

Exploring long-term variability of *Nephrops norvegicus* population in the Porcupine Bank (SW Ireland)



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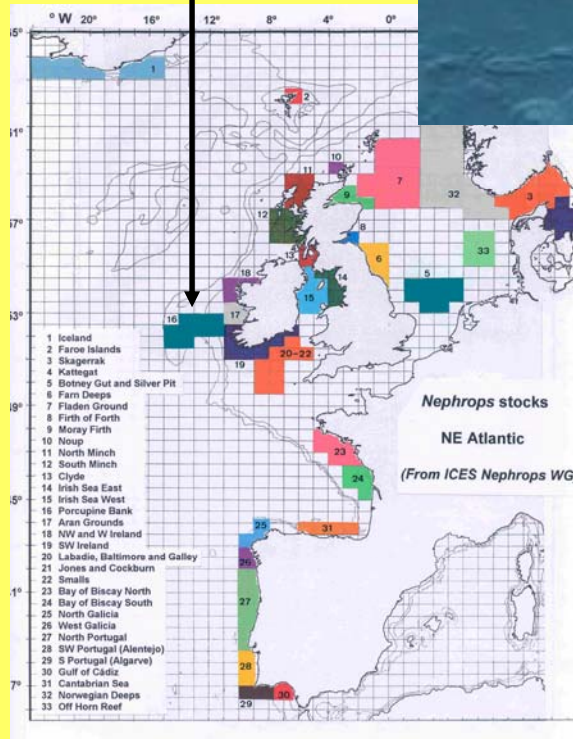
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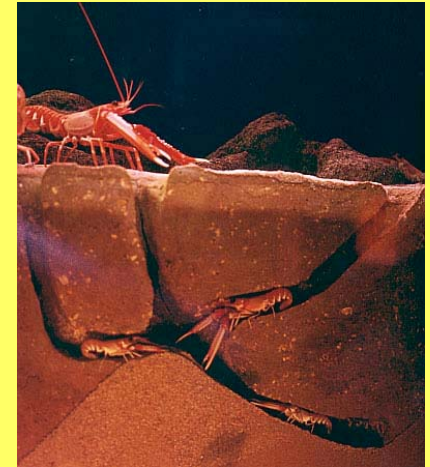
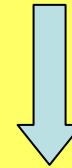
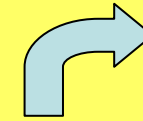


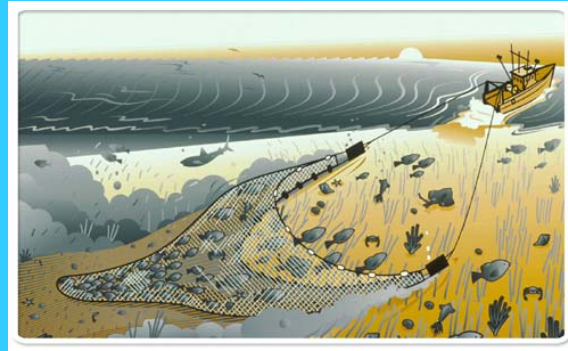
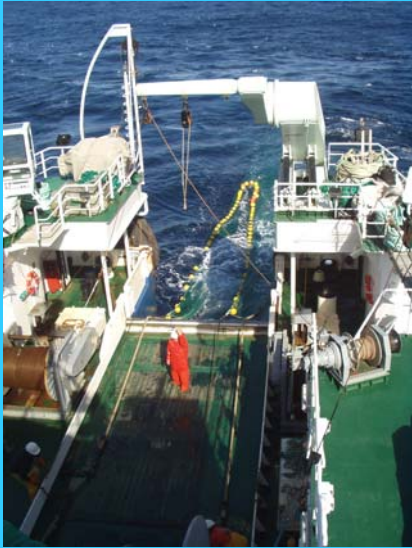
Nephrops norvegicus

Porcupine Bank (SW Ireland)

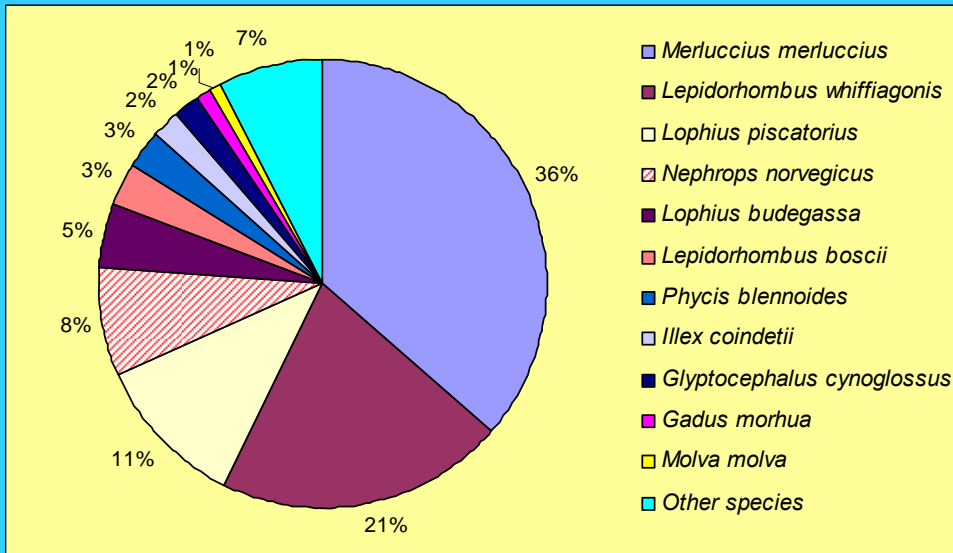


Burrows





**Bottom
trawl**

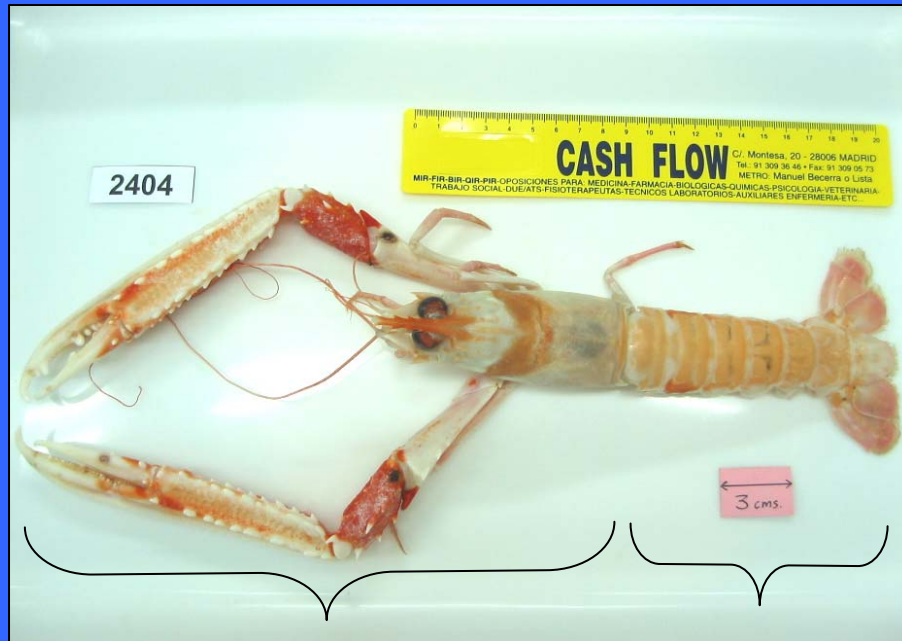
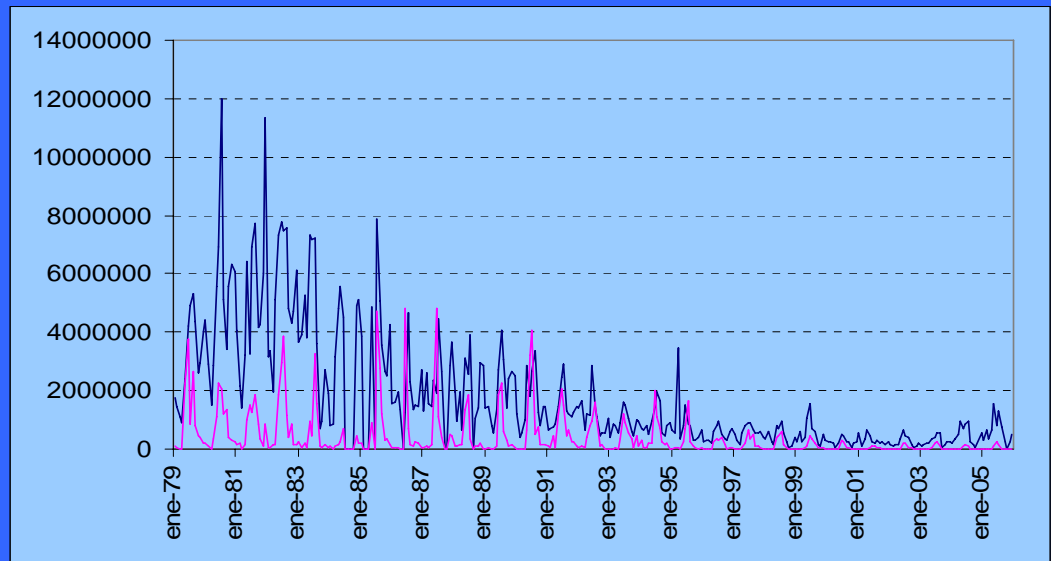
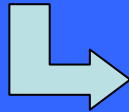


**Discards: 1%
(Pérez, 1996)**



**Principal species retained in weight per
100 f.h. by trawlers in Subarea VII**

Numbers:
males and
females.

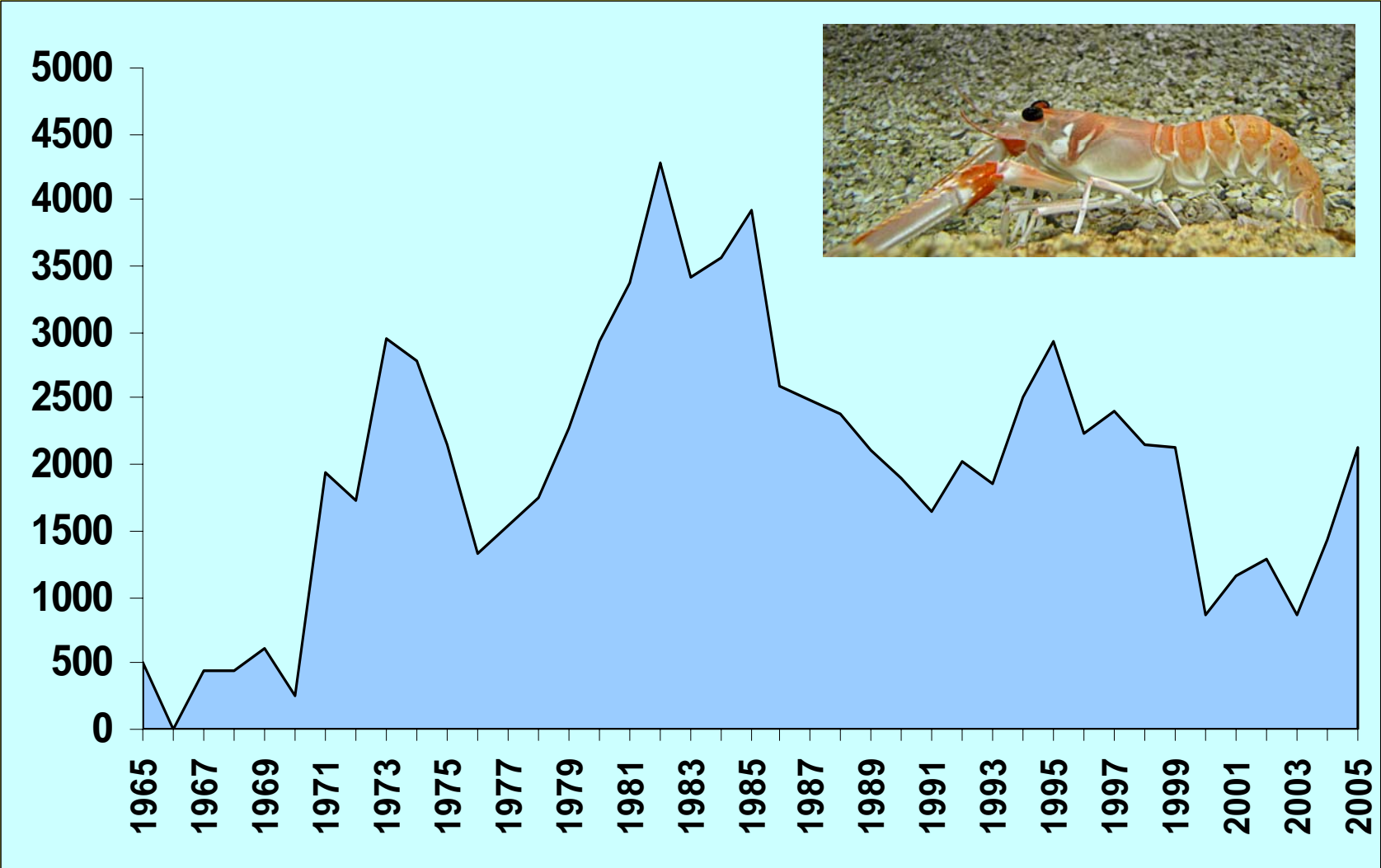


Cephalotorax

Abdomen



Porcupine Bank: *Nephrops* International Landings (tonnes) (From ICES WGHMM, 2006)



OBJECTIVES

- To explore the fluctuations in the landings-per-unit-effort (LPUE) from Porcupine Bank (SW Ireland) *Nephrops* under time-series approach.
- Which factors (population or environmental) are significantly related with these fluctuations.

MATERIAL AND METHODS

- DATA USED (monthly basis)

- *Nephrops* LPUE (number / trip) (1979 – 2005)

- Population data from commercial landings:

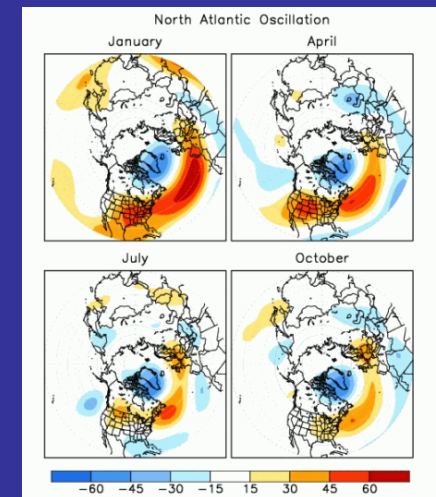
- ❖ Males proportion (1979 – 2005)

- ❖ Ovigerous females prop. (1979 – 2005)

- ❖ Recruits (N<30 mm CL) (1979 – 2005)

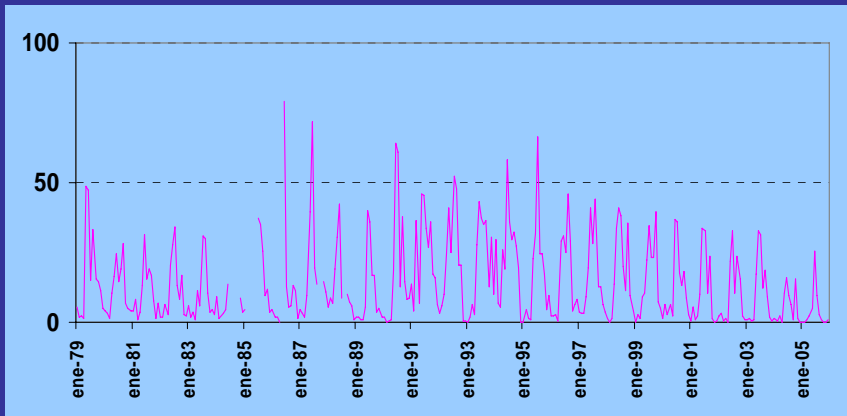
- Environmental factors:

- North Atlantic Oscillation index (1971 – 2006)

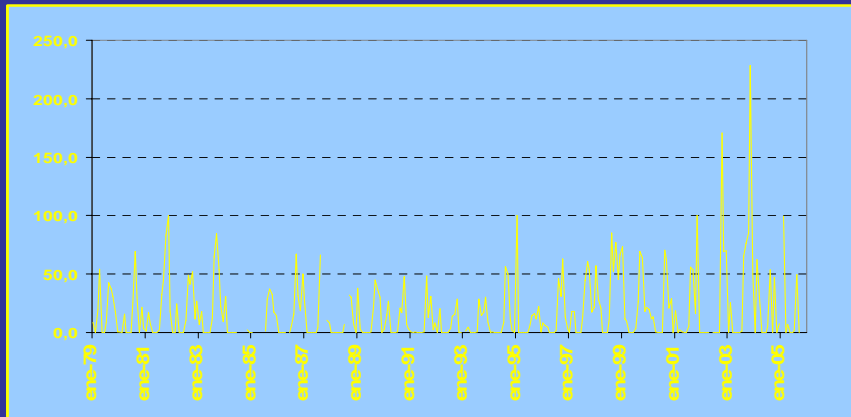


Nephrops POPULATION SERIES

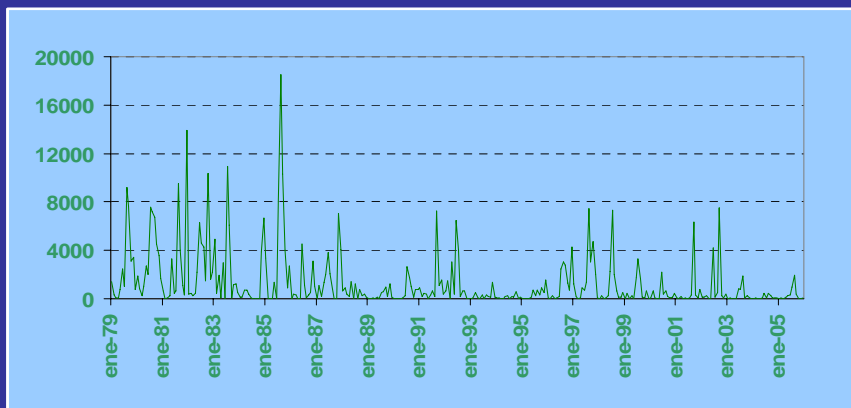
Sex-ratio
(Percentage Females)



Percentage ovigerous females



RPUE (<30 CL)

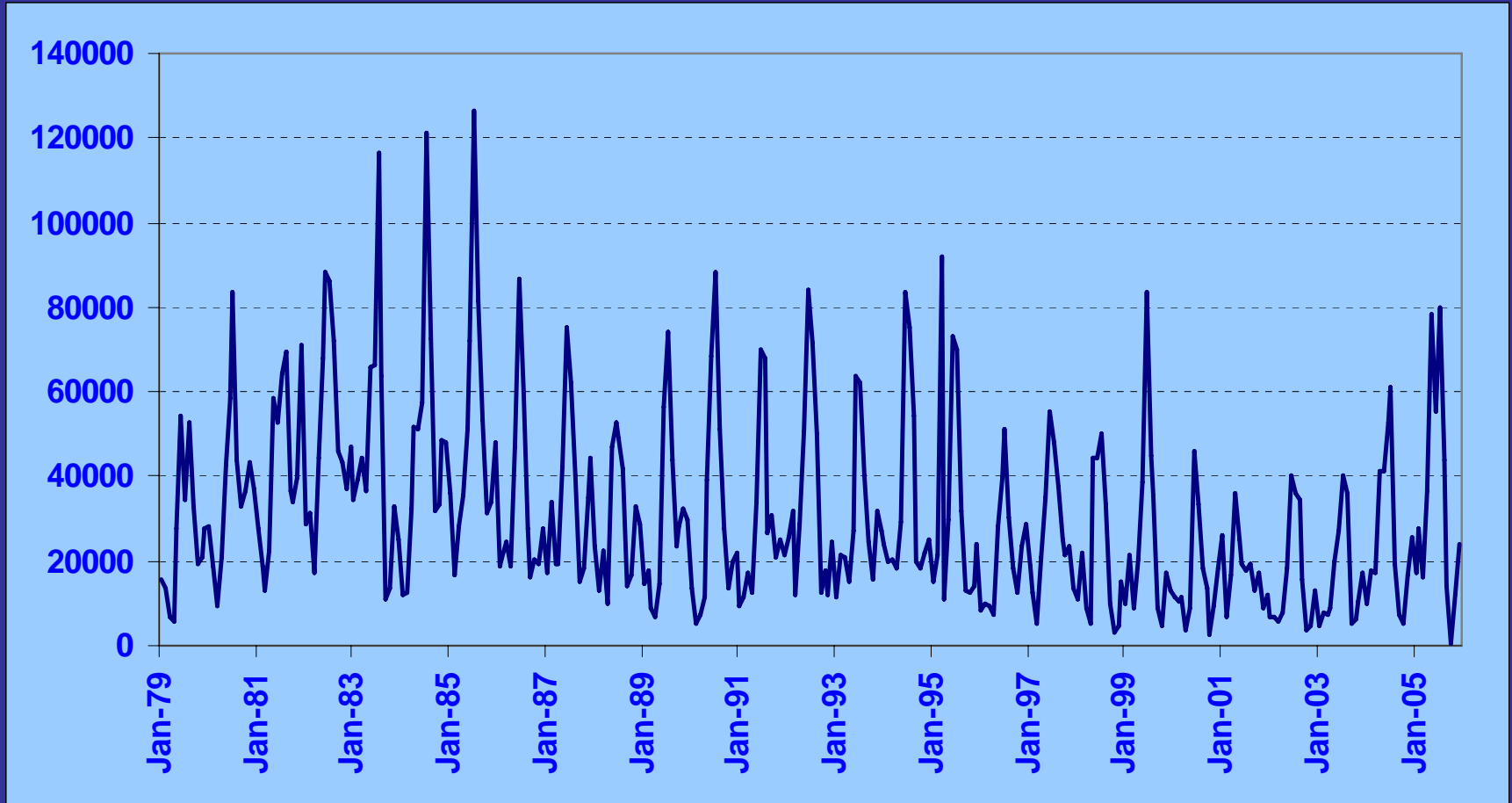


- TIME-SERIES ANALYSIS

- » Seasonal decomposition of LPUE series.
- » Modelling LPUE time-series: Identification, estimation and diagnosis.
- » Analysis of the input factors in the model, with different lags (various trials, i.e. $t=0$, 12, 24, 48 months, etc.).

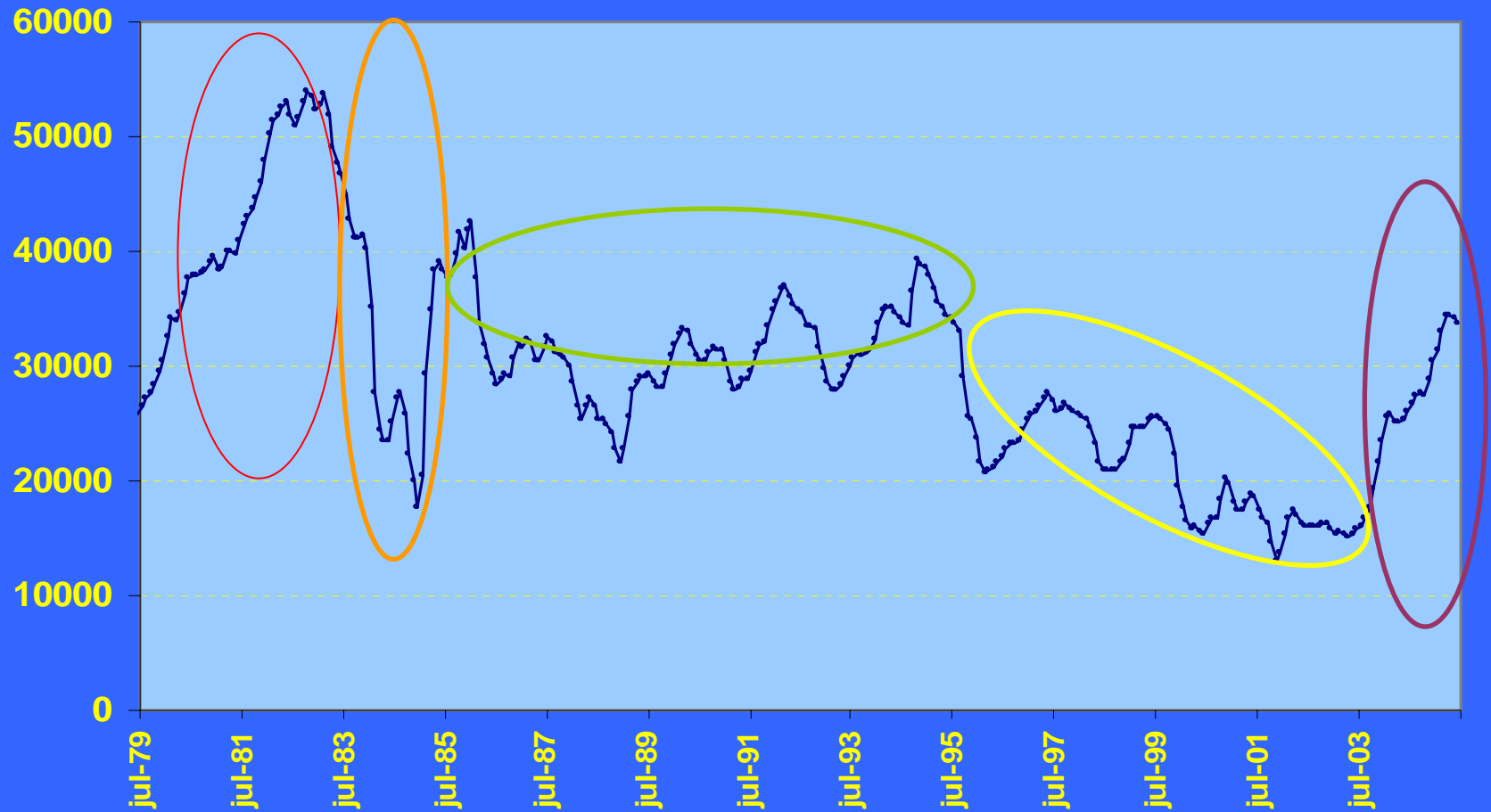
RESULTS

Nephrops monthly LPUE (number/trip) time series from 1979-2005



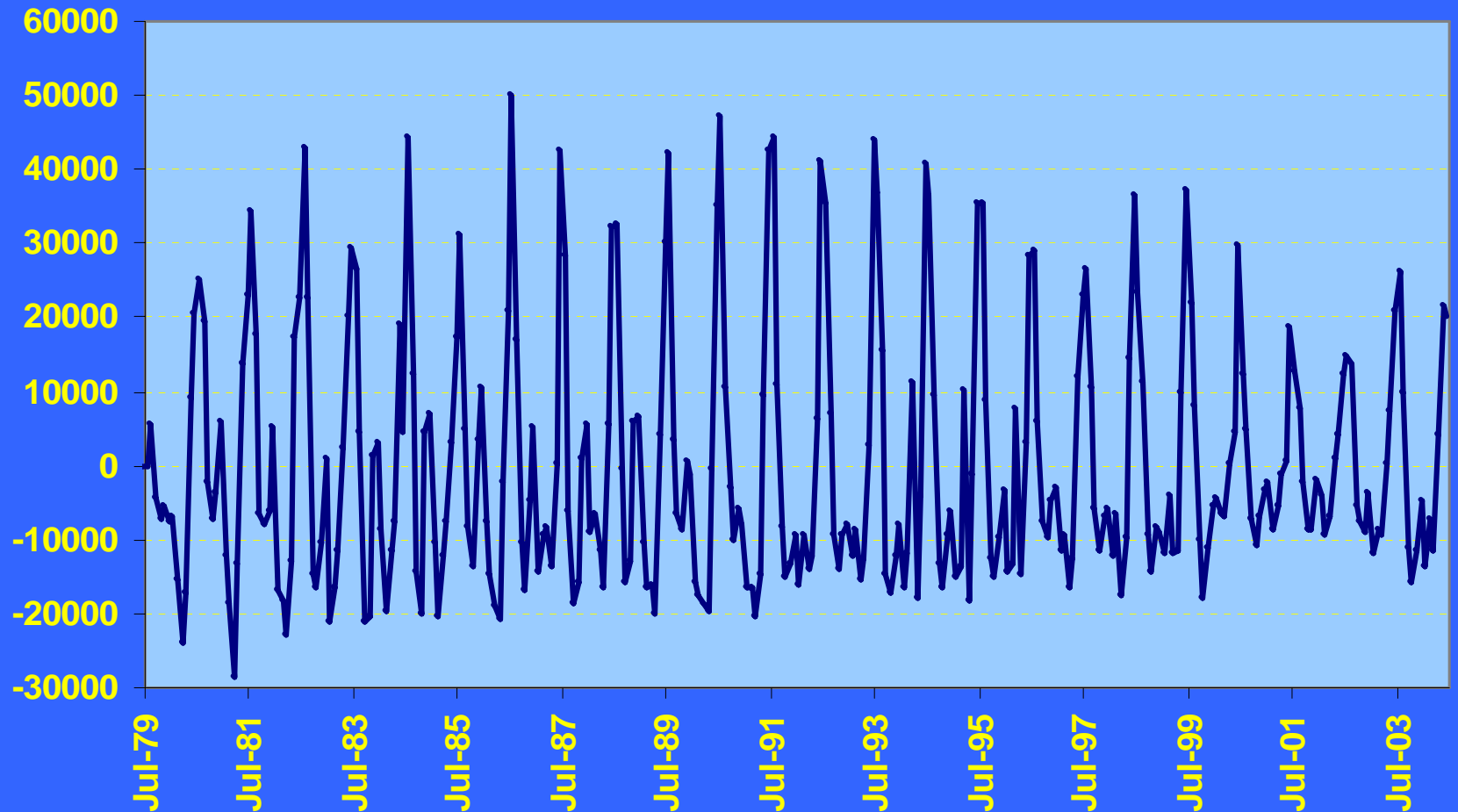
SEASONAL DECOMPOSITION OF THE 1979-2005 LPUE TIME SERIES

1) Trend-cycle component



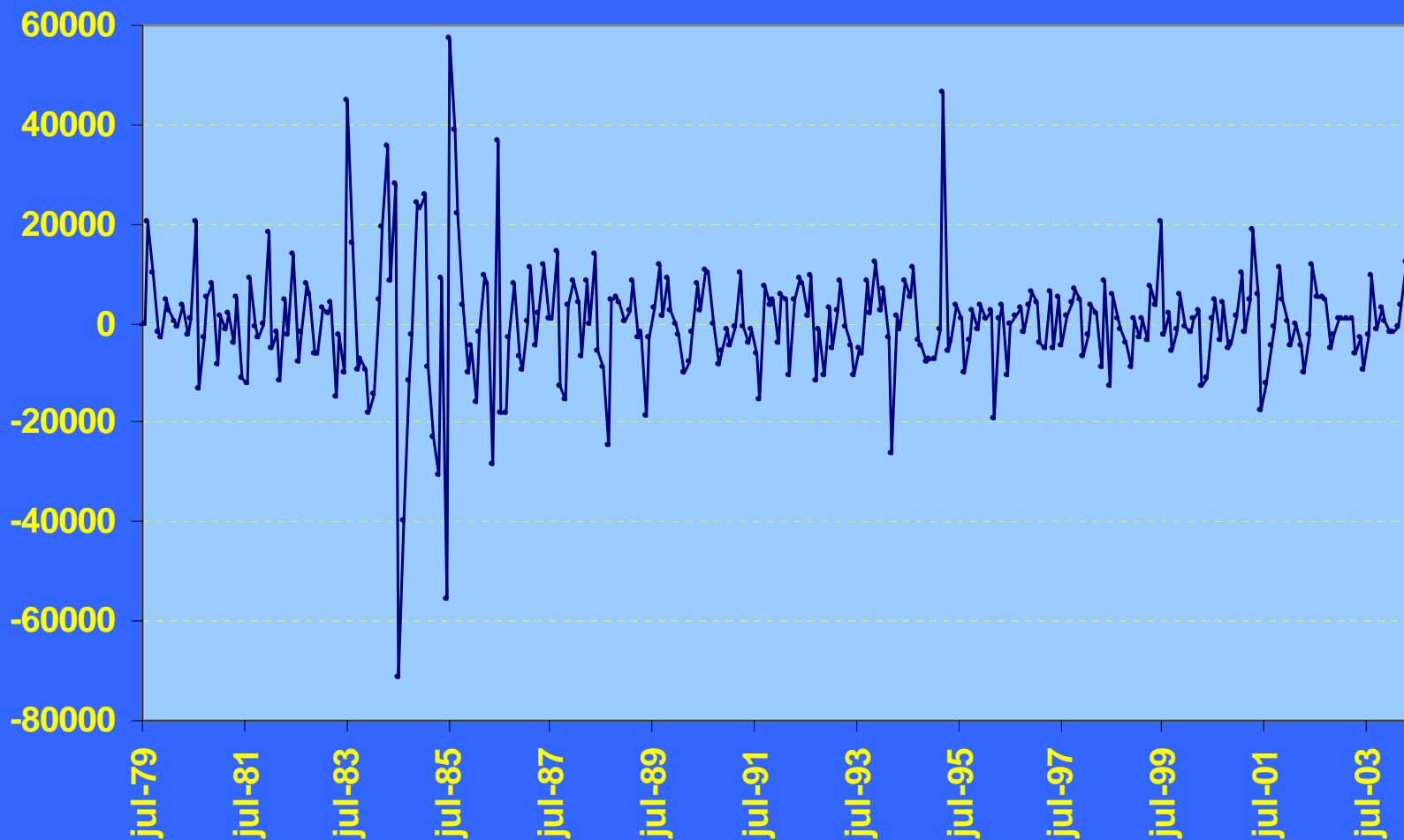
SEASONAL DECOMPOSITION OF THE 1979-2005 LPUE TIME SERIES

2) Seasonal component



SEASONAL DECOMPOSITION OF THE 1979-2005 LPUE TIME SERIES

3) Irregular component



Nephrops landings per unit effort
ARIMA model

$$Y_t = \phi Y_{t-1} + a_t + \Theta a_{t-12}$$

$$Y_t = \underline{0.34} Y_{t-1} + a_t + \underline{0.87} a_{t-12}$$

Population and environmental factors:

FACTOR	TIME SERIES	LAG	COEFFICIENT	CONFIDENCE LEVEL	CONSTANT	pvalue
RPUE	1979-2005	12	-0,92	97,8%	NS	0,022
RPUE	1979-2005	36	-0,92	97,5%	-905,85	0,025
%MACHOS	1979-2005	96	16163,00	96,4%	NS	0,036
%OVADAS	1979-2005	54	-89,28	84,9%	-598,39	0,151
NAO	1971-2006	80	-1986,17	98,5%	-707	0,015
NAO	1971-2006	92	1818,30	97,4%	NS	0,026

Example: NAO 80

$$Y_t = \underline{0.34} Y_{t-1} + a_t + \underline{0.87} a_{t-12} - \underline{1986.17} \text{NAO}_{t-80} \underline{-707}$$

MULTIFACTORIAL MODEL

	B	SEB	T-RATIO	PROB.	LEVEL CONFIDENCE
AR1	0,39	0,06	6,10	0	100,0%
SMA1	0,73	0,06	12,78	0	100,0%
NAO80	-2588,34	757,36	-3,42	0,001	99,9%
PORMA96	14960,25	7167,63	2,09	0,038	96,2%
RPUE36	-1,50	0,41	-3,62	0,000	100,0%
RPUE12	-1,26	0,61	-2,06	0,041	95,9%

$$Y_t = 0.39Y_{t-1} + a_t + 0.73 a_{t-12} - 2588.34 \text{ NAO}_{t-80} + 14960.25 \text{ MAL}_{t-96} - 1.26 \text{ RPUE}_{t-12} - 1.49 \text{ RPUE}_{t-36}$$

Density today =

= 0.39(Density 1 month ago) + (error today)

+ 0.73(error 1 year ago) – 2588.34 (NAO 80 months ago)

+ 14960.25 (Males 8 years ago)

- 1.26 RPUE (1 year ago) – 1.49 RPUE (3 years ago)

Final remarks

- Population regulation
 - Density-dependence
 - Population structure and dynamic
 - Other lags (and factors) need be tested to improve the knowledge of *Nephrops* dynamic
- Other factors
 - Population independent factors
 - Multidisciplinary studies integrating natural variability of environment and variability of species/ecosystem are still lacking



Thanks!!!