



Lucas Mesz

Portfólio Exploratório: Efeitos da Guerra de Atrito e Revelação da Informação

Dissertação de Mestrado

Orientador : Prof. Luiz Eduardo Teixeira Brandão
Co-orientador: Prof. Marco Antônio Guimarães Dias

Portfólio

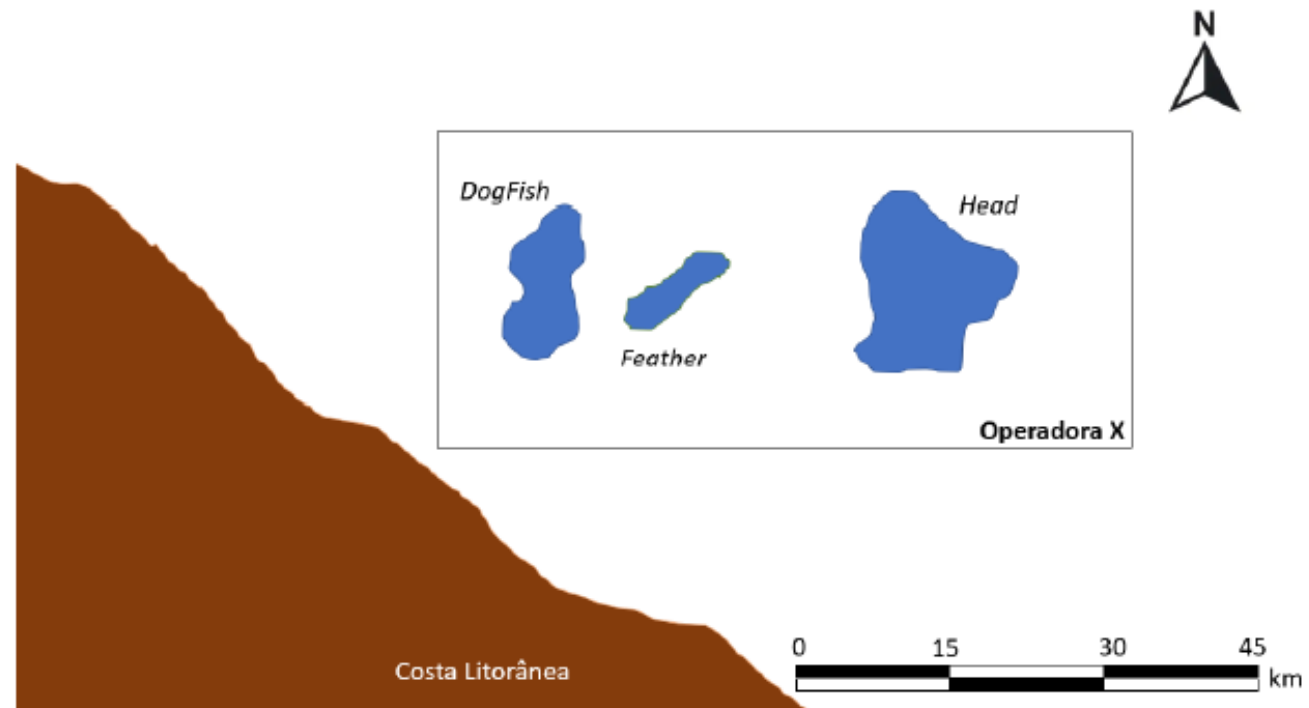


Figura 4.22: Modelo - Único Bloco

Conceitos

$$V = qBP$$

Conceitos

$$V = qBP$$



Volume Recuperável (Mbbl)

Conceitos

$$V = qBP$$



Qualidade econômica [0,1]

Conceitos

$$V = qBP$$



Preço do petróleo \$/bbl

Conceitos

$$V = qBP$$

$$\text{VPL} = V - I_d$$

Conceitos

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$$I_d(B) = K_f + K_v B$$

Conceitos

$$V = qBP$$

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$$I_d(B) = K_f + K_v B$$

$$VME = FC(\underbrace{V - I_d}_{\text{VPL}}) - I_w$$

Conceitos

$$V = qBP$$

$$\text{VPL} = V - I_d$$

$$I_d(B) = K_f + K_v B$$

$$VME = FC \underbrace{(V - I_d)}_{\text{VPL}} - I_w$$

Fator de Sucesso - %



VPL

Conceitos

$$V = qBP$$

$$\text{VPL} = V - I_d$$

$$\frac{dP}{P} = \alpha(P, t)dt + \sigma(P, t)dz$$

$$I_d(B) = K_f + K_v B$$

$$dz \sim N(0, dt).$$

$$VME = FC(\underbrace{V - I_d}_{\text{VPL}}) - I_w$$

Caso em Guerra de Atrito e Barganha Cooperativa

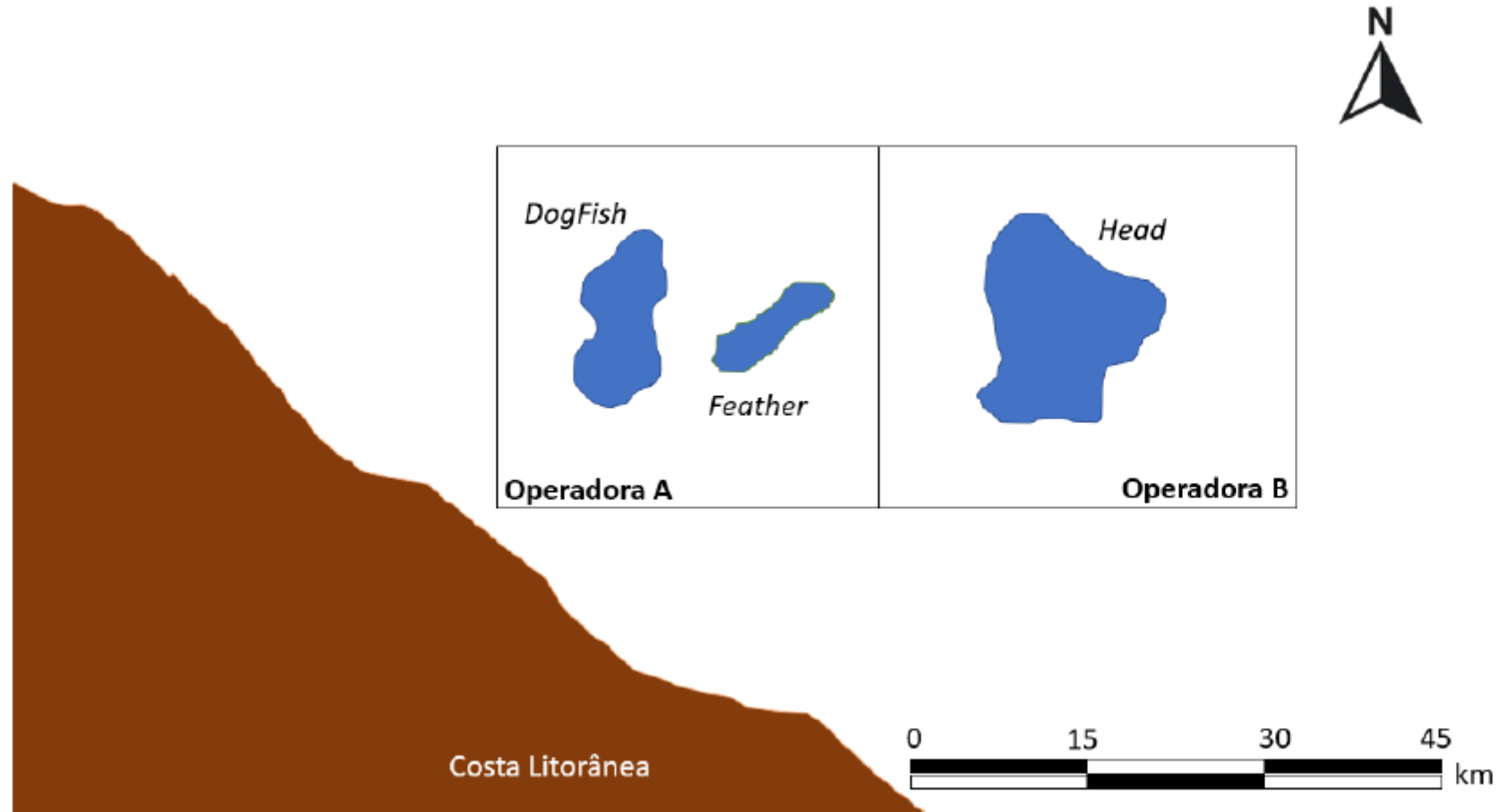


Figura 4.11: Modelo Geral - Blocos Exploratórios

Caso

Denominação	Propriedade	B (mbbl)	q (%)	FC (%)	I_w (M\$)
<i>DogFish</i>	0	620	20.00	30.00	80.00
<i>Feather</i>	0	310	21.00	25.00	60.00
<i>Head</i>	1	950	18.00	20.00	80.00

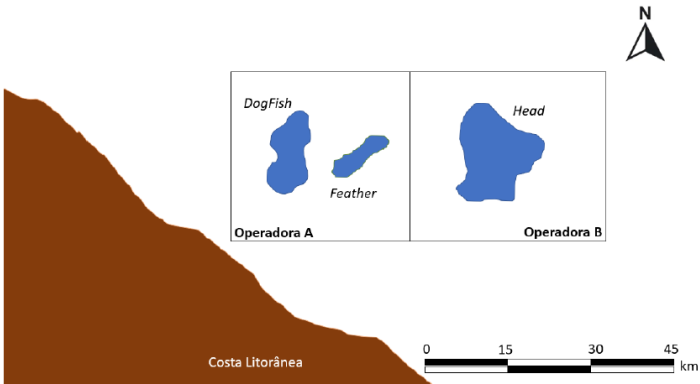


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Caso

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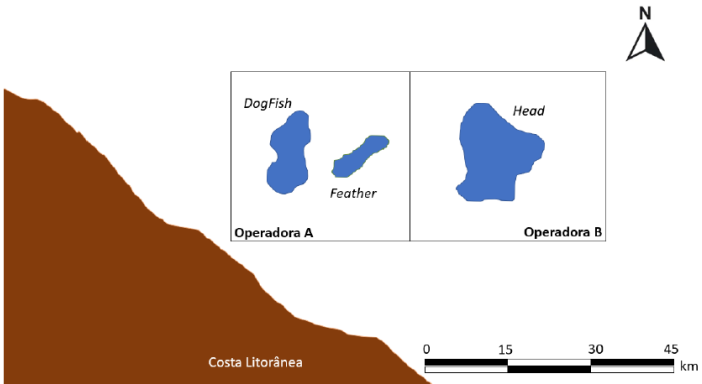
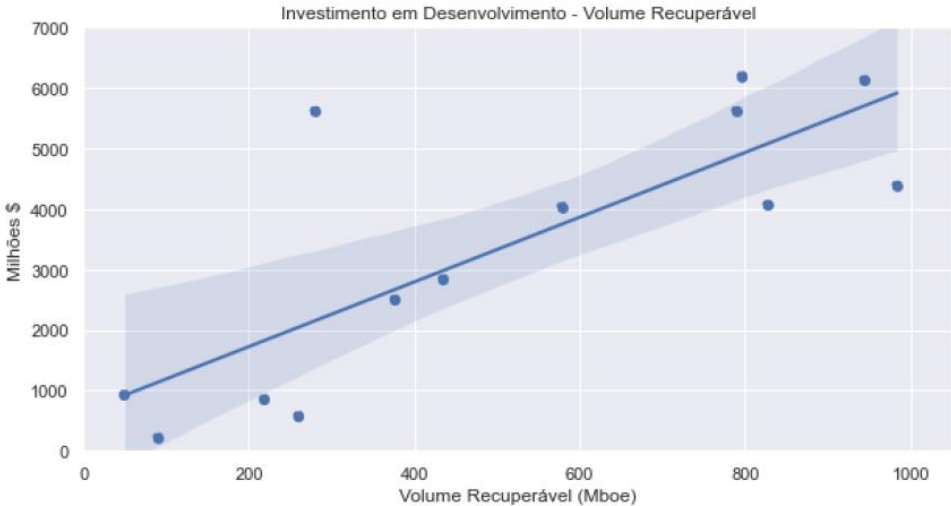


Figura 4.11: Modelo Geral - Blocos Exploratórios

$$I_d(B) = 650 + 5.35B \quad (R^2 = 0.628)$$



Caso

Denominação	Propriedade	B (mbbl)	q (%)	FC (%)	I_w (M\$)
<i>DogFish</i>	0	620	20.00	30.00	80.00
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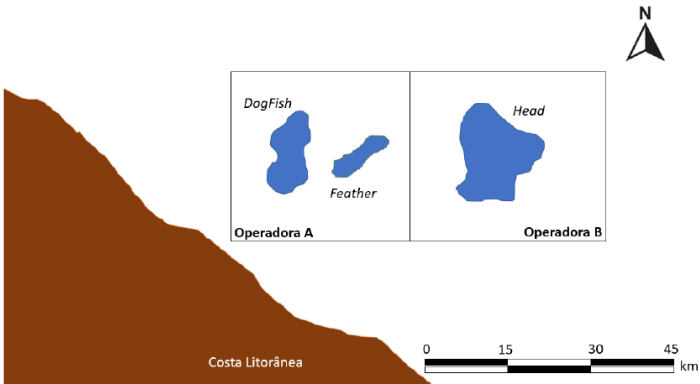
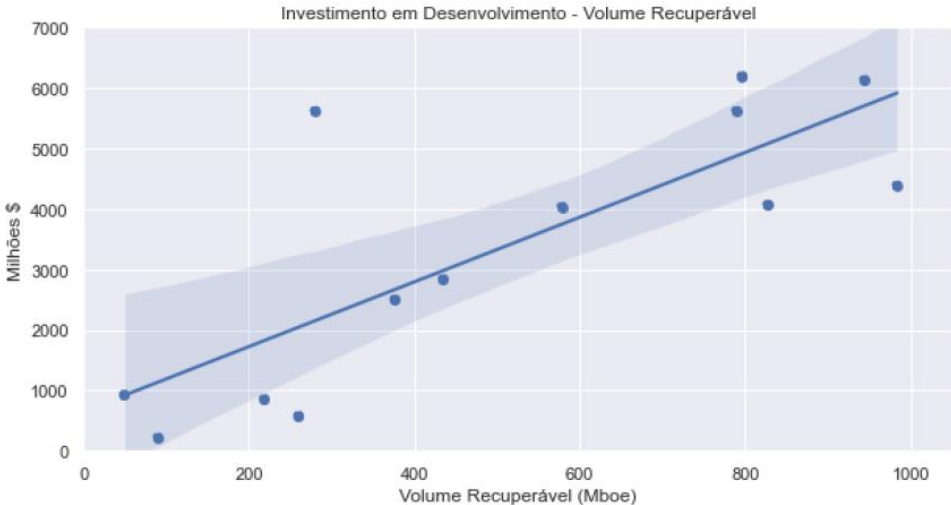


Figura 4.11: Modelo Geral - Blocos Exploratórios

$$I_d(B) = 650 + 5.35B \quad (R^2 = 0.628)$$



ρ	DogFish	Feather	Head
DogFish	1	—	—
Feather	0.6	1	—
Head	0.5	0.6	1

Tabela 4.4: Correlação dos prospectos da bacia

Caso

Denominação	Propriedade	B (mbbl)	q (%)	FC (%)	I_w (M\$)
<i>DogFish</i>	0	620	20.00	30.00	80.00
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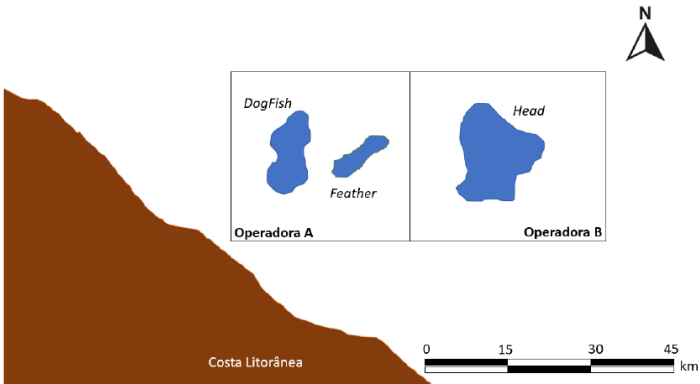
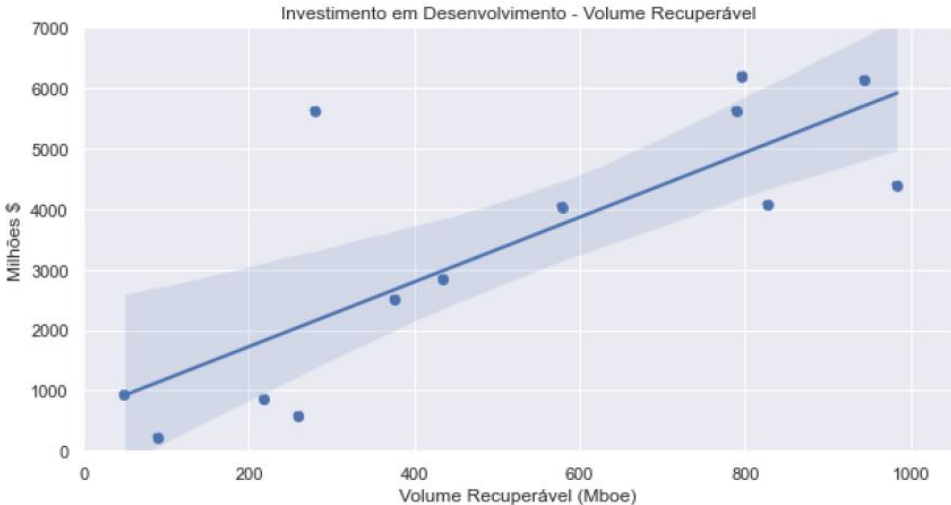


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$$I_d(B) = 650 + 5.35B \quad (R^2 = 0.628)$$



ρ	DogFish	Feather	Head
DogFish	1	—	—
Feather	0.6	1	—
Head	0.5	0.6	1

Tabela 4.4: Correlação dos prospectos da bacia

r (%)	δ (%)	σ (%)
3.00	3.80	30.00

Tabela 4.2: Parâmetros Exógenos Estimados

Caso - Stand-Alone

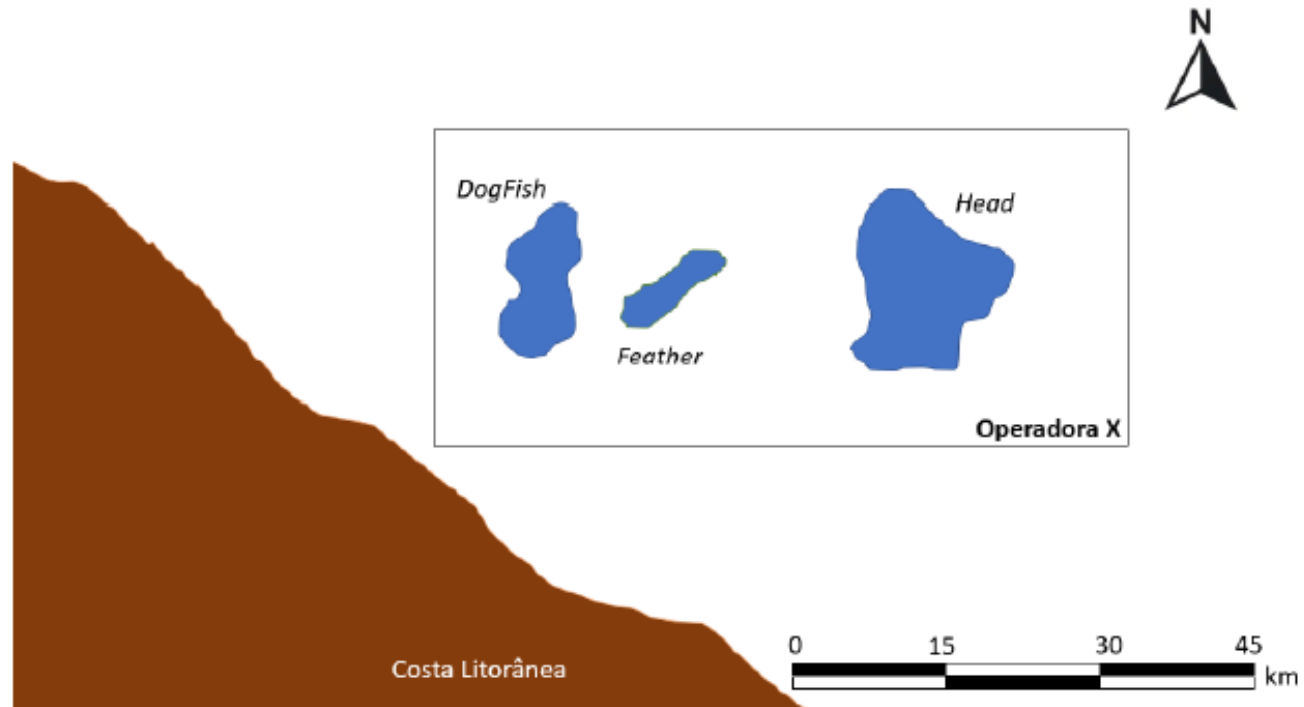


Figura 4.22: Modelo - Único Bloco

Caso – DogFish + Head

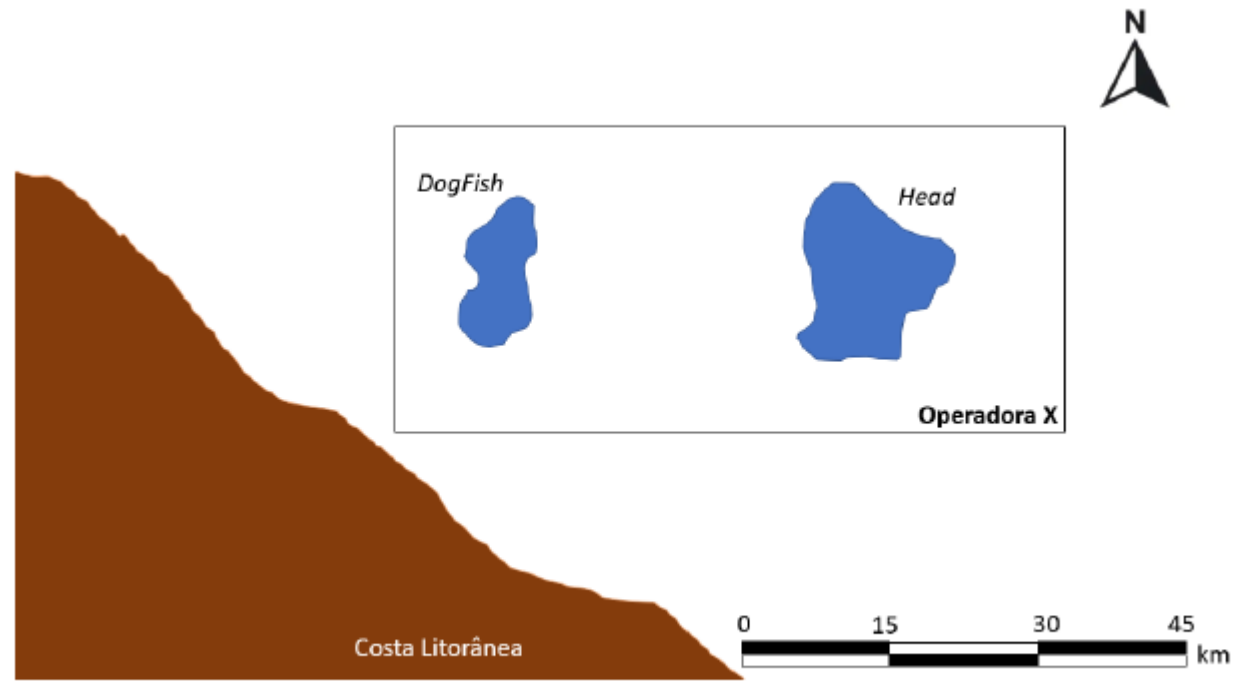


Figura 4.16: Único Bloco - DogFish e Head

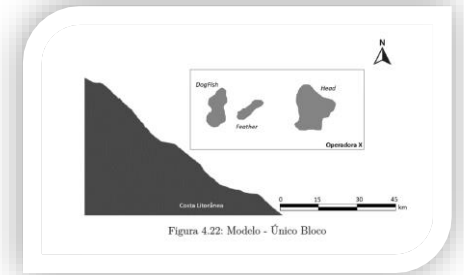


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Caso – DogFish + Feather

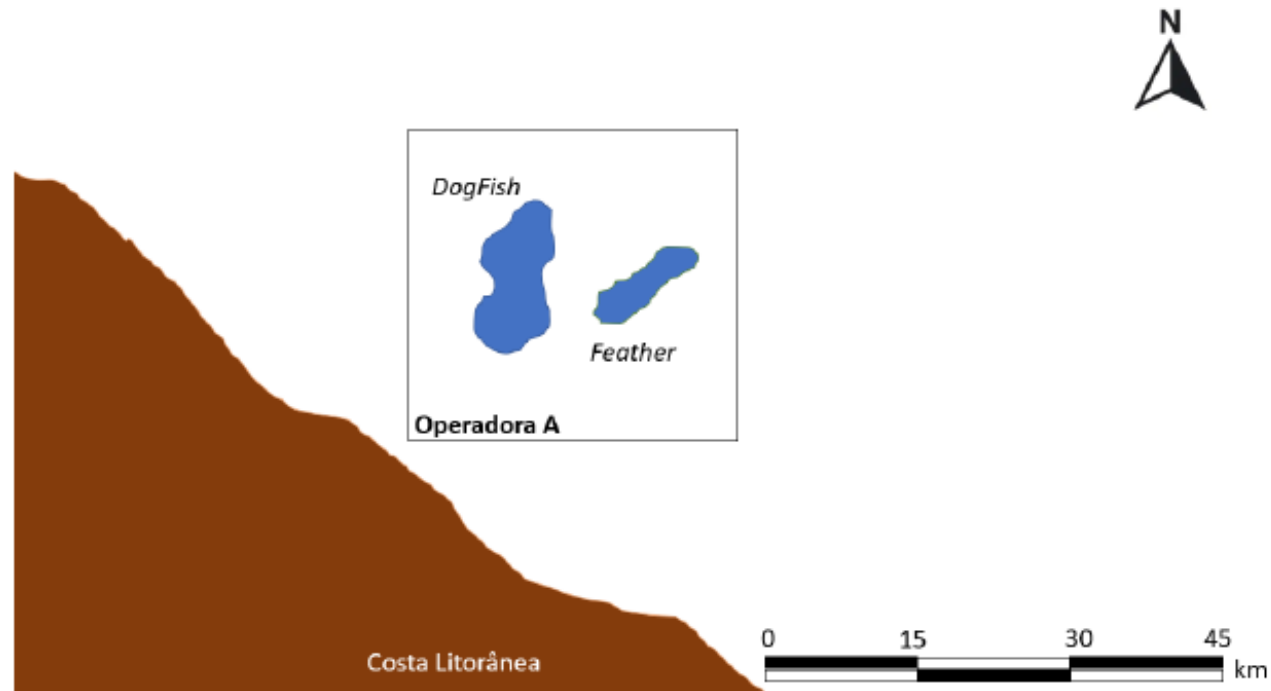


Figura 4.20: Bloco A- DogFish e Feather

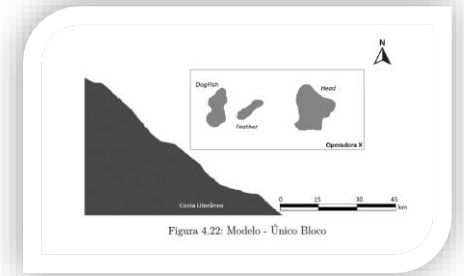


Figura 4.22: Modelo - Único Bloco

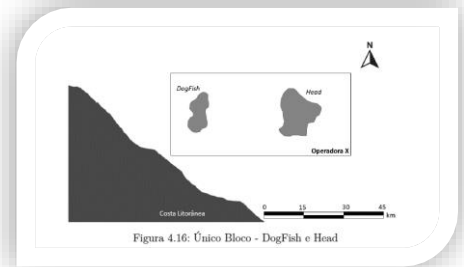


Figura 4.16: Único Bloco - DogFish e Head

Caso – Unitização

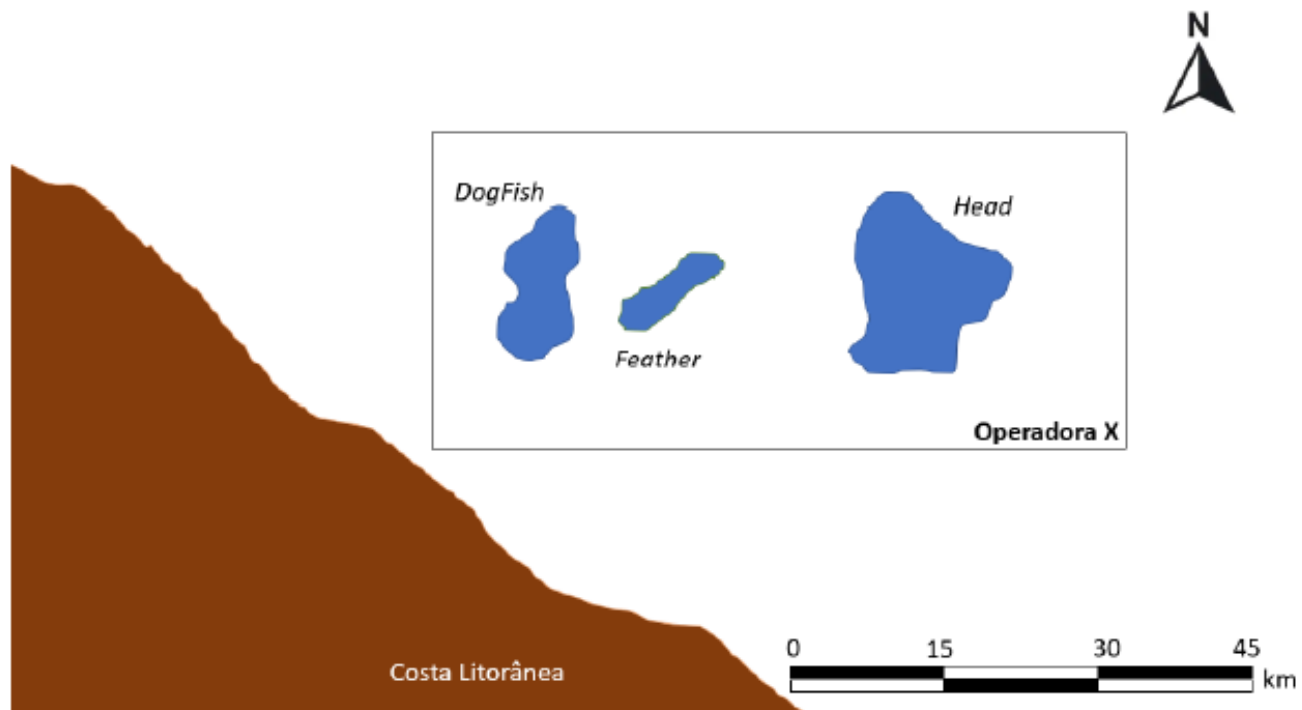


Figura 4.22: Modelo - Único Bloco

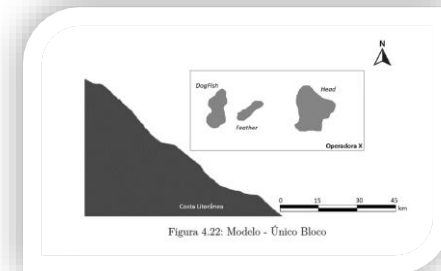


Figura 4.22: Modelo - Único Bloco

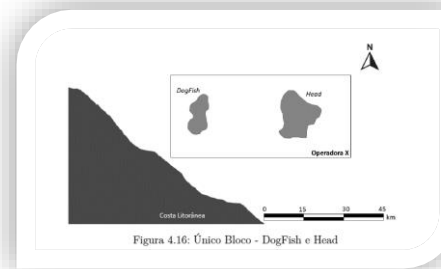


Figura 4.16: Único Bloco - DogFish e Head

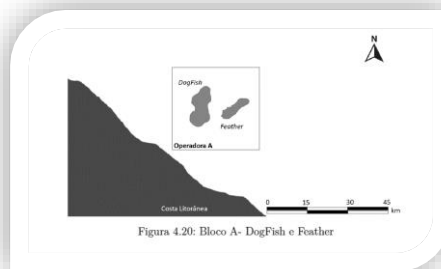
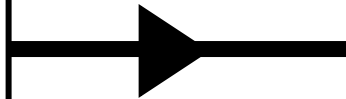
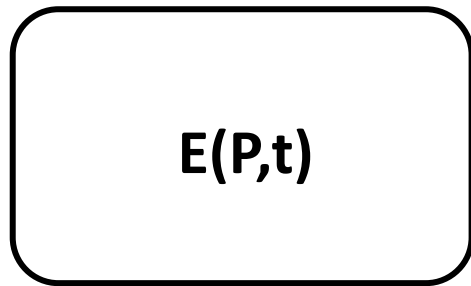


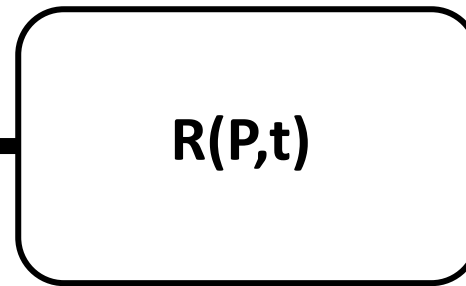
Figura 4.20: Bloco A - DogFish e Feather

Opções existentes

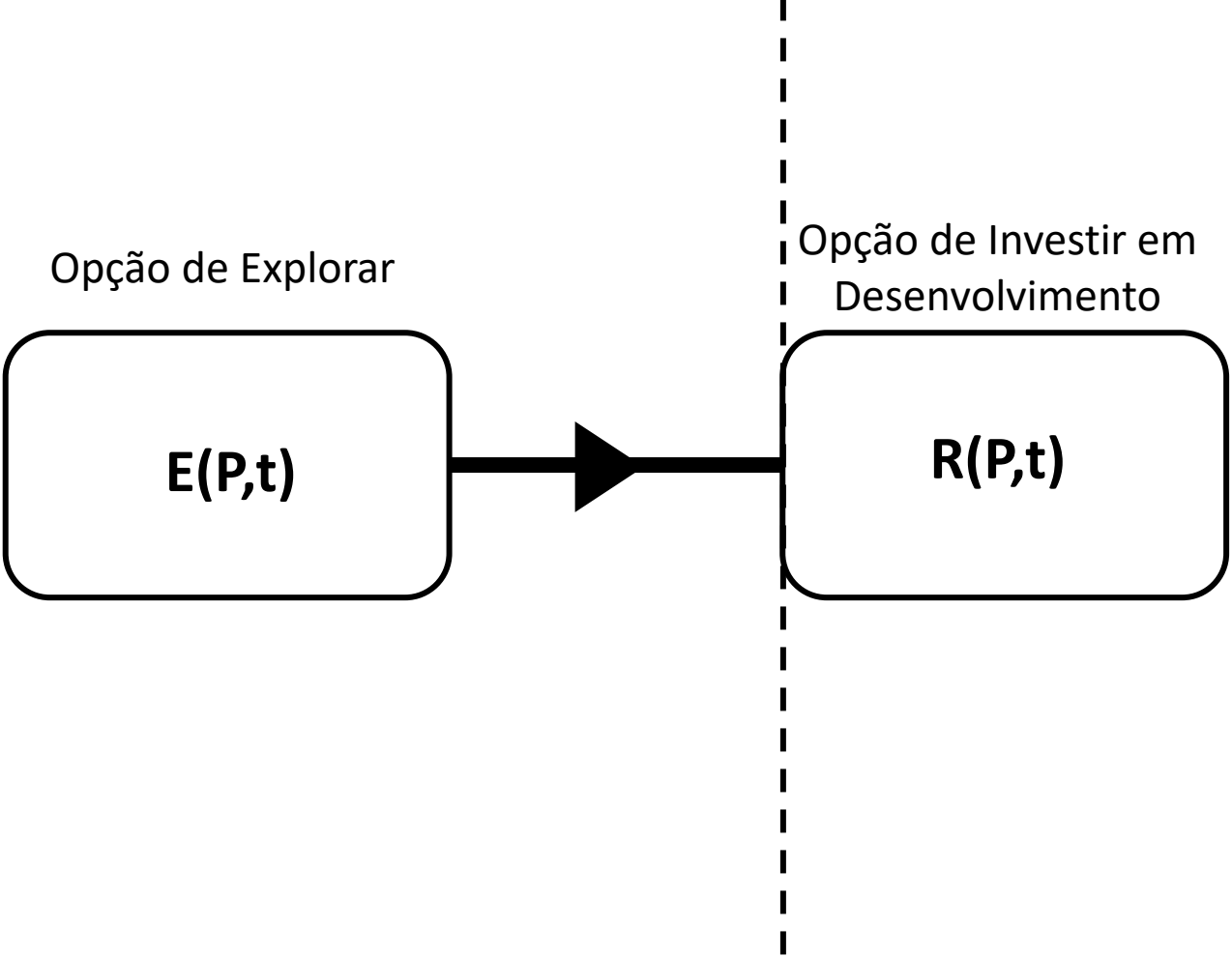
Opção de Explorar



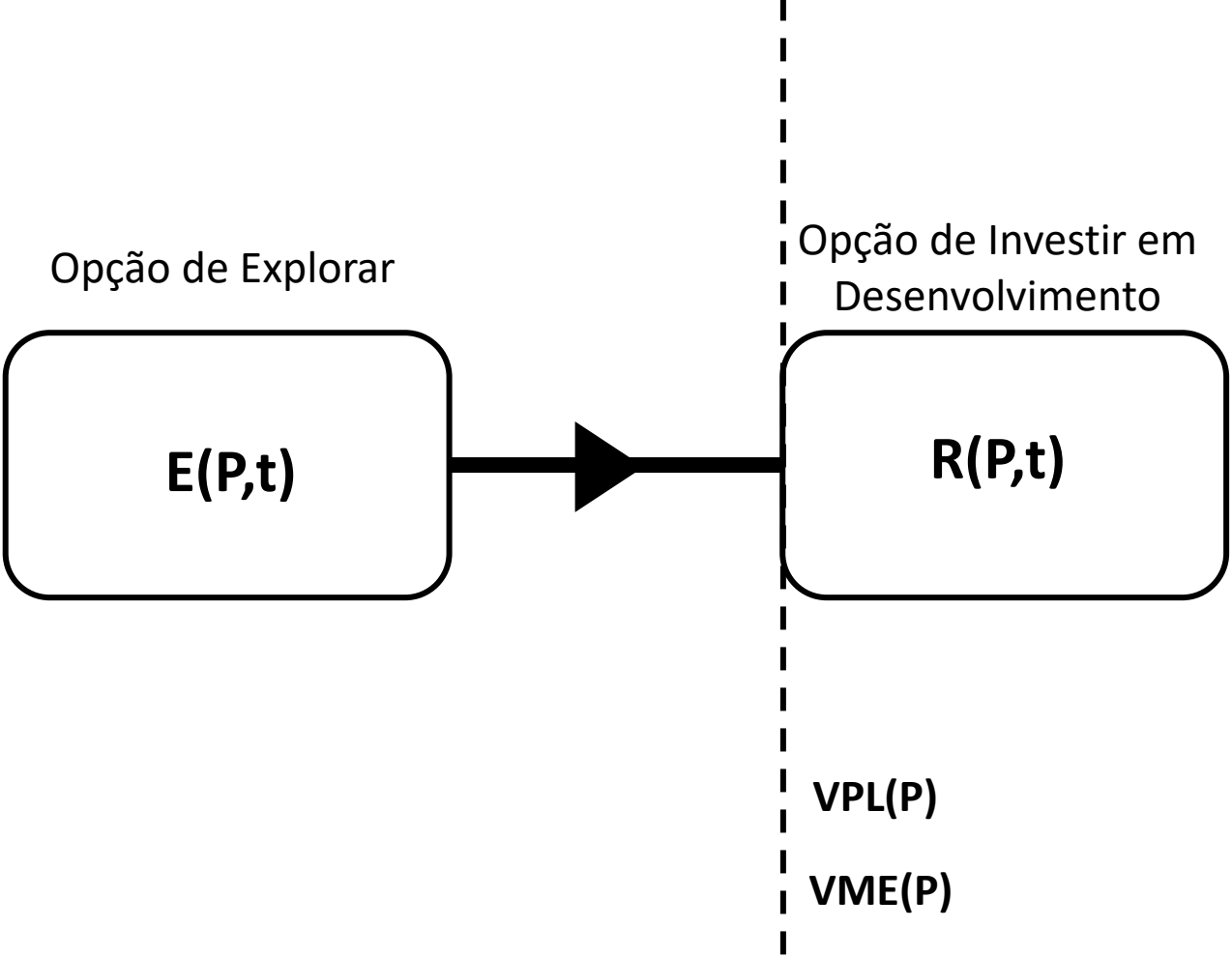
Opção de Investir em
Desenvolvimento



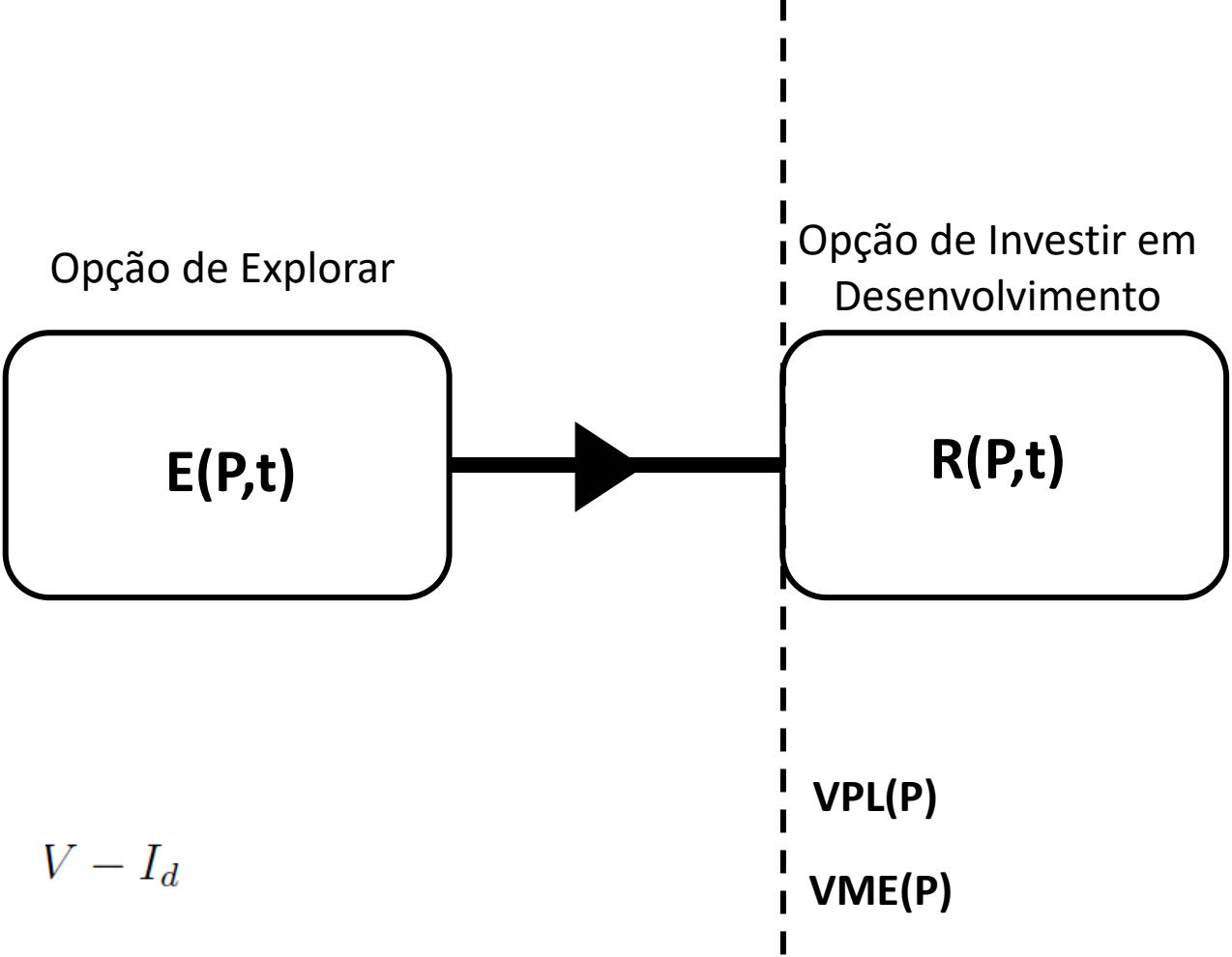
Contrato de Exploração



Contrato de Exploração



Contrato de Exploração

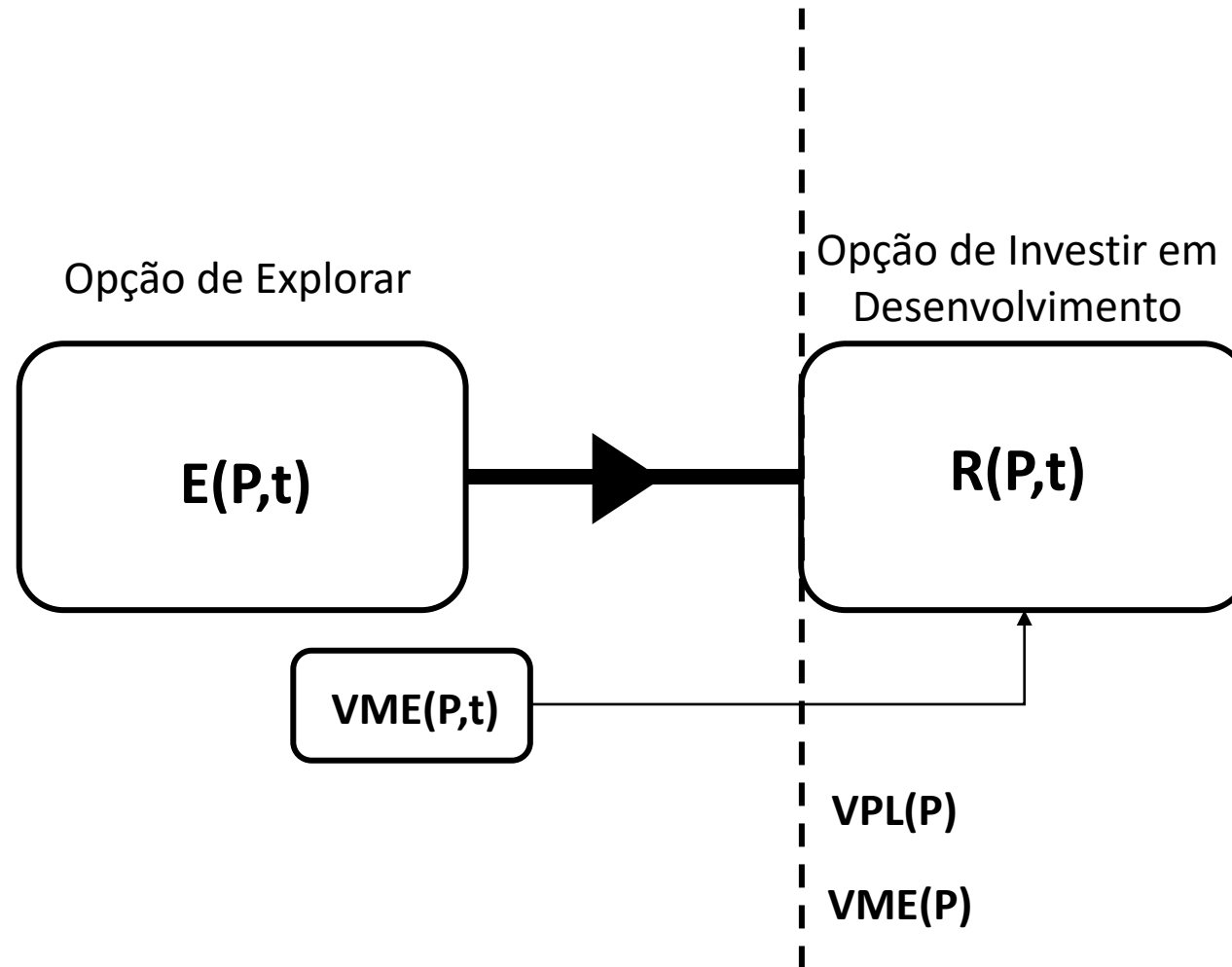


$$VPL = V - I_d$$

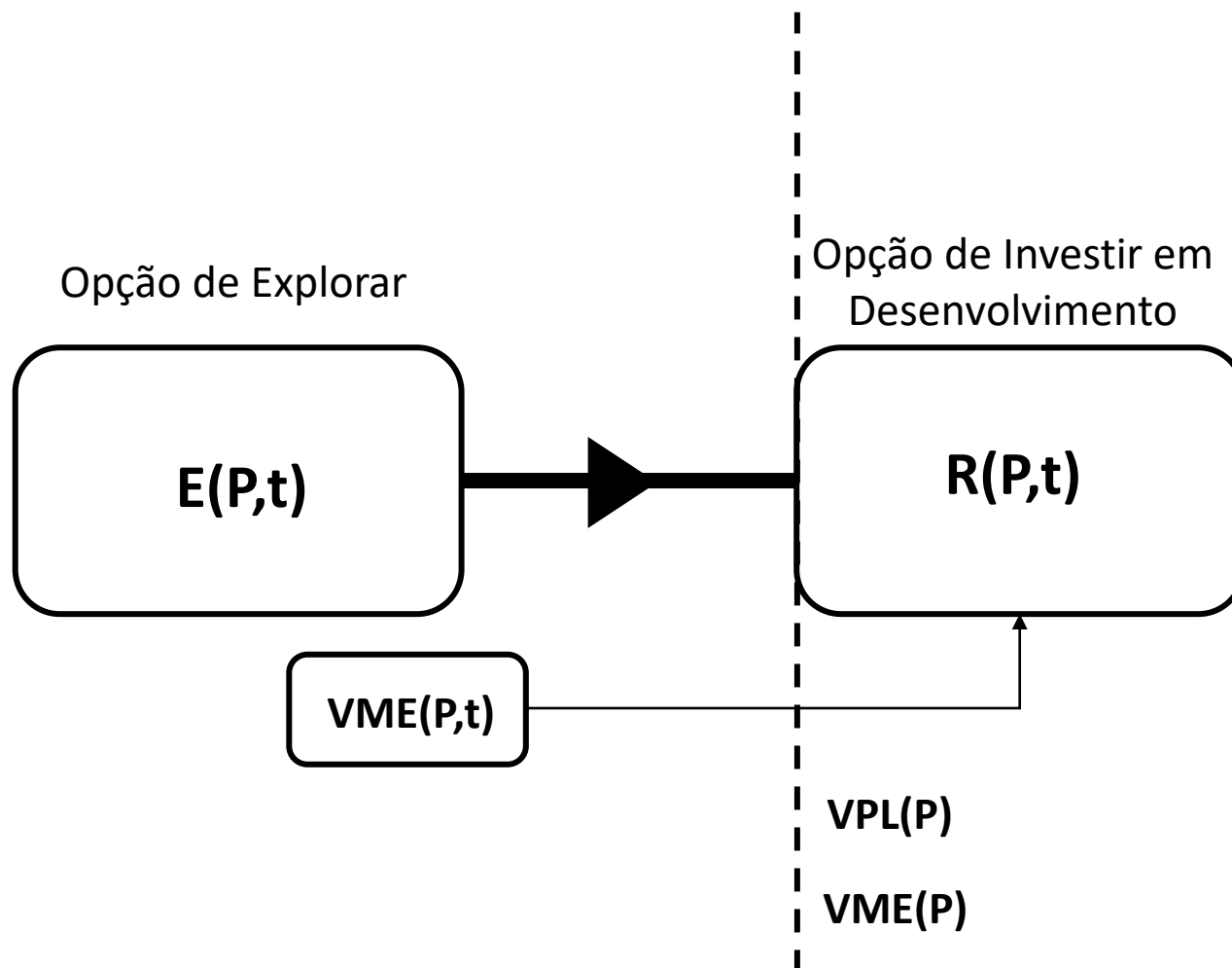
$$VME = \underbrace{FC(V - I_d)}_{VPL} - I_w$$

VPL

Contrato de Exploração



Contrato de Exploração



$$VME(P,t) = FC * R(P,t) - I_w$$

$$VME = \underbrace{FC(V - I_d)}_{VPL} - I_w$$

VPL

Caso - Stand-Alone - DogFish

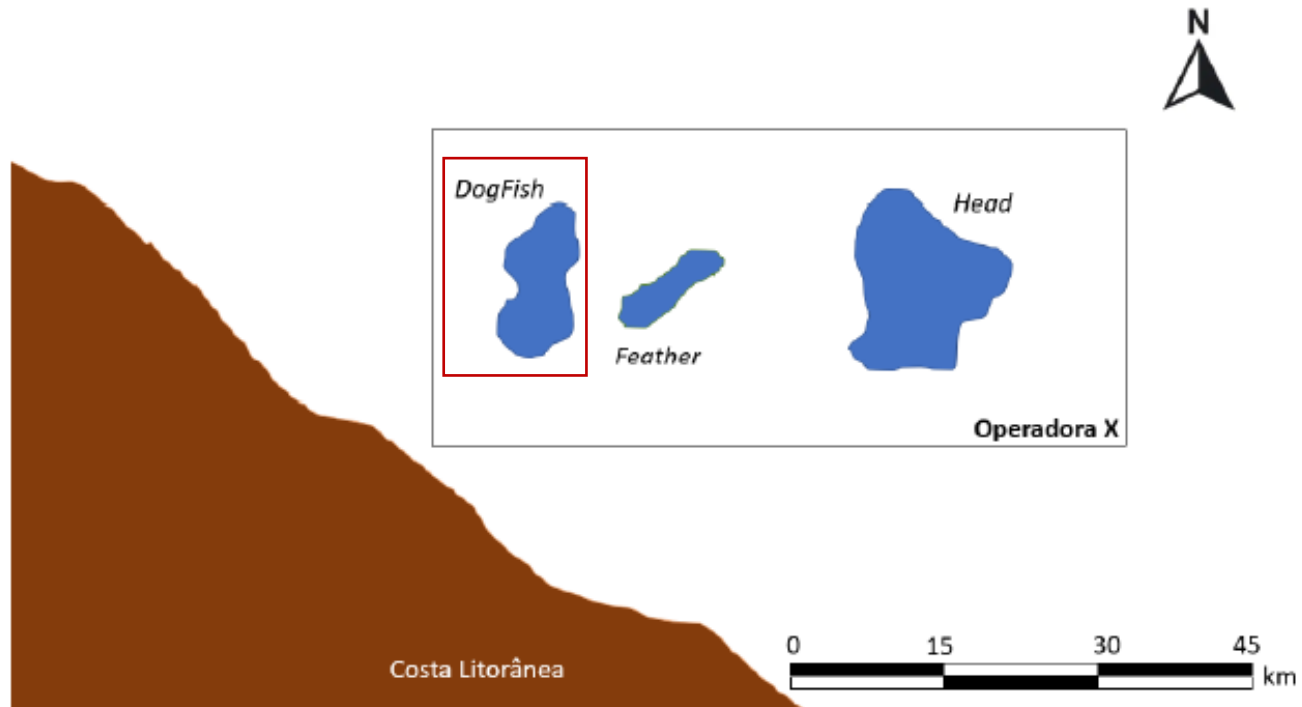


Figura 4.22: Modelo - Único Bloco

$E(P,t)$

3 anos de Contrato

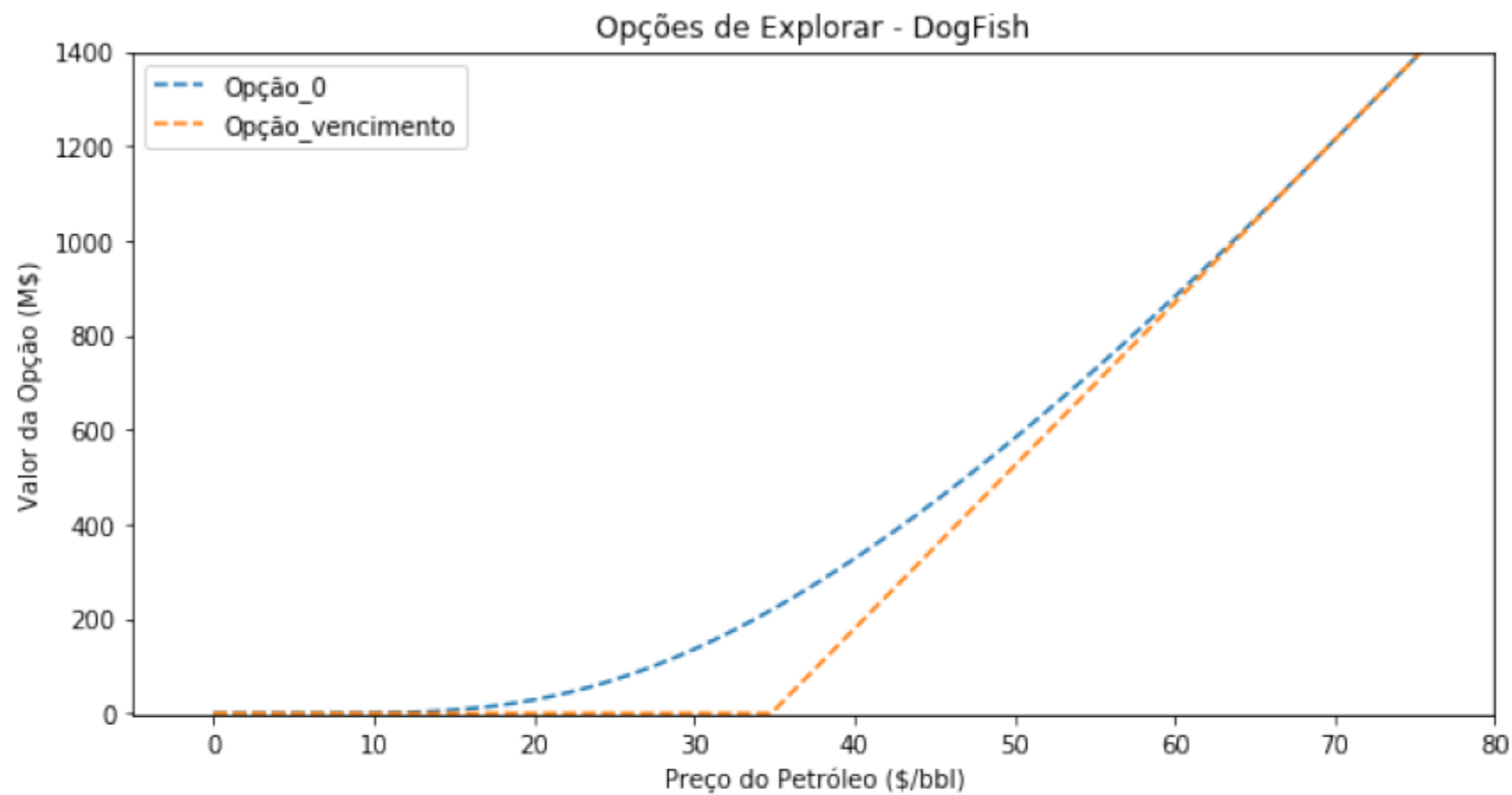


Figura 4.14: Opção de Explorar - DogFish

$E(P,t)$

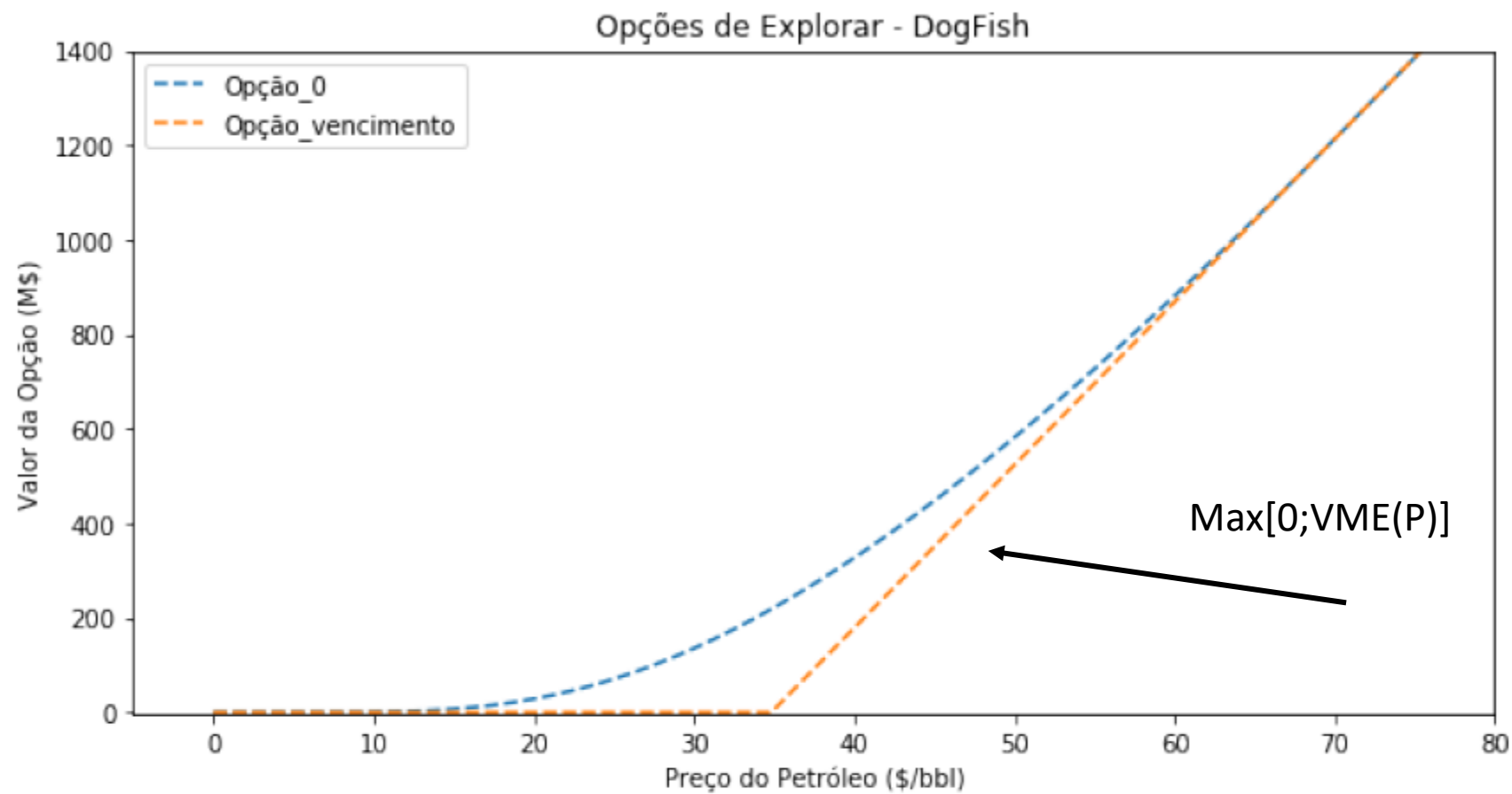


Figura 4.14: Opção de Explorar - DogFish

$E(P,t)$

$VME(P,t)$

$VME(P)$

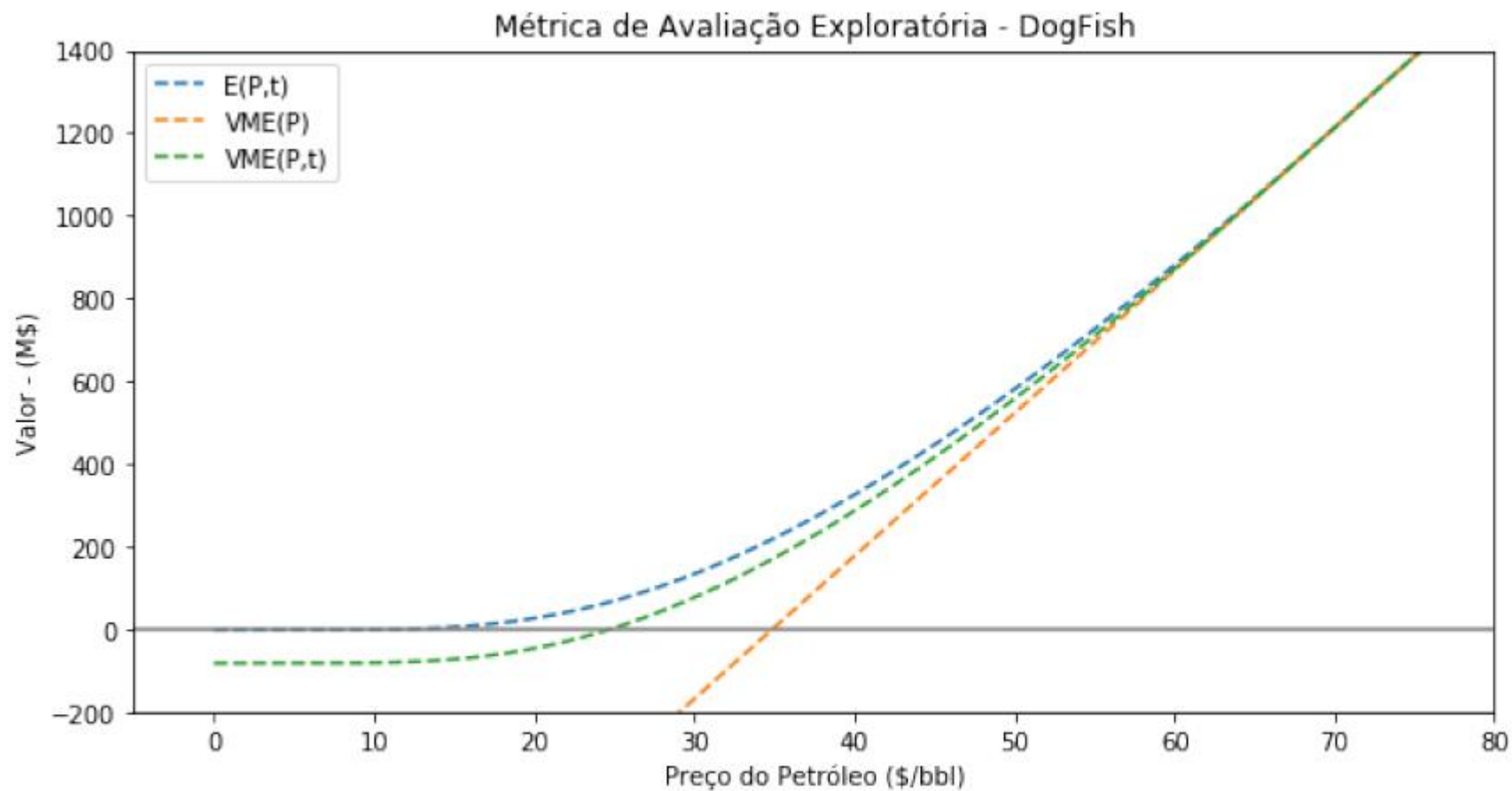


Figura 4.15: Métricas de Avaliação Exploratória - DogFish - $\tau = 3$ anos

$E(P,t)$

3 anos de Contrato

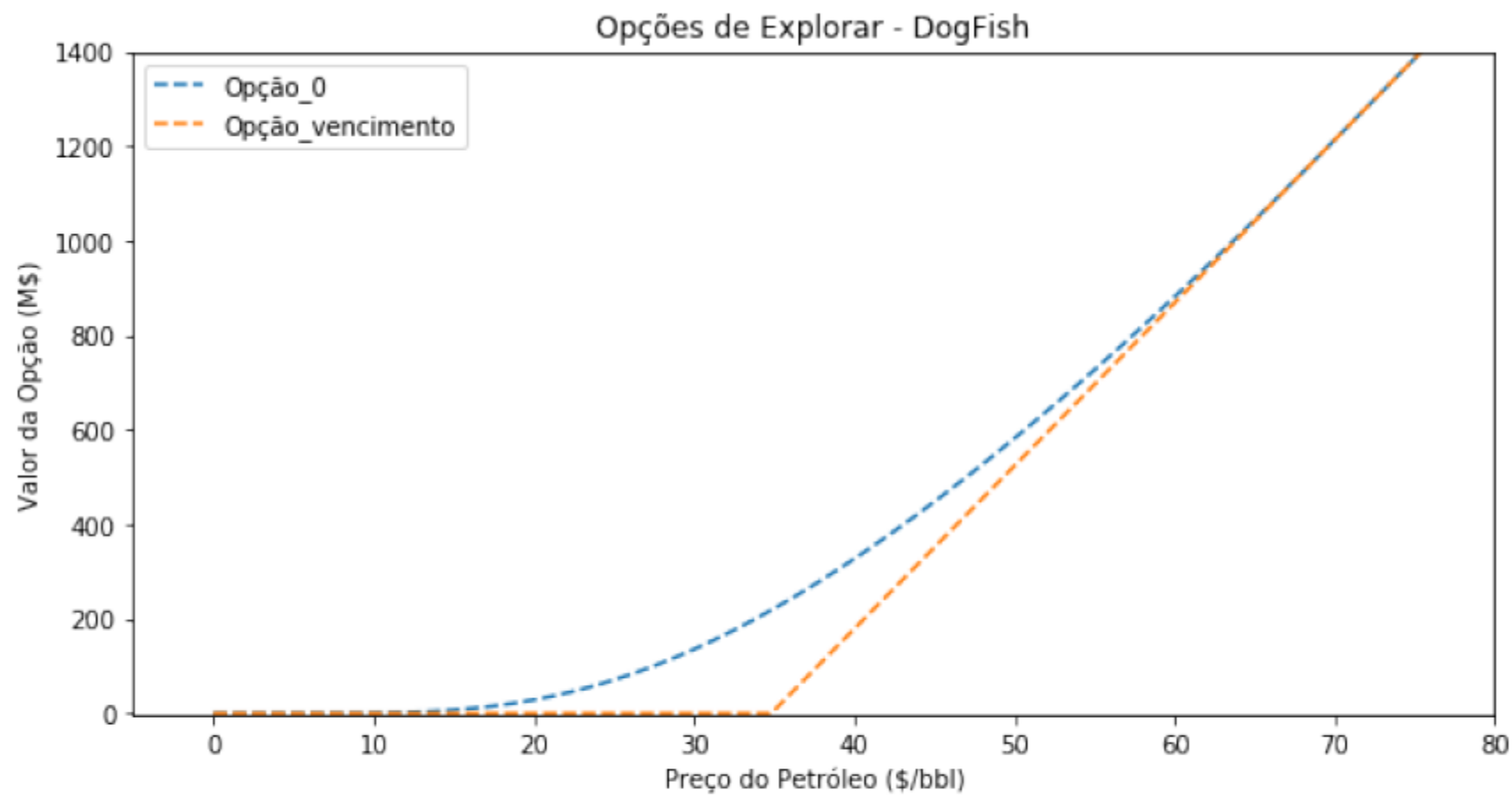


Figura 4.14: Opção de Explorar - DogFish

$E(P,t)$

$R(P,t)$

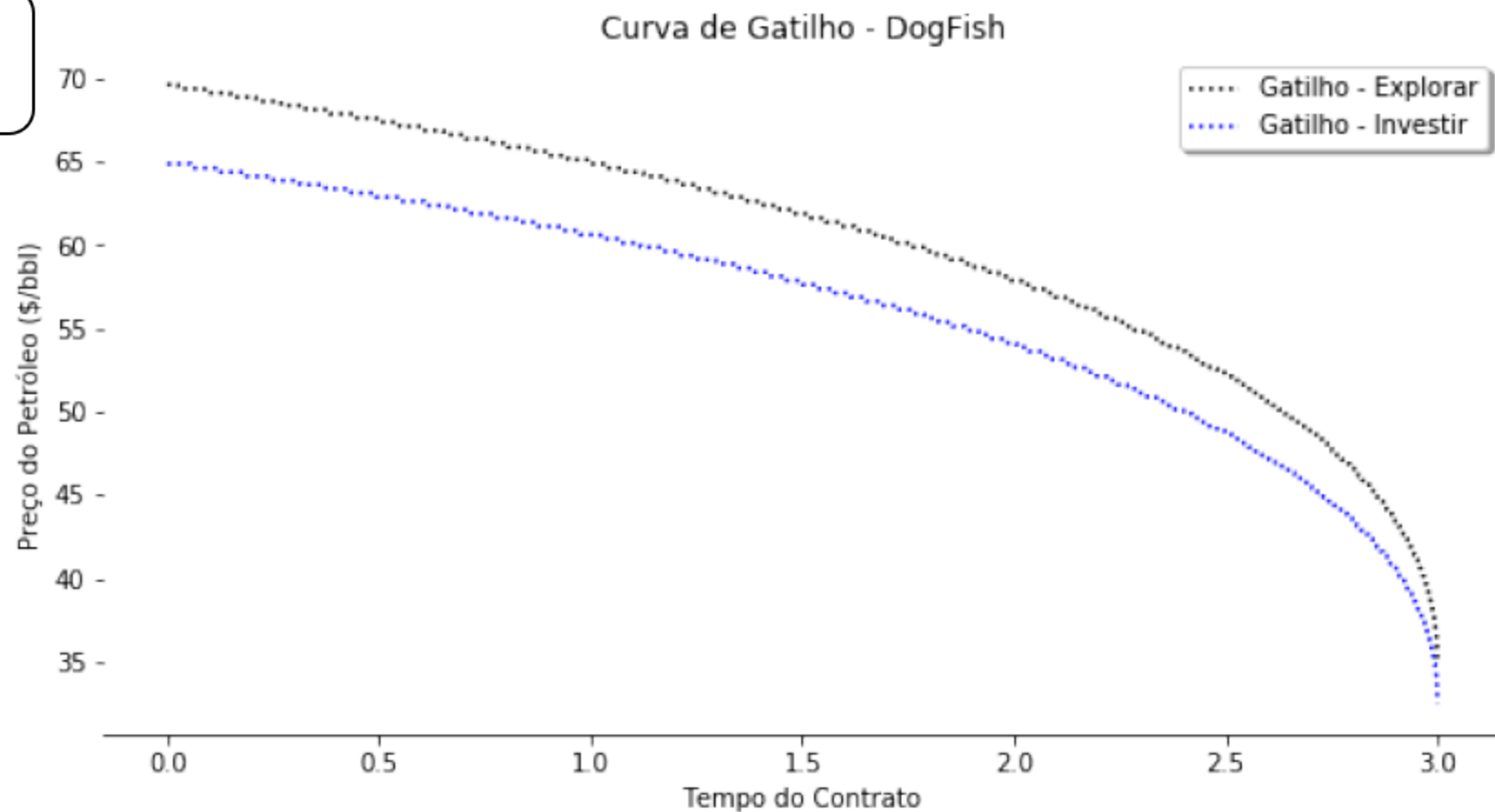


Figura 4.13: Curvas de Gatilho - DogFish

<i>DogFish</i>	M\$	%
VME(P)	523.08	-
VME(P,t)	558.23	6.72
E(P,t)	581.28	11.13

Métrica	<i>DogFish</i>	
	\$M	%
VME(P)	523.08	-
VME(P,t)	558.23	6.72
E(P,t)	581.28	11.13
	\$/bbl	
P^*	64.875	-
P^{**}	69.625	-

Tabela 4.6: Avaliação das opor

Métrica	<i>DogFish</i>		<i>Feather</i>	
	\$M	%	\$M	%
VME(P)	523.08	-	150.68	-
VME(P,t)	558.23	6.72	182.23	20.94
E(P,t)	581.28	11.13	206.14	36.81
	\$/bbl		\$/bbl	
P^*	64.875	-	72.125	-
P^{**}	69.625	-	79.875	-

Tabela 4.6: Avaliação das oportunidades *stanta*

Métrica	<i>DogFish</i>		<i>Feather</i>		<i>Head</i>	
	\$M	%	\$M	%	\$M	%
VME(P)	523.08	-	150.68	-	425.12	-
VME(P,t)	558.23	6.72	182.23	20.94	471.13	10.82
E(P,t)	581.28	11.13	206.14	36.81	497.71	17.08
	\$/bbl		\$/bbl		\$/bbl	
P^*	64.875	-	72.125	-	68.125	-
P^{**}	69.625	-	79.875	-	73.125	-

Tabela 4.6: Avaliação das oportunidades *stand-alone* - $\tau=3$ anos

Métrica	<i>DogFish</i>		<i>Feather</i>		<i>Head</i>	
	\$M	%	\$M	%	\$M	%
VME(P)	523.08	-	150.68	-	425.12	-
VME(P,t)	558.23	6.72	182.23	20.94	471.13	10.82
E(P,t)	581.28	11.13	206.14	36.81	497.71	17.08
	\$/bbl		\$/bbl		\$/bbl	
P^*	64.875	-	72.125	-	68.125	-
P^{**}	69.625	-	79.875	-	73.125	-

Tabela 4.6: Avaliação das oportunidades *stand-alone* - $\tau=3$ anos

Métrica	<i>DogFish</i>		<i>Feather</i>		<i>Head</i>	
	\$M	%	\$M	%	\$M	%
VME(P)	523.08	-	150.68	-	425.12	-
VME(P,t)	558.23	6.72	182.23	20.94	471.13	10.82
E(P,t)	581.28	11.13	206.14	36.81	497.71	17.08
	\$/bbl		\$/bbl		\$/bbl	
P^*	64.875	-	72.125	-	68.125	-
P^{**}	69.625	-	79.875	-	73.125	-

Tabela 4.6: Avaliação das oportunidades *stand-alone* - $\tau=3$ anos

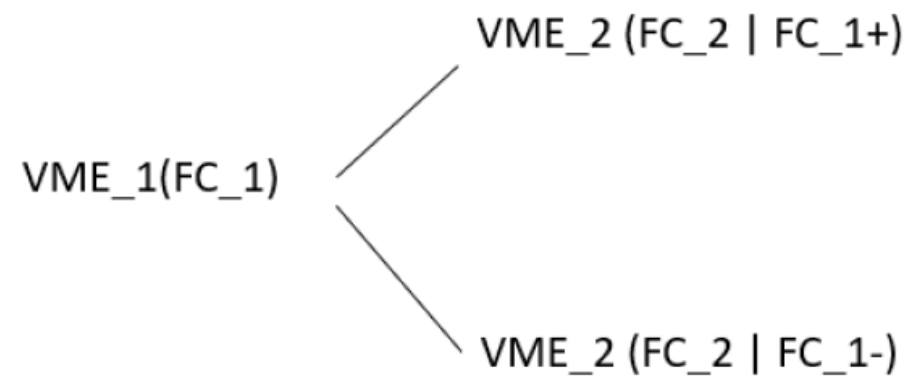
Correlação e FC

$$VME(P,t) = FC * R(P,t) - \text{lw}$$

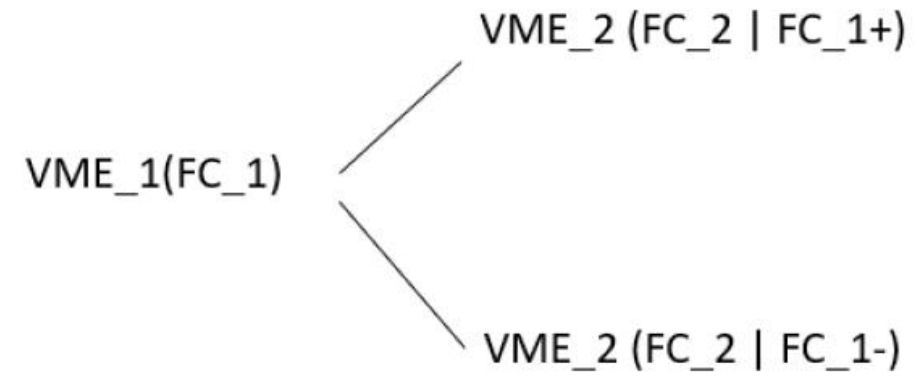
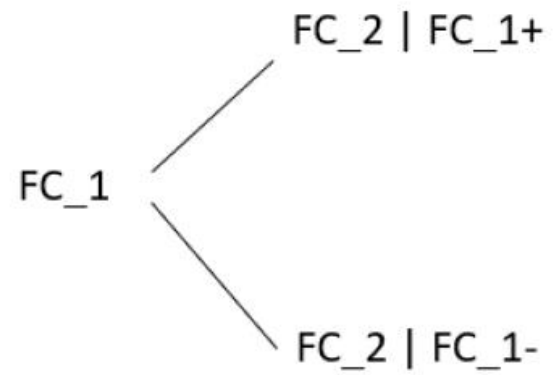
$$VME = FC(V - I_d) - I_w$$

$$FC = [0\% \ 100\%]$$

FC e VME



FC e VME



Exemplo Hipotético

6 Prospectos

Correlação
=50%

FC incondicional =
30%

Exemplo Hipotético

6 Prospectos

Correlação
=50%

FC incondicional =
30%

Investimentos	Média	Desvio Padrão	Cenários
1	0,3	0,0	1
2	0,3	0,23	2
3	0,3	0,30	4
4	0,3	0,35	8
5	0,3	0,38	16
6	0,3	0,40	32

Tabela 3.2: Simulação: Bernoulli Bivariada

Exemplo Hipotético

6 Prospectos

Correlação
=50%

FC incondicional =
30%

Investimentos	Média	Desvio Padrão	Cenários
1	0,3	0,0	1
2	0,3	0,23	2
3	0,3	0,30	4
4	0,3	0,35	8
5	0,3	0,38	16
6	0,3	0,40	32

Tabela 3.2: Simulação: Bernoulli Bivariada

Exemplo Hipotético

Antes do 6
investimento

Correlação
=50%

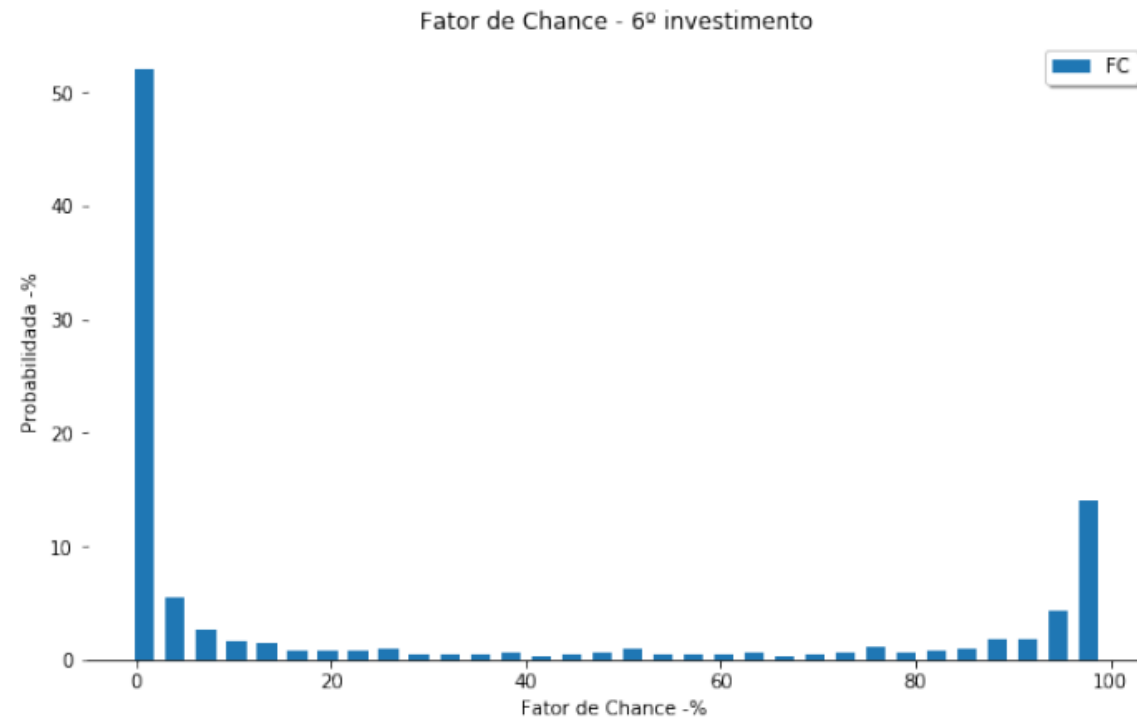


Figura 3.1: Revelação no Sexto Investimento - FC e Probabilidade

Caso – DogFish + Head

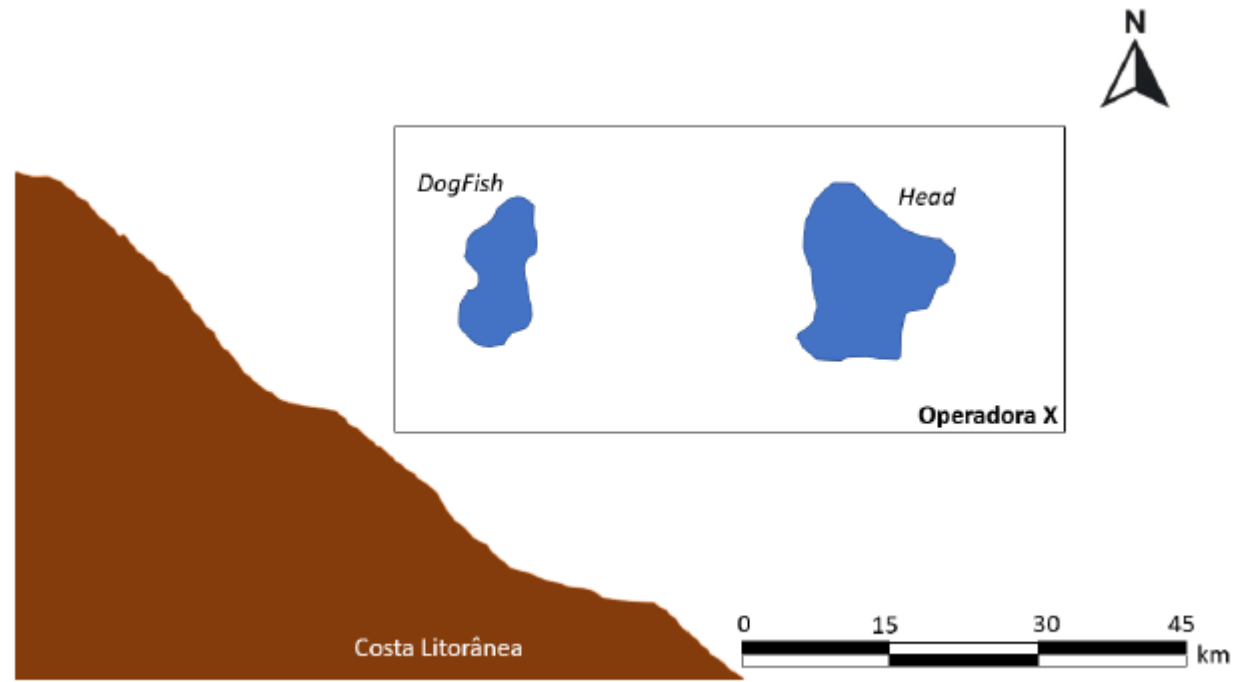
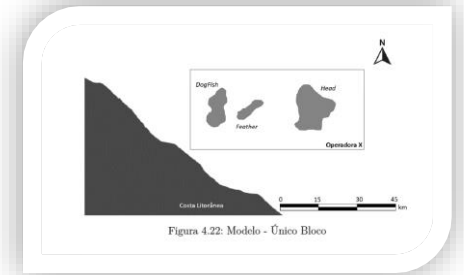
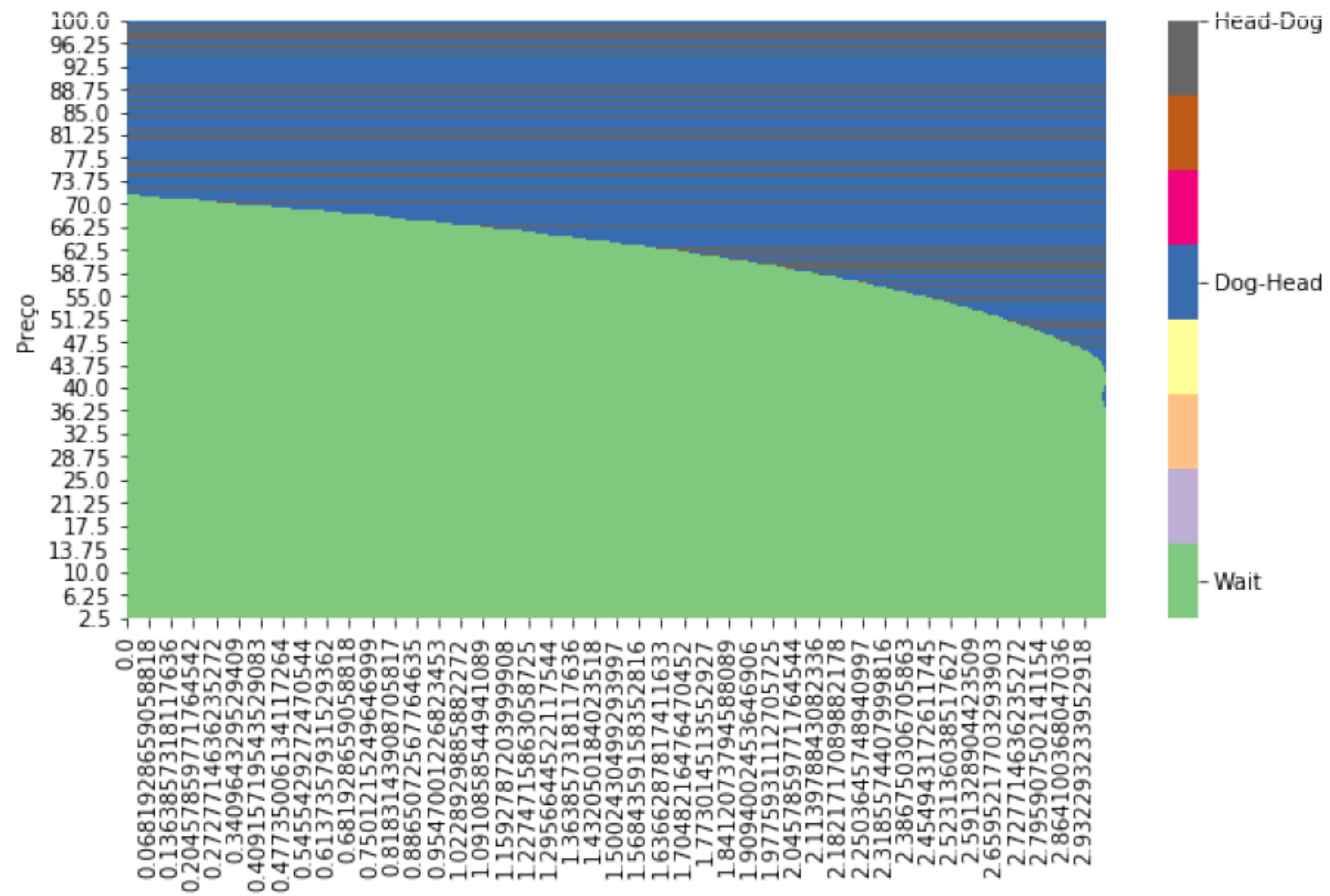


Figura 4.16: Único Bloco - DogFish e Head



Caso – DogFish + Head



$\Pi(P, t)$	1092.98
$\sum E(P, t)$	1078.99
$VOI(P, t)$	13.99
\$/bb	
P^{**}	71.50

Tabela 4.7: Avaliação dos

Caso – DogFish + Feather

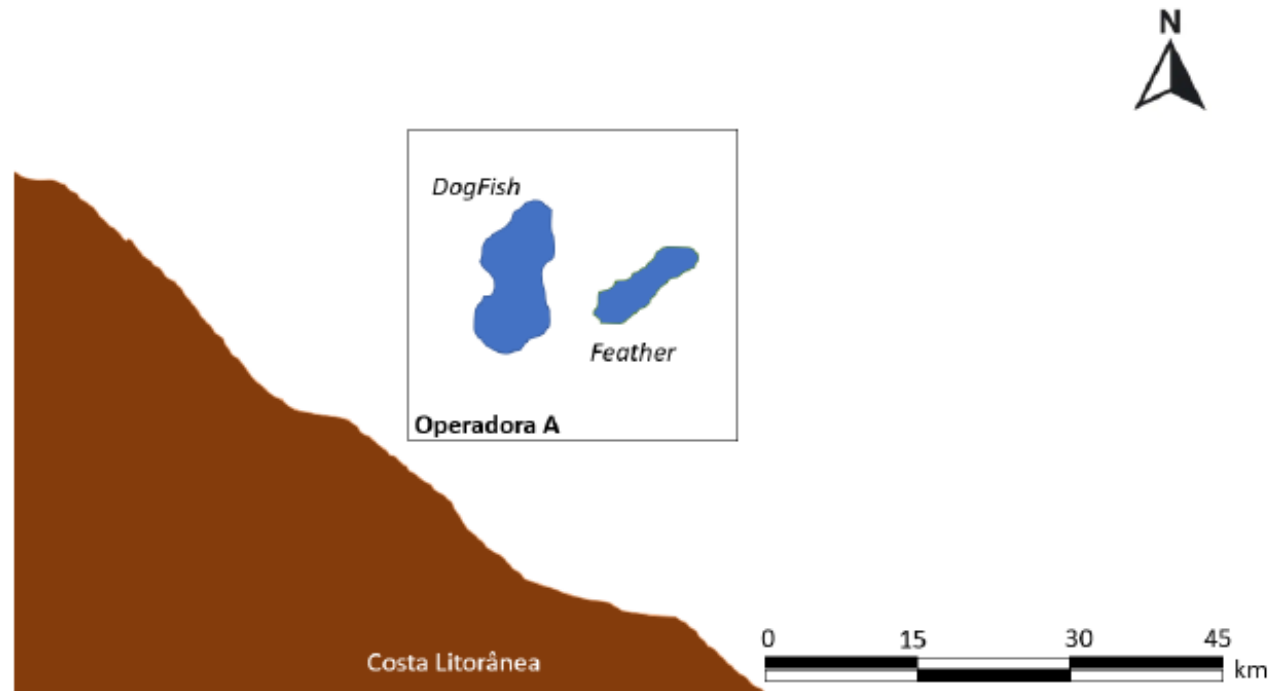


Figura 4.20: Bloco A- DogFish e Feather

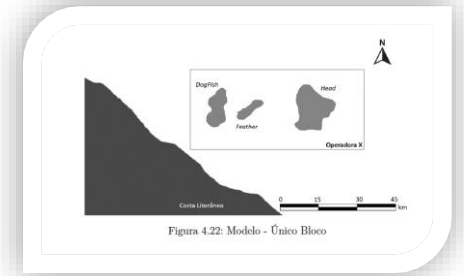


Figura 4.22: Modelo - Único Bloco

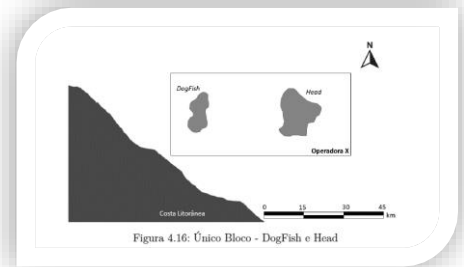
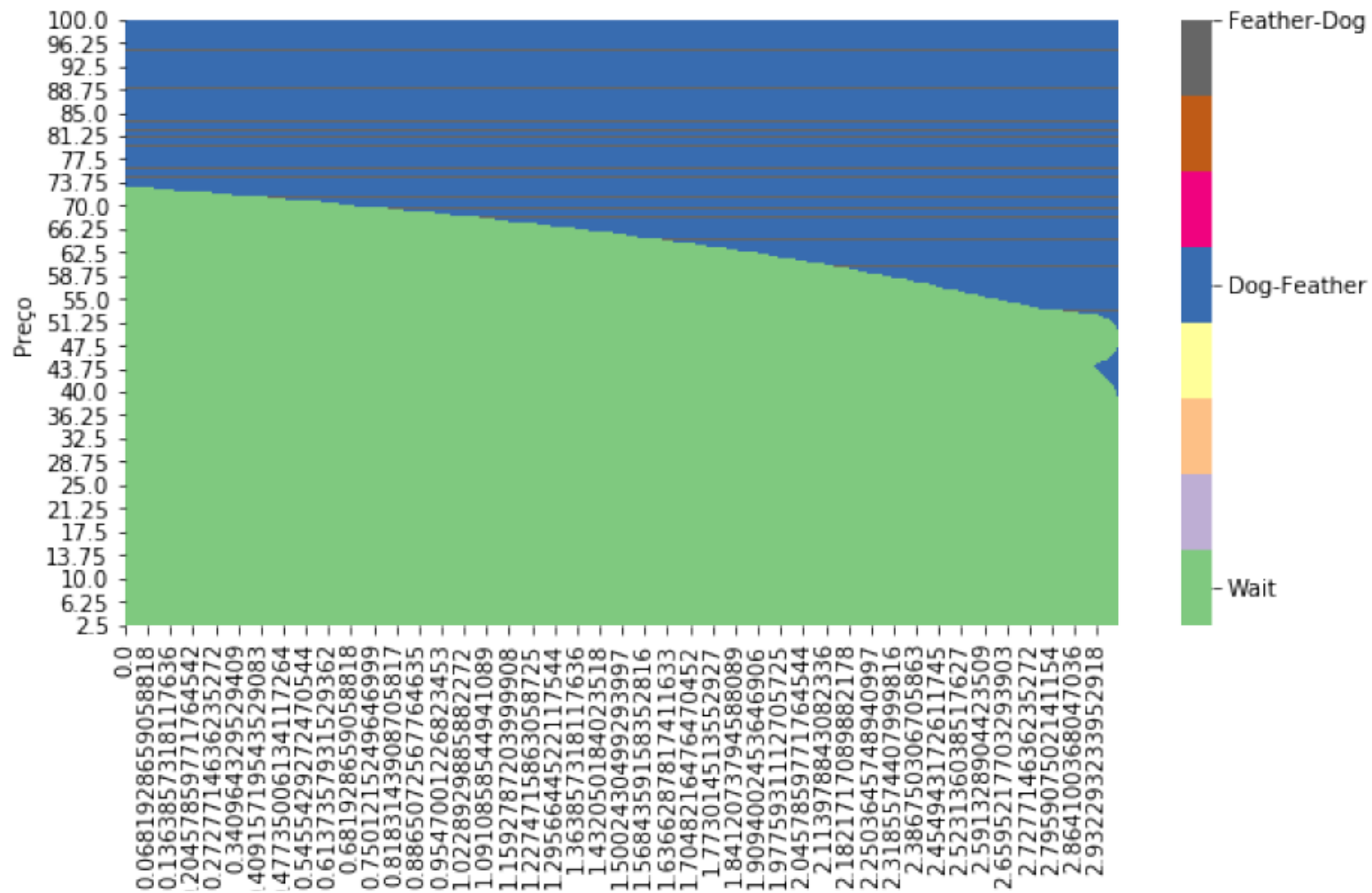


Figura 4.16: Único Bloco - DogFish e Head

Caso – DogFish + Feather



$\Pi(P, t)$	796.60
$\sum E(P, t)$	787.42
$VOI(P, t)$	9.18
b	
P^{**}	73.25

ela 4.7: AvalPortfólios

Caso – Unitização

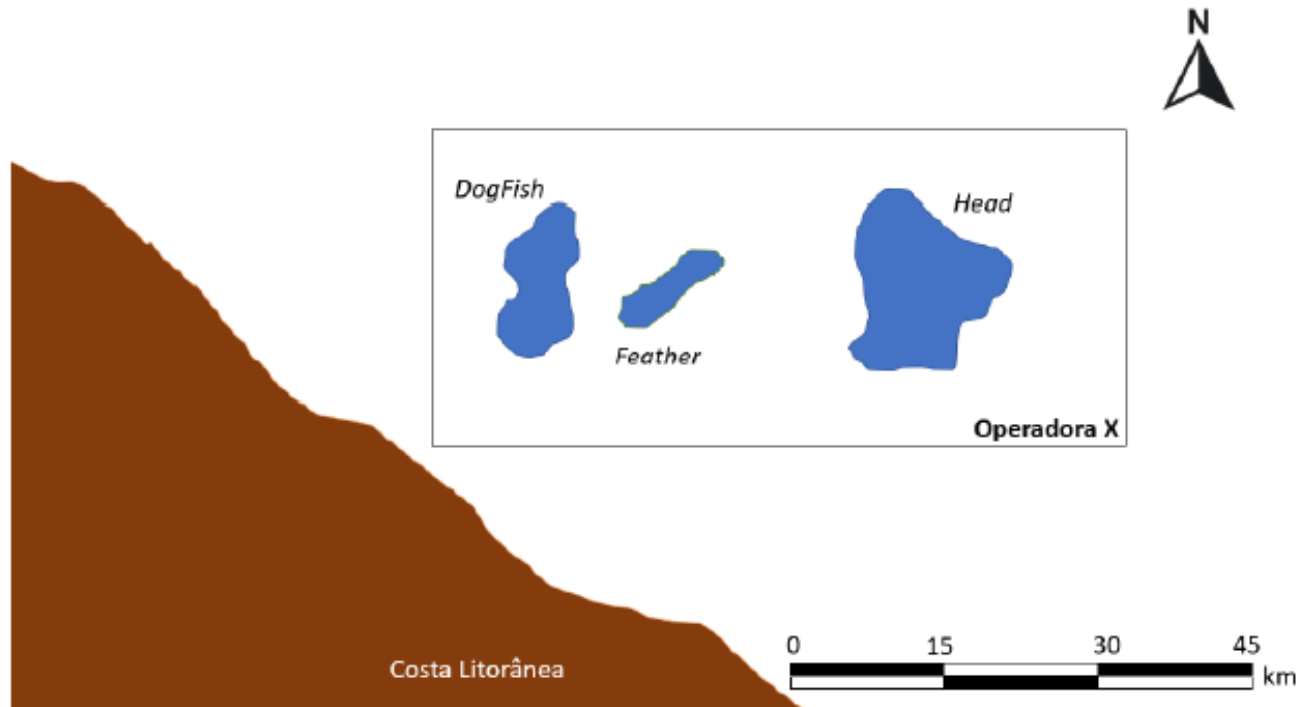


Figura 4.22: Modelo - Único Bloco

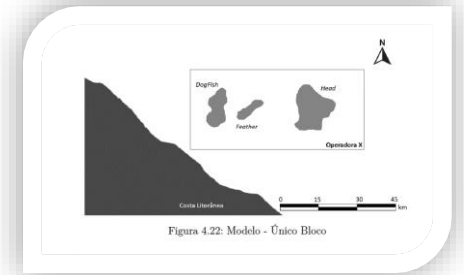


Figura 4.22: Modelo - Único Bloco

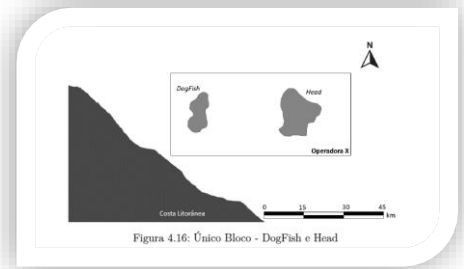


Figura 4.16: Único Bloco - DogFish e Head

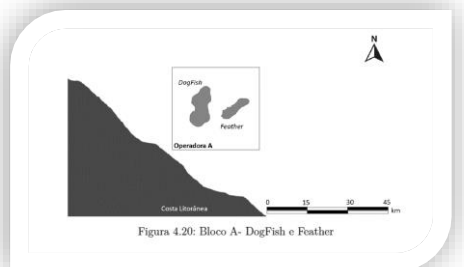
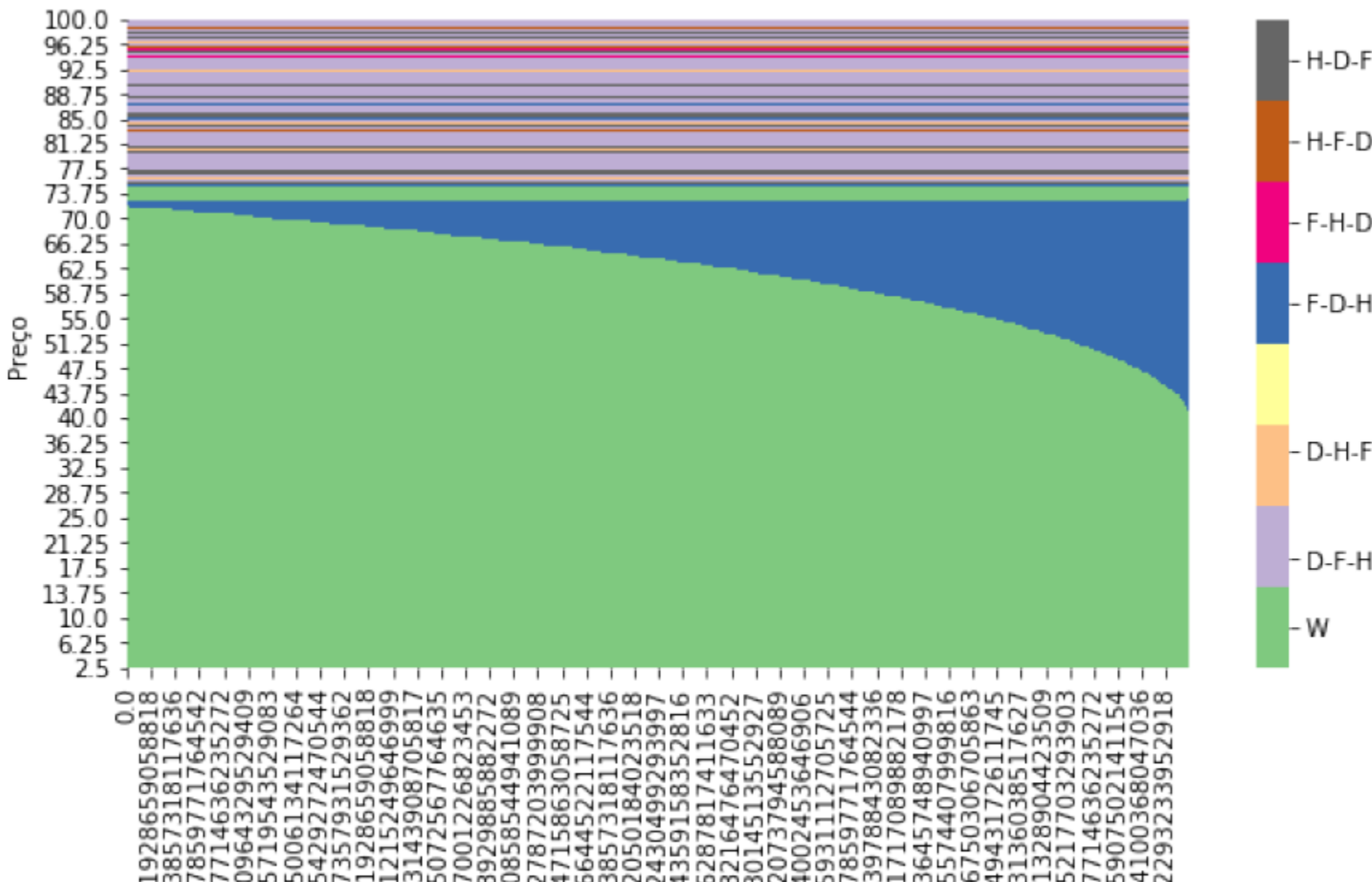


Figura 4.20: Bloco A - DogFish e Feather

Caso – Unitização



$\Pi(P, t)$	1309.54
$\sum E(P, t)$	1285.13
$VOI(P, t)$	24.41
	b
P^{**}	72-74.75

Tabela 4.7: Avaliação dos

Caso – Unitização

<i>Métrica</i>	<i>D+H</i>	<i>D+F</i>	<i>D+F+H</i>
\$ Milhões			
$\pi(P)$	948.20	673.76	1129.69
$\sum VME(P)$	948.20	673.76	1098.88
$VOI(P)$	-	-	30.81

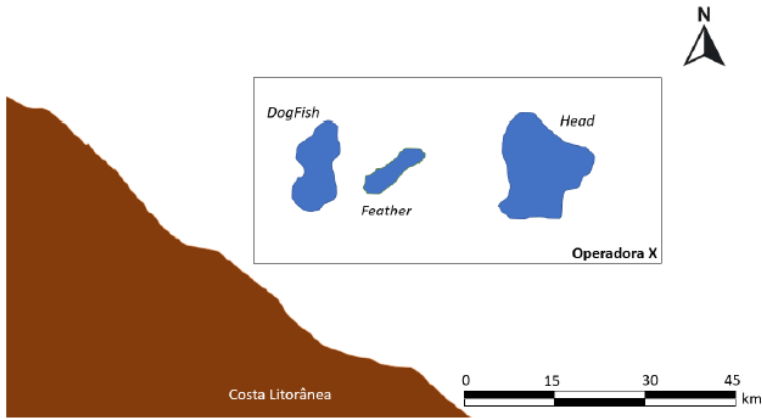


Figura 4.22: Modelo - Único Bloco

Caso – Unitização

<i>Métrica</i>	<i>D+H</i>	<i>D+F</i>	<i>D+F+H</i>
\$ Milhões			
$\pi(P)$	948.20	673.76	1129.69
$\sum VME(P)$	948.20	673.76	1098.88
$VOI(P)$	-	-	30.81
$\Pi(P, t)$	1092.98	796.60	1309.54
$\sum E(P, t)$	1078.99	787.42	1285.13
$VOI(P, t)$	13.99	9.18	24.41
\$/bbl			
P^{**}	71.50	73.25	72-74.75

Tabela 4.7: Avaliação dos Portfólios - $\tau=3$ anos

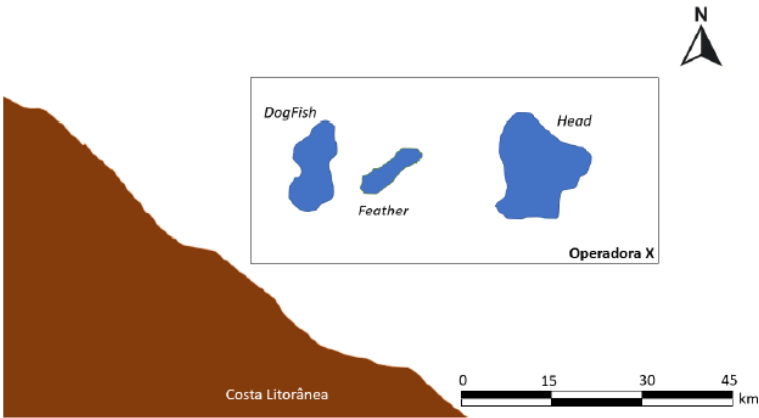


Figura 4.22: Modelo - Único Bloco

Anexos

Possible seismic hydrocarbon indicators in offshore Cyprus and Lebanon

Per Helge Semb

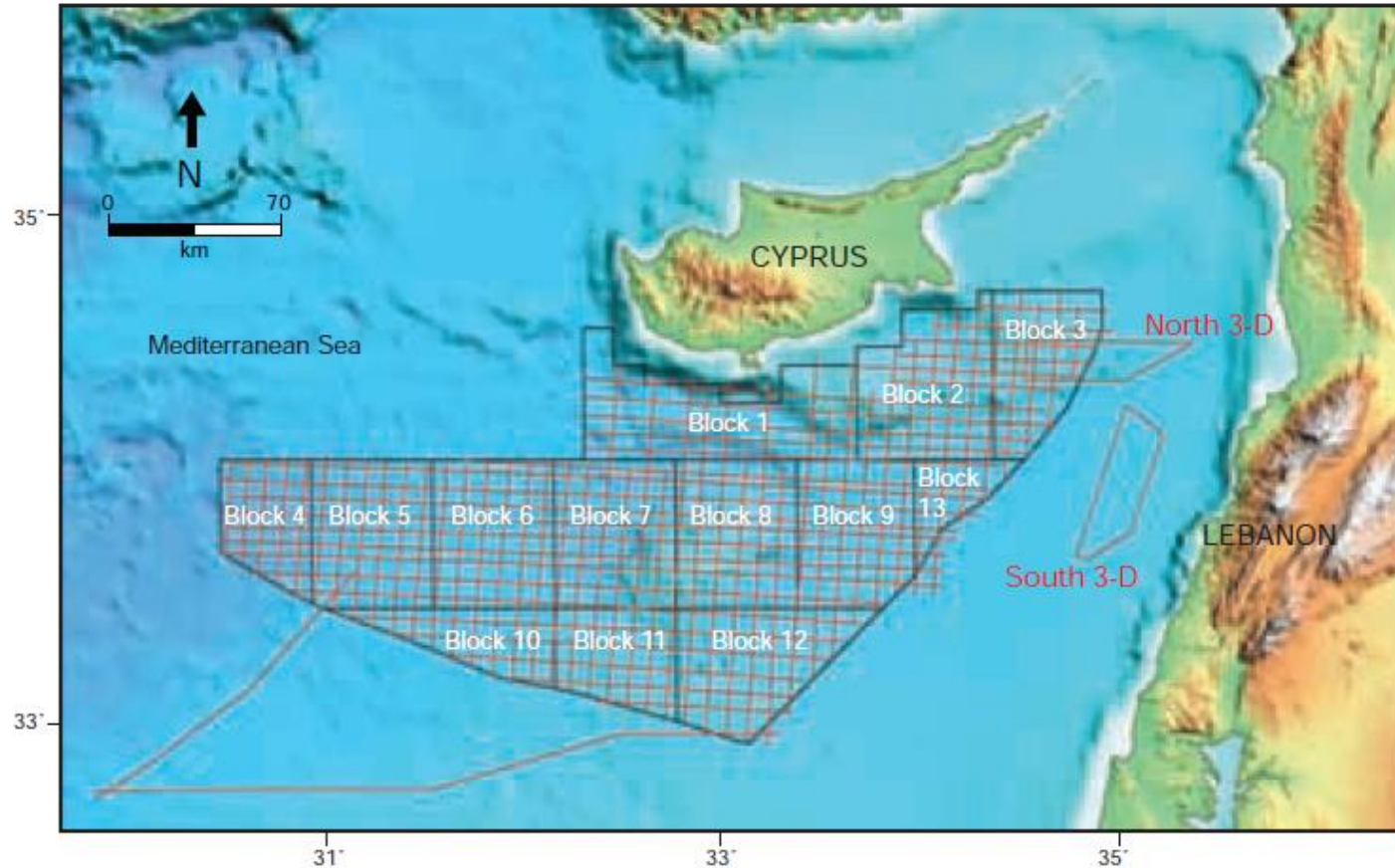


Figure 2: Exploration blocks 1 to 13 in offshore Cyprus, Mediterranean Sea, are shown together with the location of the 2006 PGS multi-client 2-D seismic survey in the offshore of Cyprus. Two 3-D surveys were also acquired in 2006 and 2007 in offshore Cyprus and Lebanon.

Possible seismic hydrocarbon indicators in offshore Cyprus and Lebanon

Per Helge Semb

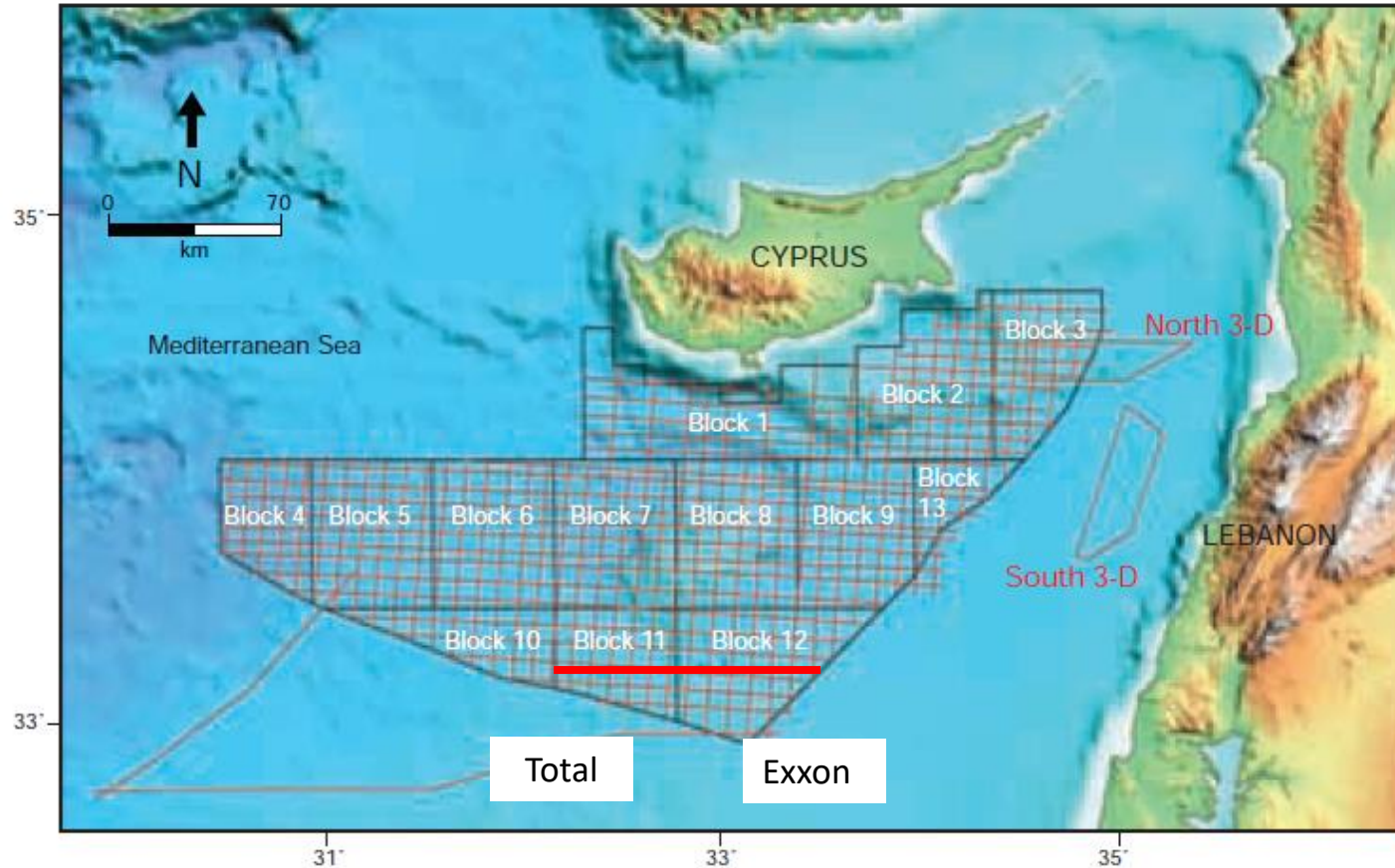


Figure 2: Exploration blocks 1 to 13 in offshore Cyprus, Mediterranean Sea, are shown together with the location of the 2006 PGS multi-client 2-D seismic survey in the offshore of Cyprus. Two 3-D surveys were also acquired in 2006 and 2007 in offshore Cyprus and Lebanon.

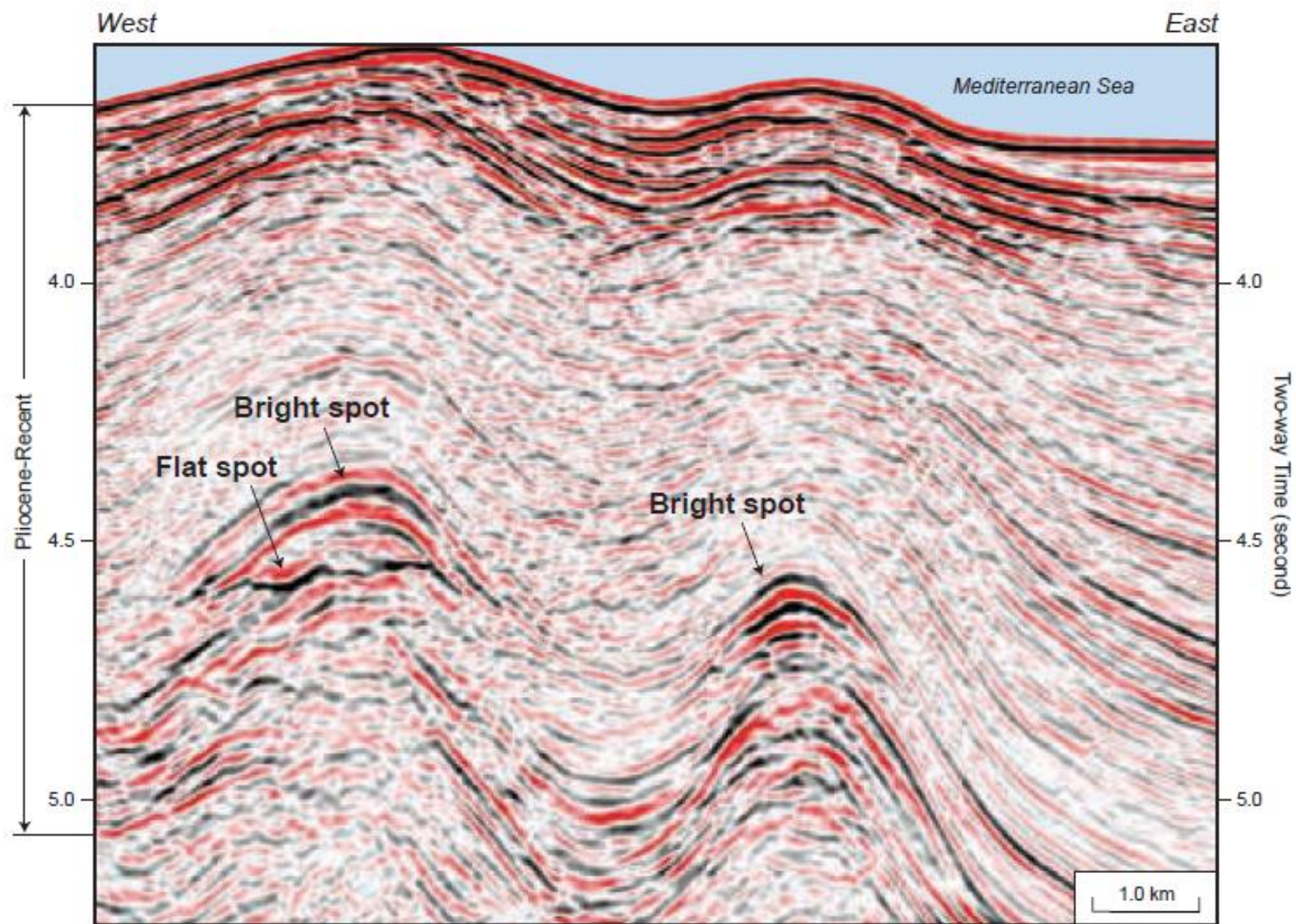
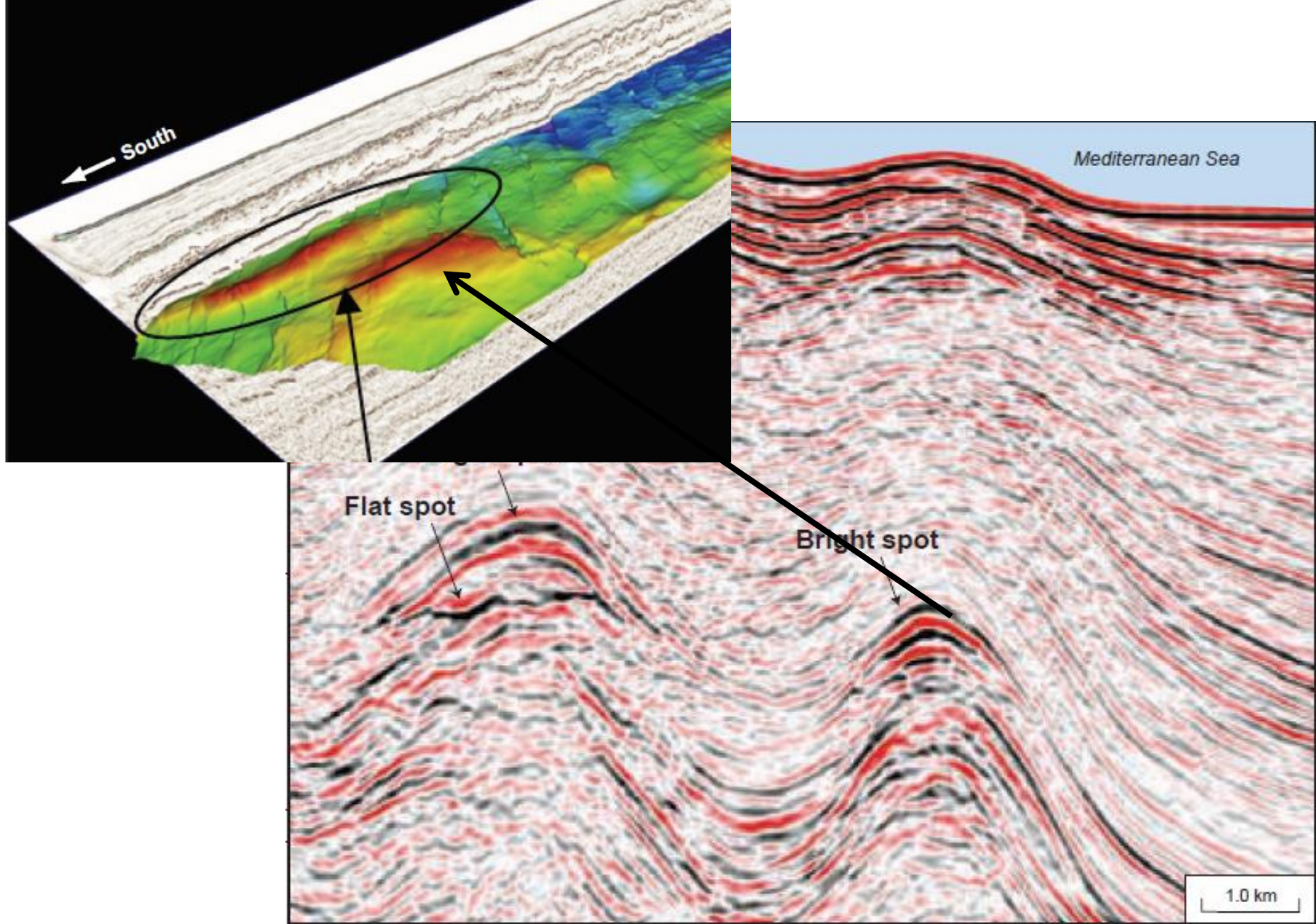


Figure 6: Seismic flat spot and two bright spots identified in the PGS 2-D in offshore Cyprus. These DHIs are believed to occur in the same interval as in Shell's discovery in the Nile Delta



Estimam Para as duas oportunidades:

Volume (B)

Qualidade de produção, do óleo, do reservatório (q)

Fator de Sucesso (FC)

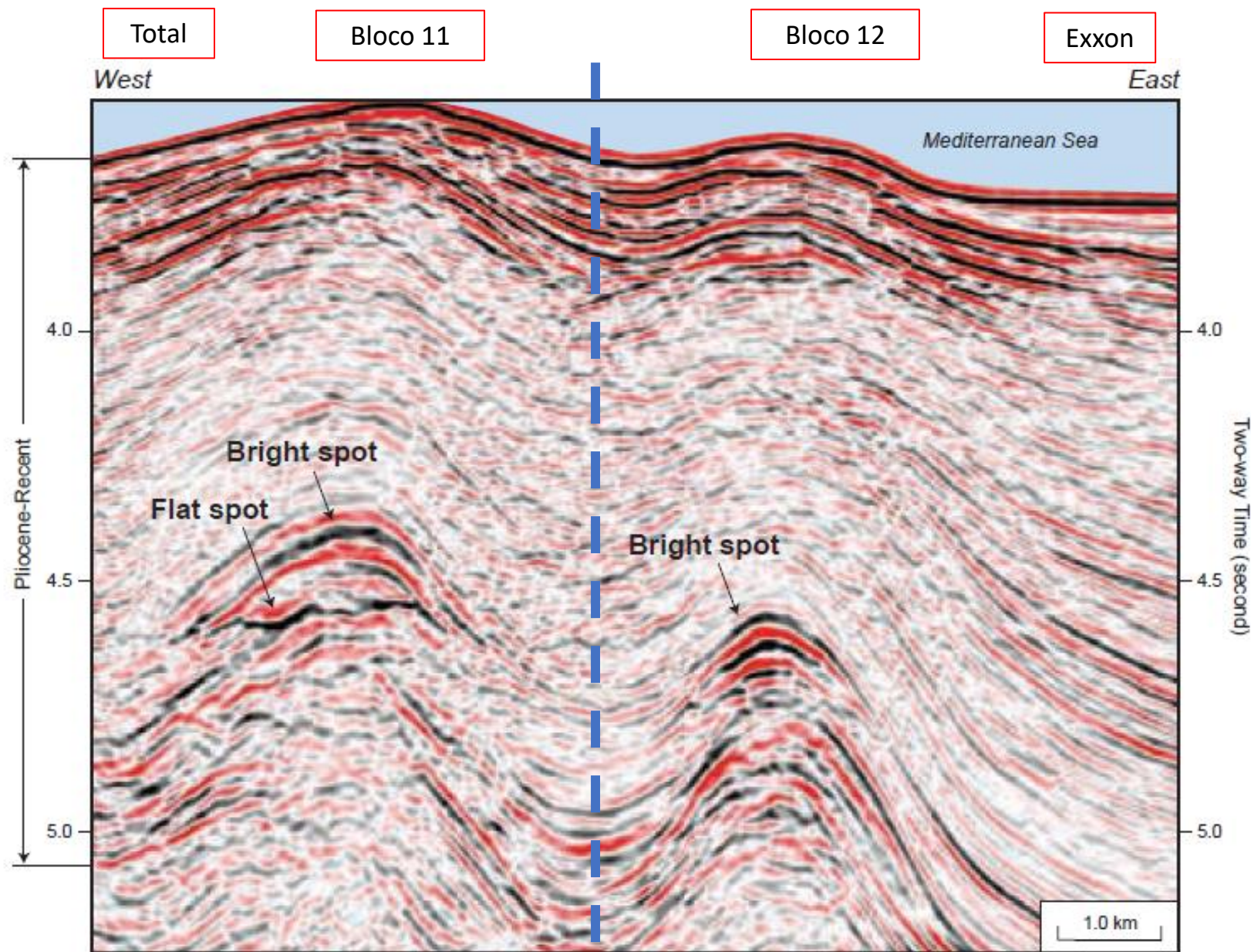
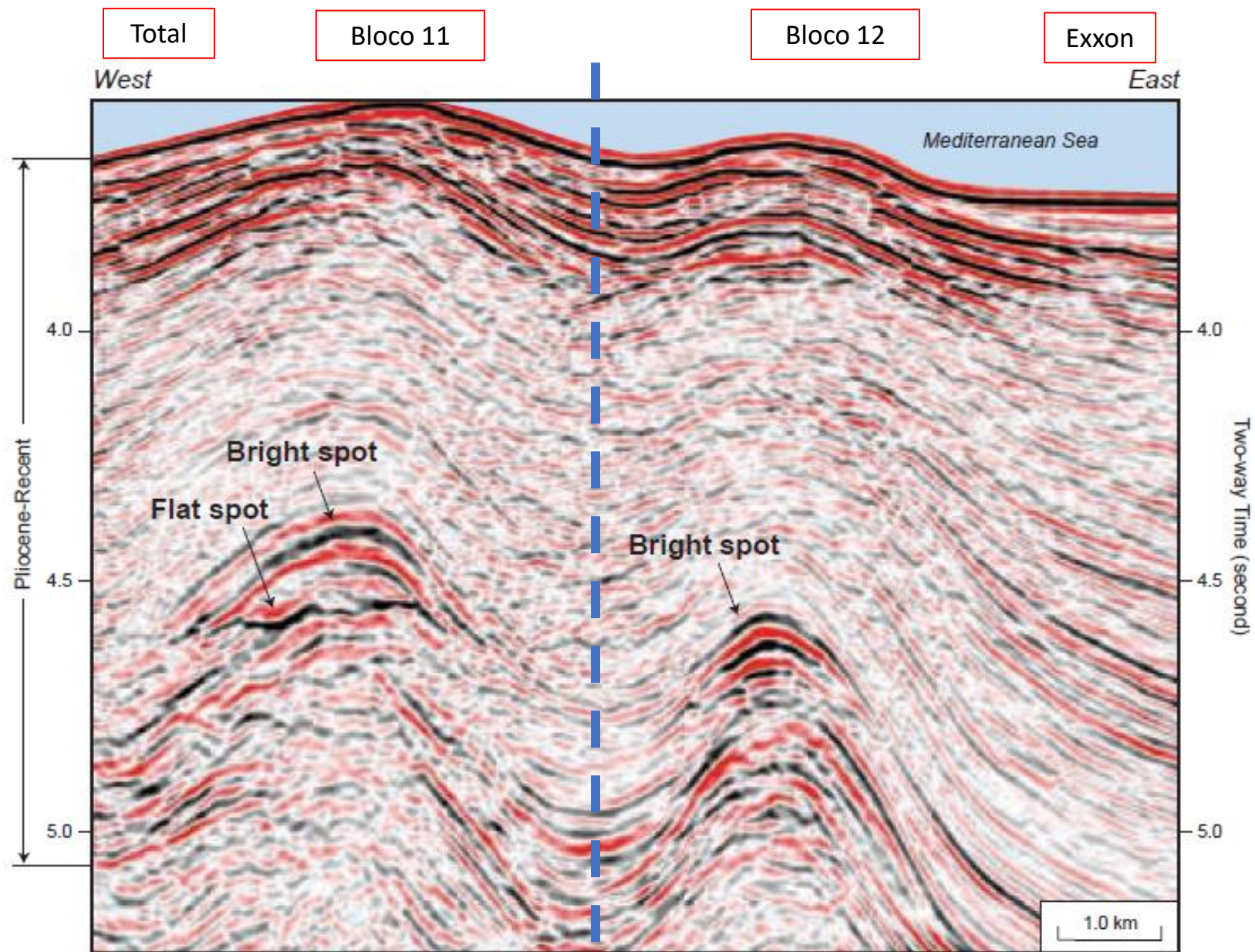


Figure 6: Seismic flat spot and two bright spots identified in the PGS 2-D in offshore Cyprus. These DHIs are believed to occur in the same interval as in Shell's discovery in the Nile Delta

Caso Total Perfurar antes (Líder):

Fator de Sucesso da Exxon vai alterar, pois haverá informação do sucesso ou fracasso

Isso acontece pois há correlação entre as oportunidades

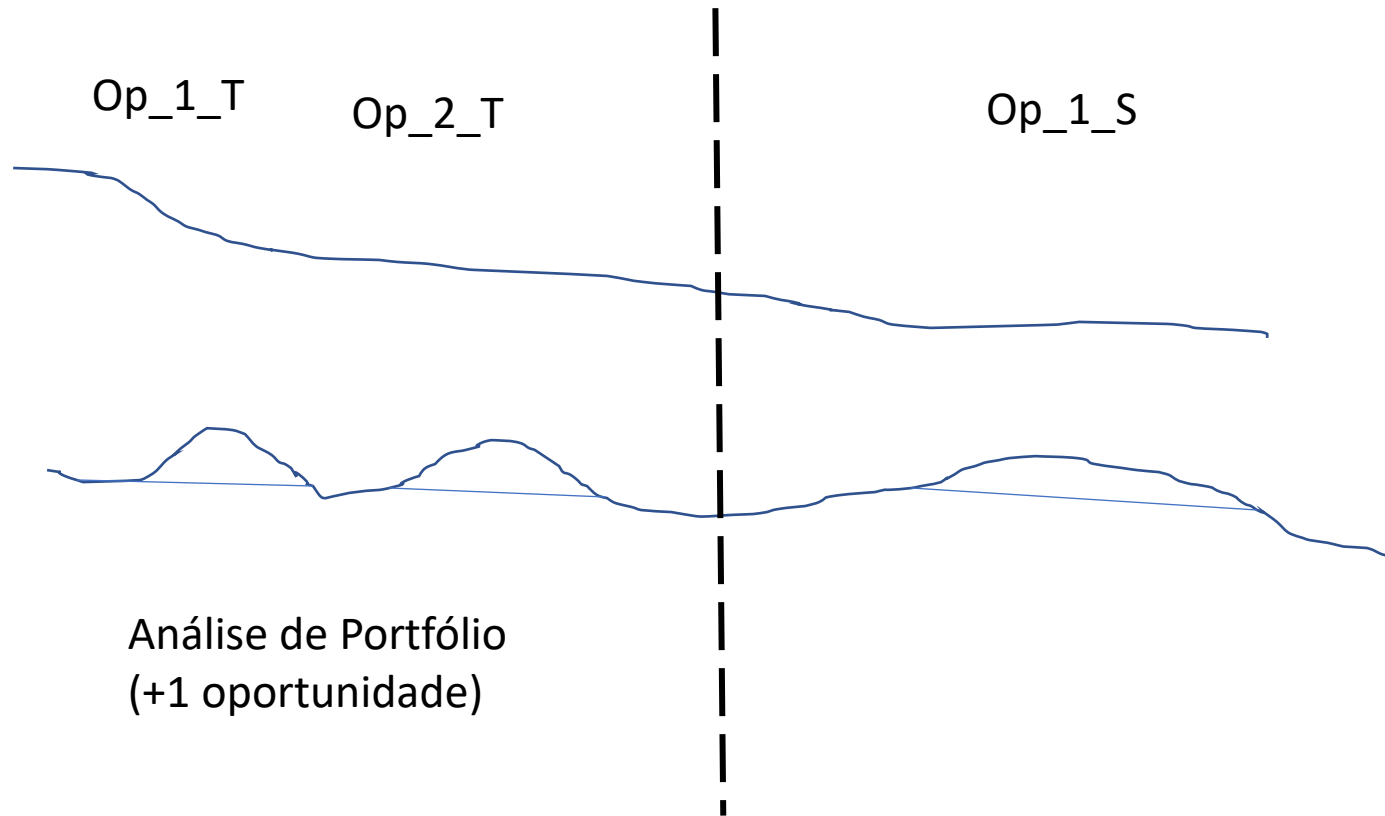


Uncertainty:

- Preço do Petróleo (P)
- Incerteza Técnica (FC)
- Incerteza Estratégica (Atrito entre Exxon xTotal)

Figure 6: Seismic flat spot and two bright spots identified in the PGS 2-D in offshore Cyprus. These DHIs are believed to occur in the same interval as in Shell's discovery in the Nile Delta

Apresentação do Problema da Dissertação



Parâmetros

Endógenos:

- $B[1 : n]$ - Volume Recuperável (bbl)
- $q[1 : n]$ - Qualidade da Reserva (%)
- $FC[1 : n]$ - Fator de Chance dos prospectos (%)
- $\rho[n \times n]$ - Matriz de correlação dos prospectos (%)
- $dummy_1[1 : n]$ - Dummy de propriedade [0,1]
- I_w - Investimento no poço pioneiro (MM\$)
- I_d - Investimento em desenvolvimento - função do Volume Recuperável (MM\$)

Parâmetros

Exógenos:

- $P(\alpha, \sigma)$ - hiperparâmetros dos Preço do petróleo (%a.a, %a.a.)
- δ - taxa de conveniência (%a.a)
- r - Taxa livre de risco (%a.a.)
- τ - Tempo do contrato de exploração - comum em todos os blocos (anos)