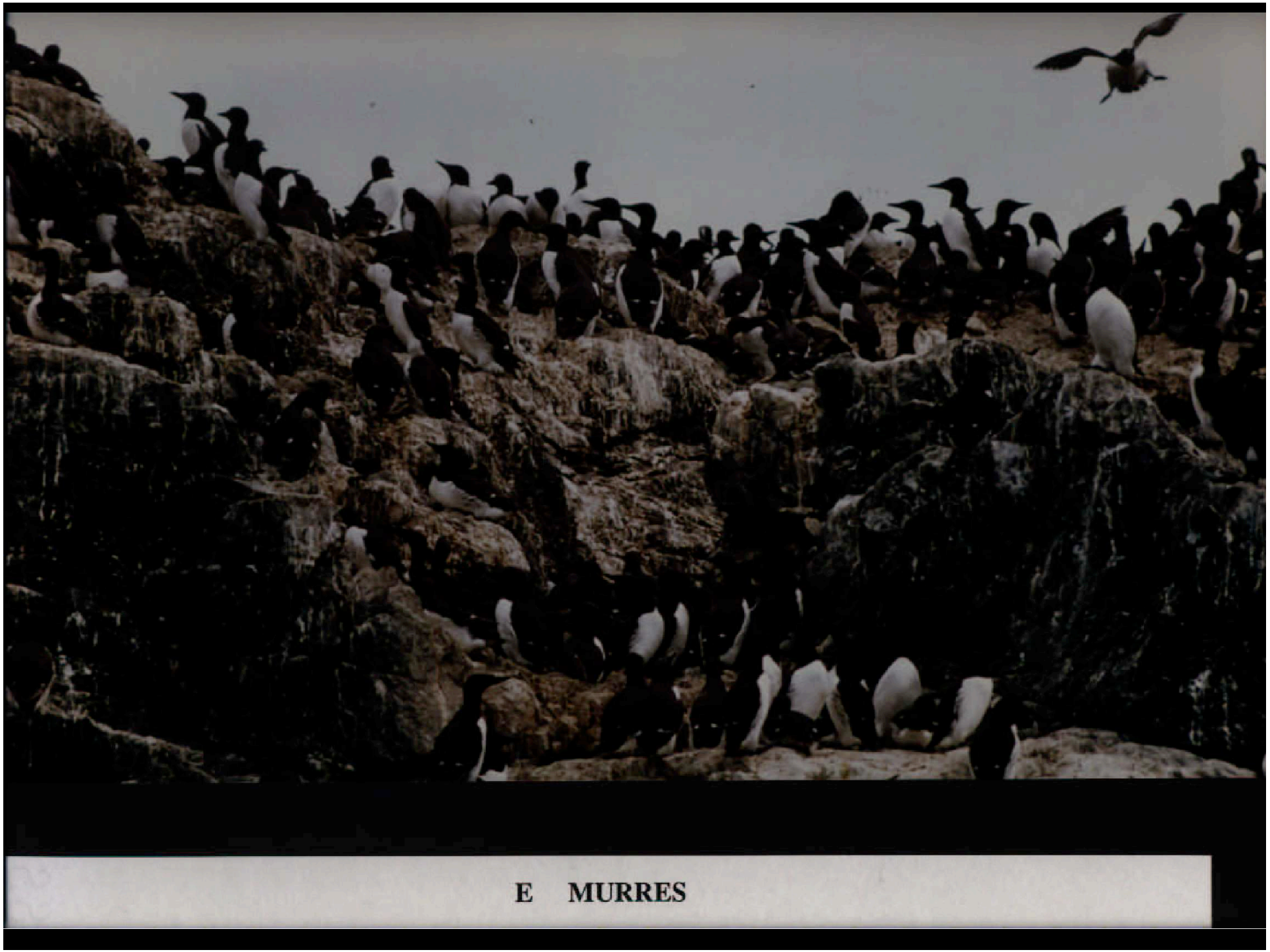


G TANKER SAILING THROUGH PRINCE WILLIAM SOUND



C VIEW OF PRINCE WILLIAM SOUND

D NESTING GULLS AND CORMORANTS ON CLIFF



E MURRES

F SEA OTTER

BOX B

During the period of the spill there were about one and a half million seabirds and sea ducks of various species in the spill area inside and outside Prince William Sound. (POINT)

As you can see from this card, 22,600 dead birds were found. (POINT)

The *actual* number of birds killed by the oil was larger because not all the bodies were recovered. Scientists estimate that the total number of birds killed by the spill was between 75,000 and 150,000.

About *three-fourths* of the dead birds found were *murres*, the black and white bird I showed you earlier. This is shown on the first line of the card. (POINT)

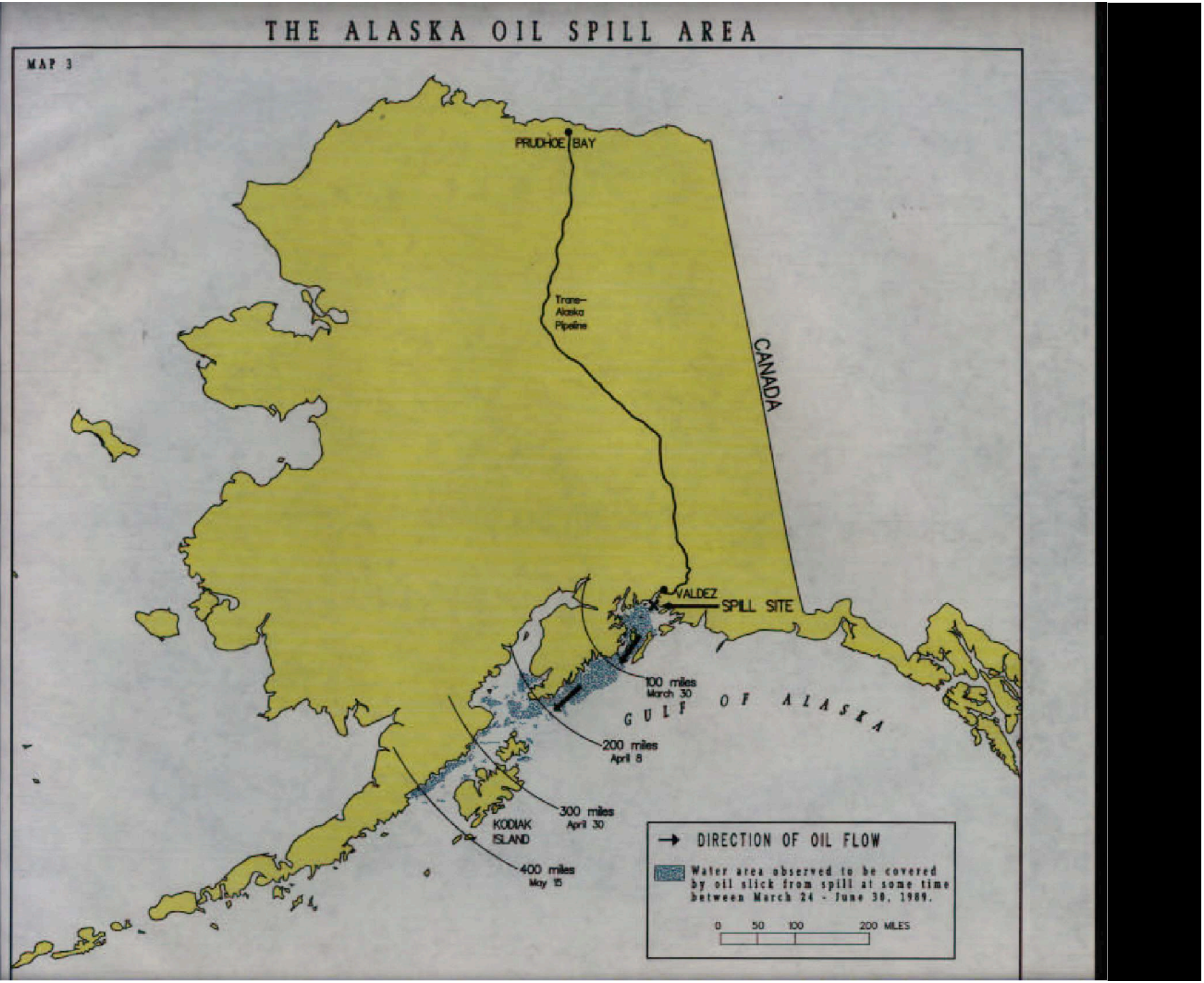
Because an estimated 350,000 murres live in the spill area, this death toll, though high, does *not* threaten the species.

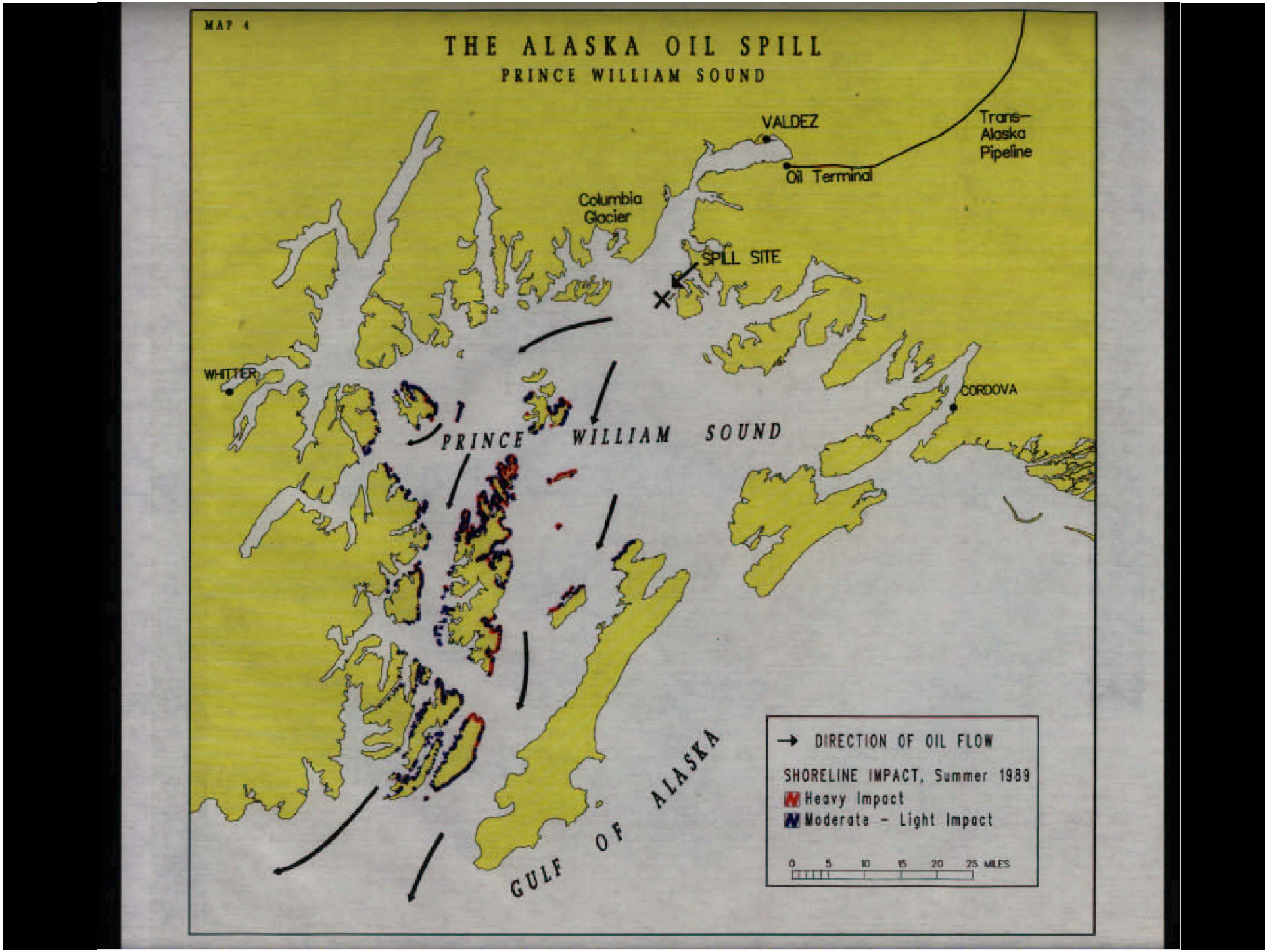
One hundred of the area's approximately 5,000 bald eagles were also found dead from the oil.

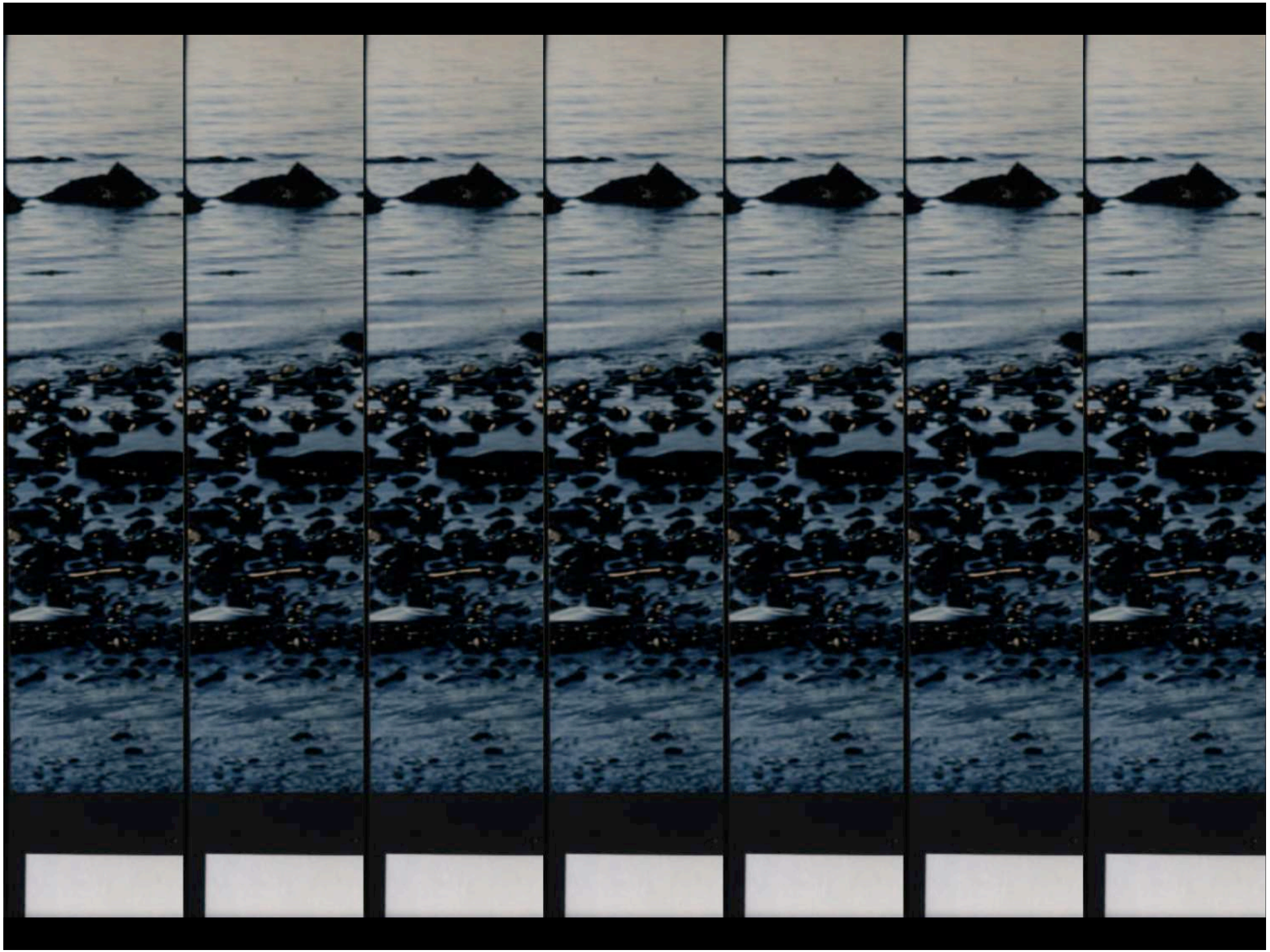
The spill did *not* threaten any of the Alaskan bird species, including the eagles, with extinction. (PAUSE)

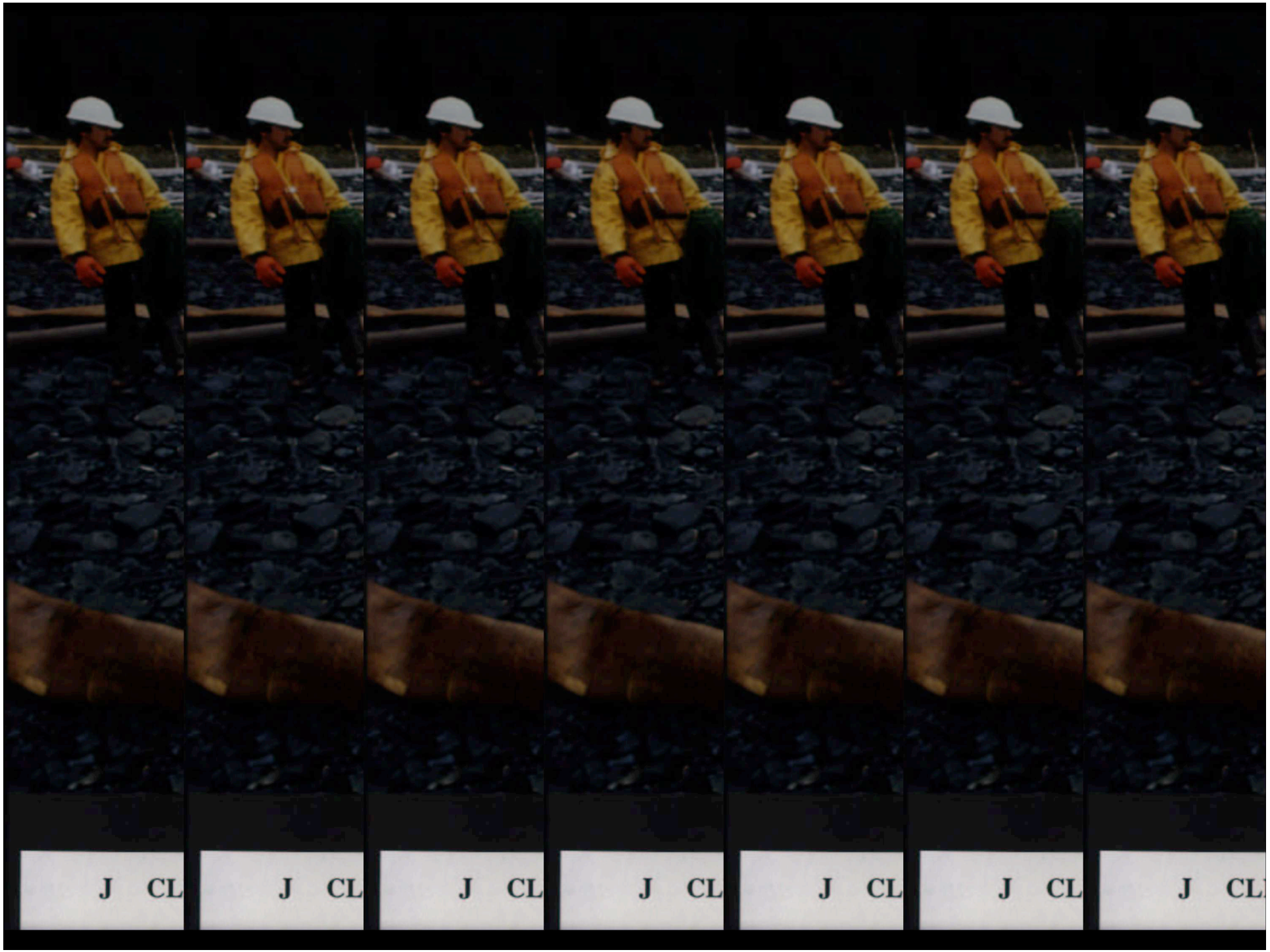
Bird populations occasionally suffer large losses from disease or other natural causes. Based on *this* experience, scientists expect the populations of all these Alaskan birds to recover within 3 to 5 years after the spill. (PAUSE)

THE ALASKA OIL SPILL AREA




MAP 4
THE ALASKA OIL SPILL
PRINCE WILLIAM SOUND
VALDEZ
Trans-
Alaska
Pipeline
Oil Terminal
Columbia
Glacier
SPILL SITE
WHITTIER
CORDOVA
PRINCE WILLIAM SOUND
GULF OF ALASKA
DIRECTION OF OIL FLOW
SHORELINE IMPACT, Summer 1989
Heavy Impact
Moderate - Light Impact
0 5 10 15 20 25 MILES




J CL
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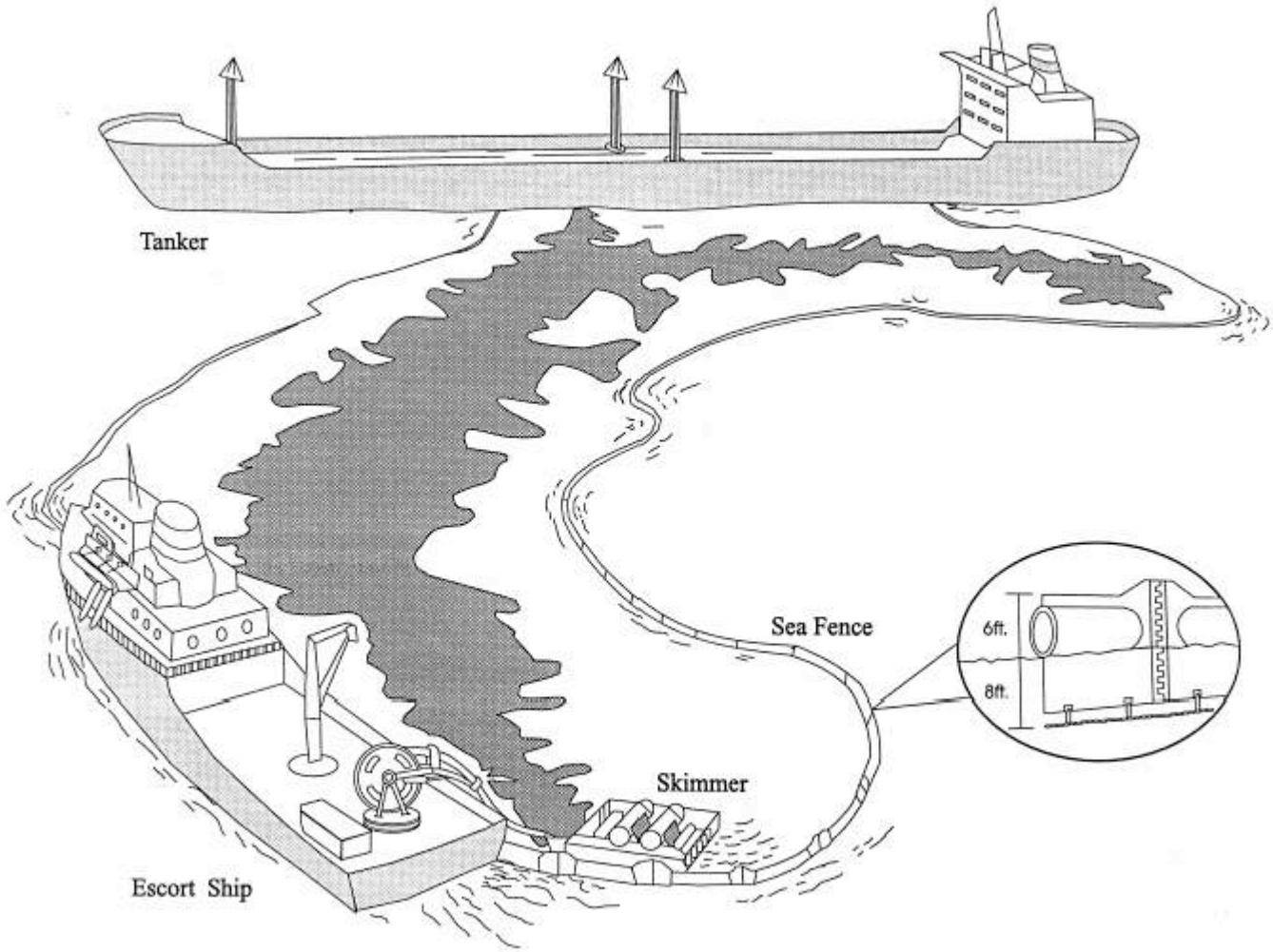

Tanker
Sea Fence
6ft.
8ft.
Skimmer
Escort Ship

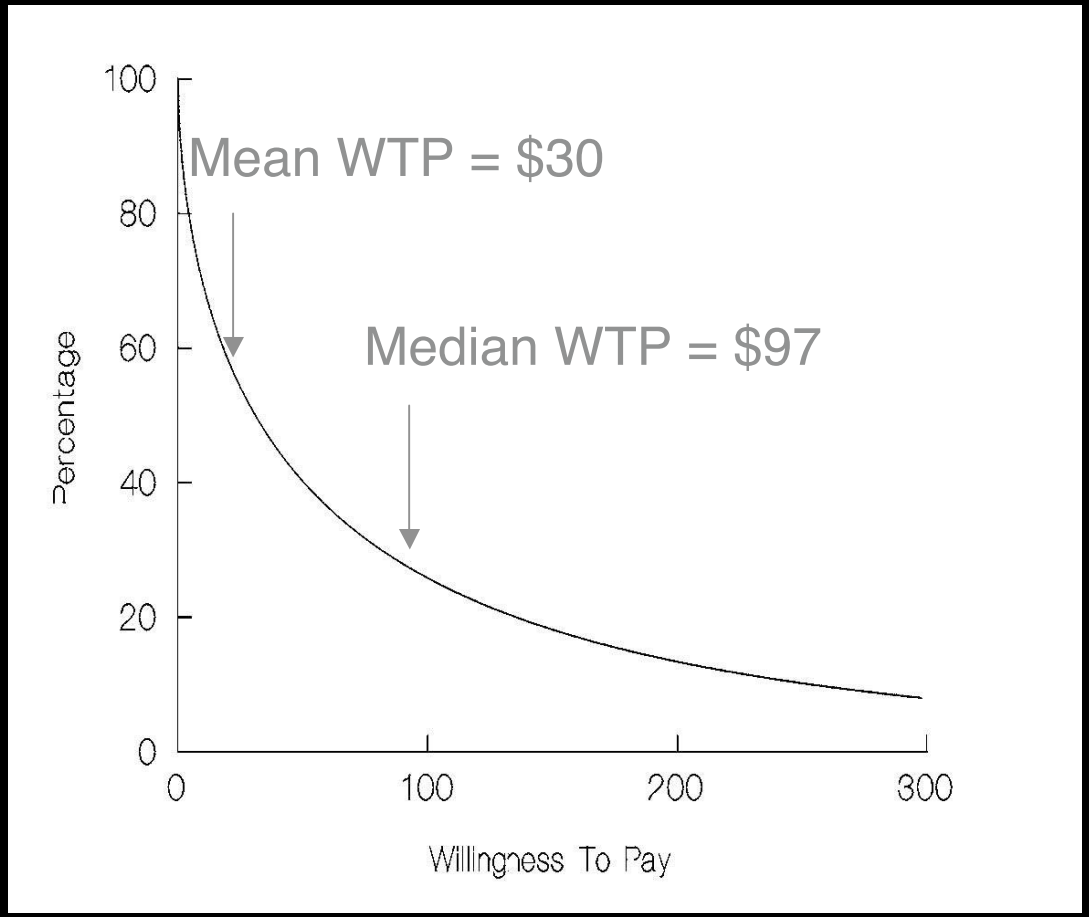
Willingness to Pay Question

"At present government officials estimate that the program will cost your household a total of $X (where $X is randomly assigned amount). You would pay this in a special one time charge in addition to your regular federal taxes.

The money would only be used for the program to prevent the damage from another large oil spill in Prince William Sound.

If the program cost your household a total of $X would you vote for the program or against it."

Percent Willingness to Pay as a Function of Program Cost



California Oil Spill CV Study

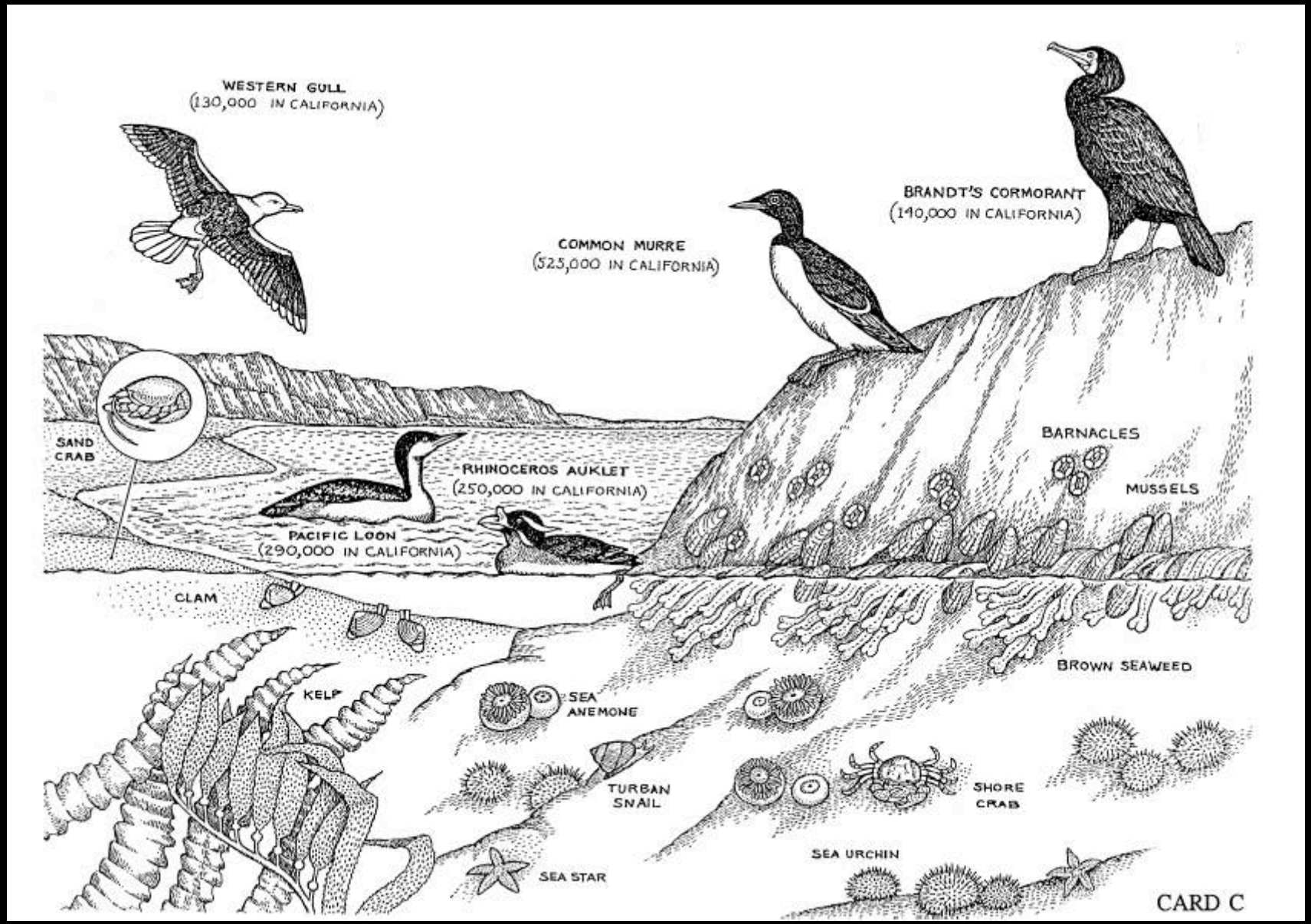
Carson *et al.* (2004)


Super-Tanker
Routes
Oregon
Crescent City
Eureka
San Francisco
Farallon
Islands
Santa Cruz
Central Coast
Small Tanker and
Barge Route
San Luis Obispo
Ventura
Los Angeles
Channel
Islands
San Diego
Mexico
CARD B

Saltwater marsh

Rocky shoreline

Sandy beach


WESTERN GULL
(130,000 IN CALIFORNIA)
COMMON MURRE
(525,000 IN CALIFORNIA)
BRANDT'S CORMORANT
(140,000 IN CALIFORNIA)
SAND CRAB
RHINOCEROS AUKLET
(250,000 IN CALIFORNIA)
PACIFIC LOON
(290,000 IN CALIFORNIA)
BARNACLES
MUSSELS
CLAM
BROWN SEAWEED
KELP
SEA ANEMONE
TURBAN SNAIL
SHORE CRAB
SEA URCHIN
SEA STAR
CARD C

Expected Harm from Oil Spills off Central Coast

TOTAL HARM OVER NEXT 10 YEARS	TIME TO RECOVER AFTER EACH SPILL
12,000 birds killed **1,000 birds** injured	10 years
Many small animals and saltwater plants killed along **10 miles** of shoreline	5 years

CARD D

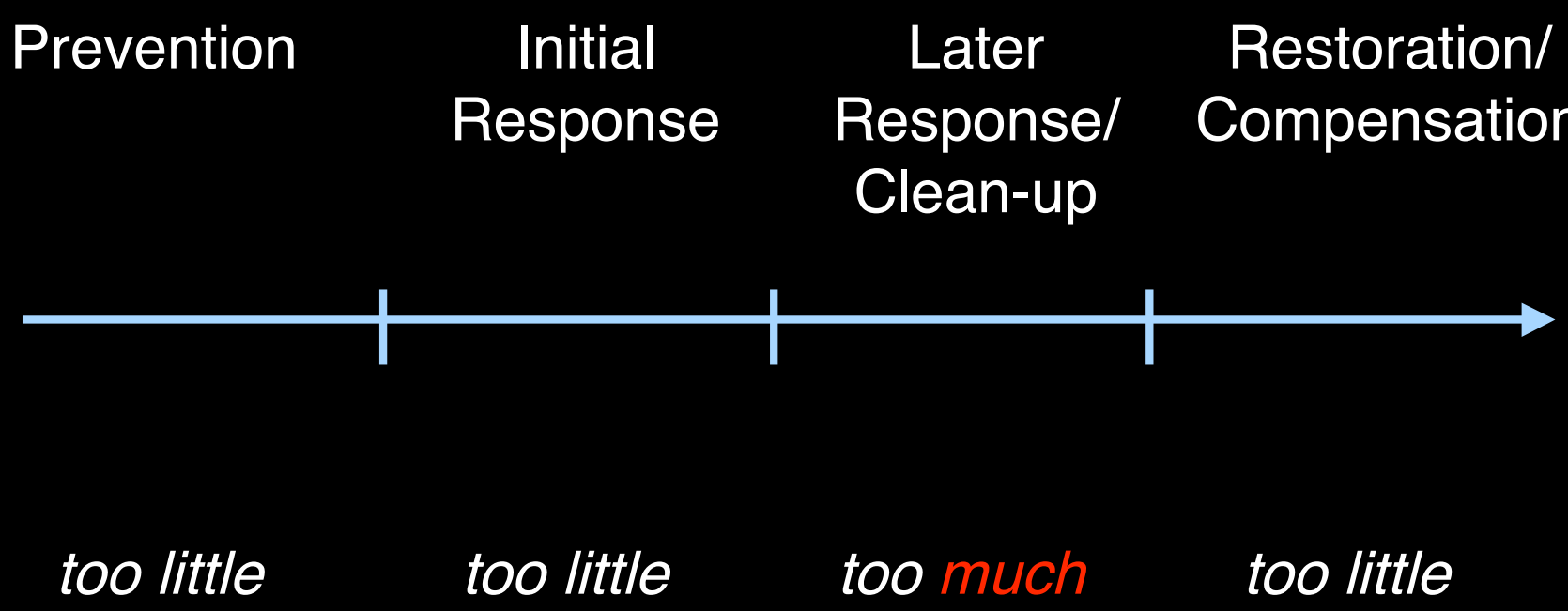
Undesired Response to Unlimited Liability

- Moral Hazard Problem:
  - May be optimal to contract-out high risk activity to asset-poor firms so that firms can go bankrupt once a spill occurs
- Implications:
  - No incentive to prevent oil spill
  - Firms least able to prevent spills are shipping oil

Comprehensive Response Plan Elements

- coordination of regional, national, local government agencies and ship owners
- area-specific response plans registered by ship owner
- pre-existing contracts for equipment and personnel
- government response plan manager with authority to override local laws to avoid great environmental harm

Allocating Resources



Remaining Problems

- 37% oil pollution from operational discharge and land-based sources
- 12% from accidental ships spills

(NRC 2002)

Acute Oil Spills vs. Chronic Spills

Similarity: low liability

Difference: lack of observation or assignment of responsibility

Conclusions

- Implementing the correct liability structure can dramatically reduce the injuries from oil spills
- Economic techniques for setting the correct liability are now well-developed

(NOAA 1980)

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Jeremy Jackson

Dale Squires

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