

# Louisiana red crayfish meal: a novel functional feed ingredient for organic fish diets?

Capoccioni F.<sup>1</sup>, Pulcini D.<sup>1</sup>, Contò M.<sup>1</sup>, Failla S.<sup>1</sup>, Tulli F.<sup>2</sup>, Cardinaletti G.<sup>2</sup>, Buttazzoni L.<sup>1</sup>, Tibaldi E.<sup>2</sup>

1. Consiglio per la Ricerca in Agricoltura e l'Analisi dell'Economia Agraria – Centro di Ricerca Zootecnia e Acquacoltura, Monterotondo (Rome, Italy)

2. Dipartimento di Scienze Agroalimentari, Ambientali e Animali (Di4A) - Università degli Studi di Udine

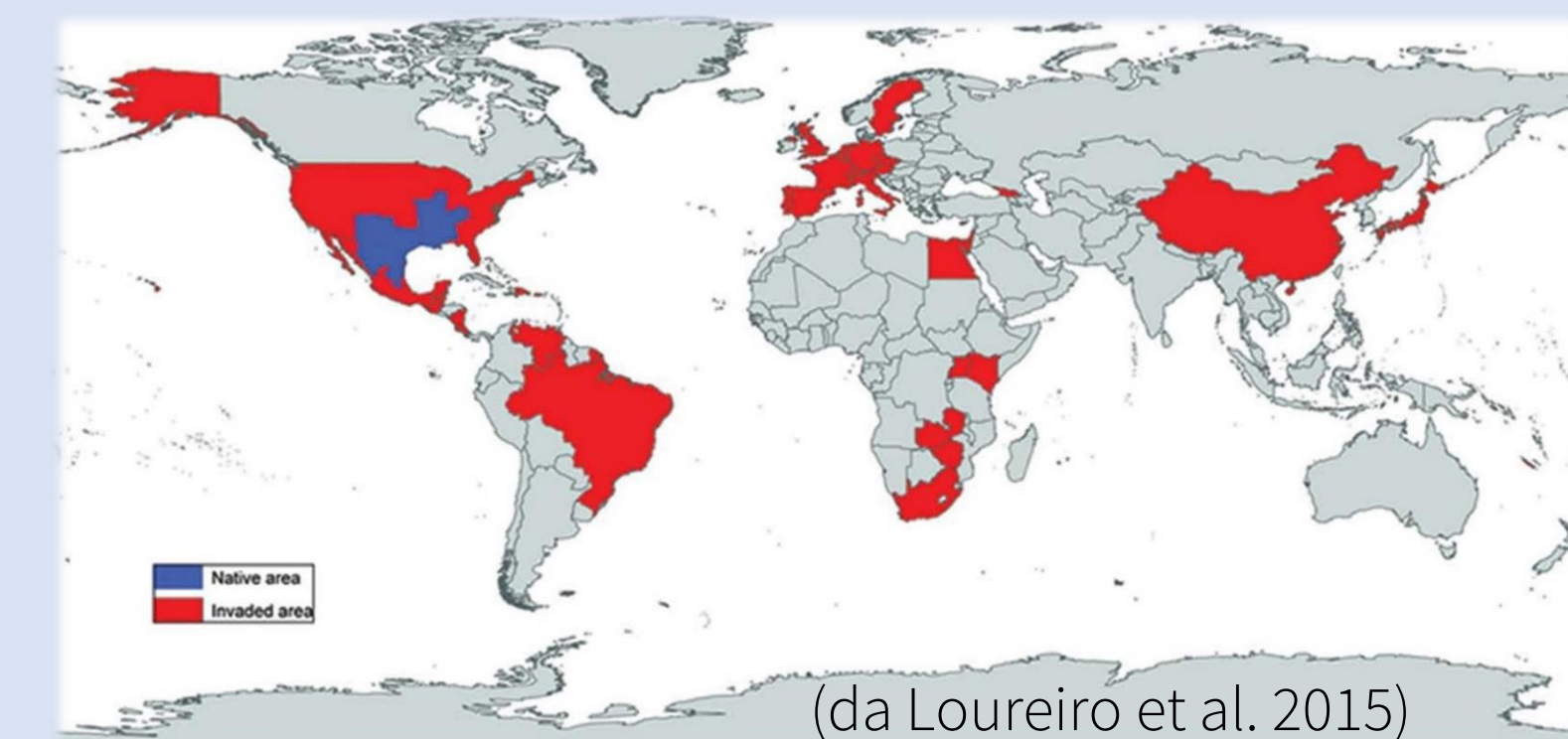
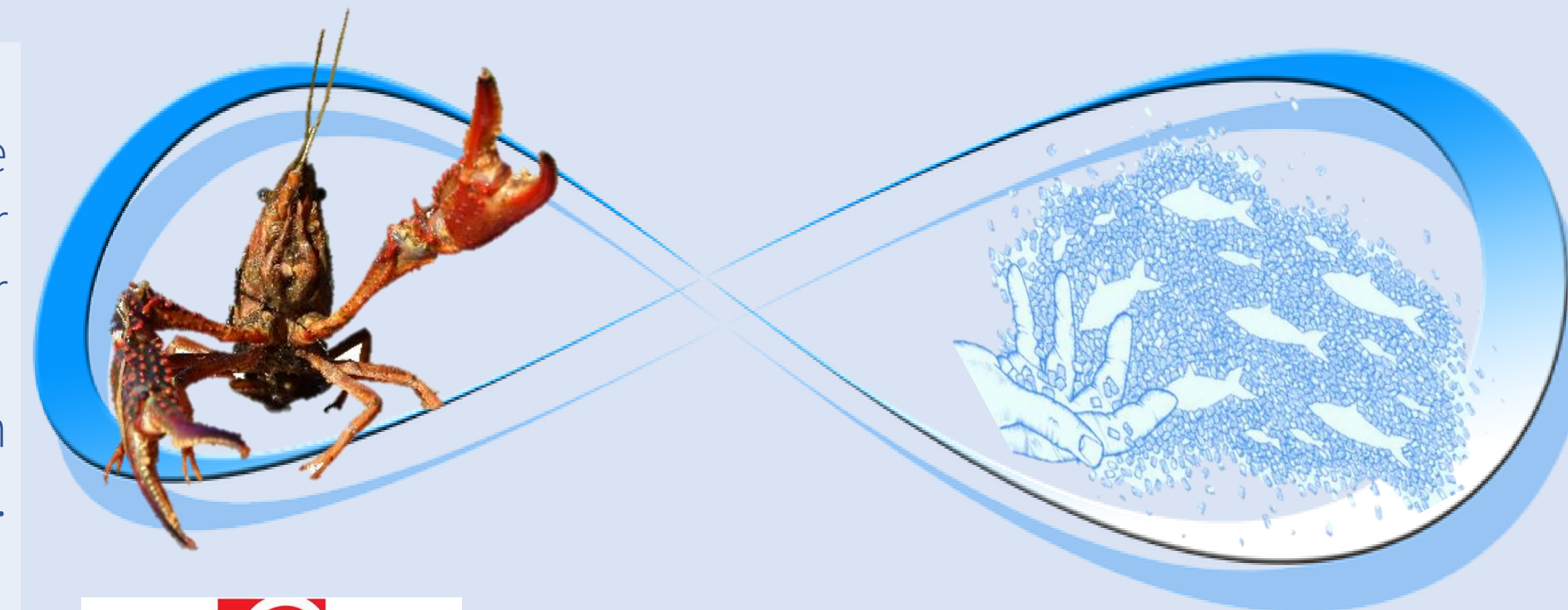
## Introduction

Economic and ecological sustainability of aquaculture will depend to a great extent on the ability to save poorly renewable resources or heavily depleted ones, furthermore increasingly contended with other sectors, by using novel nutrient-rich raw materials or feed ingredients that are currently little studied or valued, possibly by finding them outside the human food chain.

The Louisiana Red swamp crayfish (*Procambarus clarkii*) is one of the most invasive alien species (IAS) in Europe. In Italy, its diffusion caused alterations of freshwater environments impairing species biodiversity. To limit crayfish invasions, several EU authorities have issued eradication campaigns.

## Aims

The SUSHIN project investigated, among others, a new ingredient derived from crayfish, in order to face: (1) the need of reducing the dependence of the sector on the exploitation of natural resources converted into fish meal and fish oils, in alternative to conventional vegetable protein sources; (2) the requirement of a natural ingredient with high nutritional value and high in carotenoid (astaxanthin) to be used in finishing diets for improving skin or flesh pigmentation of certain cultured fish species.



## Collection and Transformation



## Results

Tab. 1: Nutritional composition of the RSCM test ingredient (dry matter basis)

Proximate composition (%)	Fatty acids (%)	Amino acids (g/100g)		Minerals (mg/100g)	Pigments (µg/g)
Dry matter	SFA	Asp	Ile	Ca	Astaxanthin
Crude proteins	MUFA	Thr	Leu	Cu	Total carotenoids
Ash	PUFA	Ser	Tyr	Mn	
Ether extract	EPA	Glu	Phe	Fe	
Glicogen	DPA	Gly	Lys	K	
Chitin	DHA	Ala	Trp	Na	
Gross energy (Kj/g)	ω-3	Cys	His	Zn	
	ω-6	Val	Arg	Mg	
	ω-3:ω-6	Met	Pro	P	

Apparent digestibility coefficients (ADCs) was calculated in Rainbow trout and European seabass according to NRC (2011)



20 juveniles/tank (mean b.w. 46.9±0.2 g) kept at 13.5±1.2°C



20 juveniles/tank (mean b.w. 36.9±1.0 g) kept at 21.2±0.7°C



Tab. 2: Test diet composition

Ingredients (g/kg)	Value
REF	700
RSCM	300

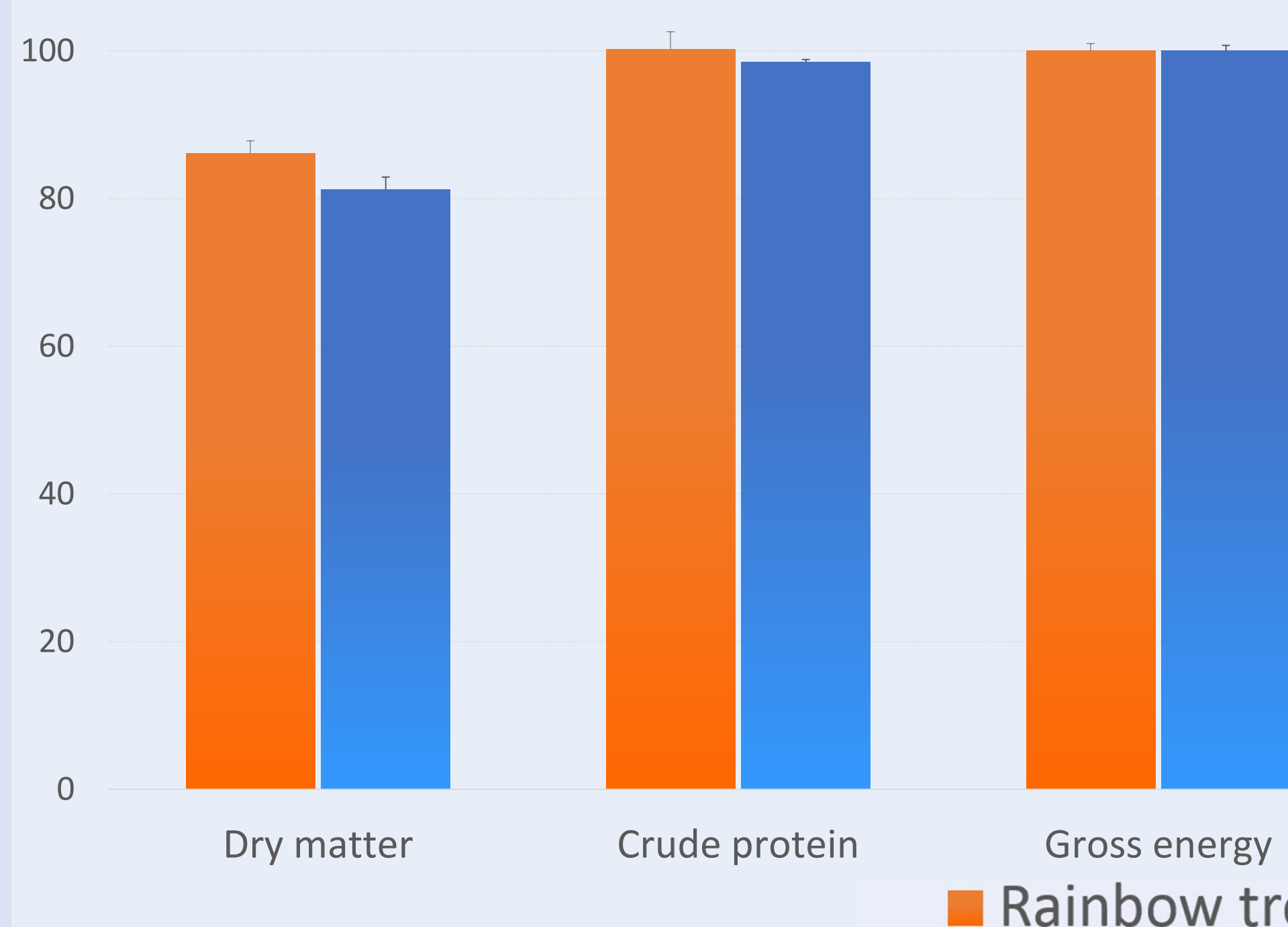
Proximate composition (%)	Value
Dry matter	89.9
Crude proteins	42.1
Ash	15.0
Gross energy (Kj/g)	19.6

Tab. 3: Reference Diet Formulation (REF)

Ingredients (g/kg)	Value
Fish meal	370
Wheaten gluten meal	100
Soy Protein concentrate	120
Dried Brewer's yeast	60
Wheat starch	120
Wheat meal	62.8
Fish oil	80
Rapeseed oil	40
Soy lecithin	20
Vitamin and Mineral premix	12.1
Yttrium(III) oxide	0.1
Celite®545 (AIA)	15

In 2017 sampling campaigns aimed at collecting a sufficient biomass of *P. clarkii* for laboratory analysis and digestibility fish trials were set up in two protected areas of Latium: Circeo National park and Regional Natural reserve of Tevere-Farfa. A total of 400 kg of crayfish (corresponding to ~ 23.000 individuals) were removed, frozen and stored. Red swamp crayfish meal (RSCM) was obtained by flash drying technique.

## Acid-Insoluble Ash



## Yttrium



Fig. 1 Mean Apparent digestibility coefficients (ADCs)(obtained by 3 independent measurements) of REF+RSCM experimental diet in Rainbow trout and European seabass.

The experimental diet, containing 30% of red claw meal, and 70 % of a Reference diet (Tab. 2 and 3) was tested. Two inert markers (Acid-Insoluble Ash and Yttrium) were used to calculate the Apparent digestibility coefficients (ADCs) for dry matter, crude protein and gross energy in Rainbow trout and European sea bass (Fig. 1). Similar and very high ADCs values were obtained between species, confirmed by the two markers, concerning the three indagated aspects.

## Conclusion

The experimental diet based on the invasive Louisiana Red swamp crayfish meal showed a high valuable nutrient composition and a great digestibility in both rainbow trout and seabass, thus RSCM has the potential to be included (as complement or partially replacing raw material) in fish diets. Moreover, being a source of astaxanthin, a high value keto-carotenoid pigment, it could be a suitable candidate feed ingredient for organic aquafeed, meeting the requirements of by the EU rule N° 775/2008 (i.e. the need to substitute synthetic pigments with natural ones in organic feedstuffs).