Fisher's local ecological knowledge about fish and climatic change

Renato A.M. **Silvano**[1,2], Henry P. Huntington[3] and Alpina Begossi[2,4]

[1] **Depto. Ecologia/ UFRGS, Porto Alegre , RS, Brazil**
[2] **Fisheries and Food Institute, Campinas, SP , Brazil**
[3] **Pew Environment Group, Eagle River, Alaska, USA**
[4] **Capesca- PREAC (Lepac) & CMU, Unicamp, SP, Brazil.**
E-mail: renato.silvano@ufrgs.br

F · I · F · O
FISHERIES AND FOOD INSTITUTE

ecologia
UFRGS

Outline

1. Introduction
   - What we know about climatic changes effects on fish: developed countries
   - What we still don't know very well: developing countries
2. How to apply fishers' knowledge to research on climatic changes

Two study cases: Brazil and Alaska

3. Brazilian and Alaska study cases
   - Methods
   - Main findings
4. Main conclusions
5. Further directions

Introduction and background

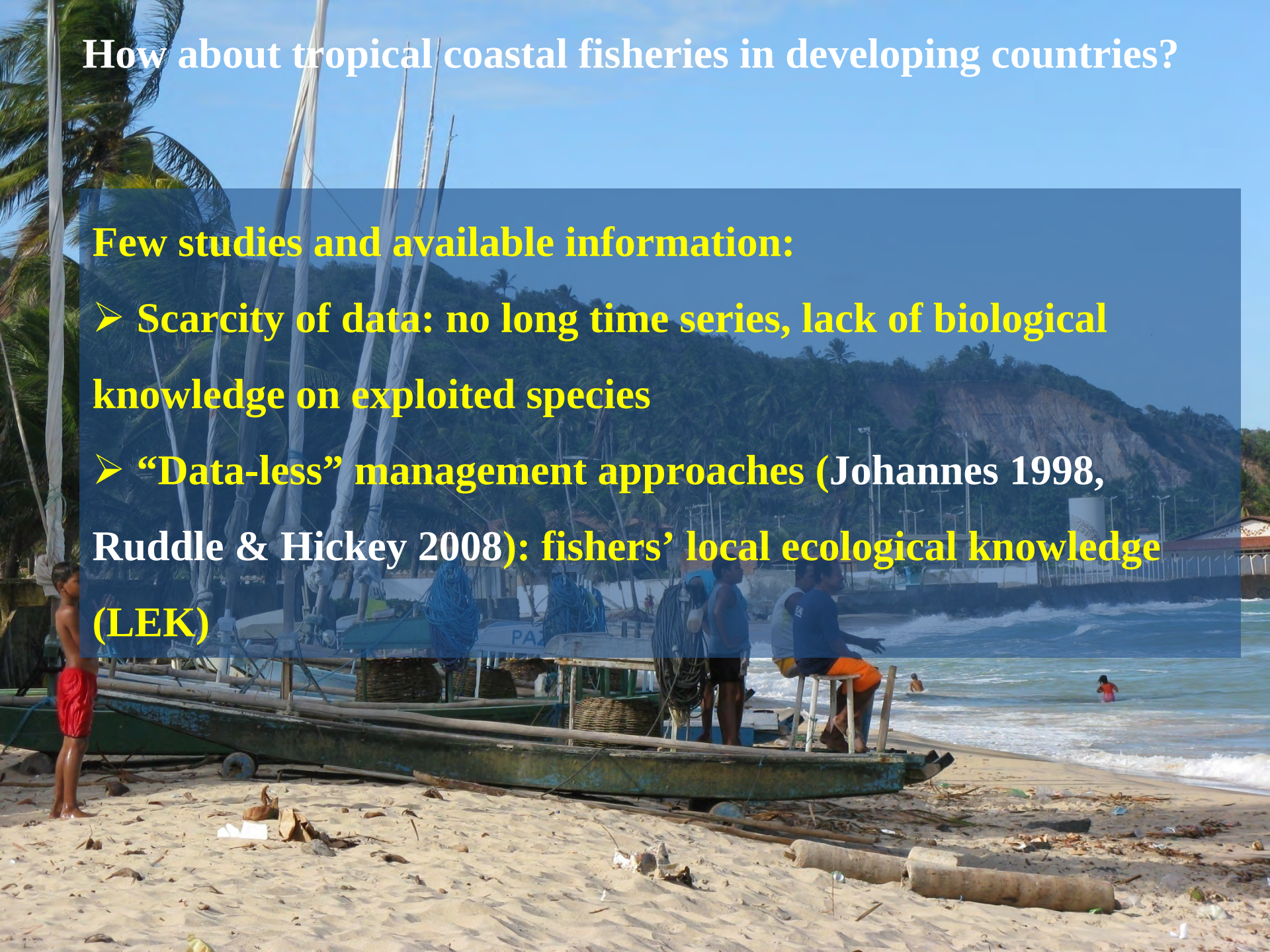
Climatic changes effects on marine fish and fisheries:

- **Increased water temperature and acidification**
- **Wind patterns and changes on currents**
- **Food availability (plankton)**
- **Synergistic effects with overfishing**

Eggs and larvae (survival) → juveniles and adults (distribution)

Most evidence from cold temperate ecosystems (North Seas, California) (Hofmann & Powell 1998, Beaugrand et al. 2003, Rindorf & Lewy 2006, Hsieh et al. 2009) or from tropical reefs in Australia (Dixson et al. 2010)

How about tropical coastal fisheries in developing countries?



Few studies and available information:

- **Scarcity of data: no long time series, lack of biological knowledge on exploited species**
- **"Data-less" management approaches (Johannes 1998, Ruddle & Hickey 2008): fishers' local ecological knowledge (LEK)**

Fishers have detailed local ecological knowledge (LEK) on fish: new biological hypotheses (Silvano and Valbo-Jorgensen 2008)

Fishers' LEK have been providing biological information :

Migration (Huntington et al. 2004, Silvano & Begossi 2005)

Reproduction (Aswani & Hamilton 2004, Silvano et al. 2006)

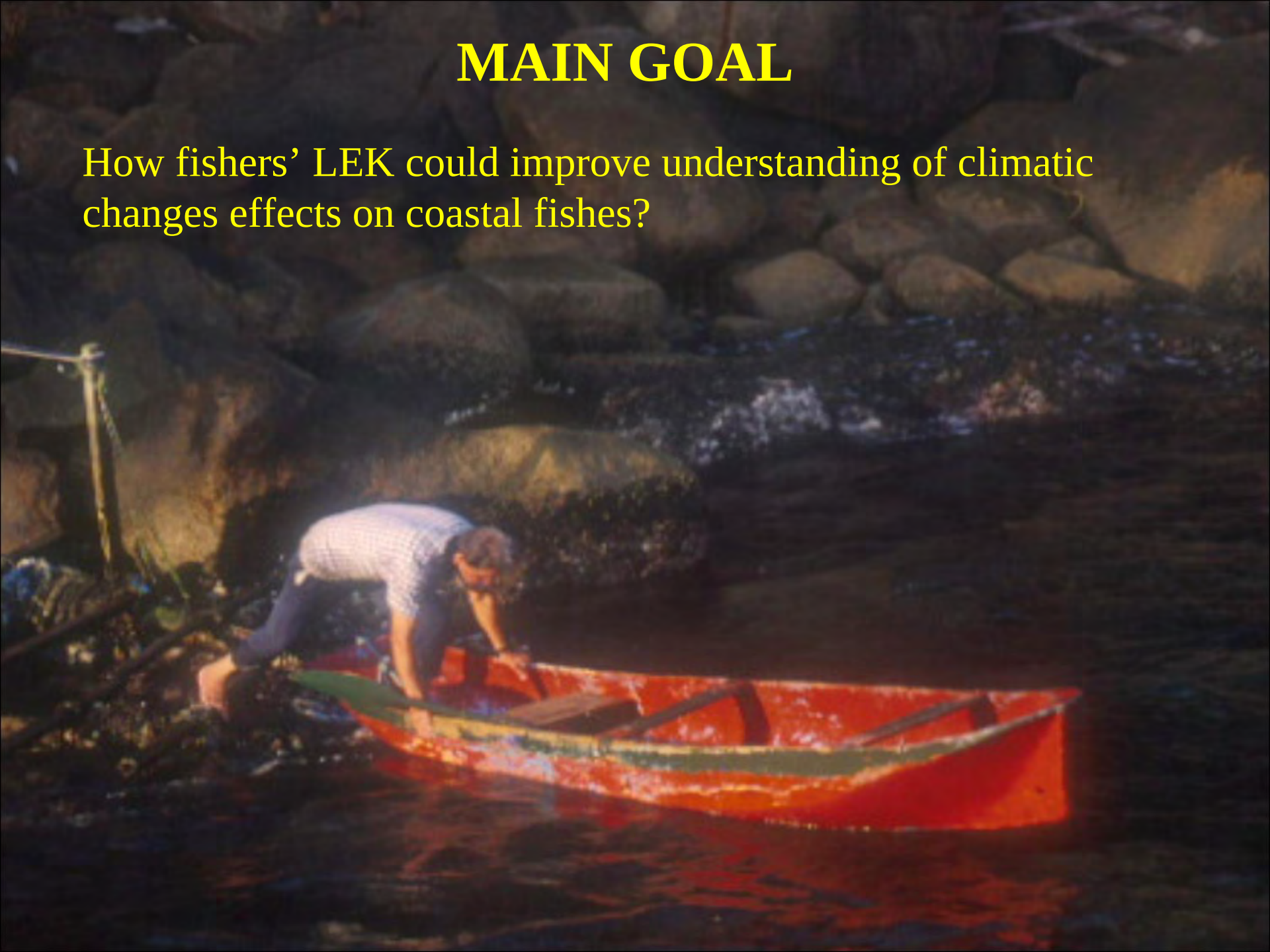
Trends in abundance patterns (spatially and temporally) (Saenz-Arroyo et al. 2005)

Diet and trophic relationships (Johannes et al. 2000, Silvano & Begossi 2002, Silvano et al. 2008)

Aquatic mammals incidentally caught (Souza & Begossi 2008, Silvano et al. 2009)

MAIN GOAL

How fishers' LEK could improve understanding of climatic changes effects on coastal fishes?



Two study cases on marine fishers, LEK

Southern and southwestern Alaska (U.S.A.): qualitative survey

- Environmental change

Brazilian southeastern coast (tropical): quantitative survey

- Fish seasonal patterns

SE Brazilian coast: Búzios Island, SP

- Local small-scale artisanal coastal fishers: catch mainly fish and squid, use paddled canoes, gillnets and hook and line (Begossi 1996)
- Show detailed LEK about exploited fishes, such as bluefish (*Pomatomus saltatrix*) (Silvano and Begossi 2005)

METHODS

- Study conducted with purposes other than analyzing fishers' perceptions on climatic changes: fishers' LEK on coastal fishes
- Semi-structured interviews using standardized questionnaires: same questions to several people
- Interviews with most (more than 70 %) fishermen older than 18 years and living in the island

Fish species (all important commercial and food fishes):

Bluefish: *Pomatomus saltatrix* (pelagic)

Grouper: *Epinephelus marginatus* (reef)

Yellowtail: *Seriola* spp. (pelagic)

Jack: *Caranx latus* (pelagic)

SE Brazilian coast: Búzios Island, SP

Comparison of answers between two fishers' age categories:

19-40 years: younger, current events

41 years and over: older, past events

40 years: criteria was also adopted in other surveys, middle age.
OBS: I am myself under 40 = 'younger' category

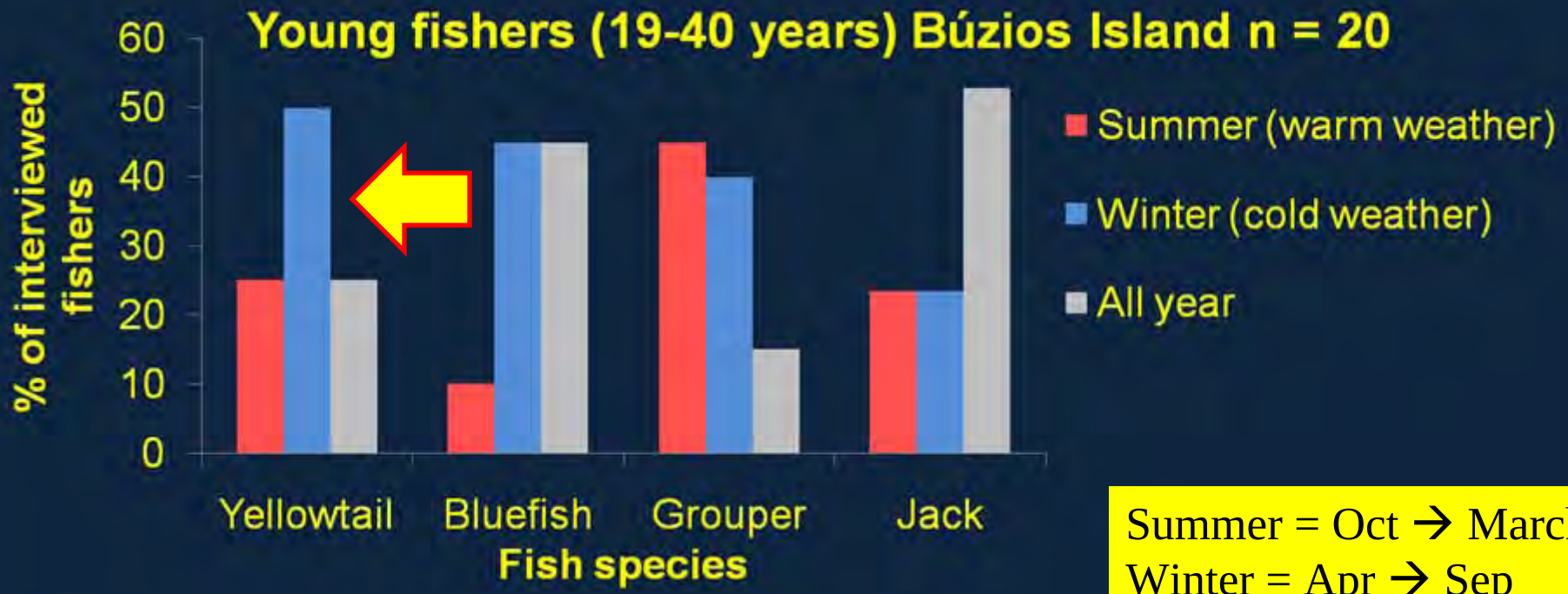
Biological aspect analyzed

Temporal variability on fish abundance (seasonal patterns): one question of the standard questionnaires

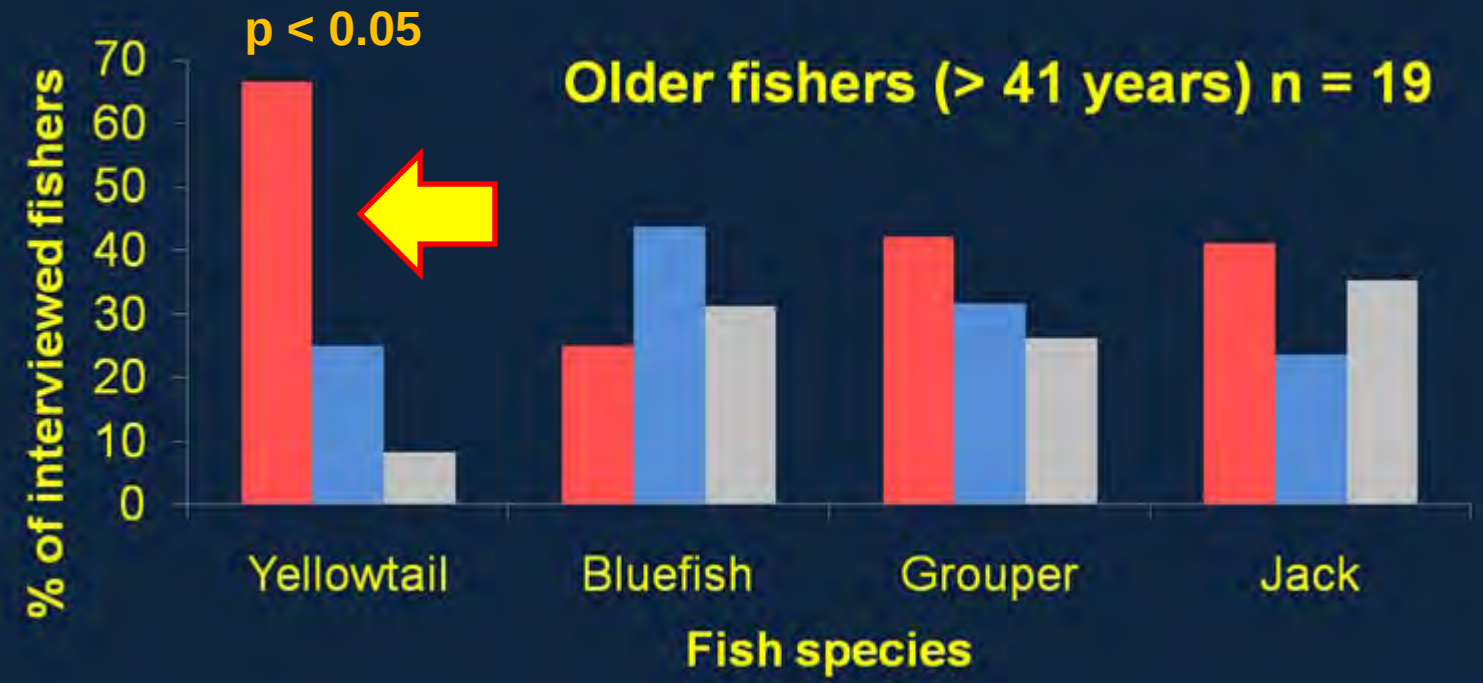
When does this fish occur here?

- More directly related to potential climatic changes: water temperature and currents.
- Fish abundance patterns not addressed: confounding factors, such as overfishing.

Comparison of cited answers between the two age categories of fishermen for each fish species (chi-square test):
Main answers differed → distinct seasonal patterns
Same main answers → no changes on seasonal patterns

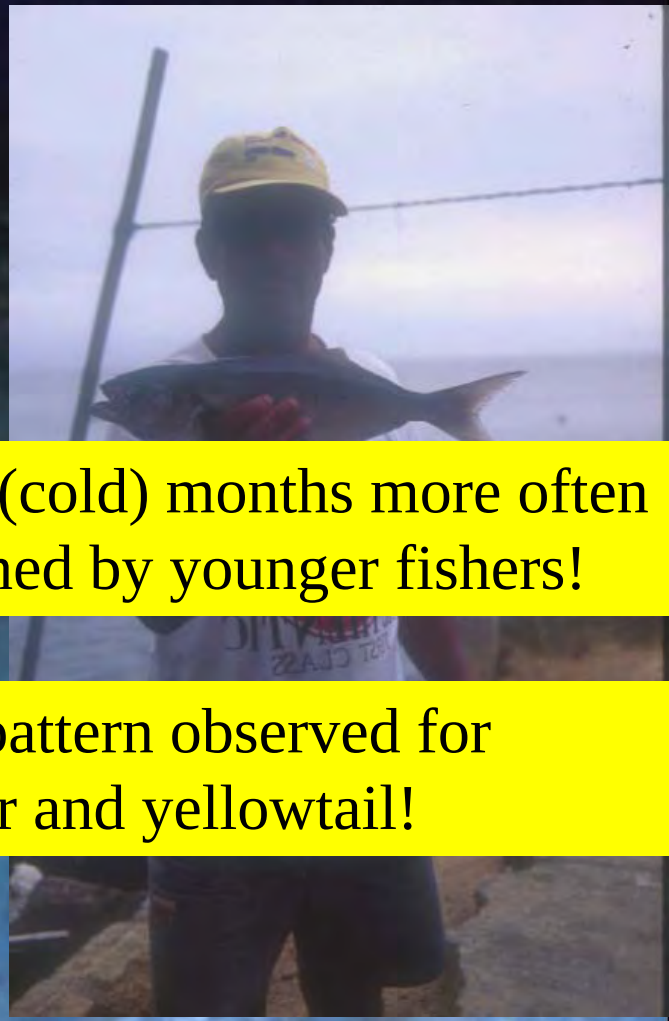


Summer = Oct → March
Winter = Apr → Sep



Monthly occurrence of bluefish according to Búzios Island fishers and chi-square tests significances

Months	Younger (n = 20) p < 0.01	Older (n = 19) n.s.
Jan	1	4
Feb	1	1
Mar	3	2
Apr	2	1
May	7	3
Jun	6	3
Jul	1	3
Aug	0	4
Sep	1	3
Oct	2	2
Nov	1	2
Dec	0	3



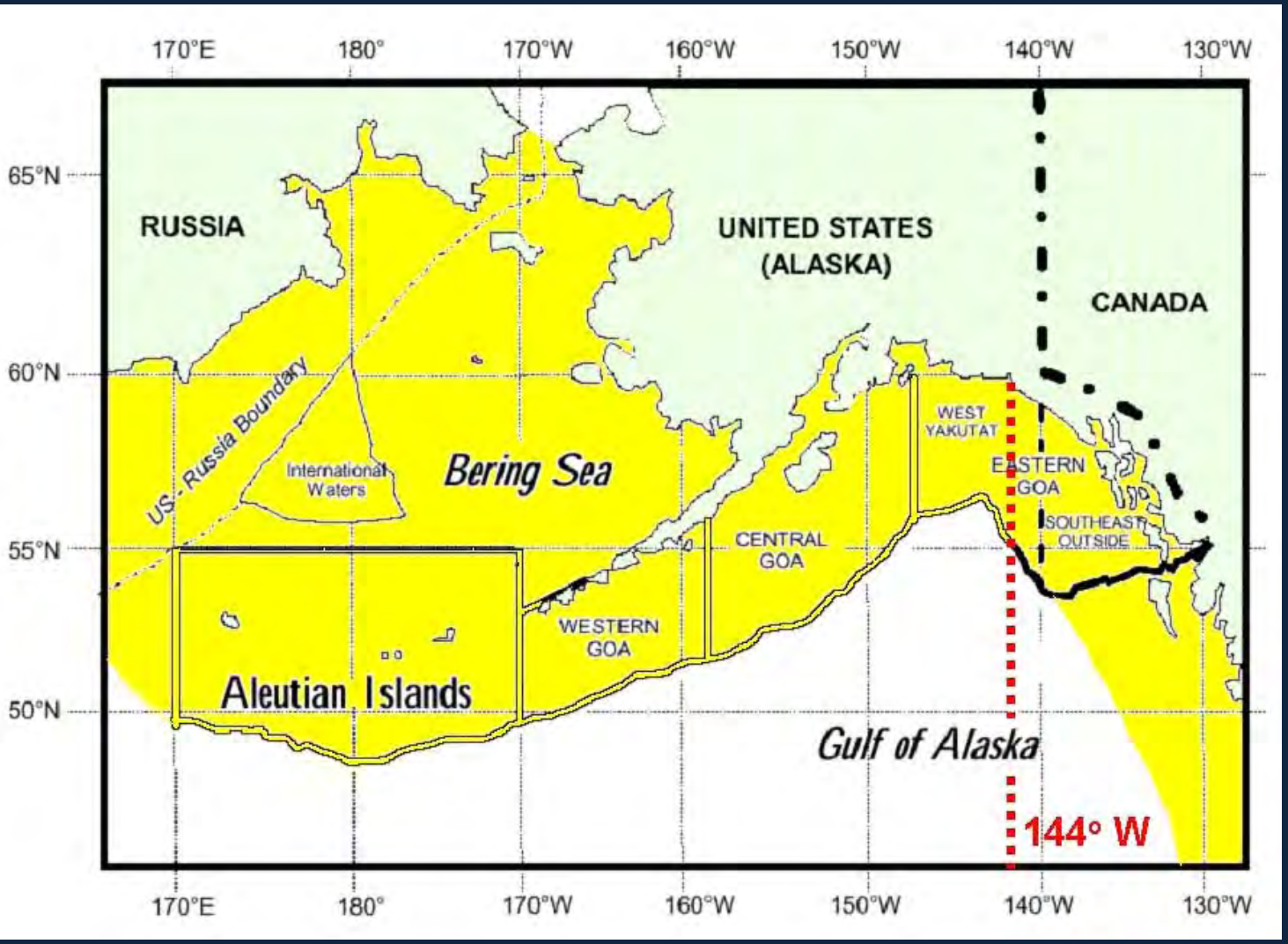
Winter (cold) months more often mentioned by younger fishers!

Same pattern observed for grouper and yellowtail!

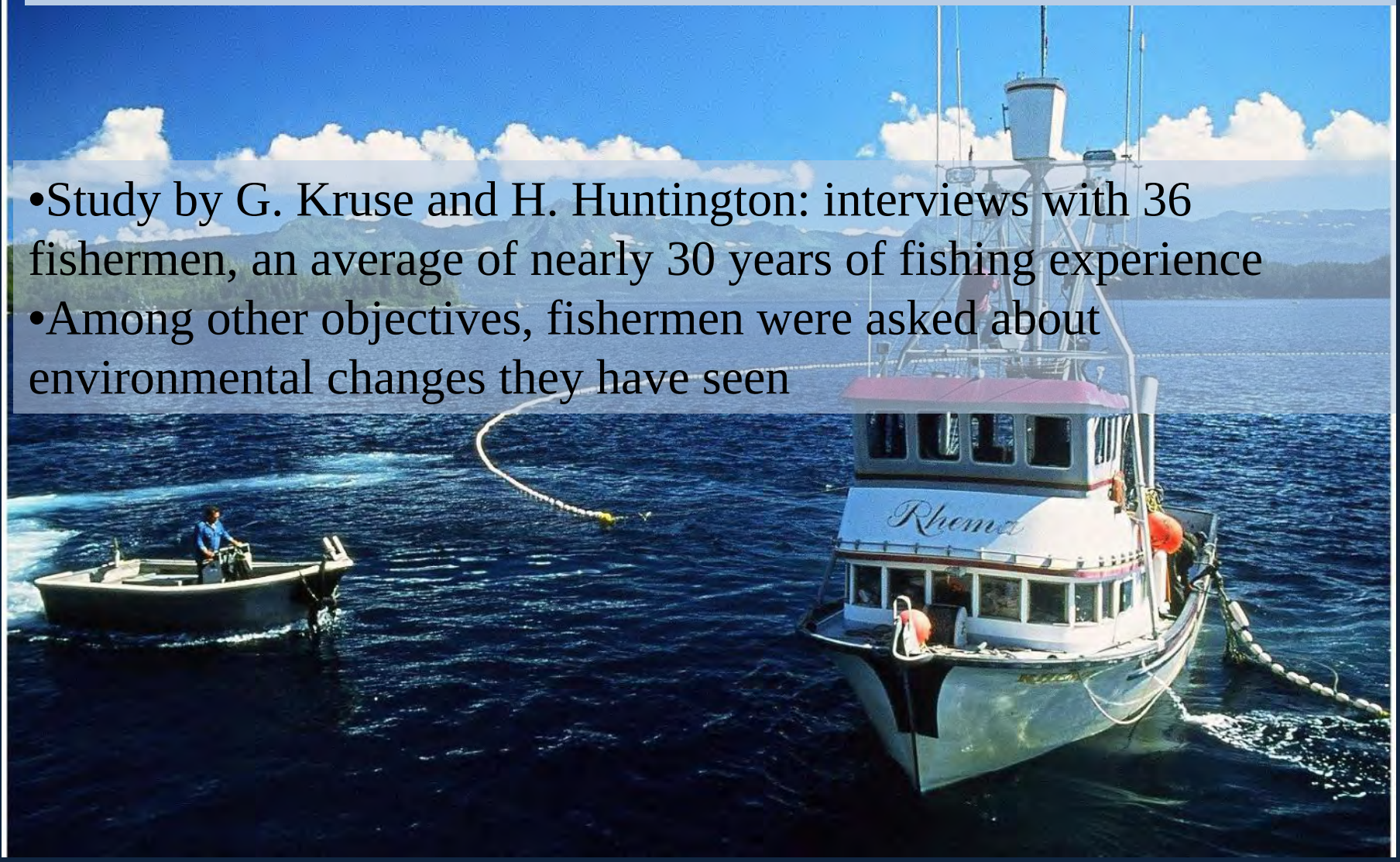
0-2	3-5	6-7	> 7

summer	winter

A Brief Comparison with Fishers' LEK from southern and southwestern Alaska



• Extensive commercial fisheries in Alaska, from small-scale artisanal fisheries to industrial-scale fisheries

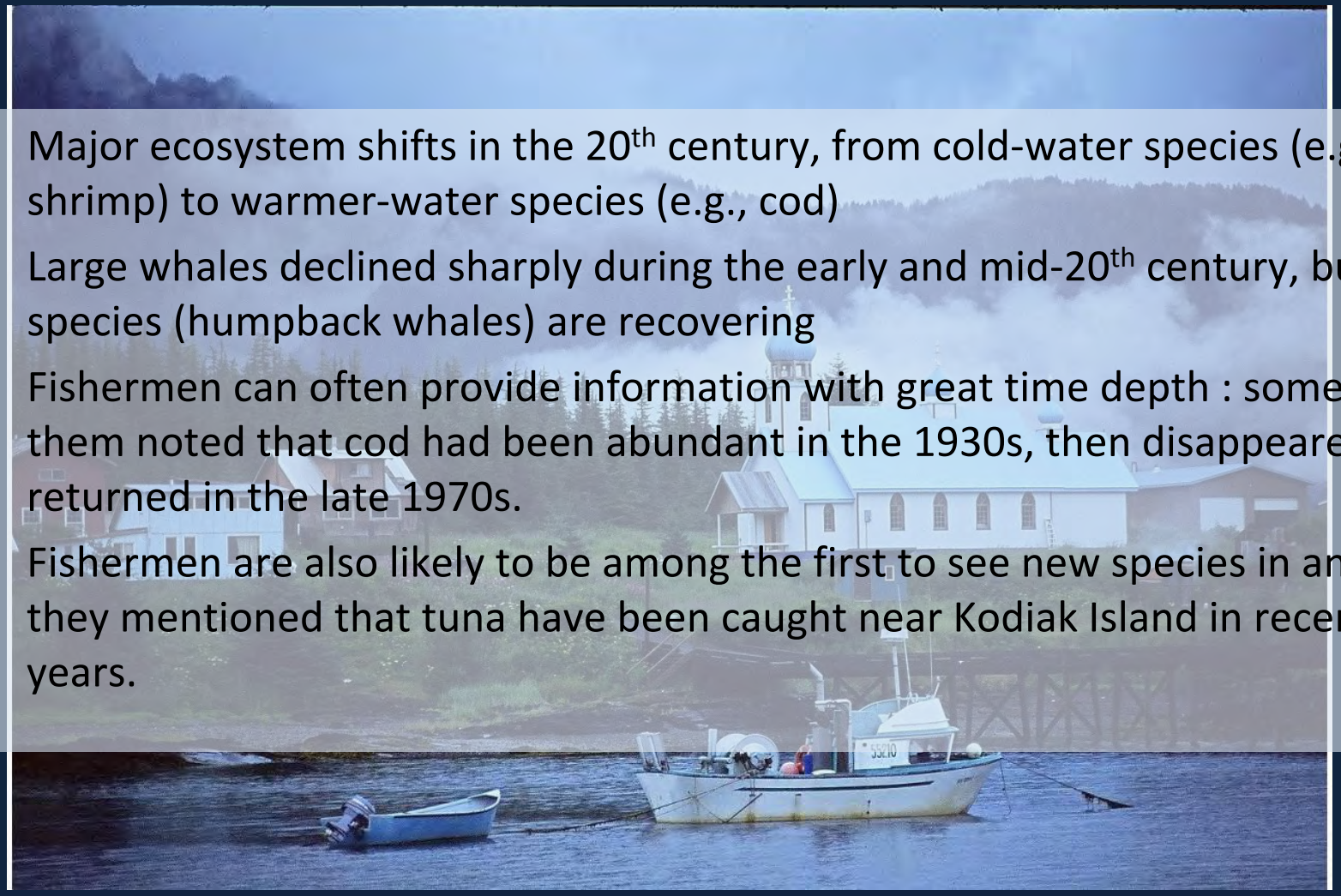


•Study by G. Kruse and H. Huntington: interviews with 36 fishermen, an average of nearly 30 years of fishing experience

•Among other objectives, fishermen were asked about environmental changes they have seen

Purse-seine fishing for salmon in Prince William Sound, Alaska

Selected Results from interview with fishers:



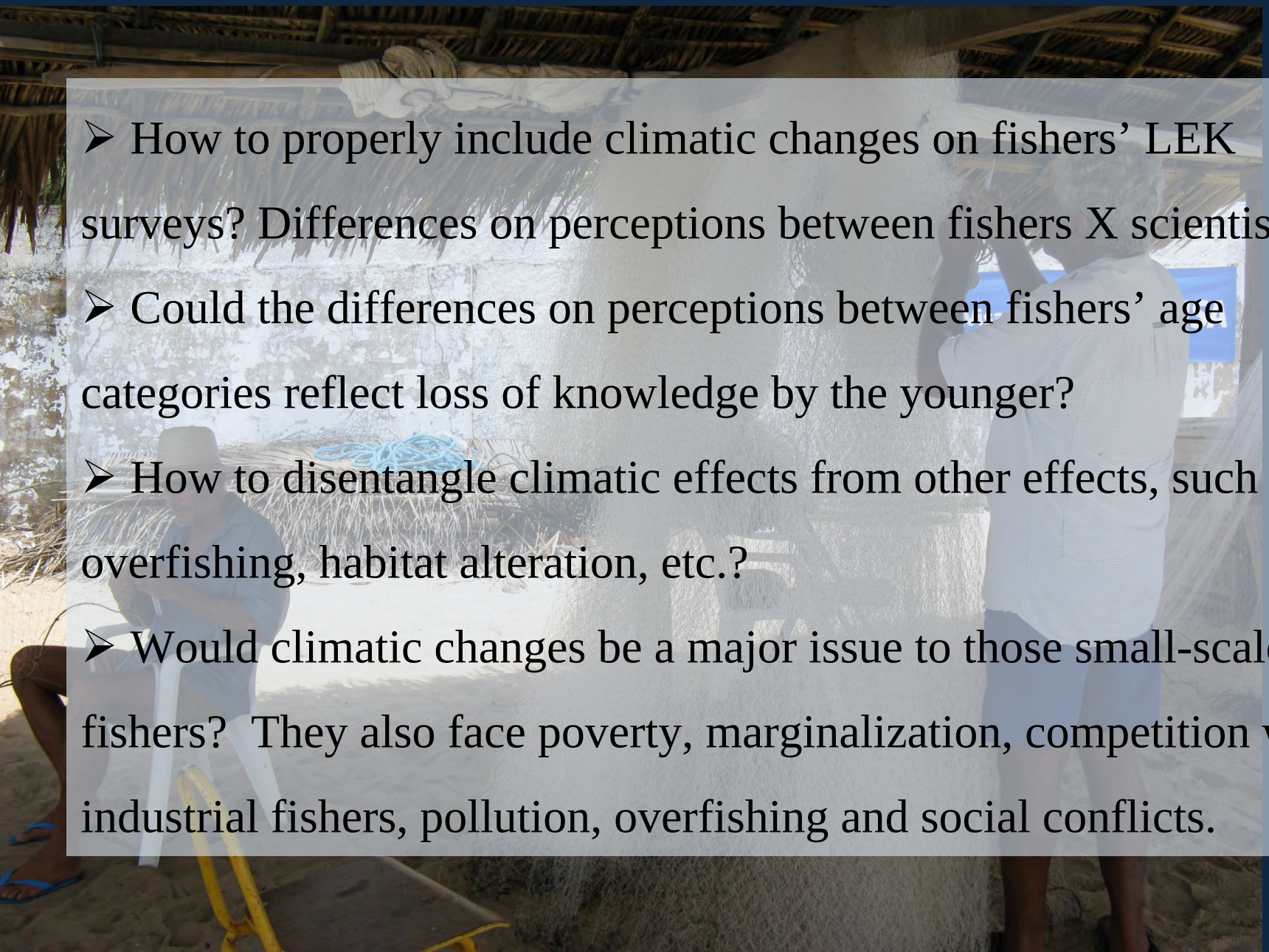
1. Major ecosystem shifts in the 20th century, from cold-water species (e.g. , shrimp) to warmer-water species (e.g., cod)
2. Large whales declined sharply during the early and mid-20th century, but some species (humpback whales) are recovering
3. Fishermen can often provide information with great time depth : some of them noted that cod had been abundant in the 1930s, then disappeared, and returned in the late 1970s.
4. Fishermen are also likely to be among the first to see new species in an area: they mentioned that tuna have been caught near Kodiak Island in recent years.

The village of Tatitlek in Prince William Sound, where local residents (predominantly Alutiiq, one of the Alaska Native groups) engage in commercial and subsistence (i.e., cultural, non-

Conclusions (so far….)

- Fishers' LEK has potential to improve understanding on climatic changes.
- In Brazil, fishers' LEK indicated that two some commercial fishes may be now occurring mainly during the winter or colder months: temporal changes in occurrence.
- Changes in water temperature (warmer waters during summer) or in currents (less cold currents)?
- In Alaska, fishers recognized changes in abundance of several marine species (from invertebrates to whales)

Future directions and challenges:



- How to properly include climatic changes on fishers' LEK surveys? Differences on perceptions between fishers X scientists
- Could the differences on perceptions between fishers' age categories reflect loss of knowledge by the younger?
- How to disentangle climatic effects from other effects, such as overfishing, habitat alteration, etc.?
- Would climatic changes be a major issue to those small-scale fishers? They also face poverty, marginalization, competition with industrial fishers, pollution, overfishing and social conflicts.

Acknowledgements

- To World Bank and PICES (conference organizers and sponsors) for financial support to R.A.M. Silvano attend to the conference and to present this paper
- To fishers of the studied communities (Brazil and Alaska) who kindly cooperate with this survey
- To FAPESP/ SP and IDRC/ Canada for funding the Brazilian research projects
- To Gordon Kruse and Mike Turek (Alaska survey)
- The Pollock Conservation Cooperative Research Center at the University of Alaska Fairbanks for funding the LEK project in Alaska