



MANAGEMENT AND ECONOMICS OF
RESOURCES AND THE ENVIRONMENT

UNIVERSITY OF SOUTHERN DENMARK

Department of Sociology, Environmental and Business Economics



Remaking of invasive species management: The RKC fishery in Norway

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IIFET

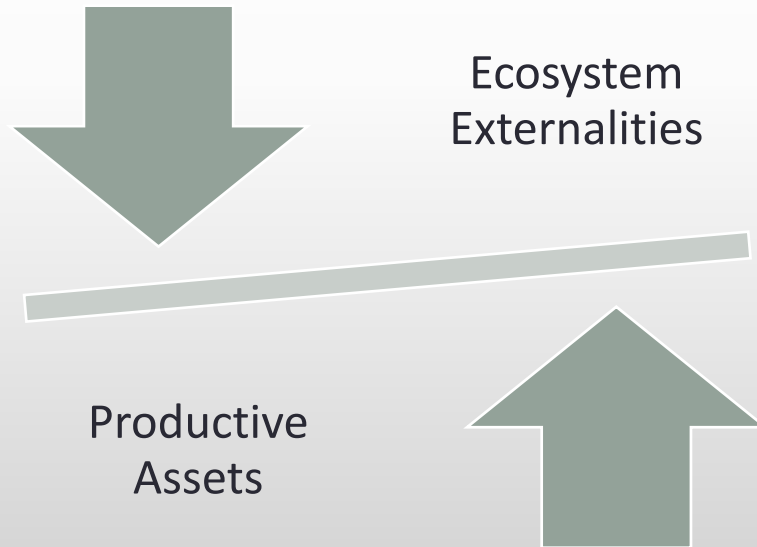
18/07/2018, Seattle

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Valuable Commodities in a world of depleting fish stocks

- Species change distributions: e.g. in Norway: Blue Whiting, Mackerel, Taskekrabbe
- Species intentionally or unintentionally introduced: Red King Crab, Snow Crab



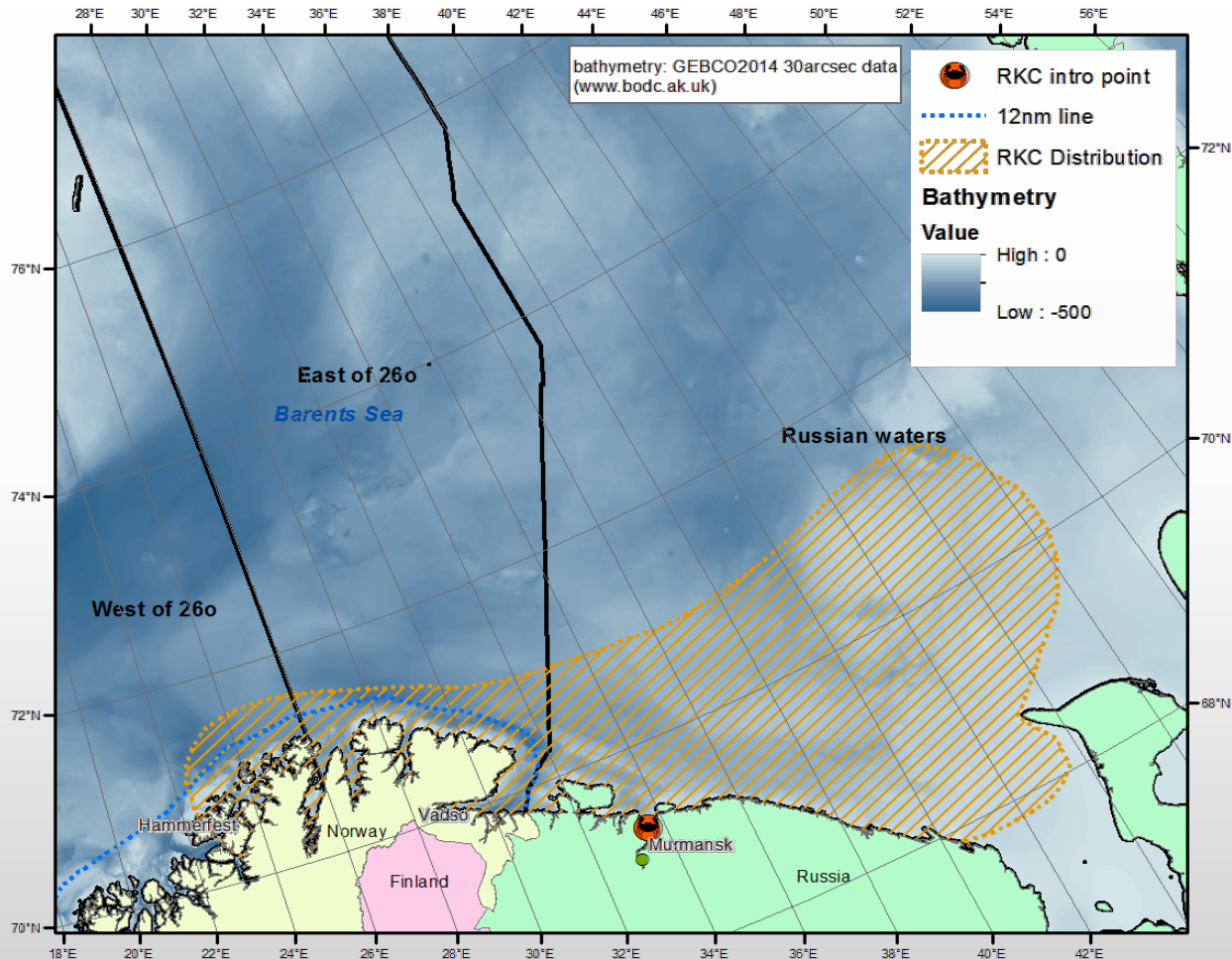


A hard to measure trade-off



Parolithodes camtschaticus

- Reconcile: long-term fishery vs. minimum spread
- High fishing mortality limits the spread but reduces stock
- Nærings- og fiskeridepartementet unclear on how to balance the **risk of spread** with **fisheries' stability**
- Socio-economic welfare in Finnmark's local communities



Russian waters

142,048.9 km²

Norwegian waters

East of 26°E

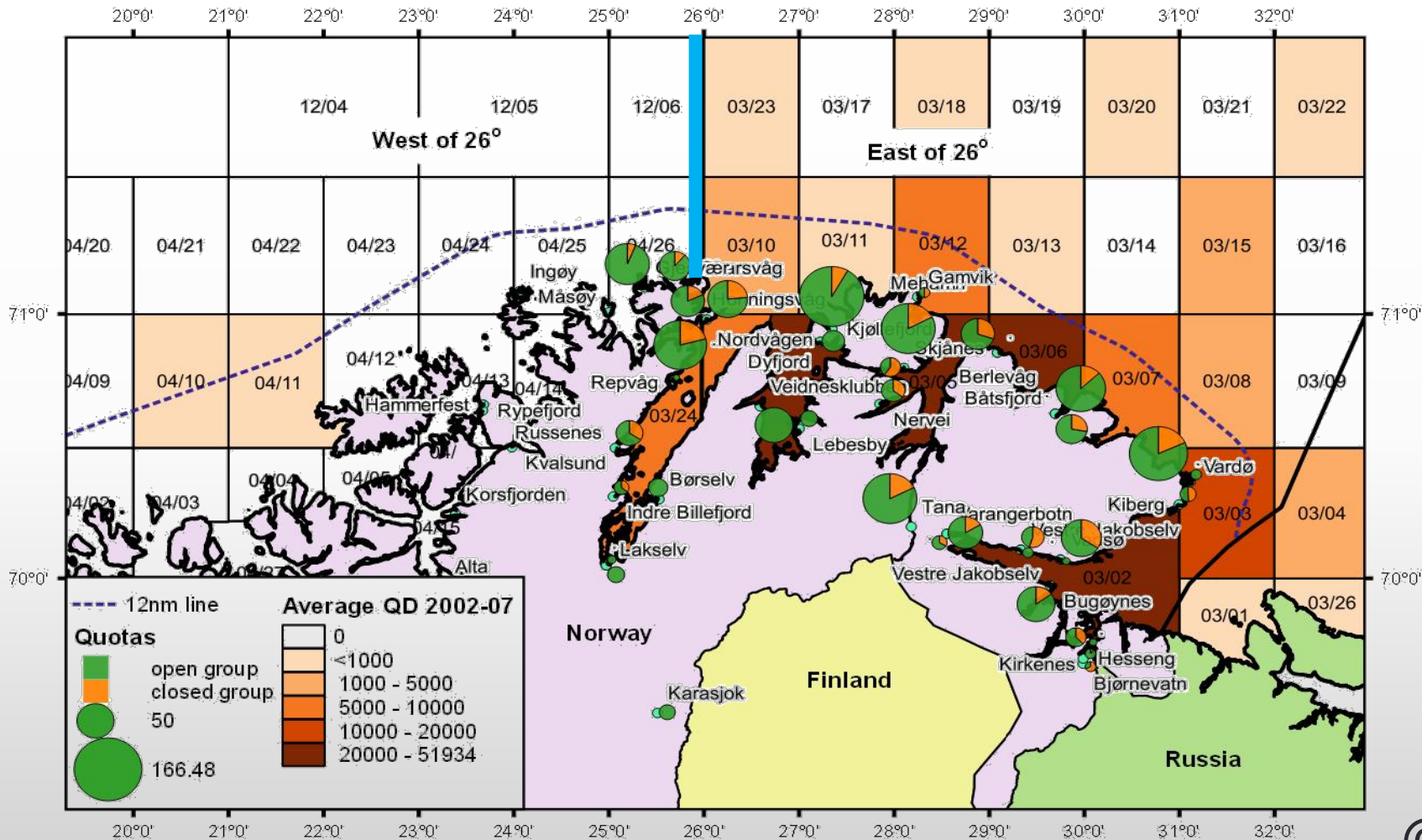
(Quota-regulated)

11,280.86 km²

West of 26°E

(Open-access)

12,253.32 km²



Catch Per Unit of Effort (CPUE)

$$\text{CPUE}_{\text{males}} = 0.0085X^{0.448}$$

- ✓ Abundance, Seasonality, Vessel Characteristics
- ✓ Logbook data (2002-2007), 52,325 fishing trips
- ✓ Vessel names & registry no. matched with 2016 catalogues (12%, 68 vessels)

Variable	Parameter Estimate	Standard Error	T Value	Pr> t
Intercept	-15.206***	0.879	-17.30	0.000
Vessel Length	1.716***	0.065	26.51	0.000
Crab Stock	0.925***	0.063	14.69	0.000
Month (9)	2.001	1.994	1.00	0.316
Month (11)	19.791***	1.553	12.74	0.000
Month (12)	22.374***	2.426	9.22	0.000
Stock * Month (9)	-0.088	0.145	-0.61	0.544
Stock * Month (11)	-1.482***	0.112	-13.15	0.000
Stock * Month (12)	-1.666***	0.175	-9.51	0.000

*** indicate statistical significance at the 99th percentile

Model F Value = 364.93; (Pr > F) = 0.0000

All model variables are in natural logs except the dummy variables for months



From CPUE to cost function

$$\bar{C}_t = AC_t^S / \sum_S T_t + AC_t^M / \sum_M T_t + AC_t^L / \sum_L T_t$$

\bar{C}_t Fixed weighted average cost

AC Annual Cost (weighted average of annual vessel length classes)

$\sum_S T_t$ Sum of trips for vessels of size 8-9.9 m long (small vessels)

$\sum_M T_t$ Sum of trips for vessels of size 10-14.9 m long (middle sized vessels)

$\sum_L T_t$ Sum of trips for vessels of size 15-20.9 m long (large vessels)

$$C(X) = \frac{\bar{C}_t * Q_i / \sum_i H}{CPUE_{males}(X)} = 32 \sim 178 NOK / X^{0.44}$$

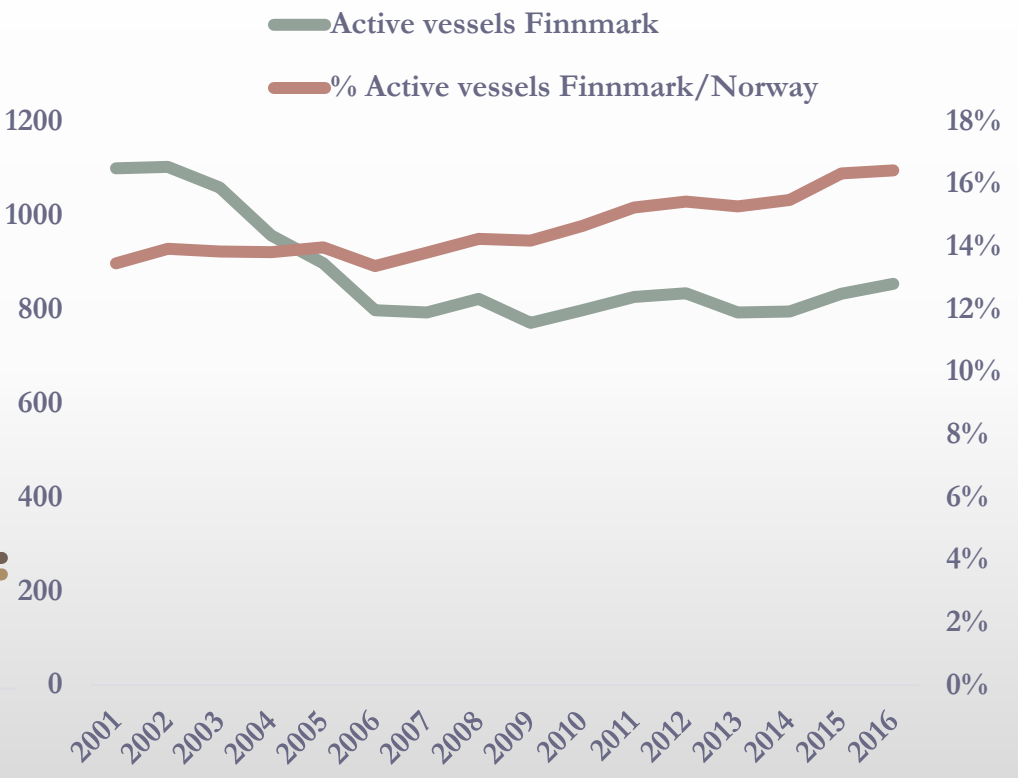
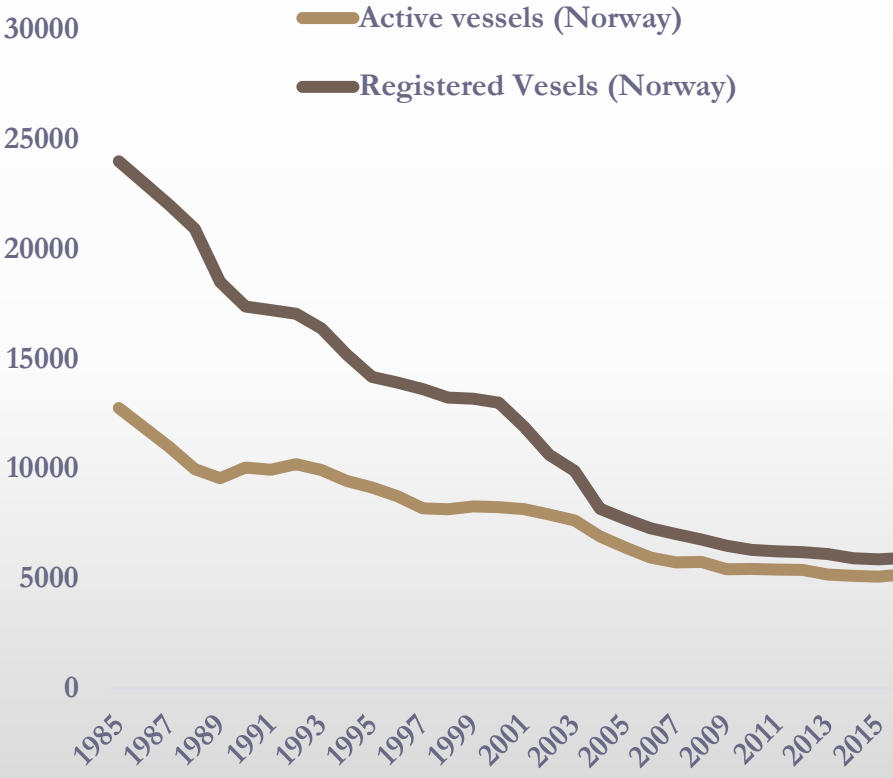
Q_i Vessels' fraction (%) of RKC quotas when compared to overall quotas (of other species)

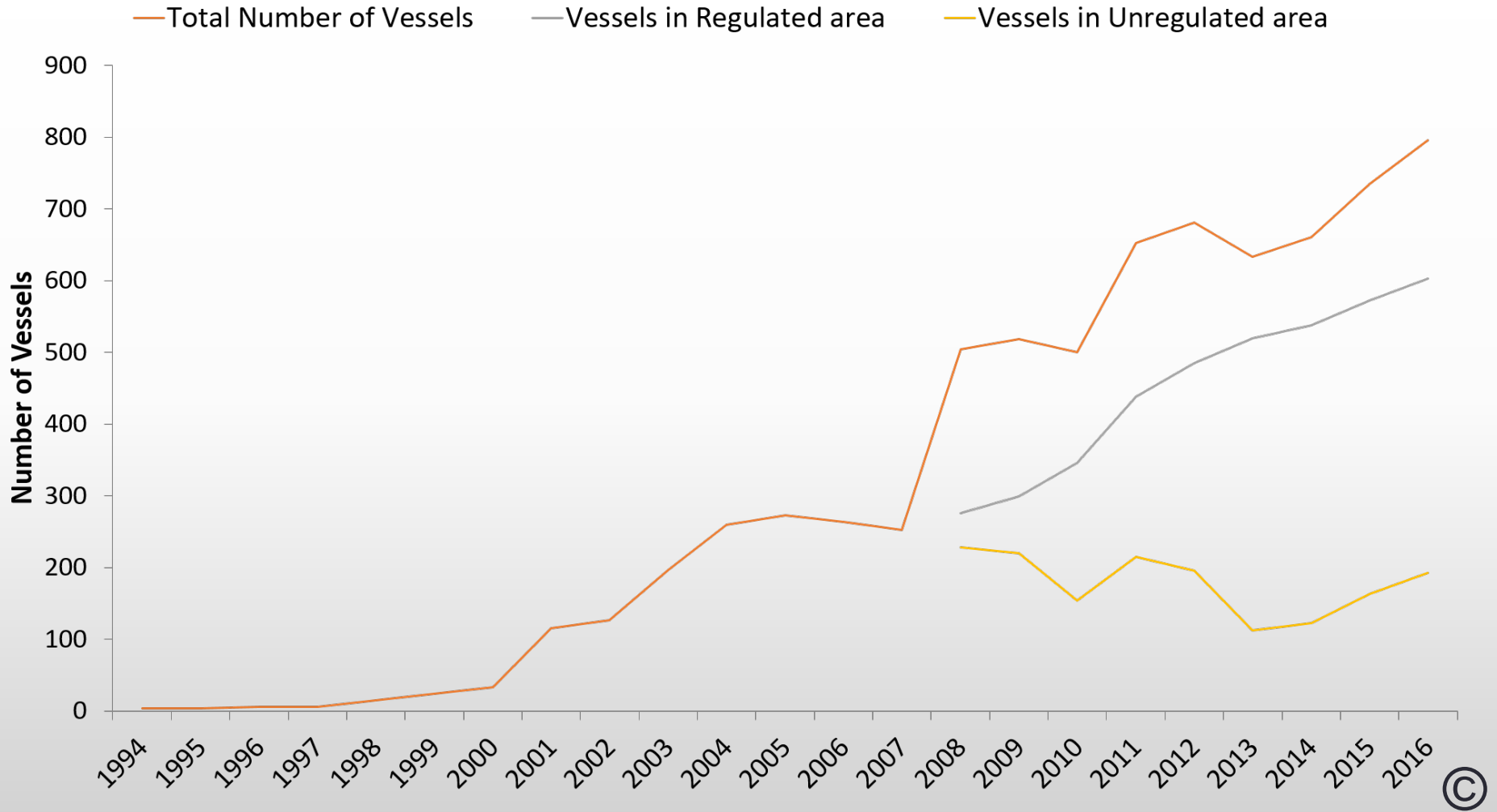
$\sum_i H$ Sum of Pot Days (for every individual trip) of every vessel i

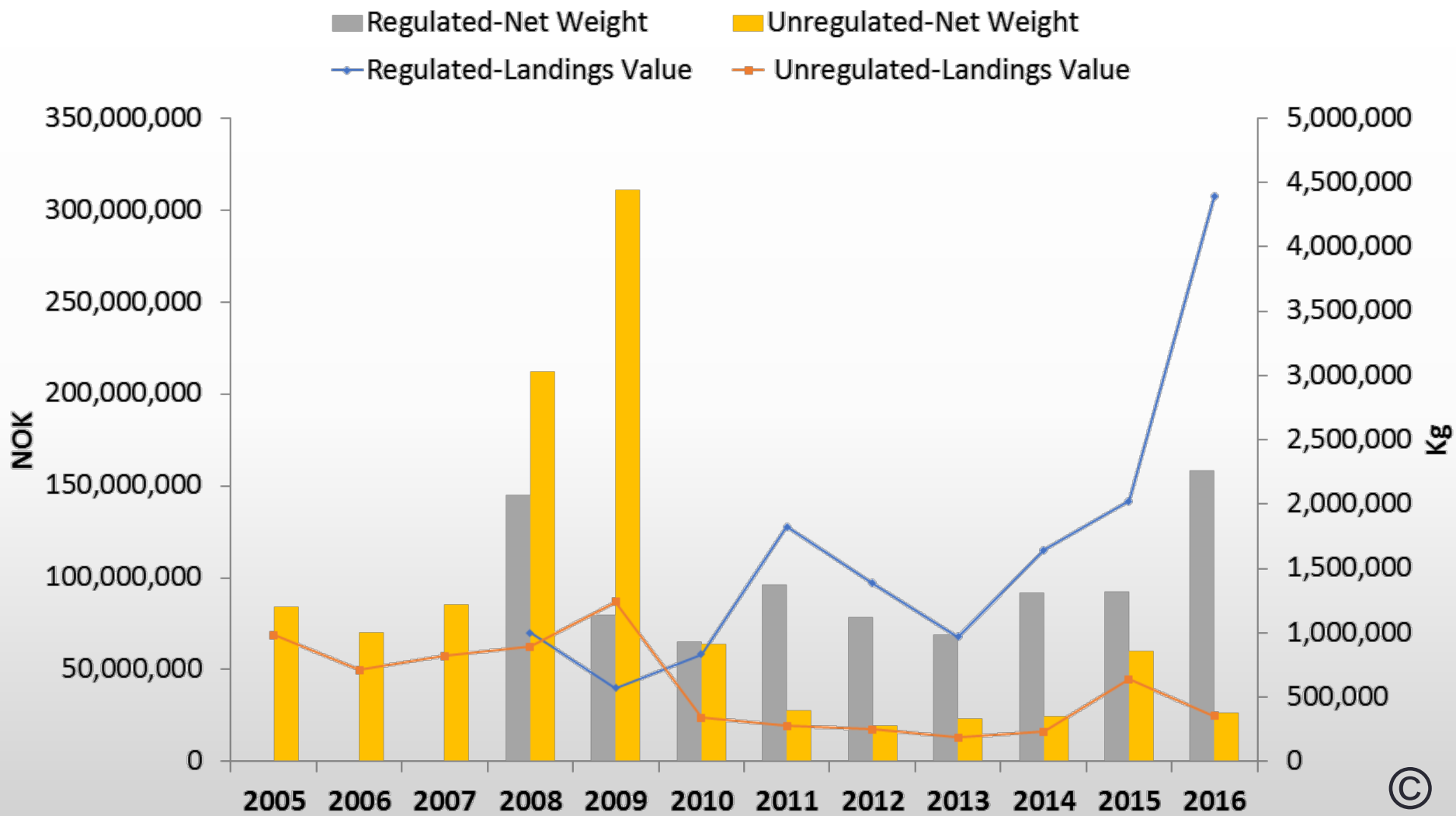
2004-2005 Average:

$$C(X) = 35 NOK / X^{0.44}$$

Finnmark's Changing Landscape

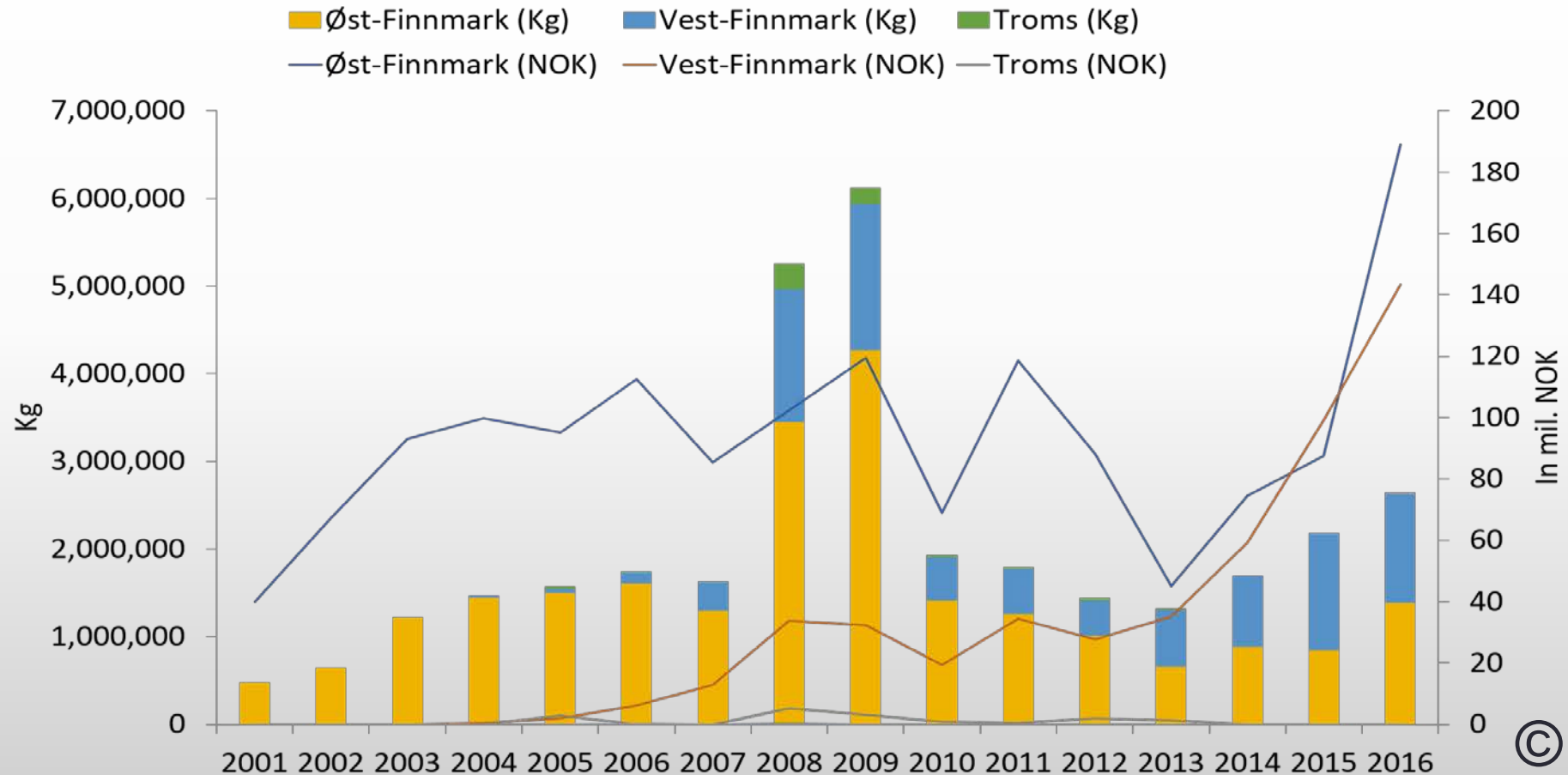




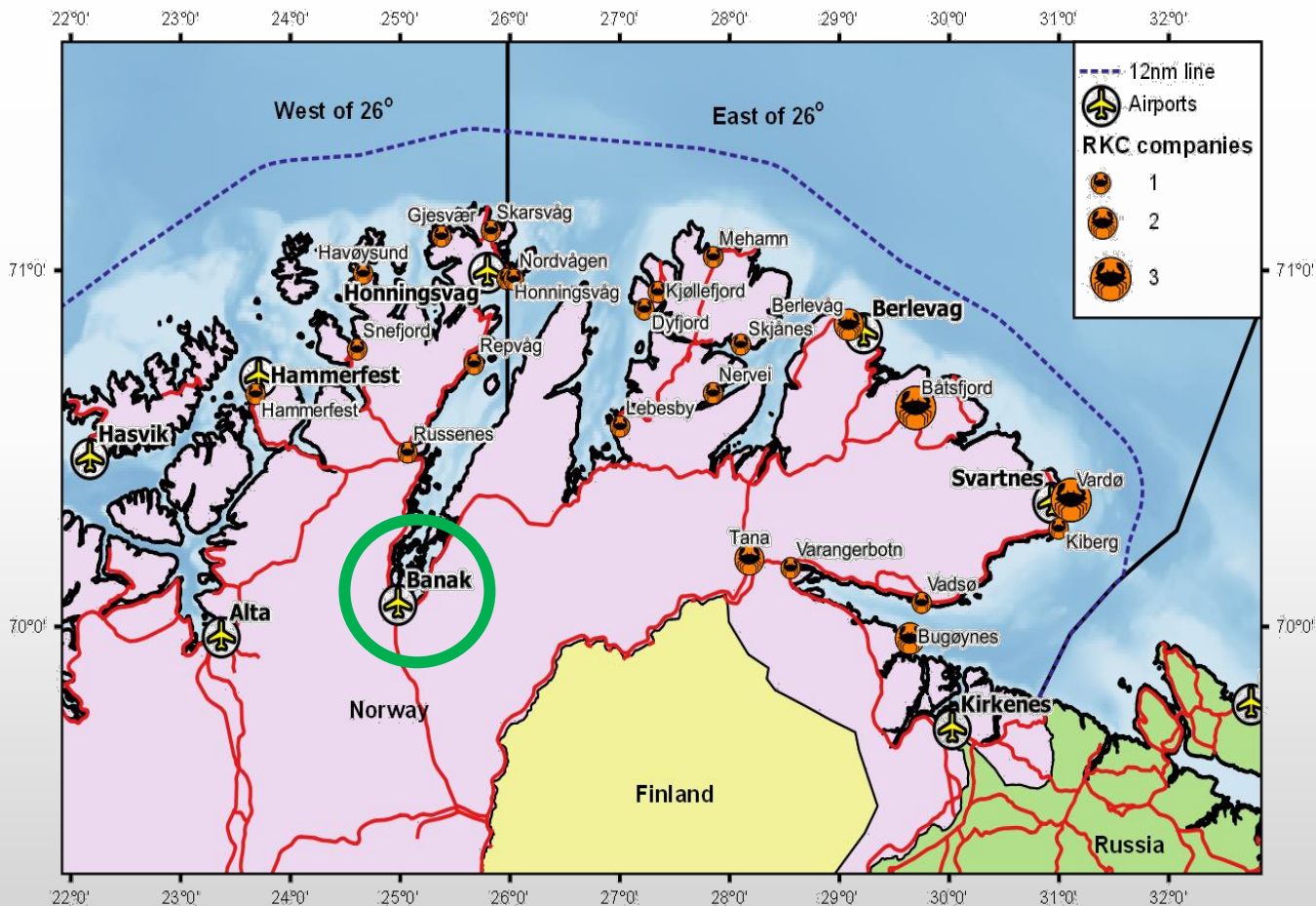


Distribution of total turnover and RKC quantities (converted to round weight)

*Vesterålen, Lofoten/Salten, Nord-Trøndelag, Sør-Trøndelag, Nordmøre



Ongoing Infrastructure Investments – A changing landscape

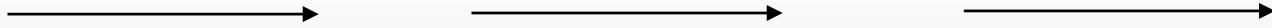


19 Registered Buyers, 31 Receiving Stations



Onshore investments – Going forward? Management

- Structural Changes (in ways beyond just commercial exploitation)
- More decentralized compared to other fisheries, e.g. (Live) RKC Processing Plants
- Opposite trend: **Consolidation** rather than **Decentralized Capital Investments**
- Ensure stability: Quotas vs. Open Access?



X-ray Mag, Aleksei Kondratuk



Cape Breton Post, Louisbourg Seafoods Ltd



Lakselv Airport, Banak, Wikipedia

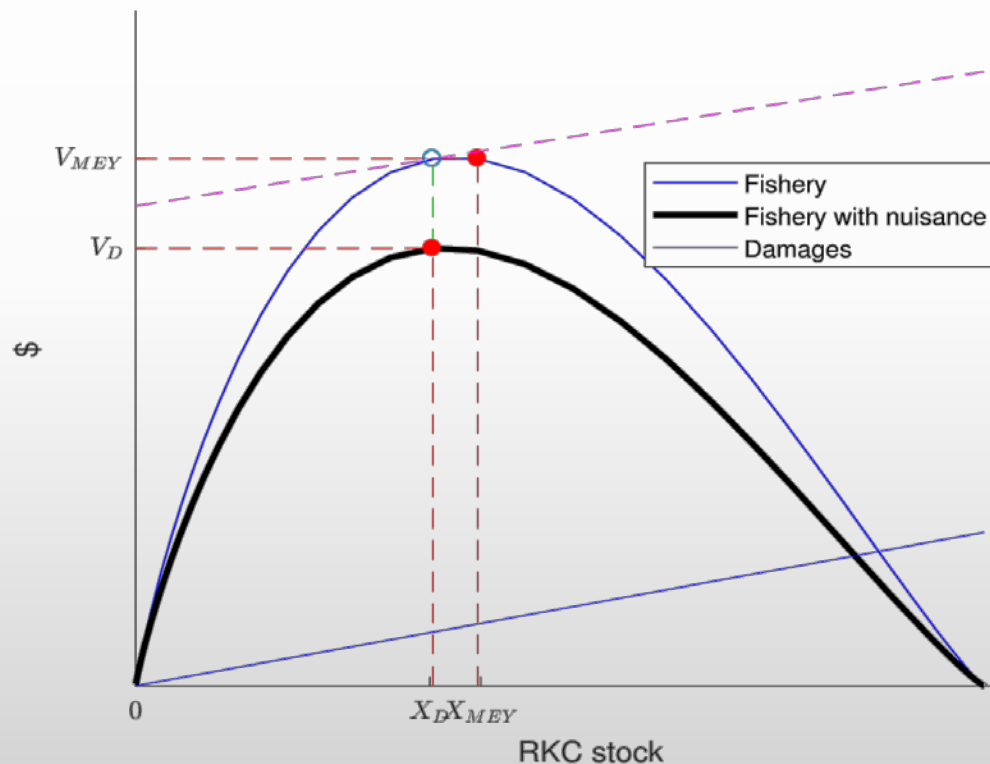


Nofima

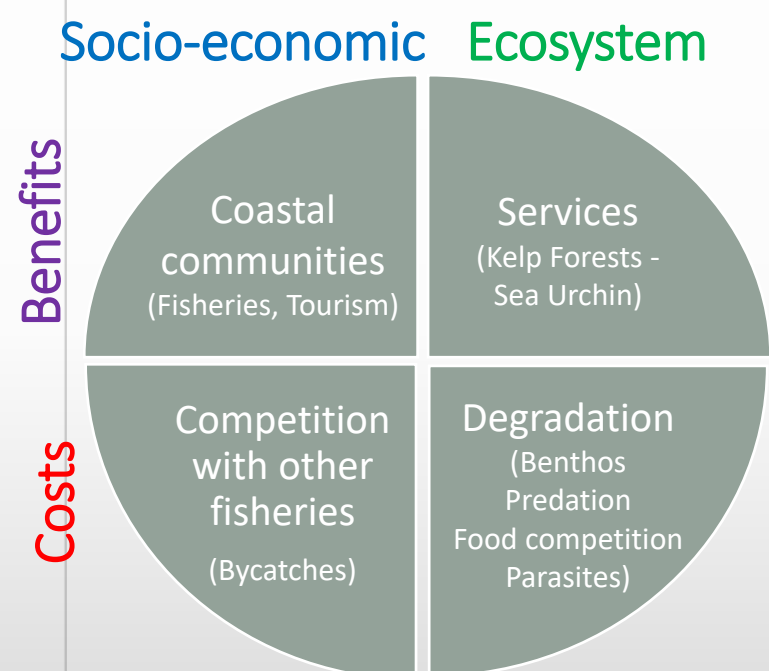
Foregone Rents to Avoid Damages

Net Revenues Foregone:

Change in our assessment of the fishery value



But how do you manage under uncertainty?



Lack in long term studies (structure, dynamics),
benthic time-series & quantitative information on
feeding interactions





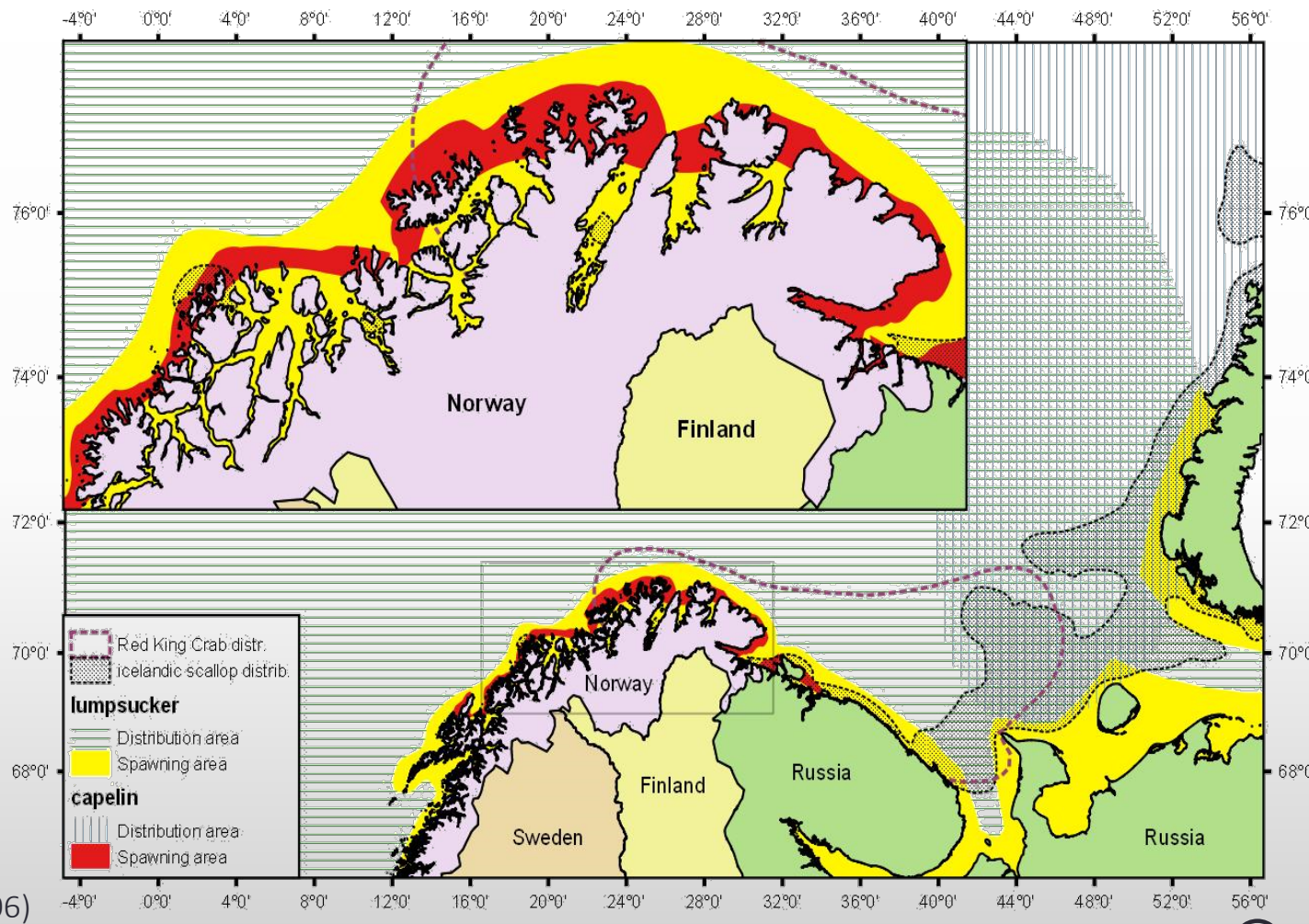
Source: Oug et al. (2011)



Source: Ulvestad (2012)



Source: Bakay and Karasev (2006)



Expectations, Uncertainties, Challenges

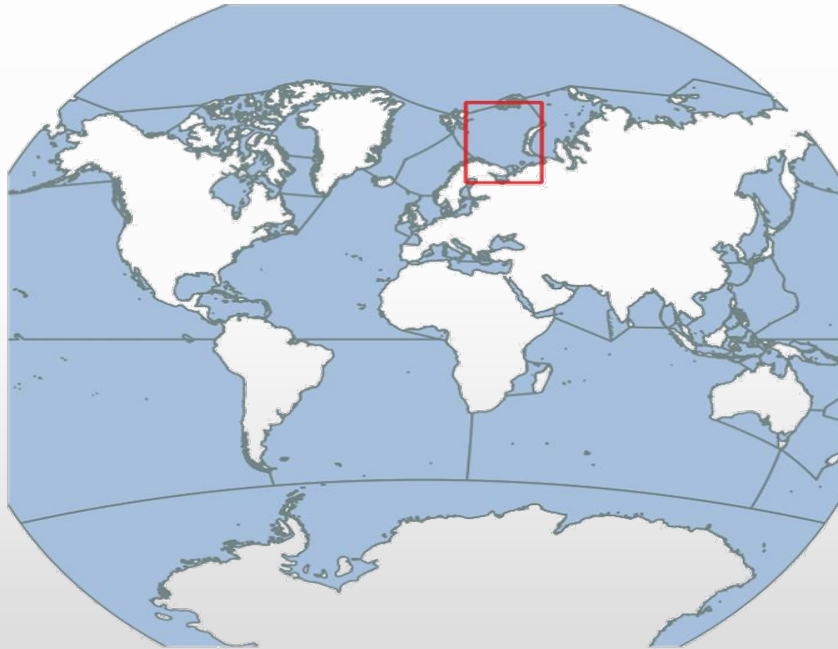
- IMR Advice vs. Authorities (**2017**: 1,500 vs. 2,000 tons, **2018**: 1250 vs. 1750 tons)
- Management Goal: 700 – 1,000tn/y - Still in RKC Golden Age? Price Peak?
- Compensation or Main Fishery?




- Do we move the 26°E line west? CBD COP6 Decision VI/23 considerations
- Spatially differentiated management goals -> What is the cost of being wrong?
 - *Economists' Fishery Optimal* vs. *Ecologists' Invasion Optimal*:
Trade-off Bioeconomic/Socially Optimal

- Precision of Economic Profit vs. Environmental Costs?
- Limited Russia-Norway cooperation (research front)

The same side of a different coin: *Chionoecetes opilio*

*Ecological uncertainties, Management Complexities,
International Conflicts, Socioeconomic costs*



-  Snow Crab distribution
-  Red King Crab distribution
-  RKC intro point

The background of the slide is an aerial photograph of a vast, flat, light-colored landscape, possibly a salt flat or a dry lake bed. The terrain is highly textured with ripples and small mounds. In the upper right, a bright sun is visible, creating a lens flare effect. The overall color palette is dominated by light blues, greys, and whites.

Thank you very much
for your attention.

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