

Assessing the cost and benefits

Dr. Sangeeta Sonak, Ms. Asha Giriyan,
Ms. Prajwala Pangam

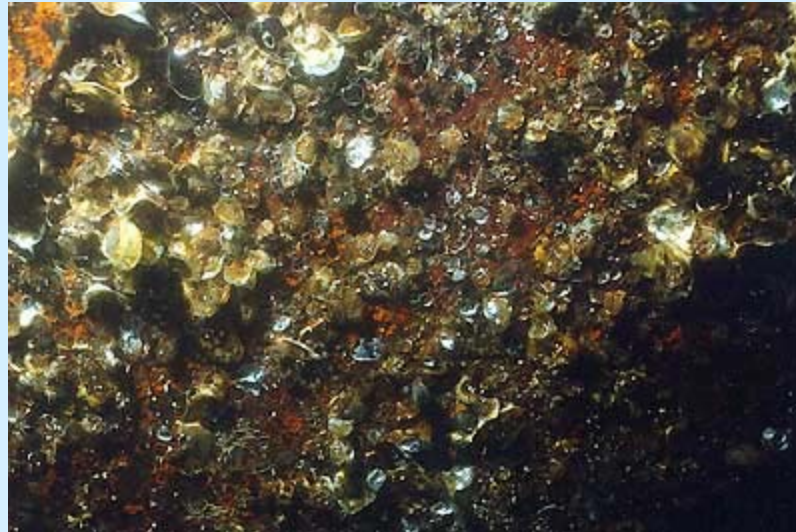


The Energy and Resources Institute

Western Regional Centre, Goa

What is fouling ?

Is an undesirable growth of organisms, such as bacteria, larvae, algae, mussels, barnacles and invertebrates on submerged surfaces.





Factors responsible for fouling

- Protective coating
- Water in which it sails
- Port stay of ship
- Speed of the vessel

Effects of fouling on shipping industry

- Roughness of surfaces
- Increasing the frictional resistance for the movement of the ship
- Decreasing the ship speed thereby increasing fuel cost

Economic impacts of fouling on shipping industry

Methodology

- Literature Review
- Field work
 - Discussion with shipping companies
 - Pilot Questionnaire
 - Final Questionnaire
 - *Shipping Companies*
 - *Shipyards*
 - *Paint Manufacturers*

Methods to estimate the cost of fouling

- Increase in fuel cost
- Increase in cost due to reduced speed
- Cost of dry-docking
- Loss of Revenue
 - *Reduced speed*
 - *Dry docking*

Increase in cost due to reduced speed

Vessel	Daily Operating Cost of normal ship	Speed Of Normal Ship	Speed of fouled ship	Reduction in speed due to fouling	Increase in fuel cost due to speed reduction	Total Increase in cost due to reduced speed
<i>(In GRT)</i>	<i>(In Rs/day)</i>	<i>(In Knots)</i>	<i>(In Knots)</i>	<i>(In Knots)</i>	<i>(In Rs/day)</i>	<i>(Rs/day)</i>

Cost of Painting during dry – docking

Vessel	Paint Cost	Daily operating cost at sea	Daily operating cost at dockyard
<i>In GRT</i>	<i>(In Th.Rs/day)</i>	<i>(In Th.Rs/day)</i>	<i>(In Th.Rs/day)</i>

Loss of Revenue due to reduced speed of the ship

Vessel	Speed of normal Ship	Speed of fouled ship	Reduction in speed due to fouling	Increase in the number of days of travel due to reduced ship	Loss of revenue due to reduced speed of the ship
<i>(GRT)</i>	<i>(In Knots)</i>	<i>(In Knots)</i>	<i>(In Knots)</i>	<i>(d_i)</i> <i>(In Rs/day)</i>	<i>(In Th.Rs/day)</i>

$$LR_{sp} = FR \times d_i$$

LR_{sp} = Loss of revenue due to reduced speed of the ship

FR is the ship freight rates

d_i is the increase in the number of days of travel due to reduced ship

Loss of revenue during dry docking

Vessel <i>(In GRT)</i>	Number of days for painting at dry – dock <i>(d_d)</i>	Freight Rate per day <i>(INR)</i>	Loss of Revenue due to dry - docking <i>(L_{dd})</i>

$$L_{dd} = FR * d_d$$

L_{dd} is the loss of revenue during dry docking

FR is the ship freight rates

d_d is the number of days required for dry docking of the ship

Additional cost due to fouling

Vessel	C_{sp}	H_{dd}	E_{pc}	DOC_{dd}	LR_{dd}	LR_{sp}	Total cost	Increase in cost
(GRT)	(INR)	(INR)	(INR)	(INR)	(INR)	(INR)	(INR)	(%)

$$C_{sp} = (DOC \times d_i)$$

C_{sp} is the increase in cost due to decrease in speed

DOC is the daily operating cost of a ship

d_i is the number of days of travel of a fouled ship

H_{dd} - is the hire of dry - dock. Here no. of days are taken as 7 days this is including scrapping painting etc.

E_{pc} - Expenses of painting

$$DOC_{dd} = DOC_{daily} \times d_d$$

DOC_{dd} is the daily operating cost of a ship during dry docking period

d_d is the number of days required for painting during dry docking of the ship

**Applicability
to
Indian scenario**

Increase in cost due to reduced speed

Vessel <i>(In GRT)</i>	Daily operating cost of normal ship <i>(In Th.Rs/day)</i>	Speed of normal ship <i>(In knots)</i>	Speed of fouled ship <i>(In knots)</i>	Reduction in speed due to fouling <i>(In knots)</i>	Increase in fuel cost due to speed reduction* <i>(In Th.Rs/day)</i>	Total Increase in cost due to reduced speed <i>(In Th.Rs/day)</i>
Less than 20000	390	12	10.6	1.4	262	416
20000 – 30000	450	12	10.7	1.3	210	471
30000 – 40000	768	13.8	12.2	1.6	283	796

* Fuel rate is \$ 250 / ton and converted in Rs. @ 42 per \$

Increase in cost due to increase in fuel consumption

Vessel <i>(In GRT)</i>	Normal fuel consumption <i>(Tons/day)</i>	Foul fuel consumption <i>(Tons/day)</i>	Increase in fuel consumption due to fouling <i>(Tons/day)</i>	Increase in cost due to increase in fuel consumption* <i>(In Th. Rs/day)</i>
Less than 20000	19	21.25	2.25	262
20000 - 30000	19.11	21.11	2.00	210
30000 - 40000	20.00	22.7	2.75	283

* Fuel rate is \$ 250 / ton and converted in Rs. @ 42 per \$

Cost of painting during dry – docking

Vessel <i>(In GRT)</i>	Paint cost <i>(In Th.Rs)</i>	Daily operating cost at sea <i>(In Th.Rs)</i>	Daily operating cost at port* <i>(In Th.Rs)</i>
Less than 20000	246	390	190
20000 - 30000	210	450	249
30000 - 40000	198	768	558

*Daily operating cost at port is excluding fuel cost

Loss of revenue due to reduced speed of the ship

Vessel <i>(In GRT)</i>	Speed of normal ship <i>(In knots)</i>	Speed of fouled ship <i>(In knots)</i>	Reduction in speed due to fouling <i>(In knots)</i>	Increase in the number of days of travel due to reduced ship* <i>(In Th.Rs)</i>	Loss of revenue due to reduced speed of the ship <i>(In Th.Rs)</i>
Less than 20000	12	10.6	1.4	3.01	316
20000 - 30000	12	10.72	1.28	2.08	1223
30000 - 40000	13.87	12.23	1.64	2.01	1266

Loss of revenue during dry docking

Vessel (In GRT)	Number of days for painting at dry – dock* (dd)	Freight rate per day (In Th.Rs)	Loss of revenue due to dry - docking (Ldd)
Less than 20000	7	105	735
20000 - 30000	7	588	4116
30000 - 40000	7	630	4410

Additional cost due to fouling

Vessel	Csp	Cfc	Epc	DOCdd	LRdd	LRsp	Total cost
<i>(In GRT)</i>	<i>(In Th.Rs)</i>	<i>(In Th.Rs)</i>	<i>(In Th.Rs)</i>	<i>(In Th.Rs)</i>	<i>(In Th.Rs)</i>	<i>(In Th.Rs)</i>	<i>(In Th.Rs)</i>
Less than 20000	7944	262	2460	1334	735	416	13771
20000 - 30000	8748	210	2100	1745	4116	471	18062
30000 - 40000	13079	283	1980	3906	4410	796	25053

Comparison - Normal v/s fouled ship

	Normal ship			Fouled ship							
Vessel <i>(In GRT)</i>	No. of days	DOCv <i>(In Th.Rs)</i>	Total cost <i>(In Th.Rs)</i>	No. of days	Csp <i>(In Th.Rs)</i>	Cfc <i>(In Th.Rs)</i>	Epc <i>(In Th.Rs)</i>	DOCdd <i>(In Th.Rs)</i>	LRdd <i>(In Th.Rs)</i>	LRsp <i>(In Th.Rs)</i>	Total cost <i>(In Th.Rs)</i>
Less than 20000	17	6770	6770	20	7944	262	2460	1334	735	416	13771
20000 - 30000	17	7812	7812	19	8748	210	2100	1745	4116	471	18062
30000 - 40000	15	11535	11535	17	13079	283	1980	3906	4410	796	25053

Thank You