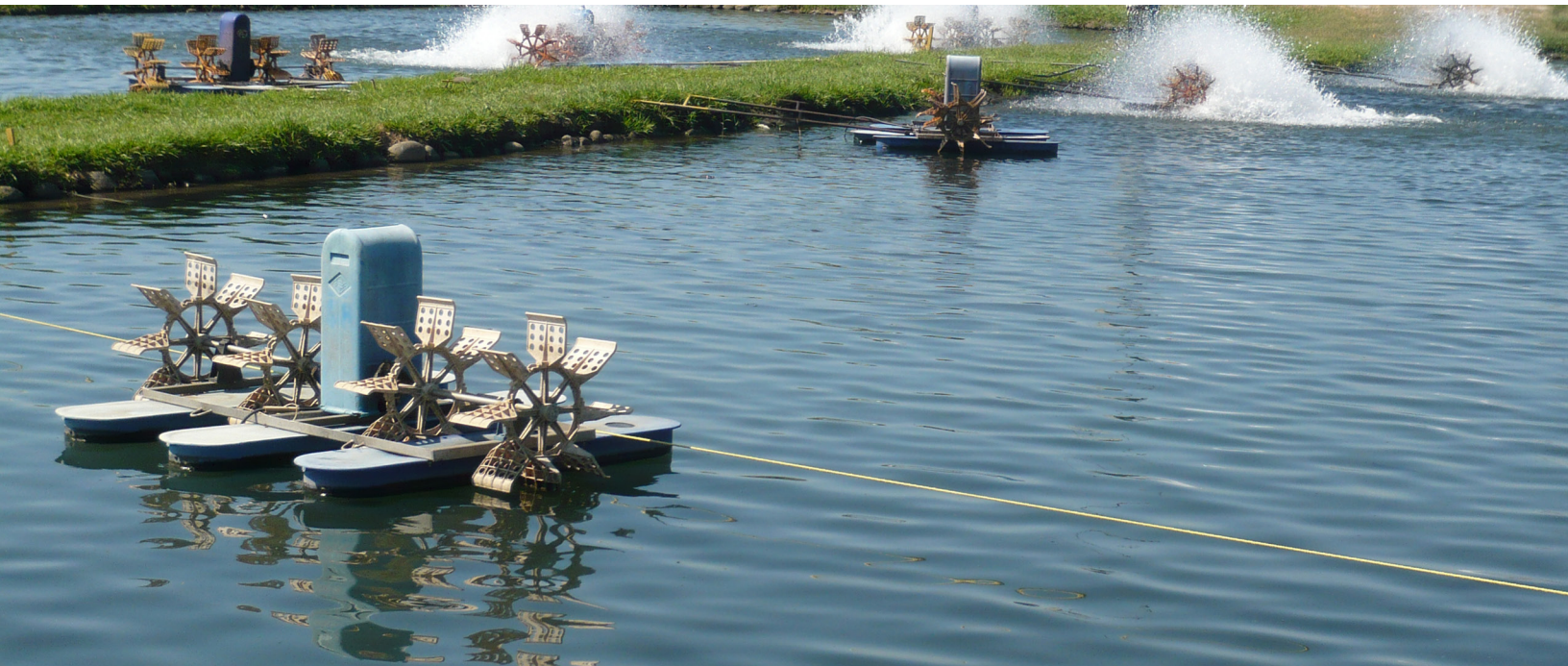
Pond

Onshore Aquaculture

TABLE OF CONTENTS



SHRIMP AQUACULTURE

ABOUT LONGLINE ENVIRONMENT

Longline Environment was incorporated in 2005, to provide marine environmental products and services based on 20 years of research and technology development experience. The company offers a range of modelling services and solutions to shrimp farmers.

EXECUTIVE SUMMARY

The Pond Aquaculture Management and Development (POND) model simulates the growth of the Pacific White Shrimp – Litopenaeus vannamei and Indian Shrimp – Fenneropenaeus indicus. The model is designed for shrimp pond aquaculture management, and has four main uses:

(i) prediction of production and feed requirement;
(ii) optimisation of seeding size and culture period;
(iii) optimisation of farming methods and
(iv) profitability assessment.

POND is a management tool, providing commercial shrimp farms with a cost effective approach to aid with the (i) production angle and (ii) the environmental component with respect to pond water quality and effluent quality. POND allows shrimp farms to stress test their production by altering key production variables, providing a valuable tool for scenario testing and aiding existing site production experiments. POND can also provide a platform for shrimp farms to demonstrate compliance with certification programs and international environmental standards.

POND AQUACULTURE MANAGEMENT AND DEVELOPMENT (POND)

The POND modelling framework applies a combination of physical, culture and biogeochemical models, species growth models and screening models for determining prawn/shrimp production, simulating different feed scenarios, product analysis and water quality effects for shrimp aquaculture in ponds.

The POND model provides insights for existing and prospective shrimp farm operations, with respect to assessing the carrying capacity threshold of production. POND allows stakeholders to assess whether their operations are producing at a sustainable level with respect to the stocking densities given local ponds conditions.

THE APPLICATION OF POND

The POND model provides outputs regarding harvestable biomass, production analysis, water quality effects and mass balance analysis. Rich data sets will improve confidence in model outputs, but even in data-poor contexts, this kind of screening model can support shrimp farms with production decisions.

Output	Application	Available	Planned
Production analysis	• Simulation of potential harvest.	x	
	• Optimisation of harvest timing.	x	
	• Changes in stocking density, mortality.	x	
	• Optimum profit structure with respect to stocking density, pond and feed characteristics.	x	
	• Calculation of Average and Marginal Physical Product (APP and MPP).	x	
Environmental effects	• Deposition analysis.	x	
	• Dissolved oxygen and sediment oxygen demand analysis.	x	
	• Effect of the pond water quality.	x	
	• Assessment of pond eutrophication.	x	
	• IMTA Simulation on water/sediment quality, e.g. combining shrimp with finfish.		x
Mass balance analysis	• Mass balance analysis for shrimp farms.	x	
	• Environmental footprint of shrimp farms.	x	
	• Production analysis, algal growth calculation using dissolved nutrient analysis, other water quality aspects.	x	
	• Quality of pond effluent for farms with circulation.	x	
Disease analysis	• Stressor-related models to assess disease outbreaks probability.		x

POND DESCRIPTION

The POND model simulates the growth of shrimp in pond culture, taking into account the shrimp farm layout, cost of seed, shrimp cultivation characteristics (species, stocking specifications, culture period) and pond characteristics (water temperature, salinity, chlorophyll, dissolved oxygen, etc) and calculates the distribution of biomass for cultivated species, with an emphasis on the harvestable weight classes.

The POND inputs can be modified to account for local conditions and culture practices, including farm layout, cultivation densities, pond areas, feed applications (as % of stock), number of ponds, seed cost, mortality rates, culture periods and sale price per kg, etc.

Figure 1. The POND Drivers

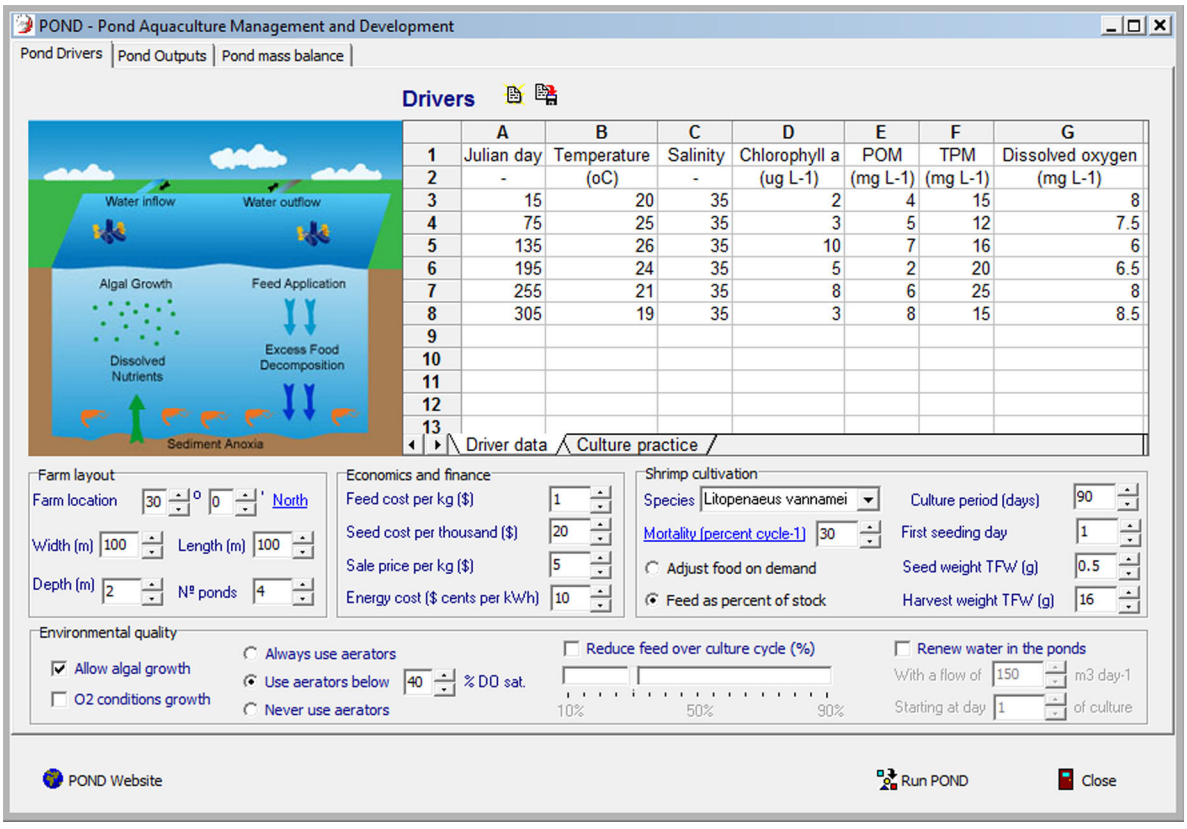
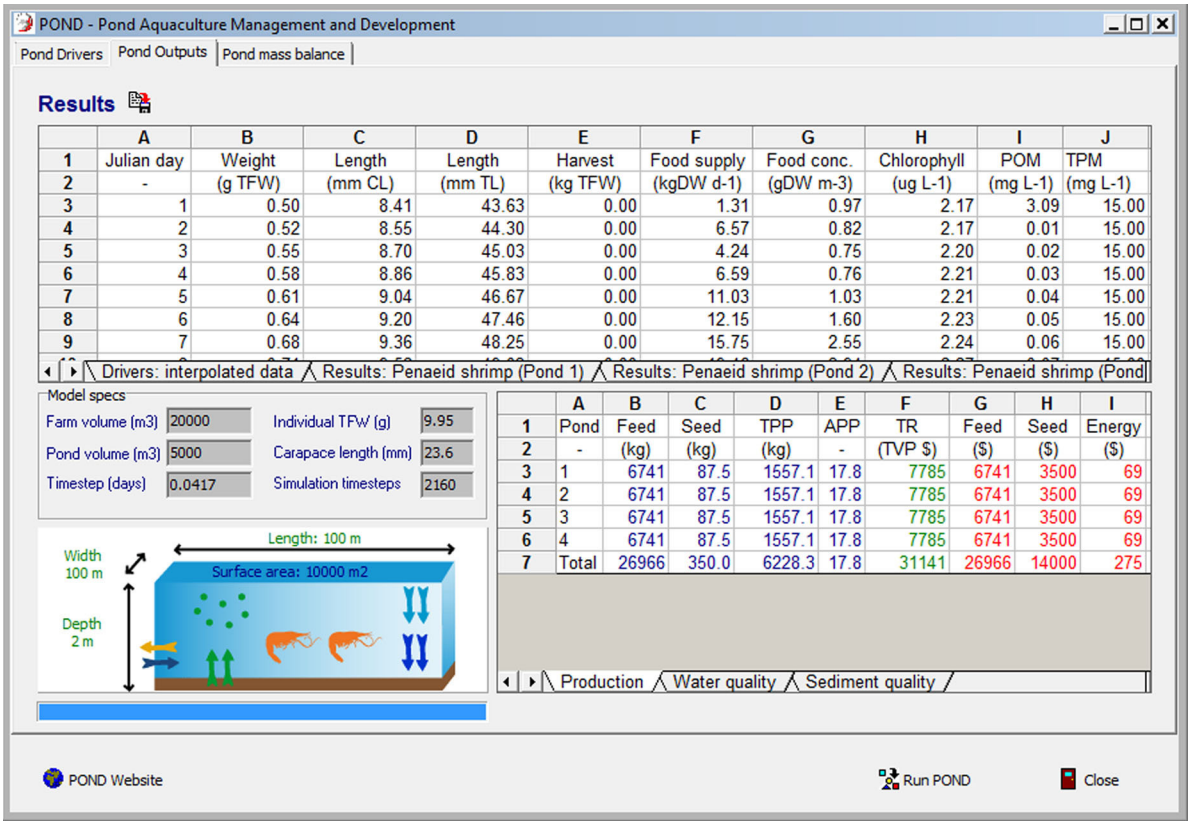


Figure 1 - The POND drivers (above) provides a visual representation of the software, highlighting how the model is designed to run on a minimal amount of data providing a simple and user friendly interface.

Figure 2. The POND Outputs



	A	B	C	D	E	F	G	H	I	J
1	Julian day	Weight	Length	Length	Harvest	Food supply	Food conc.	Chlorophyll	POM	TPM
2	-	(g TFW)	(mm CL)	(mm TL)	(kg TFW)	(kgDW d-1)	(gDW m-3)	(ug L-1)	(mg L-1)	(mg L-1)
3	1	0.50	8.41	43.63	0.00	1.31	0.97	2.17	3.09	15.00
4	2	0.52	8.55	44.30	0.00	6.57	0.82	2.17	0.01	15.00
5	3	0.55	8.70	45.03	0.00	4.24	0.75	2.20	0.02	15.00
6	4	0.58	8.86	45.83	0.00	6.59	0.76	2.21	0.03	15.00
7	5	0.61	9.04	46.67	0.00	11.03	1.03	2.21	0.04	15.00
8	6	0.64	9.20	47.46	0.00	12.15	1.60	2.23	0.05	15.00
9	7	0.68	9.36	48.25	0.00	15.75	2.55	2.24	0.06	15.00

	A	B	C	D	E	F	G	H	I
1	Pond	Feed	Seed	TPP	APP	TR	Feed	Seed	Energy
2	-	(kg)	(kg)	(kg)	-	(TVP $)	($)	($)	($)
3	1	6741	87.5	1557.1	17.8	7785	6741	3500	69
4	2	6741	87.5	1557.1	17.8	7785	6741	3500	69
5	3	6741	87.5	1557.1	17.8	7785	6741	3500	69
6	4	6741	87.5	1557.1	17.8	7785	6741	3500	69
7	Total	26966	350.0	6228.3	17.8	31141	26966	14000	275

Figure 3. The POND Mass Balance

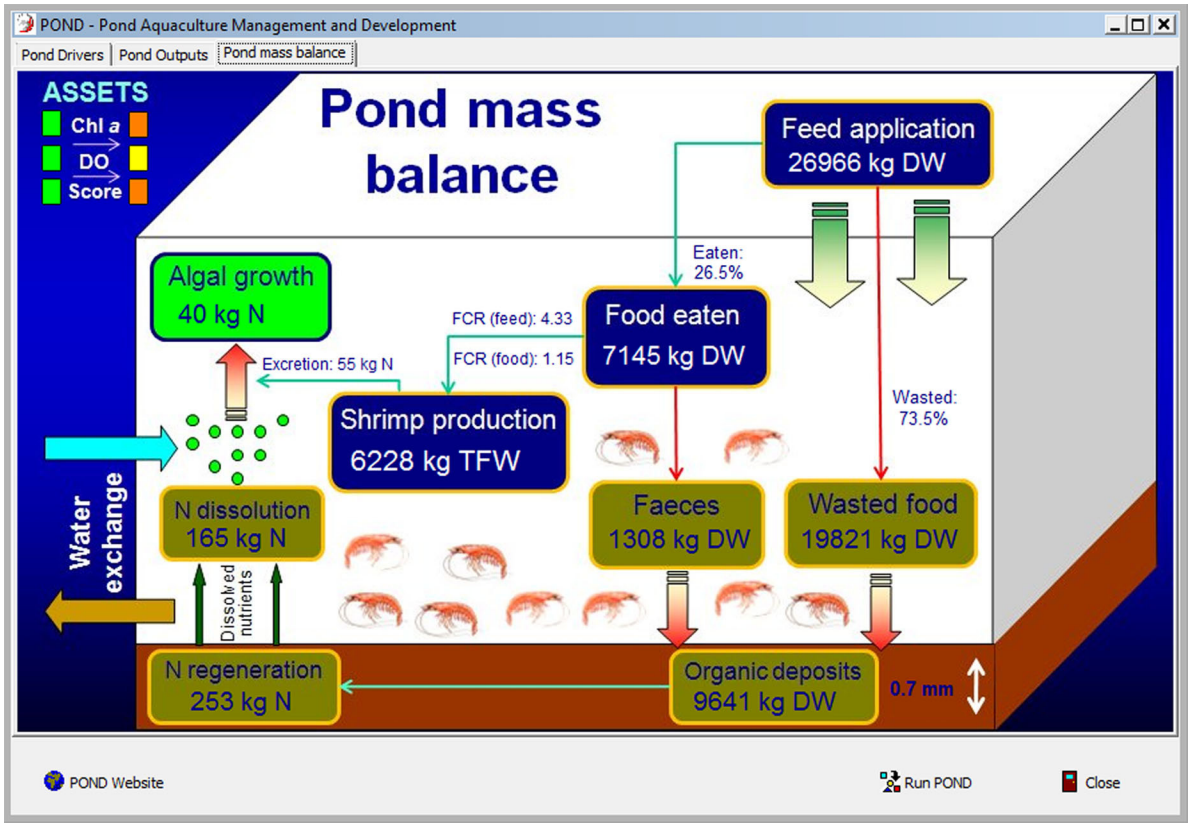


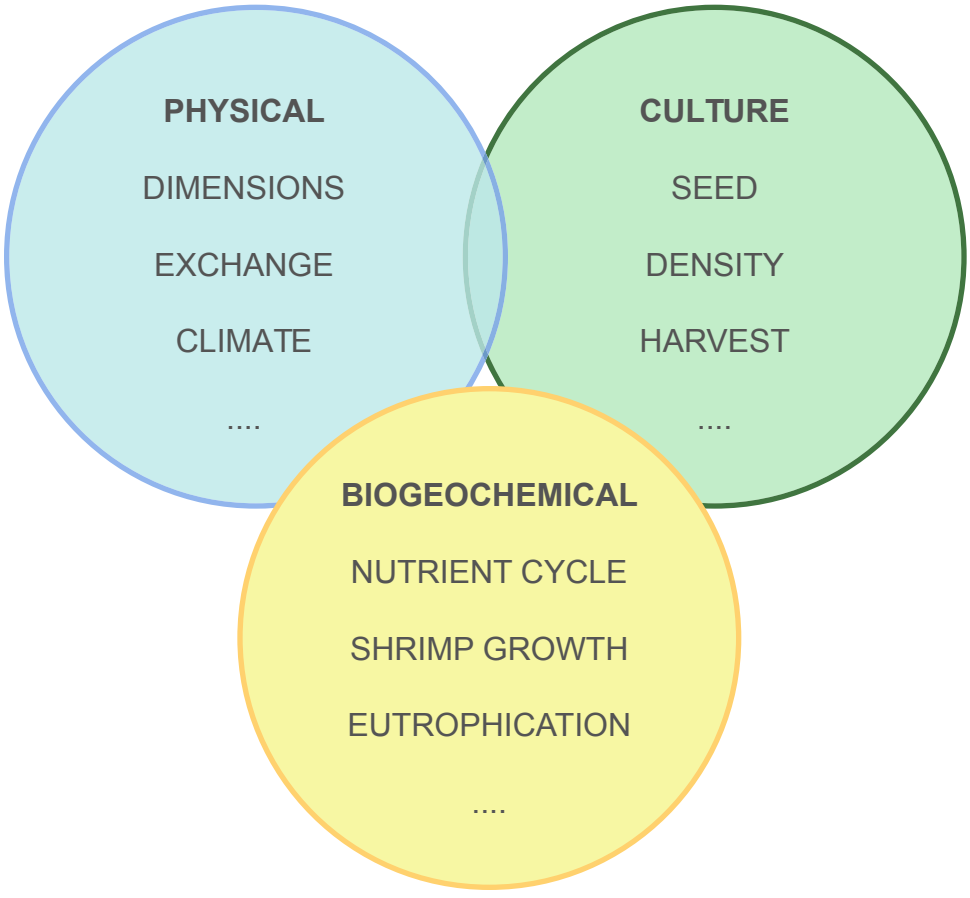
Figure 2 – The POND Outputs shows farm performance in terms of shrimp individual growth and harvestable biomass, together with other key aspects such as food supply and feed concentration in the ponds.

Figure 3 – The POND Mass Balance shows how much feed was consumed by the animals and calculates the shrimp production in Total Fresh Weight (TFW). The mass balance also provides a handle of the organic deposits in the pond.

WHY USE POND?

POND simulates growth by combining biogeochemical models, which explicitly simulate processes such as feeding, assimilation, and metabolism, with population dynamics models. This is extended by modelling the effects of wasted feed and faecal material, as well as dissolved products of shrimp metabolism.

HOW DOES POND WORK?



By modelling the concentration of feed in the pond water, the model can optimize the feed supply at various stages of the culture cycle, a significant improvement over the standard % stocking approach. Furthermore, since dissolved oxygen, eutrophication, and other components are explicitly simulated, the model can examine the effects both on mortality and on effluent quality (with implications for certification) of varying densities.

DATA REQUIREMENTS

POND requires a minimum amount of data to apply the model. The type of data required is usually monitored by stakeholders. In order to maximise the potential of the model, the driver data (Chl, etc) should be seasonal/ quarterly (minimum) or monthly (ideal) over a year.

Category	Data Type
Farm Layout	• Farm Coordinates.
	• Farm width, length and depth.
	• Number of ponds.
Economics and Finance	• Seed cost per thousand.
	• Sale price per kg.
	• Feed cost per kg.
Shrimp Cultivation	• Species cultivated.
	• Seed weight – Total Fresh Weight (g).
	• Harvest weight – Total Fresh Weight (g).
	• Culture period (days).
	• Mortality (% y^{-1}).
Drivers	• Water temperature.
	• Salinity.
	• Chlorophyll a
	• Particulate Organic Matter (POM)
	• Total Particulate Matter (TPM).
	• Dissolved Oxygen (DO)
Culture Practice	• Pond data
	• Cultivation density.
	• Feed applied (% of Total Fresh Weight)

FURTHER INFORMATION

Longline Environment can help shrimp farms with production analysis, environmental analysis (pond water quality aspects), mass balance and disease analysis. POND provides a cost-effective method for shrimp farms to optimise current production, analyse the potential of future expansions or changes in stocking density.

Further information about how we can assist your shrimp farm needs can be found on our webiste:

http://www.longline.co.uk

KEY CONTACT

If you have any enquiries please do not hesitate to contact us:

Longline Environment Ltd
2nd Floor, 145-157 St John Street
London, EC1V 4PY
United Kingdom
Email: info@longline.co.uk