



SMART SCIENTISTS - SMART FISHERMEN

*WORKING WITH COMMERCIAL FISHERMEN TO
SOLVE THE MYSTERIES OF THE OCEAN*

Bruce G. Hatcher, Ph.D.

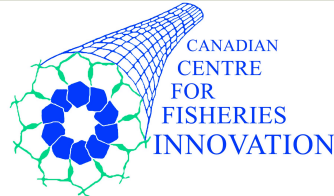
Chair in Marine Ecosystem Research, Cape Breton University

WOC – MEOPAR : Smart Industry Smart Ocean Workshop

Montreal, Quebec, 27-29 May, 2014



The International Business Alliance
for Corporate Ocean Responsibility



WOC-CCFI Smart Fishing Vessels Workshop. St. John's Nfld. Sept. 2013

Summary Input: The group agreed that there is a place for the industry to collect scientific data for release and that the types of data collected should be basic at the beginning and possibly include bottom temperature, depths, substrate type, species identification and size and catch per unit of effort. The group identified a number of challenges to the opportunity of collecting this kind of information including:

Sharing of data and clarity of use

Quality assurance parameters and electronic compatibility

How to accurately report catch and discards in real time

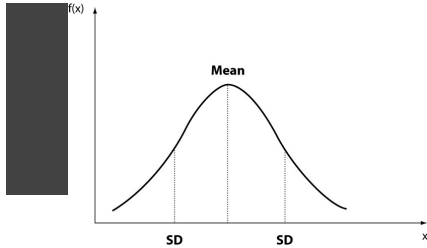
Overlapping jurisdictions



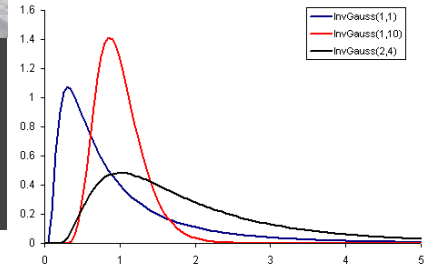
From whence I speak

- 1974: Lobster fishery, St. Margaret's Bay, Nova Scotia
- 1984: Rock Lobster fishery, Western Australia
- 1990: Scallop fishery, South shore, Nova Scotia
- 1994: Coral reef fisheries, Caribbean Sea
- 1998: Coral reef fisheries, Red Sea, Eritrea
- 2000: Tuna fishery, Maldives
- 2005: Benthic fisheries, Scotian Shelf (Louisbourg Seafoods Ltd)
- 2009: Ground fisheries (FRCC), Atlantic Canada
- 2011: Artificial Reef fisheries, Sydney Harbour, Nova Scotia





TWO WORLD VIEWS?



SCIENTISTS' OCEAN

1. IS ENDLESSLY FASCINATING
2. FOCUS IS THE ECOSYSTEM
3. IS WORTH KNOWING FOR ITS OWN SAKE
4. CAN BE UNDERSTOOD
5. IS PROBABLISTICALLY DETERMINISTIC
6. SUSTAINS LIVELIHOODS
7. IS **OPAQUE**, DANDEROUS AND FOREIGN

FISHERMEN'S OCEAN

1. SUSTAINS LIVELIHOODS
2. FOCUS IS THE TARGET SPECIES
3. AFFORDS AND INDEPENDENT LIFESTYLE
4. DEMANDS RESPECT AS AN **ADVERSARY**
5. CAN BE FIGURED OUT
6. IS OPAQUE, **DANGEROUS** AND FOREIGN
7. STIMULATES CURIOSITY

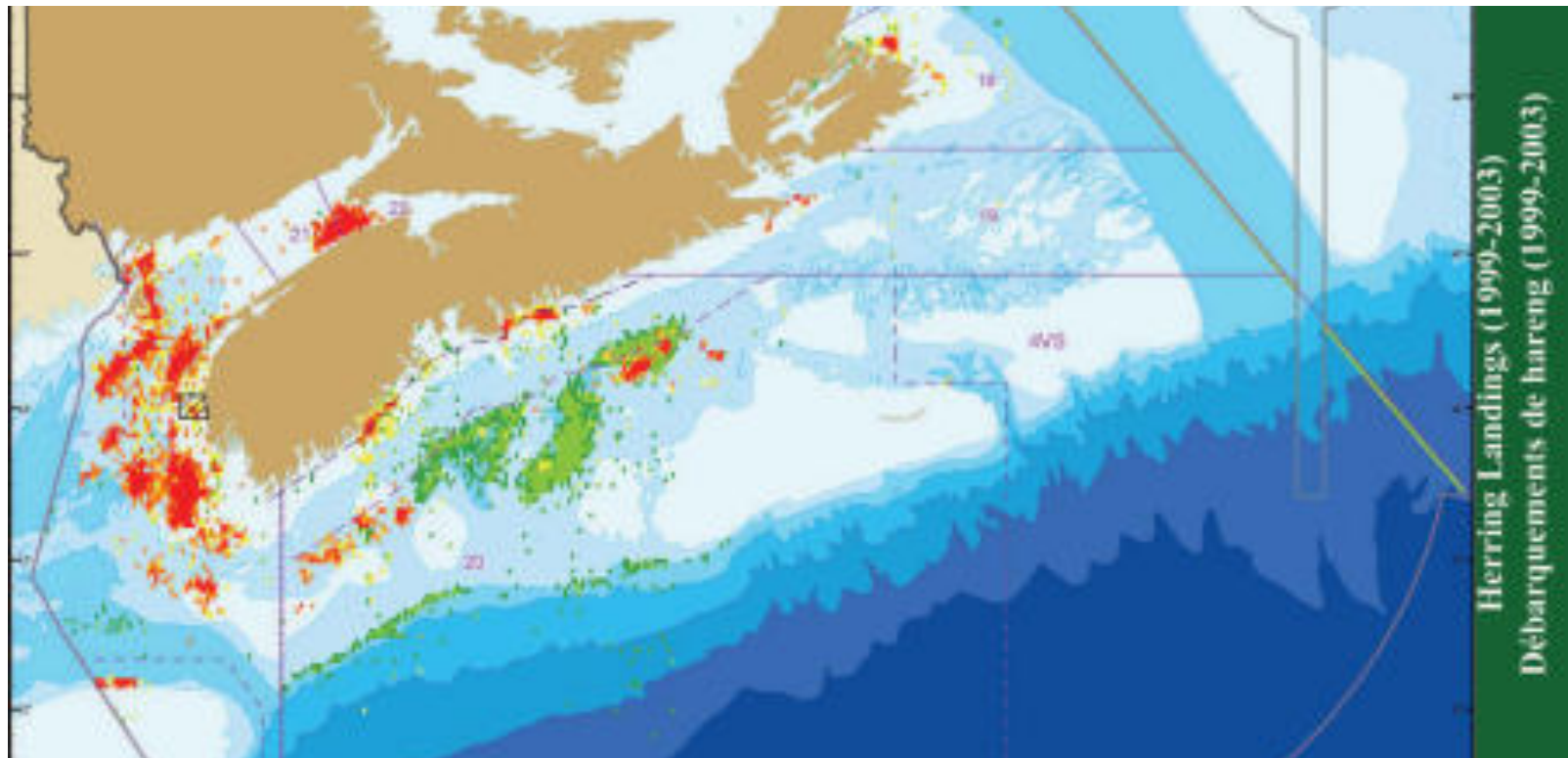


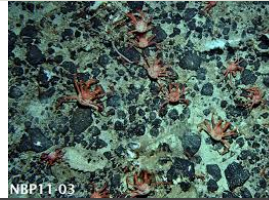
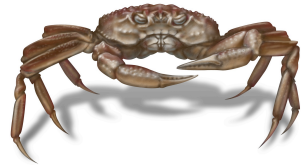
Atlantic Herring



MAPPING FISHING ACTIVITIES

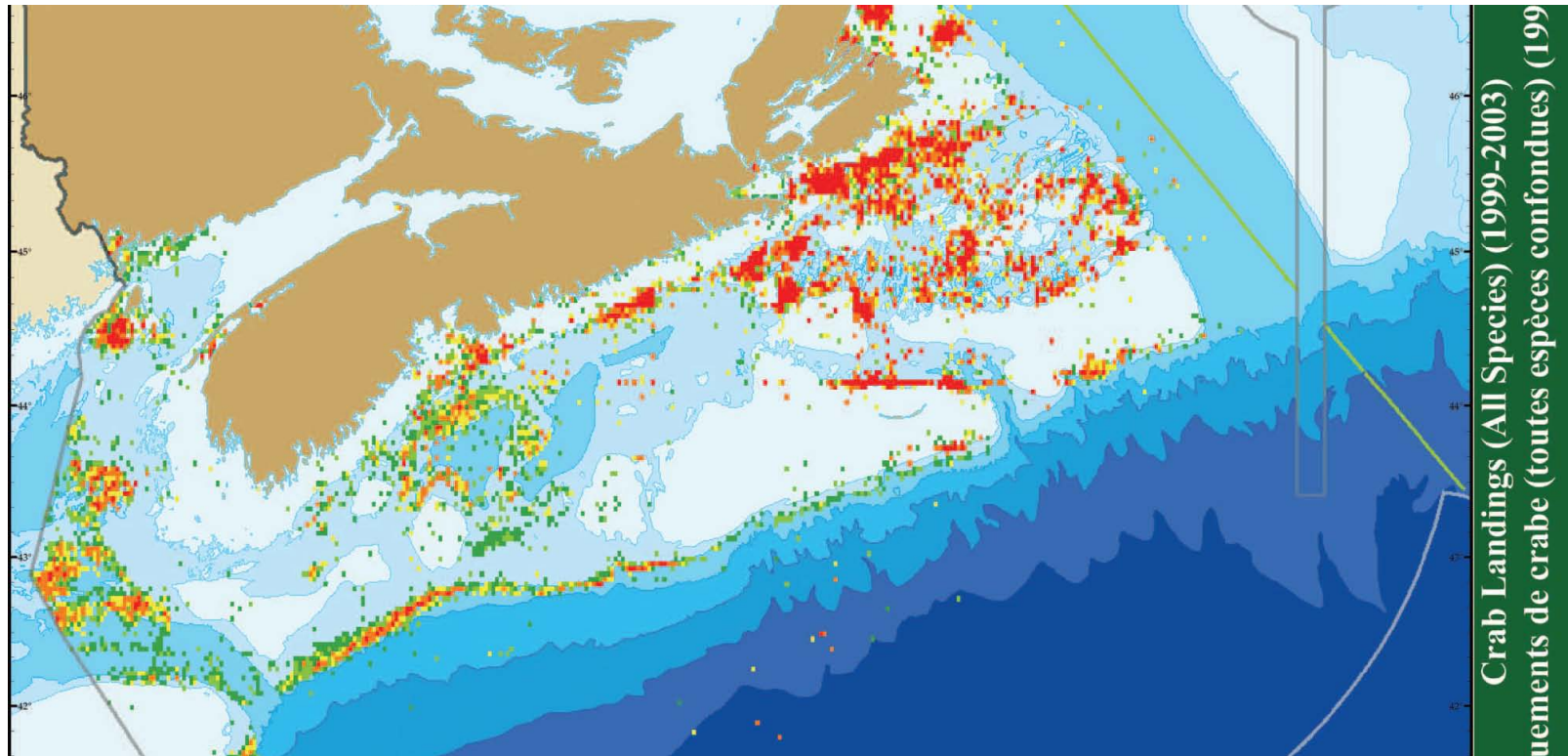
<http://www.mar.dfo-mpo.gc.ca/Maritimes/Oceans/OCMD/Atlas/Fisheries#Herring>





MAPPING FISHING ACTIVITIES

http://www.mar.dfo-mpo.gc.ca/folios/00252/images/lg_img062.jpg





ATLANTIC FISHERIES

FISHERY	GEAR	HABITAT	DISTANCE	DEPTH
OYSTER	TONGS	ESTUARY	1-100M	5
SEA URCHIN	DIVER	ROCKY REEF	10M-1KM	25
LOBSTER	POTS	BROKEN BOTTOM	0.1-10KM	5-40
S-CRAB	POTS	FINE SEDIMENT	10-140KM	40-180
S-CLAM	HYD-DREDGE	COARSE SEDIMENT	50-100KM	20-40
SCALLOP	DRAG	COARSE SEDIMENT	30-160KM	20-80
SHRIMP	TRAWL	FINE SEDIMENTS	30-90KM	30-120
HALIBUT	LONGLINE	MIXED SEDIMENTS	10-80KM	30-100
REDFISH	TRAWL	BROKEN BOTTOM	10-60KM	80-300
HERRING	SEINE	MIXED LAYER	5-140KM	5-20
SWORDFISH	HARPOON	SURFACE WATERS	20-200KM	0-5m



FISHING (SAMPLING) PLATFORMS

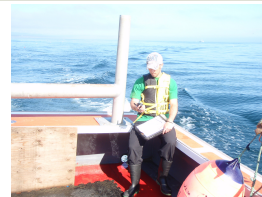
VESSEL TYPE	SIZE [LOA] (m)	CREW * O-O	TRIP (d)	AMBIT (Km)	FISHED AREA (Km ²)
COASTAL SKIFF	4 – 8	1-2*	1	10	5
COASTAL *F-G BOAT	9-14	2-4*	1-2	25	25
OFFSHORE F-G BOAT	15-20	3-5*	1-5	100	25
SEINER	15-25	4-5	2-6	75	5
LONG-LINER	15-25	4-6	3-7	200	10
DRAGGER / TRAWLER	20-35	5-8	4-8	300	25
TRAWL SHIP	35-60	10-25	10-15	500	50
FACTORY SHIP	60-100	20-60	15-30	1,000	3,000

* F-G = FIXED GEAR / * O-O = Owner-Operator



DATA COLLECTION SCALES OF OBSERVATIONS FROM FISHING VESSELS

- Transit Ambit for horizontal time series of **1h to 10d** duration, and **10 to 1,000Km** length
- Concentrated Fishing Effort Intensity of **1 to 10d** duration, and **5 to 50Km²** length.
- Fixed gear sampling intensities of **25 to 500** sets.km⁻².d⁻¹.
- Mobile gear sampling intensities of **0.1 to 4km²** swept.d⁻¹
- The intensity of sampling opportunity in the fishing industry is inversely proportional to distance from shore (primarily in the 370km wide EEZ), and directly proportional to the societal and economic value of the ocean space. [Most peoples' ocean is close to the coast].



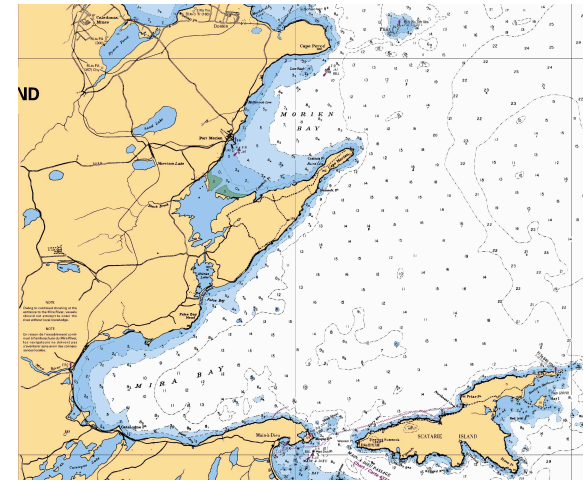
Calculating Secondary Productivity in the Morien-Mira bays of Cape Breton

Partnered with 25 owner-operator fishermen in the coastal fishing fleets of Port Morien, False Bay and Main-a-Dieu.

Lobster, Rock Crab & Scallop fisheries during 2012 & 2013

Student observers on 38 trips measured meteorological & water column attributes, and recorded depth, substratum type, and counts of all catch at 8,300 sites of gear sets over 300km² of ocean space.

Spatially explicit Assessment of the Commercial Fishery Yields, Productivity and Fishing Activities in the Area of the Donkin Export Coking Coal Trans-shipment Project

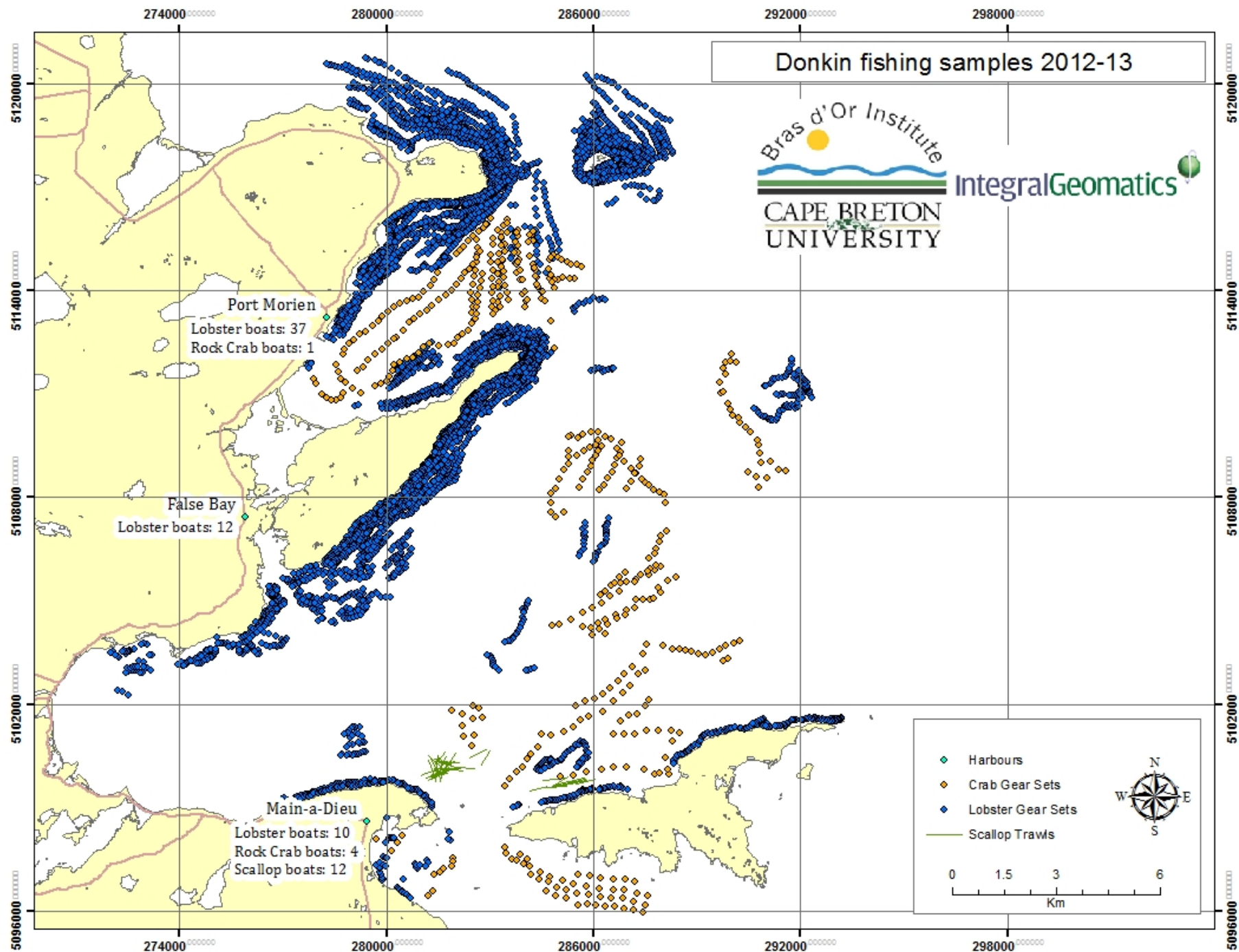


Canadian Hydrographic Service Chart #4794

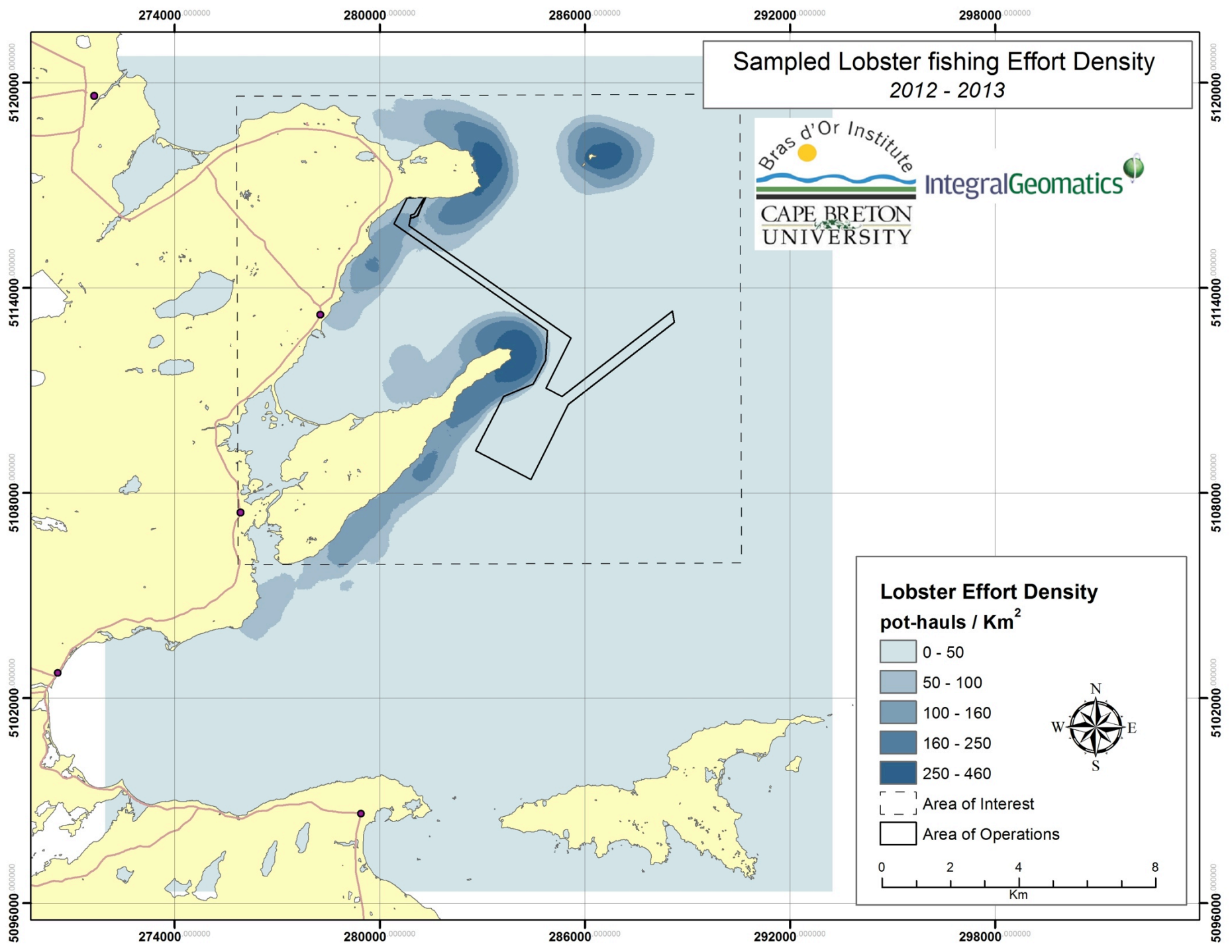
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Sampled Lobster fishing Effort Density 2012 - 2013

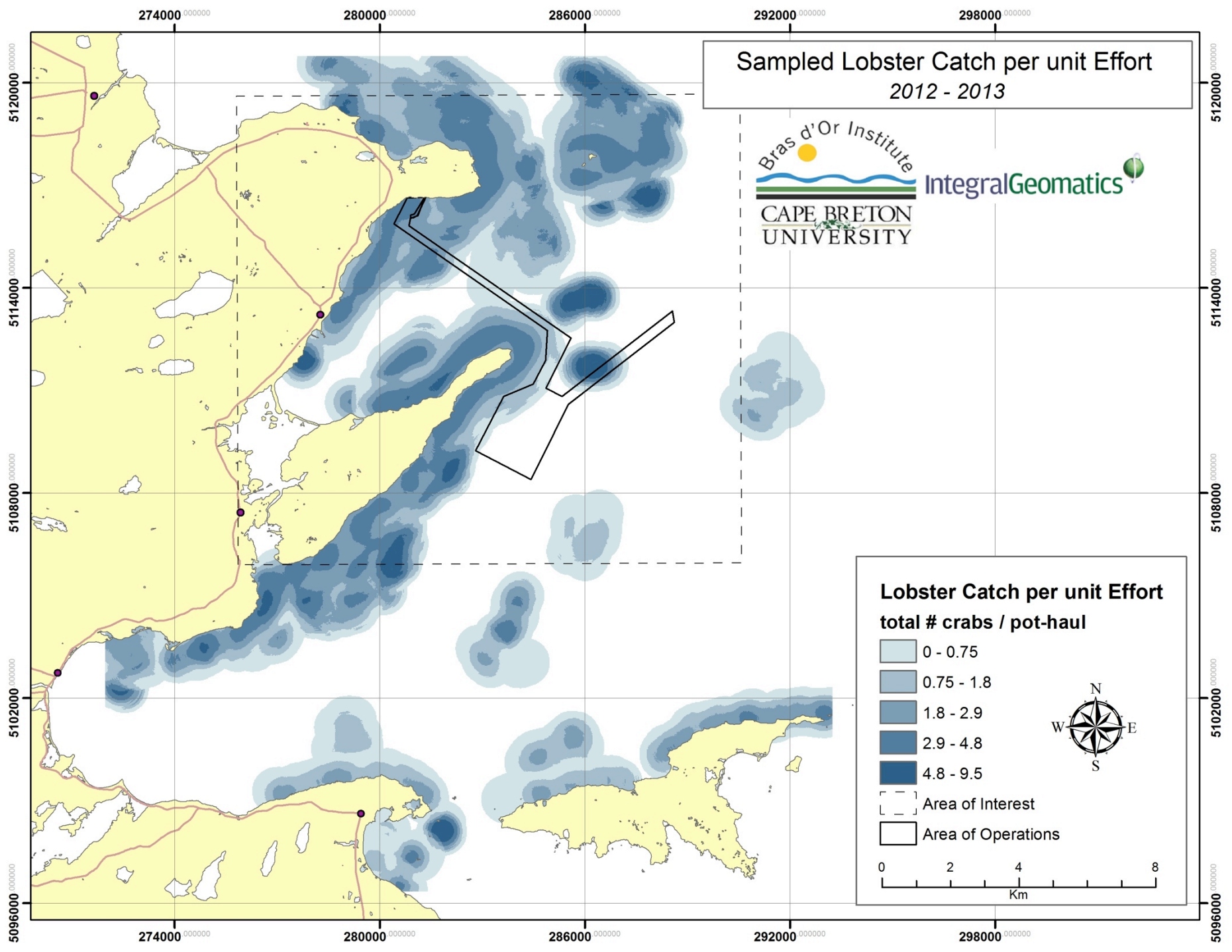


Lobster Effort Density pot-hauls / Km²

0 - 50
50 - 100
100 - 160
160 - 250
250 - 460

Area of Interest (dashed line)
Area of Operations (solid line)

Sampled Lobster Catch per unit Effort 2012 - 2013





MATCHING FISHERIES & OBSERVATIONS

FISHERY TYPES	OBSERVATIONS
SEINE & HARPOON	SURFACE TEMPERATURE, SALINITY & pH
SHALLOW BENTHIC	SUBSTRATUM – VISUAL
BENTHIC FIXED GEAR	DEPTH & SUBSTRATUM – SOUNDER SURFACE & BOTTOM TEMP. & SALT'Y. VERTICAL CTD, PH, O ₂ & NO ₃ PROFILES DETECTIONS OF ACOUSTIC TAGS DENSITY OF CATCHABLE ORGANISMS (CPUE)
DRAG, DREDGE & TRAWL	SUBSTRATUM – VISUAL & COMPOSITION MULTI-BEAM BATHYMETRY
ALL	BATHYMETRY, SEA STATE +++

BUT: how to get these observing systems onto fishing vessels?

CROWD-SOURCING?

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We are a life-style driven, technology venture enabling the active and adventurous to capture data during their recreational rituals to advance scientific possibilities



ADVENTURISTS



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FISHERMEN & SCIENTISTS RESEARCH SOCIETY



the Fisheries Scientist Research Society has an excellent, 20y record of sourcing high quality, standardized ocean science data with and for commercial fisheries.

Currently work with more than 50 fishing partners (primarily owner-operator) across the Maritimes.

Oceanographic data: surface temp (sounders), bottom temp. on gear and fixed coastal sites, CTD casts.

Lobster larval abundance, recruitment rates, moult index, size-at-maturity, meat quality, CPUE

Mackerel & herring tagging, Groundfish sentinel fishing

WORKING WITH FISHERMEN

- ❑ DEVELOP **GENUINE** RESPECT
- ❑ GET TO KNOW THEM PERSONALLY [FAMILY]
- ❑ UNDERSTAND THEIR MOTIVATIONS
- ❑ DON'T COST THEM MONEY WITHOUT PAYING THEM
- ❑ KNOW THEIR GEAR AND ITS LIMITATIONS
- ❑ ALWAYS GIVE SOMETHING BACK [Teach them Something]
- ❑ LEARN SOMETHING FROM THEM [LEK]



QUESTIONS WE CAN REASONABLY EXPECT to ANSWER from FISHING VOO

- What is the fine-to-meso-scale (100m to 100km) pattern of key oceanographic metrics in intensely fished areas of the coastal ocean? [e.g. see Morien-Mira Bay case study]
- At what scales (if any) are the distributions and abundances of exploited (and by-catch) species correlated with the basic physical & chemical attributes of the water column and the seabed? [the stuff of the master fisherman's logbook! – where do we go when to catch the fish?]
- What easily-measured bio-physical metrics can we use to monitor the health of the ocean food production system?
- What is the value proposition for fishermen and fishing companies to participate in such schemes?

Challenges of using Smart Fishermens Vessels to meet Ocean Data needs

- 1. Sharing of data and clarity of use:** must be determined by the data suppliers (the fishermen). Methods of protecting IP exist. Social Science Required!
- 2. Quality assurance parameters and electronic compatibility:** becomes increasingly problematic as we move from individual to regional to global studies.
- 3. How to accurately report catch and discards in real time:** use observers for best results, video monitoring for more affordable results. [e.g. B.C. groundfish fishery]
- 4. Overlapping jurisdictions:** should not be a problem if data are supplied voluntarily.