The R/ETS ratio: Where we are now

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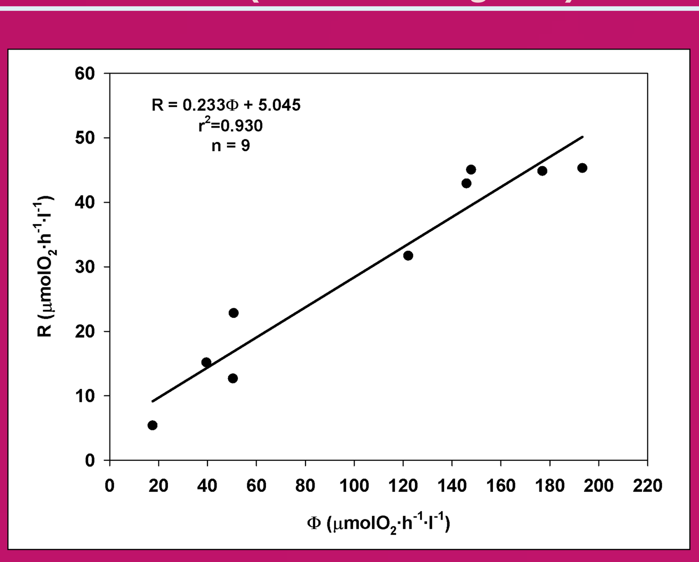
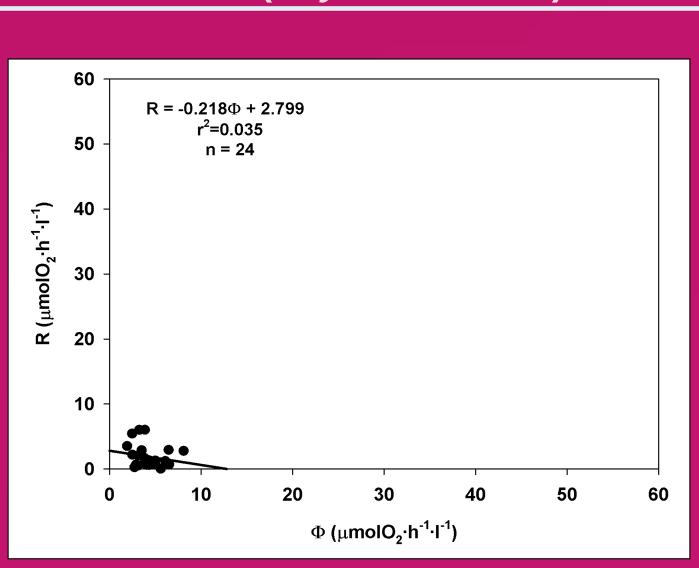
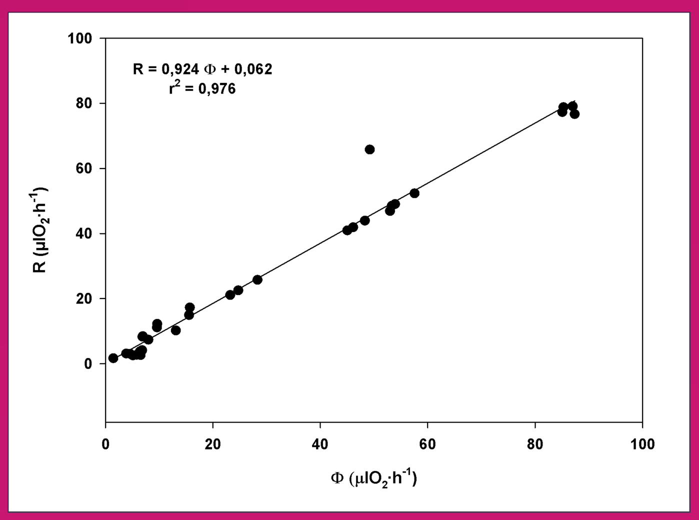
R/ETS (*Vibrio natriegans*)



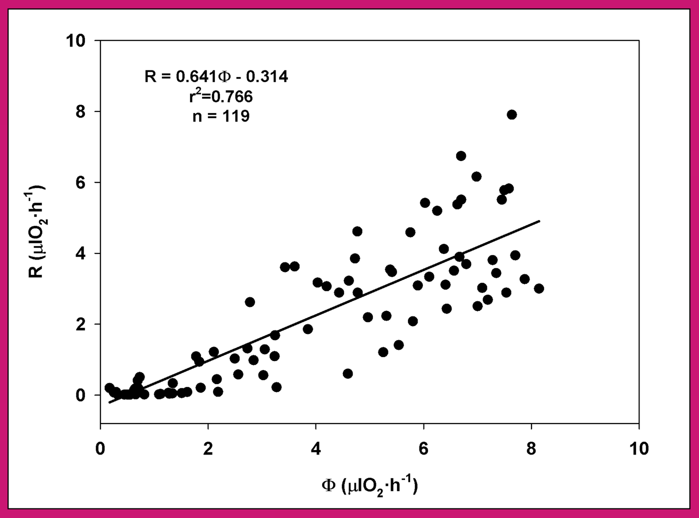
R/ETS (*Oxyrrhis marina*)



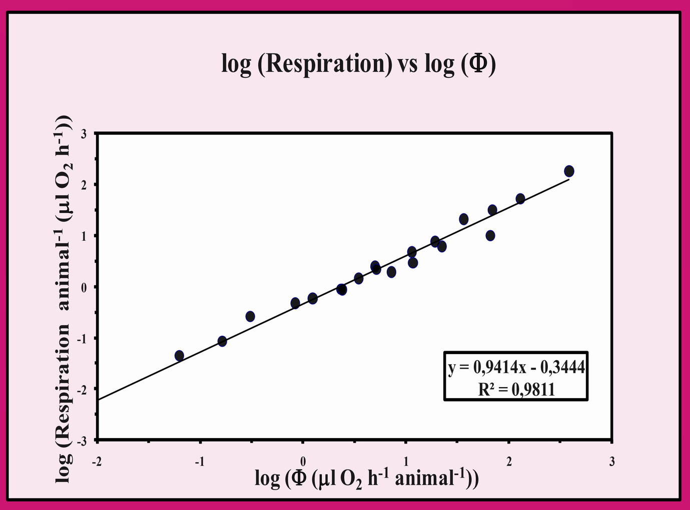
R/ETS (*Artemia sp.*)



R/ETS (*Leptomysis lingvura*)



R/ETS (Zooplankton mix Pacific)



R/ETS (Zooplankton mix Canary Islands)

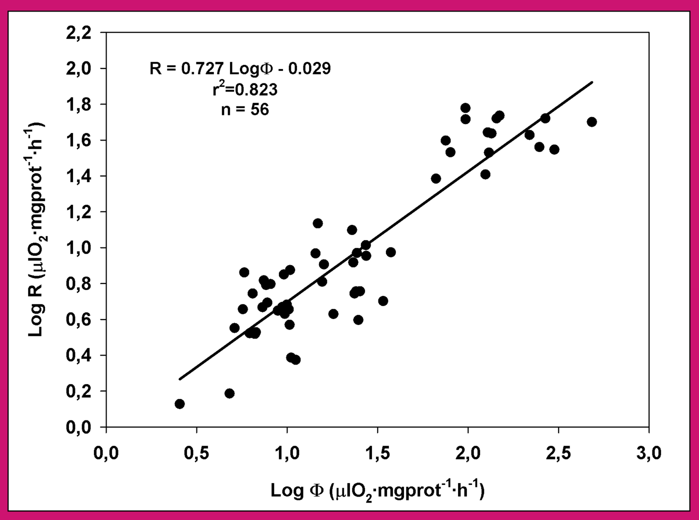


Fig. 1

The relationship between respiration and the activity of the electron transport system (ETS) is an unresolved issue that begs more understanding, because measuring ETS activity or its equivalent, potential respiration, is the fastest and most synoptic way of assessing respiration (R) in ocean space. Furthermore, this topic is an entry point to the understanding of respiratory control. As we know from the variability in respiration measurements, in Kleiber's Law, and in past R/ETS studies, many factors can alter respiration. Temperature, nutrient-limitation, age, size, temporal periodicity, and activity levels are among these factors. To model or to measure respiration accurately, these factors need to be understood.

Here we present our progress in both the field and in the laboratory in measuring and interpreting R and ETS measurements and their relationship. We review measurements made on different size classes of marine zooplankton from many different oceanographic areas (Central Atlantic, North Pacific, Canary Islands, Baltic Sea, and Antarctica) and on a spectrum of species from 5 phyla of zooplankton plus protozoans and bacteria, (Fig. 1, Table 1).

We find that the variability in the relationship is associated with organism size, age, nutritional state, and temperature. These findings are helping us understand the variability in the R/ETS ratio that we observe in the sea.

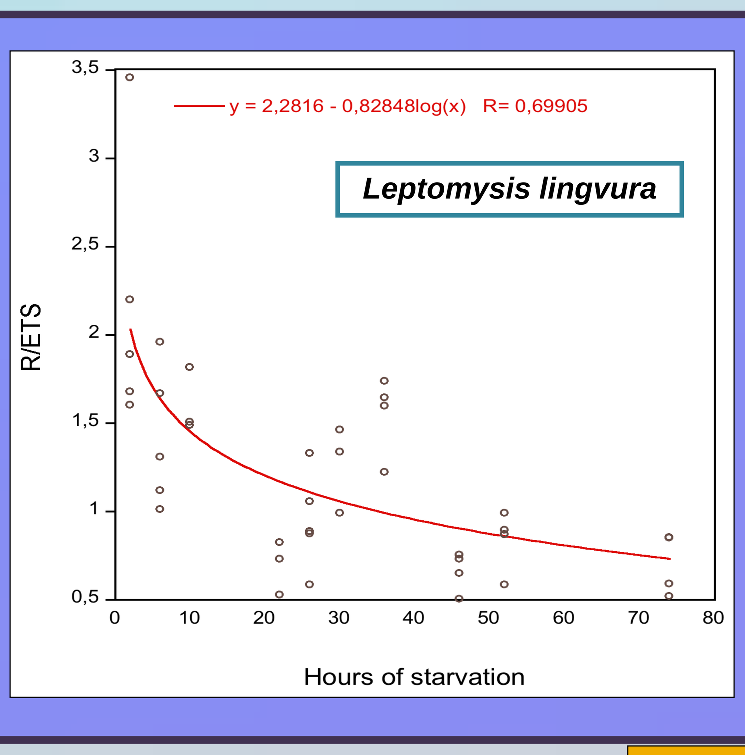
Sample	R/Φ	Location
Vibrio natriegans	0,30 ± 0,07 (n=9)	Laboratory cultures
Oxyrrhis marina	0,53 ± 0,52 (n=27)	Laboratory cultures
Artemia salina	0,89 ± 0,23 (n=31)	Laboratory cultures
Leptomysis lingvrura	0,73 ± 0,18 (n=14)	Laboratory cultures (well fed)
Leptomysis lingvrura	0,41 ± 0,19 (n=35)	Laboratory cultures (starved)
Calanus pacificus	0.59 ± 0.19 (n=2)	North Pacific
Copepods	0.71 ± 0.40 (n=6)	North Atlantic (East) North Pacific (Tropical East)
Zooplankton	0.50 ± 0.17 (n=146)	North Atlantic (East) North Pacific
Zooplankton (100-200 µm)	0.94 ± 0.47 (n=13)	Baltic Sea
	1.59 ± 0.88 (n=2)	Canary Islands
	0.95 ± 0.98 (n=10)	Gran Canaria (Onshore)
Zooplankton (200-500 µm)	0.42 ± 0.19 (n=16)	Baltic Sea
	0.77 ± 0.28 (n=60)	Canary Islands
	0.65 ± 0.39 (n=42)	Gran Canaria (Lab. Experiments)
Zooplankton (500-1000 µm)	0.40 ± 0.06 (n=4)	Baltic Sea
	0.57 ± 0.17 (n=6)	Canary Islands
	0.35 ± 0.06 (n=4)	Tropical Atlanctic
Zooplankton 1000 µm	0.19 ± 0.11 (n=20)	Antartica

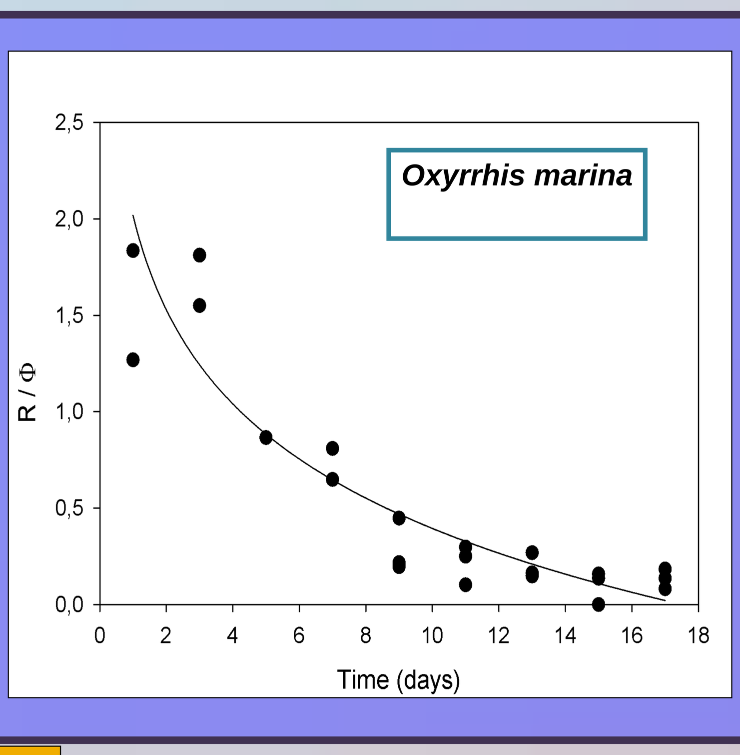
Oxyrrhis marina

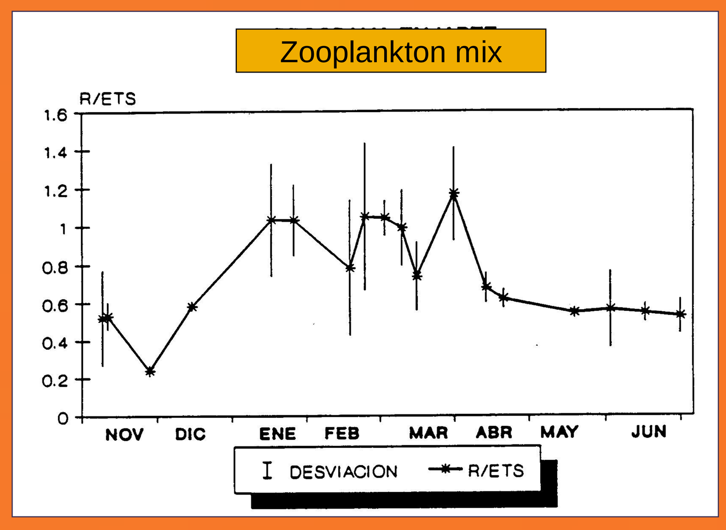
Artemia sp.

Leptomysis lingvura

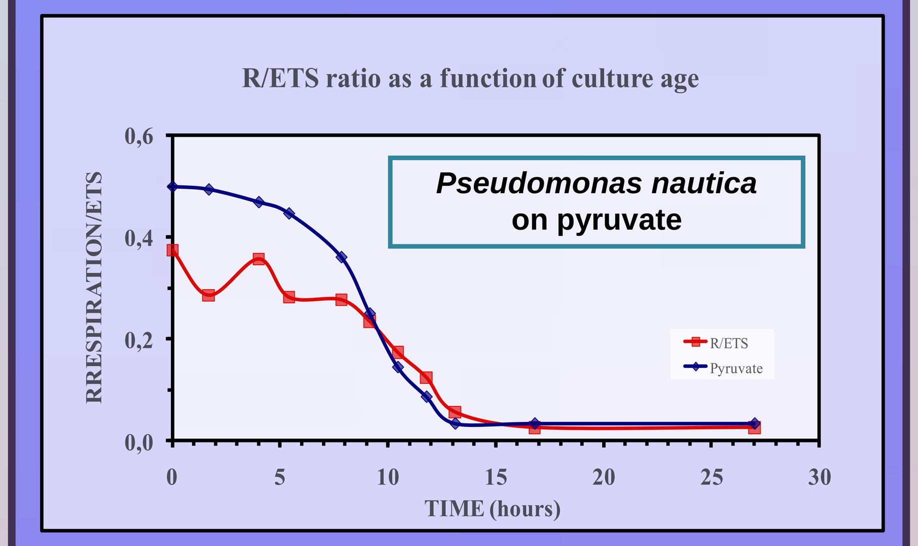
Zooplankton samples

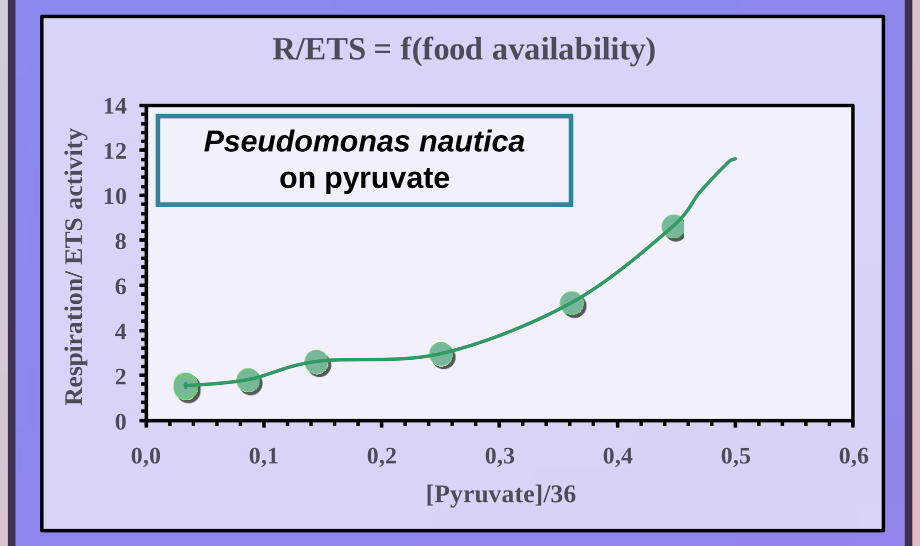


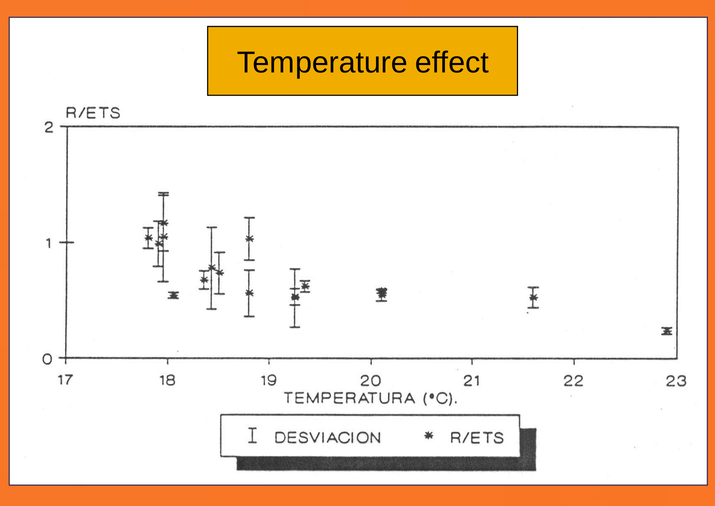




Starvation effect







Conclusions:

The main factors affecting the Respiration / ETS ratio are:

1.- The nutritional state. Well-fed organisms have higher ratios than starved organisms.

2.- The age of organisms, juveniles have ratios higher than adults.

Another factor might be the temperature, the ratios seems to be higher at lower temperatures